

Appendix B2: Noise and Vibration Management Sub- Plan

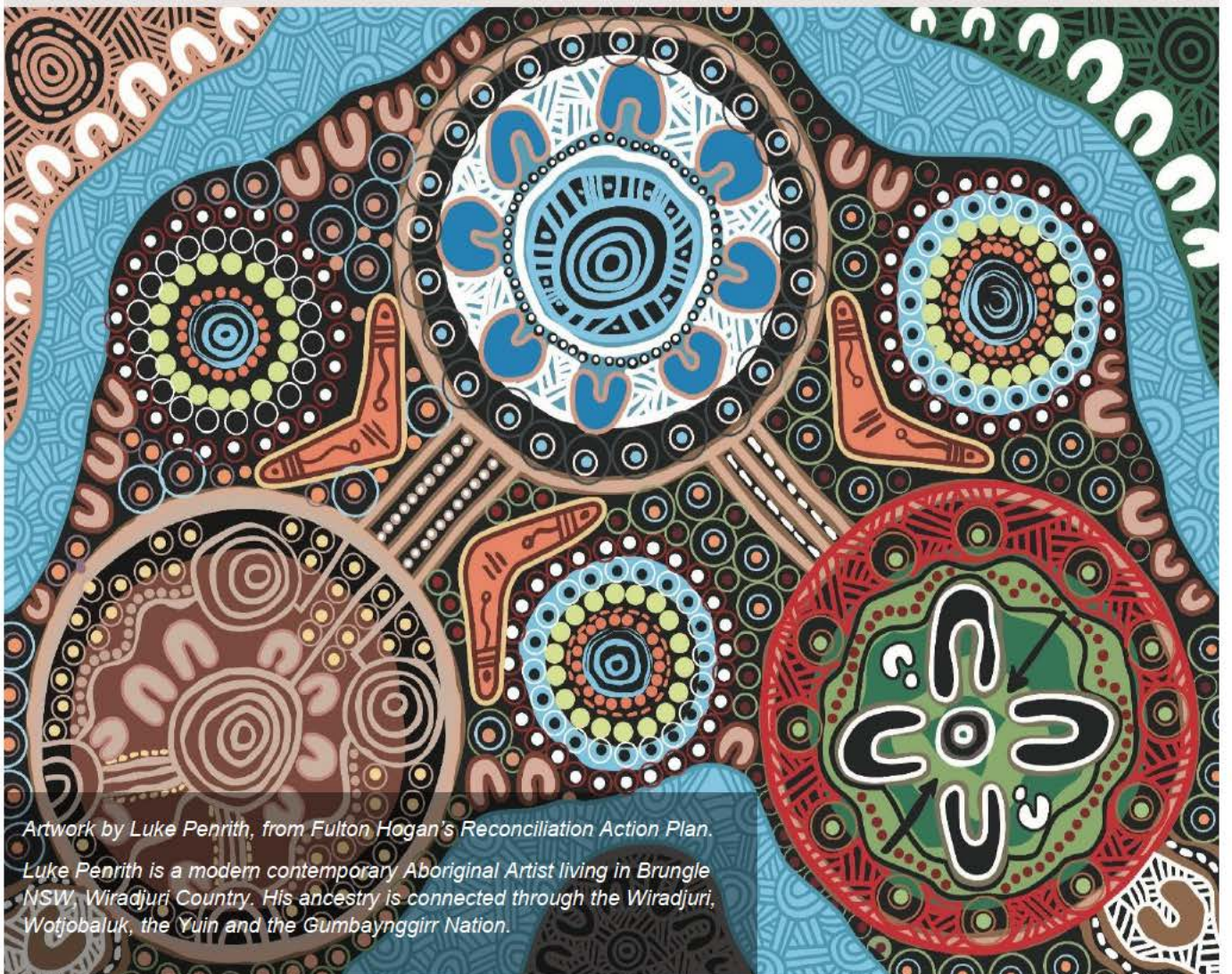
NEWCASTLE INNER CITY BYPASS – RANKIN PARK TO
JESMOND (STAGE 4 – MAIN WORKS)

ACKNOWLEDGMENT OF COUNTRY

Fulton Hogan acknowledges the Awabakal People as the Traditional Owners of the land we are working on, and pay our respect to their Elders past, present and emerging.

We recognise their deep connection to Country and value the contribution to caring for, and managing the land and water.

We are committed to pursuing genuine and lasting partnerships with Traditional Owners to understand their culture and connections to Country in the way we plan for and carry out the delivery of the Works.



*Artwork by Luke Penrith, from Fulton Hogan's Reconciliation Action Plan.
Luke Penrith is a modern contemporary Aboriginal Artist living in Brungle NSW, Wiradjuri Country. His ancestry is connected through the Wiradjuri, Wotjobaluk, the Yuin and the Gumbaynggirr Nation.*

Document control

This is an e-copy of the Plan and it interfaces with the other associated plans, which together describe the proposed overall project management system for the project.

The latest revision of this plan is available on the Fulton Hogan server. If any unsigned hard copies of this document are printed, they are valid only on the day of printing.

The revision number is included at the bottom of each page. When revisions occur, the entire document will be issued with the revision number updated accordingly for each owner of a controlled copy.

Attachments/Appendices to this plan are revised independently of this plan.

Revision history

REV	DATE	AUTHOR / REVISED BY	ENDORSED BY	BRIEF DESCRIPTION OF CHANGE
0	25/08/2022	Muller Acoustic Consulting Pty Ltd	█ █	Initial issue for TfNSW & ER review
1	26/10/2022	Muller Acoustic Consulting Pty Ltd and █ █	█ █	Revised in response to comments from TfNSW & the ER
2	07/11/2022	█ █ and █ █	█ █	Revised in response to comments from TfNSW & the ER
3	01/12/2022	█ █	█ █	Revised in response to comments from Health Administration Corporation. Also made minor amendments for consistency.
4	09/12/2022	█ █	█ █	Revised in response to comments from Health Administration Corporation.
5	08/02/2023	█ █ and EMM Consulting	█ █	Revised in response to comments from DPE and the draft issue of EPL Number 21762
6	14/02/2023	█ █	█ █	Revised in response to comments from TfNSW
7	24/02/2023	█ █	█ █	Revised in response to comments from DPE
8	24/02/2023	█ █	█ █	Revised Section 7.2 in response to verbal feedback received from DPE in meeting held 24/02/23.

Table of contents

1. Introduction	1
1.1. Purpose	1
1.2. Background	1
1.3. Structure of NVMP	1
1.4. Consultation for preparation of the NVMP	1
1.5. Operational noise and vibration	2
2. Objectives, targets and environmental performance outcomes	2
2.1. Objectives	2
2.2. Targets	2
2.3. Environmental performance outcomes	2
3. Legal and other requirements	3
3.1. Legislation	3
3.2. Guidelines and standards	3
3.3. Conditions of approval	3
3.4. Revised environmental management measures	18
4. Existing environment	22
4.1. Sensitive receivers	22
4.1.1. Critical working areas	25
4.2. Noise catchment areas	27
4.3. Background noise and vibration monitoring	29
4.3.1. Summary of baseline noise	29
5. Construction noise and vibration criteria	33
5.1. Noise criteria	33
5.1.1. Construction working hours	33
5.1.2. Construction noise management levels (NMLs)	33
5.1.3. Modifying factor adjustments for annoying activities	35
5.1.4. Sleep disturbance criteria during construction	35
5.1.5. Construction traffic	36
5.1.6. Project construction noise criteria	37
5.2. Vibration criteria	38
5.2.1. Construction vibration goals	38
5.2.2. Heritage structures	38
5.2.3. Other buildings and structures	38
5.2.4. Human comfort and amenity	41
6. Environmental aspects and impacts	42

7.	Noise and vibration impact assessment	42
7.1.	Construction hours	42
7.1.1.	Standard construction hours	42
7.1.2.	Highly noise intrusive work	42
7.1.3.	Out of hours work	42
7.2.	Construction activities	43
7.3.	Ancillary facilities	46
7.3.1.	Ancillary facilities identified in the EIS as amended by the documents listed in CoA A1	46
7.3.2.	Ancillary facilities not identified in the EIS as amended by the documents listed in CoA A1	46
7.4.	Construction noise impact assessment	48
7.4.1.	CNVG noise management approach	48
7.4.2.	General construction during standard construction hours	50
7.4.3.	Proposed shoulder period construction hours	53
7.4.4.	Out-of-hours work	58
7.4.5.	Construction compounds - Standard construction hours	63
7.4.6.	Construction compounds – shoulder periods	63
7.4.7.	Construction compounds – Out of hours	64
7.4.8.	Additional construction compounds – Summary of noise impacts	65
7.4.9.	Sleep disturbance	65
7.4.10.	Construction traffic	67
7.5.	Vibration impact assessment	69
7.5.1.	Structural damage	72
7.5.2.	Human comfort	72
7.5.3.	Sensitive equipment	74
7.5.4.	Ground-borne noise	74
8.	Environmental mitigation measures	75
9.	Compliance management	84
9.1.	Roles and responsibilities	84
9.2.	Training	84
9.3.	Complaints	85
9.4.	Inspections and monitoring	85
9.4.1.	Noise monitoring	85
9.4.2.	Vibration monitoring	86
9.4.3.	Monitoring program summary	87
9.5.	Auditing	95
9.6.	Reporting	95
9.7.	Non-conformances	95

10. Review and improvement of NVMP 95

List of tables

Table 1: Environmental performance outcomes relevant to noise and vibration management2

Table 2: Conditions of approval relevant to NVMP4

Table 3: Revised environmental management measures relevant to NVMP 18

Table 4: Medical, educational and places of worship sensitive receivers22

Table 5: Summary of baseline noise monitoring 30

Table 6: Construction working hours33

Table 7: Noise management levels (NMLs) for residential land uses (ICNG).....34

Table 8: Noise management levels (NMLs) for other land uses (ICNG)35

Table 9: Construction traffic noise criteria (NSW Road Noise Policy)36

Table 10: Residential construction NMLs, dB(A)37

Table 11: Structural damage criteria – heritage structures38

Table 12: Transient vibration guide values for cosmetic damage (BS 7385: Part 2:1993)39

Table 13: Guidance on effects of vibration levels for sensitive equipment (BS 5228.2 – 2009) – rms vibration velocity and PPV40

Table 14: Acceptable vibration dose values (VDV) for intermittent vibration41

Table 15: Indicative schedule of construction scenarios/ activities44

Table 16: CNVG noise management approach.....49

Table 17: Construction activity maximum predicted noise management level exceedances, standard construction hours, sensitive residential receivers by NCA, dB(A)51

Table 18: Number of construction noise management level exceedances, standard construction hours, sensitive residential receivers by NCA52

Table 19: Shoulder period construction works, Residential sensitive receiver construction noise management levels53

Table 20: Construction activity maximum predicted noise management level exceedances, shoulder construction hours, sensitive residential receivers by NCA, dB(A)54

Table 21: Number of construction noise management level exceedances, shoulder construction hours, sensitive residential receivers by NCA56

Table 22: Construction activity maximum predicted noise management level exceedances, out of hours, sensitive residential receivers by NCA, dB(A)59

Table 23: Number of construction noise management level exceedances, out of hours, sensitive residential receivers by NCA61

Table 24: Predicted construction compound impacts, standard construction hours, sensitive residential receivers.63

Table 25: Predicted construction compound impacts63

Table 26: Predicted Construction Compounds Assessment Scenario64

Table 27: Construction scenario potential sleep disturbance per NCA66

Table 28: Predicted increase in noise due to construction traffic67

Table 29: Predicted increase in noise due to construction traffic (night period).....68

Table 30: Vibration safe working distances	69
Table 31: Estimated vibration levels at distance from activity	70
Table 32: Vibration (estimated) safe working buffer distances.....	71
Table 33: Noise and vibration mitigation measures.....	75
Table 34: Out of hours noise and vibration mitigation measures	80
Table 35: Noise Monitoring Procedure	90
Table 36: Vibration Monitoring Procedure	92
Table 37: SWLs	97

List of figures

Figure 1: Critical working areas - John Hunter Hospital Main Building – Level 2.....	25
Figure 2: Critical working areas - John Hunter Hospital Main Building – Level 3.....	26
Figure 3: Critical working areas – HMRI Building, Forensic Medicine.....	26
Figure 4: Noise catchment areas and baseline noise logger locations	28
Figure 5: Summary of damage thresholds for transient vibration on domestic structures	39
Figure 6: Potential ancillary facility sites identified in the EIS as amended by the documents listed in CoA A1	47
Figure 7: Nominated construction noise monitoring locations.....	88
Figure 8: Background vibration monitoring locations (at the sensitive equipment locations in the John Hunter Hospital precinct)	89
Figure 9: OOHW approval pathway flowchart for the project (for work subject to an EPL)	103

Appendices

- Appendix A: Indicative plant and equipment sound power levels
- Appendix B: Construction scenario noise prediction figures
- Appendix C: Out-of-hours work approval procedure (for work subject to an EPL)
- Appendix D: Detailed land use survey

Glossary/ Abbreviations

Term/ abbreviation	Definition
CEMP	Construction Environmental Management Plan.
CCS	Community Communication Strategy
CNVG	Construction Noise and Vibration Guideline.
CoA	Condition of Approval.
Construction	Has the same meaning as the definition of the term in the Project Approval
Construction Boundary	Has the same meaning as the definition of the term in the Project Approval. The area physically affected by works described in documents listed in Condition A1.
D&C	Design and Construct
Department/ DPE	NSW Department of Planning and Environment
dB(A)	Decibels using the A-weighted scale measured according to the frequency of the human ear.
Ecologically sustainable development	Using, conserving and enhancing the community's resources so that the ecological processes on which life depends are maintained and the total quality of life now and in the future, can be increased (Council of Australian Governments, 1992).
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPL	Environment Protection Licence
ER	Environmental Representative for the SSI
ESCP	Primary Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statement
HAPS	Hunter Area Pathology Service
HP	Hold Point: a point in the construction or verification process beyond which work may not proceed without receiving authorisation from the appropriate party.
Highly Noise Affected	Defined by the <i>Interim Construction Noise Guidelines</i> (DECC 2009) (ICNG) to be a sensitive receiver exposed to construction noise levels greater than 75 dB $L_{Aeq,15min}$
Highly Noise Intensive Works	Project related works exceeding an $L_{Aeq,15min}$ of 75dBA at a sensitive receiver
ICNG	<i>Interim Construction Noise Guidelines</i> (DECC 2009)
Incident	Has the same meaning as the definition of the term in the Project Approval: An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance <i>Note: "material harm" is defined below.</i>
JHHIP	John Hunter Health and Innovation Precinct

Term/ abbreviation	Definition
Leq	Equivalent continuous sound level - the constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L _{Aeq,15min}	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
L _{AMax}	The A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
L ₉₀	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L ₉₀ .
Material Harm	Has the same meaning as the definition of the term in the Project Approval: Is harm that: (a) involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial, or (b) results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)
NA	Not applicable.
NCA	Noise Catchment Area.
NEXUS	Nexus Child and Adolescent Mental Health Unit
NML	Noise Management Level.
NPI	Noise Policy for Industry.
Non-compliance	Has the same meaning as the definition of the term in the Project Approval: An occurrence, set of circumstances or development that is a breach of the Project Approval. This includes a failure to comply with the processes included within this CEMP.
Non-conformance	Failure to conform to the requirements of project or Fulton Hogan system documentation.
NVMP	Noise and Vibration Management Sub-Plan.
OEH	Office of Environment and Heritage.
OOHW	Out-of-Hours Work.
OOHW Protocol	Out-of-Hours Work Protocol
PCG	Project Control Group
Planning Secretary, the	Planning Secretary of the DPE (or nominee, whether nominated before or after the date on which the Project Approval was granted.
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW).</i>
Project, the	Newcastle Inner City Bypass Rankin Park to Jesmond.
Project Approval, the	The Minister’s approval for the SSI.

Term/ abbreviation	Definition
RBL	The Rating Background Level for each period is the medium value of the assessment background level for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night).
Relevant Council(s)	Has the same meaning as the definition of the term in the Project Approval: Lake Macquarie City Council and City of Newcastle, as relevant.
REMM	Revised Environmental Management Measure.
RMS	Roads and Maritime Services (now TfNSW)
rms	Root mean square of vibration signal.
Sensitive Receiver	Has the same meaning as the definition of the term in the Project Approval: Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces), and others as identified by the Planning Secretary
Sound Power Level	The total sound emitted by a source.
Sound Pressure Level	The amount of sound at a specified point.
SPL	Sound pressure level.
SPIR	Submissions and Preferred Infrastructure Report
SWL	Sound power level.
SWTC	TfNSW Scope of Works and Technical Criteria.
TfNSW	Transport for NSW (previously RMS)
Work(s)	Has the same meaning as the definition of the term in the Project Approval. All physical activities to construct or facilitate the construction of the SSI, including environmental management measures and utility works. however, does not include work that informs or enables the detailed design of the SSI and generates noise that is no more than 5 dB(A) above the rating background level (RBL) at any residence.

1. Introduction

1.1. Purpose

This Noise and Vibration Management Sub-Plan (NVMP) describes how Fulton Hogan will manage construction of the Newcastle Inner City Bypass Rankin Park to Jesmond (RP2J) Project (the project) to ensure that impacts related to noise and vibration are minimised.

This NVMP has been prepared to detail how Fulton Hogan will comply with the project approval, and implement and achieve relevant performance outcomes, commitments and mitigation measures specified in the EIS as amended by the SPIR and subsequent Modification 1 Submissions Report (also known as 'Revised Environmental Management Measures' (REMMs)) during construction of the project. Additionally, this NVMP has been prepared to address the requirements of the Scope of Works and Technical Criteria (SWTC) Appendix 4 Additional Environmental Requirements, TfNSW Specification D&C G36 Environmental Protection (G36) and the Environment Protection Licence (EPL) for the project (Number 21762).

For the avoidance of doubt, the CEMP (including this NVMP) relates to the construction phase only. Detailed design environmental requirements will be addressed as part of the detailed design phase, separate to the CEMP approvals process. Detailed design is generally completed about six months after CEMP approval. In addition, operational environmental requirements will be met during the operational phase (upon the completion of construction) and addressed in the Operational Environmental Management Plan (OEMP) or Environmental Management System (EMS) as agreed with the Planning Secretary in accordance with CoA D3.

As at-property treatments work forms part of Stage 1 (early works) as per the RP2J Staging Report and is being managed by TfNSW, it has not been addressed in this Stage 4 NVMP.

1.2. Background

Chapter 9 of the EIS assessed the extent and magnitude of potential noise and vibration impacts associated with the construction and operation of the project. As part of this, a detailed assessment was undertaken and included in the EIS as:

- EIS Volume 5 and Volume 6 – Technical Paper 3 – Noise and Vibration Assessment, prepared by Aurecon for RMS, dated November 2016.

1.3. Structure of NVMP

This NVMP is part of Fulton Hogan's environmental management framework for the project and is supported by other documents, such as Environmental Work Method Statements. The review and document control processes for this NVMP are described in Chapters 11 and 12 respectively of the CEMP.

As permitted by CoA C15, the Noise and Vibration Construction Monitoring Program under CoA C9(c) has been incorporated into this NVMP. The relevant conditions (CoA C9 – C15) are listed in Table 2 along with a cross reference as to where the condition is addressed in this NVMP or other project management documents.

The Blast Management Strategy will be prepared separately to this NVMP and submitted to the Planning Secretary no later than one (1) month before the commencement of blasting in about mid-2023.

1.4. Consultation for preparation of the NVMP

In accordance with CoA C4(b), consultation with City of Newcastle and Health Administration Corporation has been undertaken during the preparation of this NVMP. This includes consultation with City of Newcastle and Health Administration Corporation in relation to the Construction Monitoring Program to satisfy the requirements of CoA C9(c).

City of Newcastle raised one comment in relation to the NVMP and confirmed the issue was satisfactorily addressed. Health Administration Corporation provided eight comments generally related to critical working areas,

the extent of the Hunter Medical Research Institute building, and noise and vibration monitoring. The NVMP was revised in response to the comments and Health Administration Corporation confirmed they were satisfied with the responses.

Copies of all consultation correspondence is included at Appendix A5 of the CEMP.

Ongoing consultation will be undertaken during detailed design and construction of the project as required by the project approval. This will be subject to a separate consultation process to that required for preparation of this NVMP and undertaken in accordance with the Community Communication Strategy (CCS) approved by the Planning Secretary under CoA B3.

1.5. Operational noise and vibration

The potential impacts relating to operational noise and vibration will be assessed and documented in a separate Operational Noise Mitigation Review (ONMR) report developed as part of the design process. A program of post construction operational noise and vibration measurements will be conducted to confirm the outcomes of the project and will be documented in a separate Operational Noise Compliance Report in accordance with requirements of CoA E41.

2. Objectives, targets and environmental performance outcomes

2.1. Objectives

The key objective of the NVMP is to ensure that impacts to noise and vibration are minimised and within the scope permitted by the project approval. To achieve this objective, Fulton Hogan will undertake the following:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise potential adverse impacts to sensitive receivers in relation to noise and vibration along the Project corridor
- Ensure appropriate measures are implemented to address the relevant CoA and REMMs outlined in Table 2 and Table 3 respectively.
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Chapter 3 of this NVMP.

2.2. Targets

The following targets have been established for the management of noise and vibration impacts during the project:

- Ensure full compliance with the relevant legislative requirements, CoA and REMMs outlined in Table 2 and Table 3 respectively.
- Conduct noise and vibration monitoring as required to assess compliance with the relevant criteria.
- Ensure complaints from the community are minimised.

2.3. Environmental performance outcomes

The construction-related environmental performance outcomes relevant to this NVMP are listed in Table 1. A cross reference is also included to indicate where the environmental performance outcome is addressed in this NVMP in terms of how it will be implemented and achieved.

Table 1: Environmental performance outcomes relevant to noise and vibration management

Key adverse impact (as identified on page xviii of the EIS)	Environmental performance outcome	Document reference
Noise – potential disturbance for sensitive receivers, including residences and the John Hunter	Noise mitigation including possible noise barriers and at-property treatments	Chapter 8 mitigation measure ID NVMM6, NVMM18, NVMM19, NVMM24, NVMM25

Key adverse impact (as identified on page xviii of the EIS)	Environmental performance outcome	Document reference
Hospital precinct during construction and operation		Section 1.1 - As at-property treatments work forms part of Stage 1 (early works) as per the RP2J Staging Report and is being managed by TfNSW, it has not been addressed in this Stage 4 NVMP.

3. Legal and other requirements

3.1. Legislation

Legislation relevant to noise and vibration management includes:

- *Protection of the Environment Operations Act 1997 (POEO Act)*
- *Protection of the Environment Operations (Noise Control) Regulation 2017.*

Relevant provisions of the above legislation are explained in the Register of Legal and Other Requirements included in Appendix A1 of the CEMP.

3.2. Guidelines and standards

The main guidelines, standards and policy documents relevant to this NVMP include:

- Interim Construction Noise Guideline (ICNG) (DECC 2009)
- Noise Policy for Industry (NPI) (EPA 2017)
- Environmental Noise Management Assessing Vibration: A Technical Guideline (DEC, 2006)
- German Standard DIN 4150 - Part 3 - Structural Vibration in Buildings - Effects of Vibration on Structures
- AS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors
- AS 2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites
- AS 1055:2018 Acoustics - Description and measurement of environmental noise
- AS IEC 61672-2019 Electroacoustics – Sound Level Meters
- AS ISO 6393:2019 Earth-moving machinery - Determination of sound power level - Stationary test conditions
- AS ISO 31000:2018 Risk management - Guidelines
- British Standard 7385: Part 2 – Evaluation and measurement of vibration in buildings
- British Standard 5228: Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration
- NSW Road Noise Policy (DECCW, 2011)
- Construction Noise and Vibration Guideline (CNVG) (TfNSW, 2016).

3.3. Conditions of approval

The CoA relevant to this NVMP are listed in Table 2 below. A cross reference is also included to indicate where the condition is addressed in this NVMP or other project management documents.

Table 2: Conditions of approval relevant to NVMP

CoA No.	Condition requirements	Document reference																								
PART C - CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN																										
C4	<p>The following CEMP Sub-plans must be prepared in consultation with the relevant public authorities identified for each CEMP Sub-plan:</p> <p>Table 3: CEMP Sub-plan and relevant public authorities</p> <table border="1"> <thead> <tr> <th></th> <th>Required CEMP Sub-plan</th> <th>Relevant public authorities to be consulted for each CEMP Sub-plan</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Traffic and transport</td> <td>Relevant council and Health Administration Corporation</td> </tr> <tr> <td>(b)</td> <td>Noise and vibration</td> <td>Relevant council and Health Administration Corporation</td> </tr> <tr> <td>(c)</td> <td>Flora and Fauna</td> <td>DPI Fisheries and Relevant council</td> </tr> <tr> <td>(d)</td> <td>Air quality</td> <td>Relevant council and Health Administration Corporation</td> </tr> <tr> <td>(e)</td> <td>Soil and water</td> <td>Relevant council, DPI Fisheries and DPE Water,</td> </tr> <tr> <td>(f)</td> <td>Aboriginal cultural heritage</td> <td>Heritage NSW and Registered Aboriginal Parties</td> </tr> <tr> <td>(g)</td> <td>Flood management</td> <td>Relevant council</td> </tr> </tbody> </table>		Required CEMP Sub-plan	Relevant public authorities to be consulted for each CEMP Sub-plan	(a)	Traffic and transport	Relevant council and Health Administration Corporation	(b)	Noise and vibration	Relevant council and Health Administration Corporation	(c)	Flora and Fauna	DPI Fisheries and Relevant council	(d)	Air quality	Relevant council and Health Administration Corporation	(e)	Soil and water	Relevant council, DPI Fisheries and DPE Water,	(f)	Aboriginal cultural heritage	Heritage NSW and Registered Aboriginal Parties	(g)	Flood management	Relevant council	Section 1.4
	Required CEMP Sub-plan	Relevant public authorities to be consulted for each CEMP Sub-plan																								
(a)	Traffic and transport	Relevant council and Health Administration Corporation																								
(b)	Noise and vibration	Relevant council and Health Administration Corporation																								
(c)	Flora and Fauna	DPI Fisheries and Relevant council																								
(d)	Air quality	Relevant council and Health Administration Corporation																								
(e)	Soil and water	Relevant council, DPI Fisheries and DPE Water,																								
(f)	Aboriginal cultural heritage	Heritage NSW and Registered Aboriginal Parties																								
(g)	Flood management	Relevant council																								
C5	<p>The CEMP Sub-plans must state how:</p> <p>(a) the environmental performance outcomes identified in the documents listed in Condition A1 and terms of this approval will be achieved;</p> <p>(b) the mitigation measures identified in the documents listed in Condition A1 and terms of this approval will be implemented;</p> <p>(c) the relevant terms of this approval will be complied with; and</p> <p>(d) issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed.</p>	<p>Section 2.3</p> <p>Through the implementation of this NVMP (in particular refer to Section 3.4).</p> <p>Through the implementation of this NVMP</p> <p>Chapter 6, second paragraph Chapter 8</p>																								
C6	<p>The CEMP Sub-plans must be developed in consultation with the relevant public authorities specified in Table 3. Details of all information requested by an authority to be included in a CEMP Sub-plan as a result of consultation, including copies of all correspondence from those authorities, must be provided with the relevant CEMP Sub-Plan.</p>	Section 1.4																								
C7	<p>Any of the CEMP Sub-plans may be submitted along with, or subsequent to, the submission of the CEMP but in any event, no later than one (1) month before construction for approval by the Planning Secretary.</p>	CEMP (main section) Section 1.4																								
C8	<p>Construction must not commence until the CEMP and all CEMP Sub-plans have been approved by the Planning Secretary, or as otherwise agreed by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by the Planning Secretary, including any minor amendments approved by the ER must be implemented for the duration of construction. Where construction of the SSI is staged, construction of a stage must not commence until the CEMP and sub-plans for that stage have been approved by the Planning Secretary.</p>	CEMP (main section) Section 1.4																								

CoA No.	Condition requirements	Document reference															
PART C - CONSTRUCTION MONITORING PROGRAMS																	
C9	<p>The following Construction Monitoring Programs must be prepared in consultation with the relevant public authorities identified for each to compare actual performance of construction of the SSI against the performance predicted in the in the documents listed in Condition A1 or in the CEMP:</p> <p>Table 4: Construction Monitoring and relevant public authorities</p> <table border="1"> <thead> <tr> <th></th> <th>Required Construction Monitoring Programs</th> <th>Relevant public authorities to be consulted for each Construction Monitoring Program</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Surface and Ground Water Quality</td> <td>DPI Fisheries, DPE Water and Relevant council</td> </tr> <tr> <td>(b)</td> <td>Air Quality</td> <td>Relevant council and Health Administration Corporation</td> </tr> <tr> <td>(c)</td> <td>Noise and vibration</td> <td>Relevant council and Health Administration Corporation</td> </tr> <tr> <td>(e)</td> <td>Flora and fauna</td> <td>DPI Fisheries and Relevant council</td> </tr> </tbody> </table>		Required Construction Monitoring Programs	Relevant public authorities to be consulted for each Construction Monitoring Program	(a)	Surface and Ground Water Quality	DPI Fisheries, DPE Water and Relevant council	(b)	Air Quality	Relevant council and Health Administration Corporation	(c)	Noise and vibration	Relevant council and Health Administration Corporation	(e)	Flora and fauna	DPI Fisheries and Relevant council	Section 1.4
	Required Construction Monitoring Programs	Relevant public authorities to be consulted for each Construction Monitoring Program															
(a)	Surface and Ground Water Quality	DPI Fisheries, DPE Water and Relevant council															
(b)	Air Quality	Relevant council and Health Administration Corporation															
(c)	Noise and vibration	Relevant council and Health Administration Corporation															
(e)	Flora and fauna	DPI Fisheries and Relevant council															
C10	<p>Each Construction Monitoring Program must provide:</p> <p>(a) details of baseline data available;</p> <p>(b) details of baseline data to be obtained and when;</p> <p>(c) the parameters of the project to be monitored;</p> <p>(d) the frequency of monitoring to be undertaken;</p> <p>(e) the location of monitoring;</p> <p>(f) the reporting of monitoring results;</p> <p>(g) procedures to identify and implement additional or alternative mitigation measures where results of monitoring are unsatisfactory; and</p> <p>(h) any consultation to be undertaken in relation to the monitoring programs.</p>	<p>Section 4.3 (vibration)</p> <p>Section 4.3.1 (noise)</p> <p>Section 4.3 (vibration)</p> <p>Section 4.3.1</p> <p>Section 9.4.2</p> <p>Table 36, 1st row</p> <p>Section 9.4.2</p> <p>Section 1.1.1</p> <p>Section 9.4.2</p> <p>Section 9.4</p> <p>Section 9.4.2</p> <p>Section 9.6</p> <p>Section 9.4.1</p> <p>Section 9.4.2</p> <p>Section 1.4</p>															
C11	<p>The Construction Monitoring Programs must be developed in consultation with the relevant public authorities specified in Table 4. Where an authority’s request(s) has not been included in the Monitoring Program, the Proponent must provide justification to the Planning Secretary as to why it was not included. Details of all information requested by an authority including copies of all correspondence from those authorities, must be provided with the relevant Construction</p>	Section 1.4															

CoA No.	Condition requirements	Document reference
	Monitoring Program.	
C12	The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month before the commencement of construction.	CEMP (main section) Section 1.4
C13	Construction must not commence until the Planning Secretary has approved, or as otherwise agreed by the Planning Secretary, all the required Construction Monitoring Programs , and all relevant baseline data for the specific construction activity has been collected.	CEMP (main section) Section 1.4
C14	The Construction Monitoring Programs , as approved by the Planning Secretary including any minor amendments approved by the ER must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.	CEMP (main section) Section 1.4
C15	<p>The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, and relevant public authorities for information, in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.</p> <p>Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.</p>	Section 9.4
PART E – NOISE AND VIBRATION		
Land Use Survey		
E25	A detailed land use survey must be undertaken to confirm sensitive receivers and land uses (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration, construction ground-borne noise and operational noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area before the commencement of works which generate audible construction or operational noise, or do not meet safe working buffer distances for vibration or ground-borne noise in that area. With the exception of works associated with Bridge 7, the results of the survey must be included in the Noise and Vibration CEMP Sub-plan .	Section 4.1 Appendix D Detailed land use survey Section 1.5 for operational noise Section 7.5.4 for ground-borne noise
Construction Hours		
E26	Work must only be undertaken during the following hours: (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 5:00pm Saturdays; and (c) at no time on Sundays or public holidays.	Section 7.1.1

CoA No.	Condition requirements	Document reference
Variation to Works Hours		
E27	<p>Notwithstanding Conditions E26 and E30, work may be undertaken outside the hours specified, in the following circumstances:</p> <p>(a) for the delivery of materials where required by the NSW Police Force or other authority for safety reasons; or</p> <p>(b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or</p> <p>(c) where different construction hours are permitted or required under an EPL in force in respect of the SSI; or</p> <p>(d) work approved under an Out-of-Hours Work Protocol or an Out of Hours Work Management Process or equivalent (for work not subject to an EPL), under Condition E31;</p> <p>or</p> <p>(e) work that causes:</p> <p>(i) no more than 5 db(A) above the rating background level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009), and</p> <p>(ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses, and</p> <p>(iii) continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006), and</p> <p>(iv) intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006).</p> <p><i>Note: Section 5.24(1)(e) of the EP&A Act requires that an EPL be substantially consistent with this approval.</i></p>	<p>Appendix C</p> <p>Section 7.1.3</p> <p>Appendix C</p> <p>Section 7.1.3</p> <p>Appendix C</p> <p>Section 7.1.3</p> <p>Appendix C</p> <p>Section 7.1.3</p> <p>Appendix C</p> <p>Section 7.1.3</p> <p>Appendix C</p> <p>Section 7.1.3</p>
E28	<p>On becoming aware of the need for emergency work in accordance with Condition E27(b), the Proponent must notify the ER and the EPA of the reasons for such work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive receivers of the</p>	<p>Appendix C</p> <p>Section 7.1.3</p>

CoA No.	Condition requirements	Document reference
	likely impact and duration of those works.	
E29	<p>In order to undertake out-of-hours work, the Proponent must identify appropriate respite periods for the out-of-hours works in consultation with the community at each affected location on a monthly basis. This consultation must include (but not be limited to) providing the community with:</p> <p>(a) a schedule of likely out-of-hours work for a period of no less than three (3) months in advance;</p> <p>(b) potential work, location and duration;</p> <p>(c) proposed respite periods;</p> <p>(d) noise characteristics and likely noise and vibration levels; and</p> <p>(e) likely mitigation and management measures.</p> <p>The outcomes of the community consultation, the identified respite periods and the scheduling of likely out-of-hour work must be provided to the ER, EPA and the Planning Secretary.</p>	<p>Appendix C Chapter 8 mitigation measure ID NVMM1</p> <p>Appendix C Chapter 8 mitigation measure ID NVMM1</p> <p>Appendix C Chapter 8 mitigation measure ID NVMM1</p> <p>Appendix C Chapter 8 mitigation measure ID NVMM1</p> <p>Appendix C Chapter 8 mitigation measure ID NVMM1</p>
Highly Noise Intensive Works		
E30	<p>Except as permitted by an EPL, highly noise intensive works exceeding 75dB(A) $L_{Aeq}(15\text{ minute})$ noise descriptor at a sensitive receiver must only be undertaken:</p> <p>(a) between 8:00 am to 6:00 pm Monday to Friday;</p> <p>(b) between 8:00 am to 5:00 pm Saturday; and</p> <p>(c) if continuously, then not exceeding three (3) hours, with a minimum respite from those activities and works of not less than one (1) hour.</p> <p>For the purposes of this condition, 'continuous' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.</p>	<p>Section 7.1.2 Chapter 8 mitigation measure ID NVMM29</p>
Out-of-Hours Work Protocol – Work not subject to an EPL		
E31	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of work which are outside the hours defined in Condition E26, and that are not subject to an EPL. The Protocol must be approved by the Planning Secretary</p>	<p>NA – The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be</p>

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



CoA No.	Condition requirements	Document reference
	before the commencement of the work. The Protocol must be prepared in consultation with the ER. The Protocol must:	subject to an EPL (Number 21762).
	(a) provide a process for the consideration of out-of-hours work against the relevant noise and vibration criteria, including the determination of low and high-risk activities;	NA – The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be subject to an EPL (Number 21762).
	(b) provide a process for the identification of mitigation measures for residual impacts, including respite periods in consultation with the community at each affected location, consistent with the requirements of Condition E29;	NA – The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be subject to an EPL (Number 21762).
	(c) identify procedures to facilitate the coordination of out-of-hours work permitted by an EPL to ensure appropriate respite is provided;	NA – The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be subject to an EPL (Number 21762).
	(d) undertake a risk analysis that considers the risk of activities, proposed mitigation, management, and coordination, including where: <ul style="list-style-type: none"> (i) low risk activities can be approved by the ER, and (ii) any other activity approved by the Planning Secretary; and 	NA – The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be subject to an EPL (Number 21762).
	(e) identify Department, EPA and community notification arrangements for approved out of hours work, which may be detailed in the Communication Strategy. The Out-of-Hours Work Protocol is not required if the Proponent has an existing Out of Hours Work Management Process or equivalent that addresses Condition E31 (a) to (e) and has been approved by the Planning Secretary prior to the commencement of work.	NA – The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be subject to an EPL (Number 21762).
Utility Coordination and Respite		
E32	All work undertaken for the delivery of the SSI, including that undertaken by third parties (such as utility relocation), must be coordinated to ensure respite periods are provided. The Proponent must: <ul style="list-style-type: none"> (a) schedule any work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with Condition E29; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the ER in support of any decision 	Appendix C Chapter 8 mitigation measure ID NVMM31

CoA No.	Condition requirements	Document reference
	made by the Proponent in relation to respite or mitigation.	
Noise and Vibration Mitigation		
E33	Noise generating work in the vicinity of sensitive receivers and land uses (including community, religious, educational institutions and noise and vibration-sensitive businesses, medical facilities, and the John Hunter Hospital) resulting in noise levels above the NMLs at critical working areas (such as operating theatres and precision laboratories) must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected receivers are made at no cost to the affected receivers.	Section 5.1.2
E34	<p>Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <p>(a) construction ‘Noise affected’ noise management levels established using the <i>Interim Construction Noise Guideline</i> (DECC, 2009);</p> <p>(b) vibration criteria established using the <i>Assessing vibration: a technical guideline</i> (DEC, 2006) (for human exposure);</p> <p>(c) Australian Standard AS 2187.2 - 2006 “<i>Explosives - Storage and Use - Use of Explosives</i>”;</p> <p>(d) BS 7385 Part 2-1993 “<i>Evaluation and measurement for vibration in buildings Part 2</i>” as they are “applicable to Australian conditions”; and</p> <p>(e) The vibration limits set out in the <i>German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures</i> (for structural damage).</p> <p>Any work identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan, including in any Out-of-Hours Work Protocol or Out of Hours Work Management Process or equivalent, required by Condition E31, and in relation to Bridge 7 the documents required by Condition A9.</p> <p><i>Note: The Interim Construction Noise Guideline identifies ‘particularly annoying’ activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.</i></p>	<p>Section 5.2.4</p> <p>Section 7.5</p> <p>Section 1.3 Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.</p> <p>Section 7.5</p> <p>Appendix C Section 7.5</p> <p>Section 9.4.2</p>
E35	<p>Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:</p> <p>(a) evening (6:00 pm to 10:00 pm) — internal $L_{Aeq(15\text{ minute})}$: 40 dB(A); and</p> <p>(b) night (10:00 pm to 7:00 am) — internal $L_{Aeq(15\text{ minute})}$: 35 dB(A).</p>	Section 7.5.4

CoA No.	Condition requirements	Document reference
	<p>The mitigation measures must be outlined in the Noise and Vibration CEMP Sub-plan, including in any Out-of-Hours Work Protocol or Out of Hours Work Management Process or equivalent, required by Condition E31, and in relation to Bridge 7 the documents required by Condition A9.</p>	
E36	<p>Landowner(s) and occupier(s) of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before works that generate vibration commences near those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, landowner(s) and occupier(s) must be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the landowner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Sub-plan, including in any Out-of-Hours Work Protocol or Out of Hours Work Management Process or equivalent, required by Condition E31, and in relation to Bridge 7 the documents required by Condition A9.</p> <p><i>Note: Condition E54 requires Pre-construction Building and Structure Condition Surveys of buildings and structures of risk of damage to be undertaken prior to the commencement of work in the vicinity of the buildings or structures.</i></p>	<p>Appendix C Section 7.5 Section 9.4.2 Chapter 8 mitigation measure ID NVMM38</p>
E37	<p>The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.</p>	Section 9.4.2
Noise Mitigation - Operational Noise Mitigation Measures		
E38	<p>The Proponent must prepare an Operational Noise Mitigation Review (ONMR) to confirm noise mitigation measures that would be implemented for the operation of the SSI. The ONMR must be prepared in consultation with the ER, EPA and the relevant council and must:</p> <ul style="list-style-type: none"> (a) confirm the operational noise predictions based on the final design of the SSI. The operational noise assessment must be based on an appropriately calibrated noise model (which has incorporated additional noise monitoring, and concurrent traffic counting, where necessary for calibration purposes); (b) review the suitability of the operational noise mitigation measures identified in the documents listed in Condition A1. The review must take into consideration the detailed design of the SSI, with the objective of achieving the noise criteria outlined in the NSW Road Noise Policy (DECCW, 2011); (c) where necessary, investigate and identify additional noise mitigation 	Section 1.5

CoA No.	Condition requirements	Document reference
	<p>measures to achieve the noise criteria outlined in the NSW Road Noise Policy (DECCW, 2011)</p> <p>(d) measures to address heavy vehicle compression (engine) braking noise; and</p> <p>(e) procedures for the management of operational noise complaints.</p> <p>The ONMR is to be verified by a suitably qualified and experienced noise and vibration expert and undertaken at the Proponent’s expense. The ONMR must be submitted to the Planning Secretary for approval before the implementation of operational noise mitigation measures.</p> <p>The Proponent must implement the identified noise mitigation measures, and following its approval, make the ONMR publicly available and provide a copy to the EPA and relevant council.</p>	
E39	<p>Operational noise mitigation measures identified in Condition E38 that will not be physically affected by work must be implemented within six (6) months of the commencement of construction in the vicinity of the impacted receiver(s), to minimise construction noise impacts. These measures must be detailed in the Noise and Vibration CEMP Sub-plan.</p>	Section 1.5
E40	<p>Where operational noise mitigation measures are not proposed to be implemented in accordance with Condition E39, the Proponent must submit to the Planning Secretary a report providing justification as to why, along with details of temporary measures that would be implemented to reduce construction noise impacts, until such time that the operational noise mitigation measures identified in Condition E38 are implemented. The report must be endorsed by the ER and submitted to the Planning Secretary within six months of construction commencing.</p>	Section 1.5
E41	<p>Within 12 months of the commencement of operation of the SSI, the Proponent must undertake monitoring of operational noise to compare the actual noise performance of the SSI against the noise performance predicted in the review of noise mitigation measures required by Condition E38.</p> <p>The Proponent must prepare an Operational Noise Compliance Report to document this monitoring. The Report must include, but not necessarily be limited to:</p> <p>(a) noise monitoring to assess compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under Condition E38;</p> <p>(b) a review of the operational noise levels in terms of criteria and noise goals established in the <i>NSW Road Noise Policy</i> (DECCW, 2011);</p> <p>(c) methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which SSI noise levels are ascertained, with specific reference to locations indicative of impacts on</p>	Section 1.5

CoA No.	Condition requirements	Document reference
	<p>receivers;</p> <p>(d) details of any complaints and enquiries received in relation to operational noise generated by the SSI between the date of commencement of operation and the date the report was prepared;</p> <p>(e) any required recalibrations of the noise model taking into consideration factors such as noise monitoring and actual traffic numbers and proportions;</p> <p>(f) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of mitigation measures; and</p> <p>(g) identification of additional measures to those identified in the review of noise mitigation measures required by Condition E38, that are to be implemented with the objective of meeting the criteria outlined in the <i>NSW Road Noise Policy</i> (DECCW, 2011), when these measures is to be implemented and how their effectiveness would be measured and reported to the Planning Secretary and the EPA.</p>	
E42	<p>The Operational Noise Compliance Report must be verified by a suitably qualified and experienced independent noise and vibration expert, made publicly available and submitted to the Planning Secretary and the EPA within 60 days of completing the operational noise monitoring.</p>	Section 1.5
E43	<p>The construction and operation of Bridge 7 and its associated components do not trigger the requirements of Conditions E38, E39, E40 and E41.</p>	<p>NA – Bridge 7 does not form part of the scope of the project as it forms Stage 2 of the overall SSI 6888 and has been completed under a separate contract managed by TfNSW.</p>
Construction Vibration		
E44	<p>The SSI must be delivered with the aim of achieving the following vibration goals:</p> <p>(a) for structural damage to heritage structures, the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration – Part 3 Effects of vibration on structures;</p> <p>(b) for damage to other buildings and/or structures, the vibration limits set out in the British Standard BS 7385-1:1990 – Evaluation and measurement of vibration in buildings—Guide for measurement of vibration and evaluation of their effects on buildings (and referenced in Australian Standard 2187.2 – 2006 Explosives – Storage and use – Use of explosives); and</p> <p>(c) for human exposure, the acceptable vibration values set out in <i>Assessing Vibration: A Technical Guideline</i> (Department of Environment and Conservation, 2006).</p>	Section 5.2.1

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



CoA No.	Condition requirements	Document reference														
E45	<p>Blasting associated with the SSI must only be undertaken during the following hours:</p> <p>(a) 9:00am to 5:00pm, Monday to Friday, inclusive;</p> <p>(b) 9:00am to 1:00pm on Saturday; and</p> <p>(c) at no time on Sunday or public holidays.</p> <p>This condition does not apply in the event of a direction from the NSW Police Force or other relevant authority for safety or emergency reasons to avoid loss of life, property loss and/or to prevent environmental harm.</p> <p>Blasting may be undertaken outside the above hours where:</p> <p>(a) no sensitive receivers would be impacted by blasting; or</p> <p>(b) an agreement has been made with potentially affected receivers.</p>	Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.														
E46	<p>Airblast overpressure generated by blasting associated with the SSI must not exceed the criteria specified in Table 6 when measured at the most affected residence or other sensitive receiver.</p> <p>Table 6: Airblast overpressure limits for human comfort</p> <table border="1"> <thead> <tr> <th>Receiver</th> <th>Type of blasting operations</th> <th>Airblast Overpressure Limit</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Sensitive site</td> <td rowspan="2">Blasting operations lasting more than 12 months or more than 20 blasts</td> <td>115 dBL for 95% of blasts per year</td> </tr> <tr> <td>120 dBL maximum limit</td> </tr> <tr> <td rowspan="2">Sensitive site</td> <td rowspan="2">Blasting operations lasting less than 12 months or less than 20 blasts in total</td> <td>120 dBL for 95% of blasts per year</td> </tr> <tr> <td>125 dBL maximum limit</td> </tr> <tr> <td>Occupied non-sensitive sites, such as factories and commercial premises</td> <td>All blasting</td> <td>125 dBL maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation</td> </tr> </tbody> </table> <p>Source – Table J5.4(A) – AS 2187.2 – 2006</p> <p><i>Note: A sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people</i></p>	Receiver	Type of blasting operations	Airblast Overpressure Limit	Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	115 dBL for 95% of blasts per year	120 dBL maximum limit	Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	120 dBL for 95% of blasts per year	125 dBL maximum limit	Occupied non-sensitive sites, such as factories and commercial premises	All blasting	125 dBL maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation	Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.
Receiver	Type of blasting operations	Airblast Overpressure Limit														
Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	115 dBL for 95% of blasts per year														
		120 dBL maximum limit														
Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	120 dBL for 95% of blasts per year														
		125 dBL maximum limit														
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	125 dBL maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation														

CoA No.	Condition requirements	Document reference																																					
E47	<p>Ground vibration generated by blasting associated with the SSI must not exceed the criteria specified in Table 7 and Table 8 when measured at the most affected residence or other sensitive receiver.</p> <p>Table 7: Ground vibration limits for human comfort</p> <table border="1"> <thead> <tr> <th>Receiver</th> <th>Type of blasting operations</th> <th>Peak component particle velocity (mm/s)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Sensitive site</td> <td rowspan="2">Blasting operations lasting more than 12 months or more than 20 blasts</td> <td>5 mm/s for 95% of blasts per year</td> </tr> <tr> <td>10 mm/s maximum limit</td> </tr> <tr> <td>Sensitive site</td> <td>Blasting operations lasting less than 12 months or less than 20 blasts in total</td> <td>10 mm/s maximum limit</td> </tr> <tr> <td>Occupied non-sensitive sites, such as factories and commercial premises</td> <td>All blasting</td> <td>25 mm/s maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation</td> </tr> </tbody> </table> <p>Source – Table J4.5(A) – AS 2187.2 – 2006</p> <p><i>Note: A sensitive site includes houses and low rise residential buildings, theatres, schools and other similar buildings occupied by people</i></p> <p>Table 8: Ground vibration limits for control of damage to structures</p> <table border="1"> <thead> <tr> <th>Receiver</th> <th>Type of blasting operations</th> <th colspan="2">Peak component particle velocity (mm/s)</th> </tr> </thead> <tbody> <tr> <td>Other structures or architectural elements that include masonry, plaster and plasterboard in their construction¹</td> <td></td> <td>15 mm/s 4 Hz to 15 Hz, except for heritage structures where a frequency dependent vibration criteria would be determined in accordance with AS 2187.2 – 2006.</td> <td>20 mm/s 15 Hz and above</td> </tr> <tr> <td>Reinforced or framed structures. Industrial and heavy commercial buildings²</td> <td>All blasting</td> <td>50 mm/s at 4 Hz and above</td> <td></td> </tr> <tr> <td>Unreinforced or light framed structure. Residential or light commercial type building²</td> <td>All blasting</td> <td>15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz</td> <td>20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above</td> </tr> <tr> <td>Unoccupied structures of reinforced concrete or steel construction</td> <td>All blasting</td> <td colspan="2">100 mm/s maximum, where agreed with the structure owner.</td> </tr> <tr> <td>Infrastructure service structures, such as pipelines, powerlines, cables and reservoirs.</td> <td>All blasting</td> <td colspan="2">Limits to be determined by structural design methodology in consultation with the infrastructure service provider.</td> </tr> </tbody> </table> <p>Source: Table J4.5(B) – AS 2187.2 – 2006 and Table J4.4.2.1 – AS 2187.2 – 2006 (BS 7385-2)</p>	Receiver	Type of blasting operations	Peak component particle velocity (mm/s)	Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	5 mm/s for 95% of blasts per year	10 mm/s maximum limit	Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	10 mm/s maximum limit	Occupied non-sensitive sites, such as factories and commercial premises	All blasting	25 mm/s maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation	Receiver	Type of blasting operations	Peak component particle velocity (mm/s)		Other structures or architectural elements that include masonry, plaster and plasterboard in their construction ¹		15 mm/s 4 Hz to 15 Hz, except for heritage structures where a frequency dependent vibration criteria would be determined in accordance with AS 2187.2 – 2006.	20 mm/s 15 Hz and above	Reinforced or framed structures. Industrial and heavy commercial buildings ²	All blasting	50 mm/s at 4 Hz and above		Unreinforced or light framed structure. Residential or light commercial type building ²	All blasting	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above	Unoccupied structures of reinforced concrete or steel construction	All blasting	100 mm/s maximum, where agreed with the structure owner.		Infrastructure service structures, such as pipelines, powerlines, cables and reservoirs.	All blasting	Limits to be determined by structural design methodology in consultation with the infrastructure service provider.		<p>Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.</p>
Receiver	Type of blasting operations	Peak component particle velocity (mm/s)																																					
Sensitive site	Blasting operations lasting more than 12 months or more than 20 blasts	5 mm/s for 95% of blasts per year																																					
		10 mm/s maximum limit																																					
Sensitive site	Blasting operations lasting less than 12 months or less than 20 blasts in total	10 mm/s maximum limit																																					
Occupied non-sensitive sites, such as factories and commercial premises	All blasting	25 mm/s maximum limit. For sites containing equipment sensitive to vibration, the vibration level should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation																																					
Receiver	Type of blasting operations	Peak component particle velocity (mm/s)																																					
Other structures or architectural elements that include masonry, plaster and plasterboard in their construction ¹		15 mm/s 4 Hz to 15 Hz, except for heritage structures where a frequency dependent vibration criteria would be determined in accordance with AS 2187.2 – 2006.	20 mm/s 15 Hz and above																																				
Reinforced or framed structures. Industrial and heavy commercial buildings ²	All blasting	50 mm/s at 4 Hz and above																																					
Unreinforced or light framed structure. Residential or light commercial type building ²	All blasting	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above																																				
Unoccupied structures of reinforced concrete or steel construction	All blasting	100 mm/s maximum, where agreed with the structure owner.																																					
Infrastructure service structures, such as pipelines, powerlines, cables and reservoirs.	All blasting	Limits to be determined by structural design methodology in consultation with the infrastructure service provider.																																					
E48	<p>The blasting criteria specified in the tables in Conditions E46 and E47 may be exceeded where the Proponent has obtained the written agreement of the landowner and occupier to increase the relevant criteria. In obtaining the agreement, the Proponent must make available to the landowner and occupier:</p> <p>(a) details of the proposed blasting program and justification for the proposed increase in blasting criteria including alternatives considered (where relevant);</p> <p>(b) an assessment of the environmental impacts of the increased blasting criteria on the surrounding environment and most affected residences or other sensitive receivers including, but not limited to noise, vibration and air quality and any risk to surrounding utilities, services or other structures; and</p> <p>(c) details of the blast management, mitigation and monitoring procedures to be implemented.</p>	<p>Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.</p>																																					
E49	<p>The Proponent must provide a copy of the landowner and occupier written agreement to the Planning Secretary and the EPA, including</p>	<p>Blast Management Strategy – to be prepared separately to this</p>																																					

CoA No.	Condition requirements	Document reference
	<p>details of the consultation undertaken (with clear identification of proposed blast limits and potential property impacts), before commencing blasting at the higher limits.</p> <p>Unless otherwise agreed by the Planning Secretary, the following exclusions apply:</p> <p>(a) the landowner and occupier may terminate at any time an agreement made with the Proponent to increase the blasting criteria, should concerns made by the landowner and occupier about the blasting criteria be unresolved. Where an agreement is terminated, the Proponent must not exceed the criteria specified in the tables in Conditions E46 and E47 for future blasting that affects the property; and</p> <p>(b) the blasting limit agreed to under any agreement must not exceed a maximum Peak Particle Velocity vibration level of 25 mm/s or maximum Airblast Overpressure level of 125 dBL.</p>	<p>NVMP before blasting about mid-2023.</p>
Blasting Management Strategy		
E50	<p>A Blast Management Strategy must be prepared and must include:</p> <ul style="list-style-type: none"> (a) sequencing and review of trial blasting to inform blasting; (b) regularity of blasting; (c) intensity of blasting; (d) periods of relief; and (e) blasting program. 	<p>Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.</p>
E51	<p>The Blast Management Strategy must be endorsed by a suitably qualified and experienced independent person.</p>	<p>Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.</p>
E52	<p>The Blast Management Strategy must be prepared in accordance with relevant guidelines in order to ensure that all blasting and associated activities are carried out so as not to generate unacceptable noise and vibration impacts or pose a significant risk to sensitive receivers.</p>	<p>Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.</p>
E53	<p>The Blast Management Strategy must be submitted to the Planning Secretary for information no later than one month before the commencement of blasting. The Strategy as submitted to the Planning Secretary, must be implemented for all blasting activities.</p>	<p>Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.</p>
PART E –SOCIO-ECONOMIC, LAND USE AND PROPERTY		
Building Condition Survey		
E54	<p>Pre-construction Building and Structure Condition Surveys must be undertake of all buildings, structures, and utilities and the like,</p>	<p>Section 7.5.1</p>

CoA No.	Condition requirements	Document reference
	<p>identified in the documents listed in Condition A1, as being at risk of damage from works associated with the SSI.</p> <p>The surveys must be undertaken by a suitably qualified structural engineer before the commencement of any work that could cause damage to buildings, structures and utilities. The results of the surveys must be documented in a Pre-construction Building and Structure Condition Survey Report for each building, structure and utility surveyed. Copies of the Preconstruction Building and Structure Condition Survey Reports must be provided to the owners of the buildings, structures and utilities surveyed no later than one (1) month before the commencement of work in the vicinity of the impacted buildings, structures and utilities.</p>	<p>Section 1.1.1</p> <p>Chapter 8 mitigation measure ID NVMM42</p>
E55	<p>After completion of construction of the SSI, a follow-up condition survey of all items for which building and structure condition surveys were undertaken in accordance with Condition E54, must be undertaken by a suitably qualified structural engineer. The results of the surveys must be documented in a Post-construction Building and Structure Condition Survey Report for each building, structure and utility surveyed. Copies of the Post-construction Building and Structure Condition Survey Reports must be provided to the owners of the buildings, structures and utilities surveyed no later than three months following the completion of construction.</p>	<p>Section 7.5.1</p> <p>Section 1.1.1</p> <p>Chapter 8 mitigation measure ID NVMM43</p>
E56	<p>The Proponent, where liable, must rectify any damage caused directly or indirectly (for example from vibration or from groundwater change) by the construction or operation of the SSI at no cost to the landowner. Alternatively, the Proponent may pay compensation for the property damage as agreed with the landowner.</p>	<p>Section 7.5.1</p>

3.4. Revised environmental management measures

Relevant construction-related REMMs from the Modification 1 Submissions Report are listed in Table 3. A cross reference is also included to indicate where the measure is addressed in this NVMP or other project management documents.

Table 3: Revised environmental management measures relevant to NVMP

ID No.	Revised environmental management measure	Document reference
Noise and vibration		
Operational noise impacts		
NV01	Roads and Maritime will review and update the operational noise model during detailed design to determine the final mitigation scenario. Where required this will include consultation with affected sensitive receivers.	OEMP
NV02	Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario prior to, or as soon as possible during construction, to assist with mitigation of construction noise levels.	Section 1.1 - As at-property treatments work forms part of Stage 1 (early works) as per the RP2J Staging Report and is being managed by TfNSW, it has not been addressed in this Stage 4 NVMP.
NV03	Roads and Maritime will carry out further review of the sensitive non-residential receivers, including those in the John Hunter Hospital precinct, where it has been identified that the internal criteria may be exceeded. This review, including assessment of building materials and monitoring (if required), will determine the transmission loss through the relevant building facades and identify if mitigation is required.	OEMP
NV04	Roads and Maritime will investigate opportunities to further refine grades where possible and assess the need for installation of signage to limit use of compression brakes by heavy vehicles.	OEMP
Vibration impacts (sensitive equipment)		
NV05	Consultation with NSW Health and Hunter New England Local Health District will be carried out to identify the specific construction vibration limits for all sensitive equipment and facilities in the hospital precinct. Appropriate buffer distances will then be established.	Section 1.4 Section 5.2.3 Section 7.5.3
Construction noise and vibration management		
NV06	A construction noise and vibration management plan (CNVMP) will be prepared as part of the construction environmental management plan (CEMP). The plan will include, but not be limited to:	

ID No.	Revised environmental management measure	Document reference
	<ul style="list-style-type: none"> <li>▪ A map indicating the locations of receivers <li>▪ A risk assessment to determine potential risk for activities likely to affect receivers (for activities carried out during standard construction hours, during the proposed extended construction hours and outside of the proposed extended construction hours) <li>▪ Management measures to avoid noise and vibration impacts during construction activities including identification of appropriate work practices and equipment selection and use <li>▪ A process for community notifications regarding construction activities <li>▪ A process for scheduling of high noise and/or vibration generating activities during less sensitive noise periods as far as is possible <li>▪ A process for implementation of respite periods, where required, in accordance with <i>Interim Construction Noise Guideline</i> (DECC 2009) for noise and vibration generating activities with impulsive, tonal or low frequency characteristics <li>▪ A process for assessing the performance of the implemented management measures <li>▪ A program of noise and vibration monitoring for sensitive receivers <li>▪ A process for updating the plan when activities affecting construction noise and vibration change. Identify in inductions and where required toolbox talks where noise and vibration management is required. 	<p>Figure 4: Noise catchment areas and baseline noise logger locations</p> <p>Section 7.4 Section 7.5</p> <p>Table 33: Noise and vibration mitigation measures</p> <p>Table 33: Noise and vibration mitigation measures Community Communication Strategy (CCS)</p> <p>Section 7.1.2 Table 33: Noise and vibration mitigation measures</p> <p>Table 33: Noise and vibration mitigation measures</p> <p>Section 10</p> <p>Section 9.4</p> <p>Section 10 Section 9.2</p>
NV07	<p>An out of hours work procedure (for work outside the proposed extended construction hours) will be developed and would include the following:</p> <ul style="list-style-type: none"> <li>▪ Contact the local community potentially affected by the proposed work and inform them by letter of the proposed work, location, type of work, days and dates of work and hours involved. The contact will be made before the start of work <li>▪ A suitable advertisement will be placed in local papers including a reference to night-time noise impacts <li>▪ A 24-hour community liaison phone number and permanent site contact will be provided so that complaints can be received and addressed in a timely manner <li>▪ Measures to investigate and respond to any valid noise complaints. 	<p>Appendix C</p> <p>Chapter 8 mitigation measure ID NVMM17 Appendix C</p> <p>Section 7.1.3</p> <p>Appendix C Section 9.3</p> <p>Appendix C Section 9.4</p>

ID No.	Revised environmental management measure	Document reference
Construction vibration impacts		
NV08	Building condition surveys will be conducted at receivers (as required) within 18 metres of proposed vibration generating activities (buildings and other structures).	Section 7.5.1 Chapter 8 mitigation measure ID NVMM42, NVMM44
NV09	Notification of the proposed construction activities by letterbox drop will be carried out for all occupied buildings within 18 metres of vibration generating activities.	Chapter 8 mitigation measure ID NVMM38
NV10	Where construction work will be located within 18 metres of any buildings vibration monitoring will be carried out at the beginning of the given construction activity. Where measurements indicate building damage criteria are exceeded, vibration generating activities are to immediately halt and alternative low-vibration work practices will be investigated and implemented.	Chapter 8 mitigation measure ID NVMM40 Section 9.4.2
NV11	A documented review will be carried out to determine if alternative methods can be implemented, where construction activity involving vibration intensive plant occurs: <ul style="list-style-type: none"> ▪ Within 18 metres of buildings ▪ Within the sensitive equipment buffer distances ▪ Or if any monitoring indicates levels are excessive. 	Chapter 8 mitigation measure ID NVMM40
Construction vibration impacts - John Hunter Hospital precinct		
NV12	Construction buffer distances and potential additional mitigation measures identified during detailed design will be implemented in relation to sensitive equipment, standard buildings and heritage buildings in the John Hunter Hospital precinct.	Chapter 8 mitigation measure ID NVMM34 Section 7.5
Construction noise impacts		
NV13	Where practical, equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate silencers and be in good working order. Machines found to produce excessive noise compared to normal industry expectations will be removed from the site or stood down until repairs or modifications can be made.	Chapter 8 mitigation measure ID NVMM12, NVMM14, NVMM18
NV14	Where reasonable and feasible, measures will be taken to shield sensitive receivers from noise such as: <ul style="list-style-type: none"> ▪ The layout of the construction compound so that primary noise sources are at a maximum distance from residences, with solid structures (sheds, containers, etc.) placed between residences and noise sources (and as close to the noise sources as is practical). ▪ Enclosures to shield fixed noise sources such as pumps, compressors, fans, screens (where practicable). ▪ Taking advantage of site topography when siting plant. 	Chapter 8 mitigation measure ID NVMM6, NVMM12, NVMM13, NVMM19, NVMM20, NVMM24

ID No.	Revised environmental management measure	Document reference
Construction noise and vibration complaints handling		
NV15	In the event of a valid noise complaint, monitoring will be carried out and reported as soon as possible. If exceedances are detected, the situation will be reviewed to attempt to identify reduce the impact to acceptable levels, where practicable.	Section 9.4.1 Section 6.2.3 of CEMP
Blasting overpressure and ground vibration impacts		
NV16	<p>If blasting is to be carried out, a detailed blasting assessment will be carried out in consultation with NSW Health Infrastructure and Hunter New England Local Health District. The assessment will be prepared with reference to the human comfort, sensitive equipment and structural damage criteria for all receivers including residential receivers and receivers located in the John Hunter Hospital precinct.</p> <p>The assessment will be carried out by a suitably qualified and experienced blast consultant/contractor and determine the allowable blast sizes based on-site specific conditions and may include carrying out test blasts (or equivalent method). The assessment will identify all relevant requirements to be incorporated into a blasting management plan for the construction phase to ensure the relevant criteria can be met.</p>	Blast Management Strategy – to be prepared separately to this NVMP before blasting about mid-2023.
Operational noise impacts		
NV17	<p>To confirm the findings of the operational noise assessment a post-construction noise monitoring program (including simultaneous traffic counts) will be carried out within 12 months of project opening once traffic flows have stabilised. Monitoring locations will be selected along the project at/near the monitoring locations carried out in this assessment.</p> <p>A review of L_{Amax} events including heavy vehicle engine (compression) braking will be included in the post-construction noise assessment.</p>	Section 9.4 OEMP

4. Existing environment

This Chapter provides a brief summary of what is known about noise and vibration within and adjacent to the project based on information provided in the EIS Technical Paper 3 – Noise and Vibration Assessment as amended by the documents listed in CoA A1.

4.1. Sensitive receivers

Noise and vibration sensitive receivers (NVSRs) are defined by the type of occupancy within the structure and the activities performed within the property boundary. NVSRs could include the following:

- Sensitive receivers (residential)
- Sensitive receivers (non-residential) – includes recreation areas, educational facilities (e.g. schools), childcare facilities, places of worship (churches), health facilities (e.g. hospitals) and community facilities (e.g. community halls)
- Commercial/industrial receivers – places of business, motels and other accommodation facilities, shops and industrial facilities.

A detailed land use survey has been undertaken to confirm the sensitive receivers and landuses potentially exposed to noise and vibration from the project. The detailed survey was conducted through the EIS process, it was subsequently revised through the SPIR. An additional review was undertaken during the detailed design phase to capture additional receivers which consisted of a desktop assessment of existing receivers followed by a ground truthing exercise to provide confirmation of the receivers.

A total of 3129 sensitive (residential and non-residential receivers) and commercial/industrial receivers have been identified in the study area. All medical, educational and places of worship sensitive receivers are also summarised in Table 4.

The results of the detailed land use survey are contained in Appendix D.

Table 4: Medical, educational and places of worship sensitive receivers

Receiver ID	Receiver Type	Address	NCA
R0359_CCF	Jesmond Early Education Centre	Fraser Street, Jesmond	NCA1
R0463_REA	Heaton Birmingham Gardens Bowling Club	48 Mordue Parade, Jesmond	
R0488_CMU	Jesmond Neighbourhood Centre	44 Mordue Parade, Jesmond	
R0427_CCF	Jesmond Community Preschool	Janet Street, Jesmond	NCA2
R0001_WOR	St Pauls Anglican Church	28 Naughton Avenue, Birmingham Gardens	
R0307_EDU	Heaton Primary School	Janet Street, Jesmond	
R0441_EDU	Callahan College	Janet Street, Jesmond	NCA3
R0841_EDU	Jesmond Public School	Ralph Street, Jesmond	
R1511_WOR	Jesmond Park Uniting Church	Coles Street, Jesmond	NCA5
R1514_WOR	St Margret's Anglican Church	Newcastle Road, Jesmond	

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Receiver ID	Receiver Type	Address	NCA
R1975_EDU	Lambton Public School	Croudace Street, Lambton	NCA8
R2611_CCF	Cambridge Hills Preschool	Elbrook Drive, Rankin Park	NCA10
R2831_EDU	New Lambton Heights Infants School	Lookout Road, New Lambton Heights	NCA12
R2418_HTH	Hunter Medical Research Institute	1 Kookaburra Circuit, New Lambton Heights	NCA14
R2429_HTH	Hunter Medical Research Institute	1 Kookaburra Circuit, New Lambton Heights	
R2430_HTH	Yallarwah Place	Kookaburra Circuit, New Lambton Heights	
R2431_HTH	John Hunter Hospital SSU	Kookaburra Circuit, New Lambton Heights	
R2440_HTH	Forensic Medicine	Kookaburra Circuit, New Lambton Heights	
R2441_HTH	Forensic Medicine	Kookaburra Circuit, New Lambton Heights	
R2468_HTH	John Hunter Hospital, main building	Kookaburra Circuit, New Lambton Heights	
R2473_HTH	Hunter Rehab	Lodge Drive, New Lambton Heights	
R2475_HTH	John Hunter Hospital, main building	Kookaburra Circuit, New Lambton Heights	
R2480_HTH	Newcastle Private Hospital	Tea House Road, New Lambton Heights	
R2482_HTH	Newcastle Private Hospital	Tea House Road, New Lambton Heights	
R2489_HTH	Newcastle Private Hospital	Tea House Road, New Lambton Heights	
R2498_HTH	Newcastle Private Hospital	Tea House Road, New Lambton Heights	
R2505_HTH	John Hunter Hospital	Kookaburra Circuit, New Lambton Heights	

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Receiver ID	Receiver Type	Address	NCA
R2507_HTH	Newcastle Private Specialist Centre	Tea House Road, New Lambton Heights	
R2537_HTH	Rankin Park Unit	Jacaranda Drive, New Lambton Heights	
R2542_HTH	Hunter Prosthetics & Orthotics Service	Jacaranda Drive, New Lambton Heights	
R2550_HTH	Byrne House	Byrne Hall Drive, New Lambton Heights	
R2570_HTH	Area Administration Building	Byrne Hall Drive, New Lambton Heights	
F0001_REA	Wallsend Brickworks Park	Iranda Grove, Wallsend	n/a
F0002_REA	Jesmond Park	Newcastle Road, Jesmond	
F0003_REA	Rudd Park	Rudd Street, Lambton	
F0004_REA	Heaton Park	Mordue Parade, Jesmond	
F0005_REA	Sygn Close Reserve	Sygn Close, Rankin Park	
F0006_REA	George McGregor Park	Cambridge Drive, Rankin Park	
F0007_REA	Blackbutt Reserve	Carnley Avenue, New Lambton	
F0008_REA	Dangerfield Drive Reserve	Dangerfield Drive, Elmore Vale	
F0009_REA	Whitegates Reserve	Davis Avenue, Wallsend	
F0010_REA	Lewis Oval	Mitchell Street, New Lambton	
F0011_REA	Ceres Close Reserve	Ceres Close, Elmore Vale	
F0012_REA	New Lambton Heights Reserve	Lookout Road, New Lambton Heights	
F0013_REA	Roberts Park	Lookout Road, New Lambton Heights	
F0014_REA	Bricho Park	Lookout Road, New Lambton Heights	

Receiver ID	Receiver Type	Address	NCA
R3114_WOR	Newcastle Intercessory Prayer Fellowship	Fraser Street, Jesmond	NCA1
R3115_CCF	Possum Place Child Care Centre	Lookout Road, New Lambton Heights	NCA14

4.1.1. Critical working areas

Due to the presence of sensitive equipment within the John Hunter Hospital precinct, the following areas are considered vibration sensitive and hence ‘critical working areas’ under CoA E25:

- John Hunter Hospital Main Building
 - Level 2 Audiology (refer to Figure 1)
 - Level 2 Sleep Lab (refer to Figure 1)
 - Level 2 Allied Health – Speech Pathology (refer to Figure 1)
 - Level 2 Emergency Department – Medical Imaging (refer to Figure 1)
 - Level 2 Medical Imaging (refer to Figure 1)
 - Level 2 Nexus Child and Adolescent Mental Health Unit (NEXUS) (refer to Figure 1)
 - Level 2 Hunter Area Pathology Service (HAPS) (refer to Figure 1)
 - Level 3 Theatres (refer to Figure 2)
- Hunter Medical Research Institute (HMRI) Building (refer to Figure 3)
- Forensic Medicine (refer to Figure 3)

Also refer to Section 5.1.2 which explains the relevance of critical working areas in the context of CoA E33.

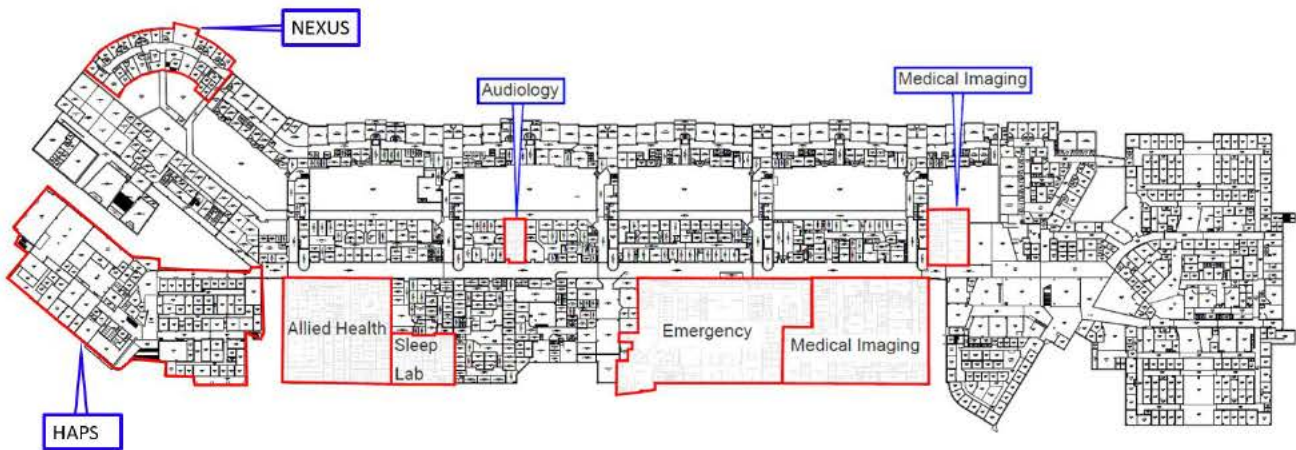


Figure 1: Critical working areas - John Hunter Hospital Main Building – Level 2

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)

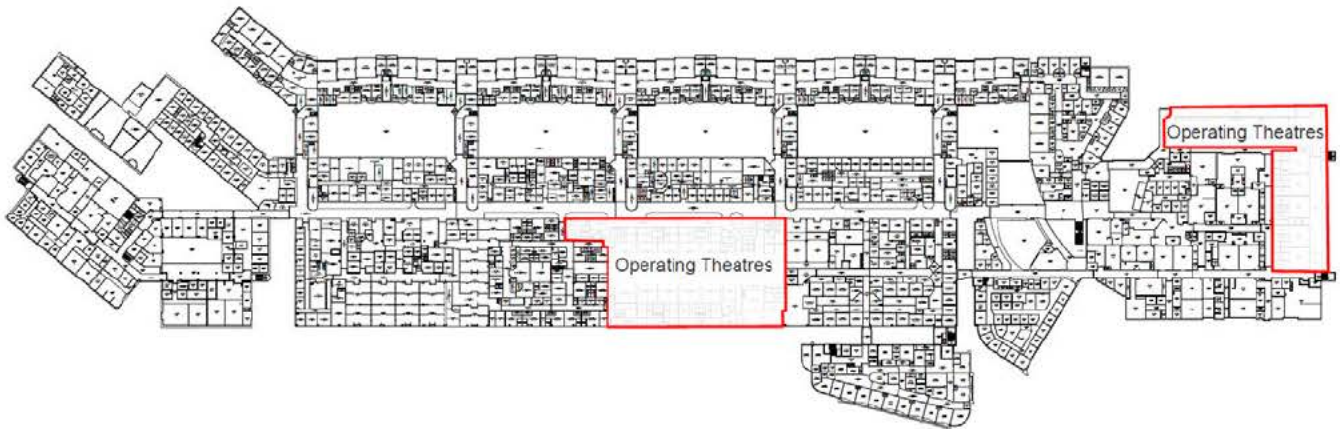


Figure 2: Critical working areas - John Hunter Hospital Main Building – Level 3

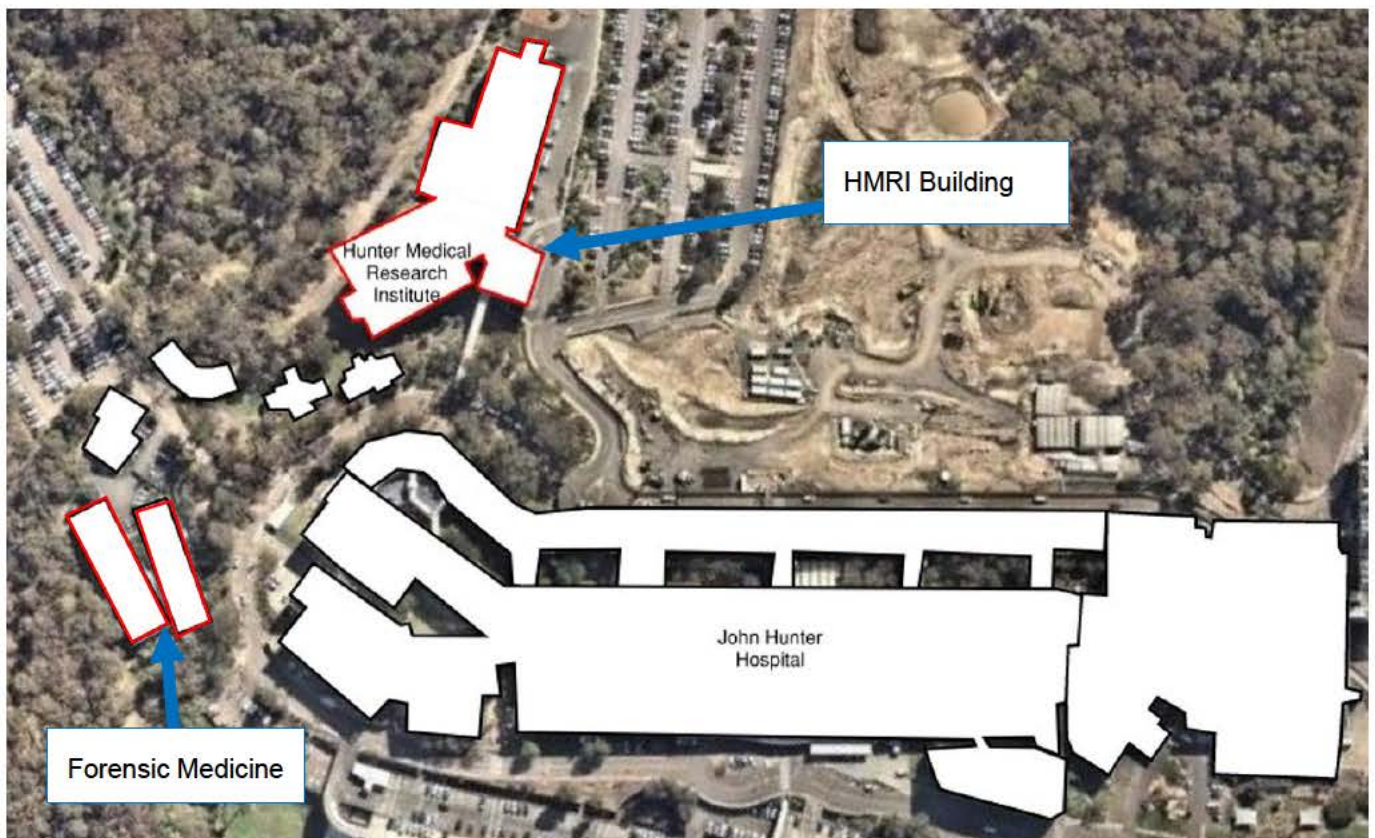


Figure 3: Critical working areas – HMRI Building, Forensic Medicine

4.2. Noise catchment areas

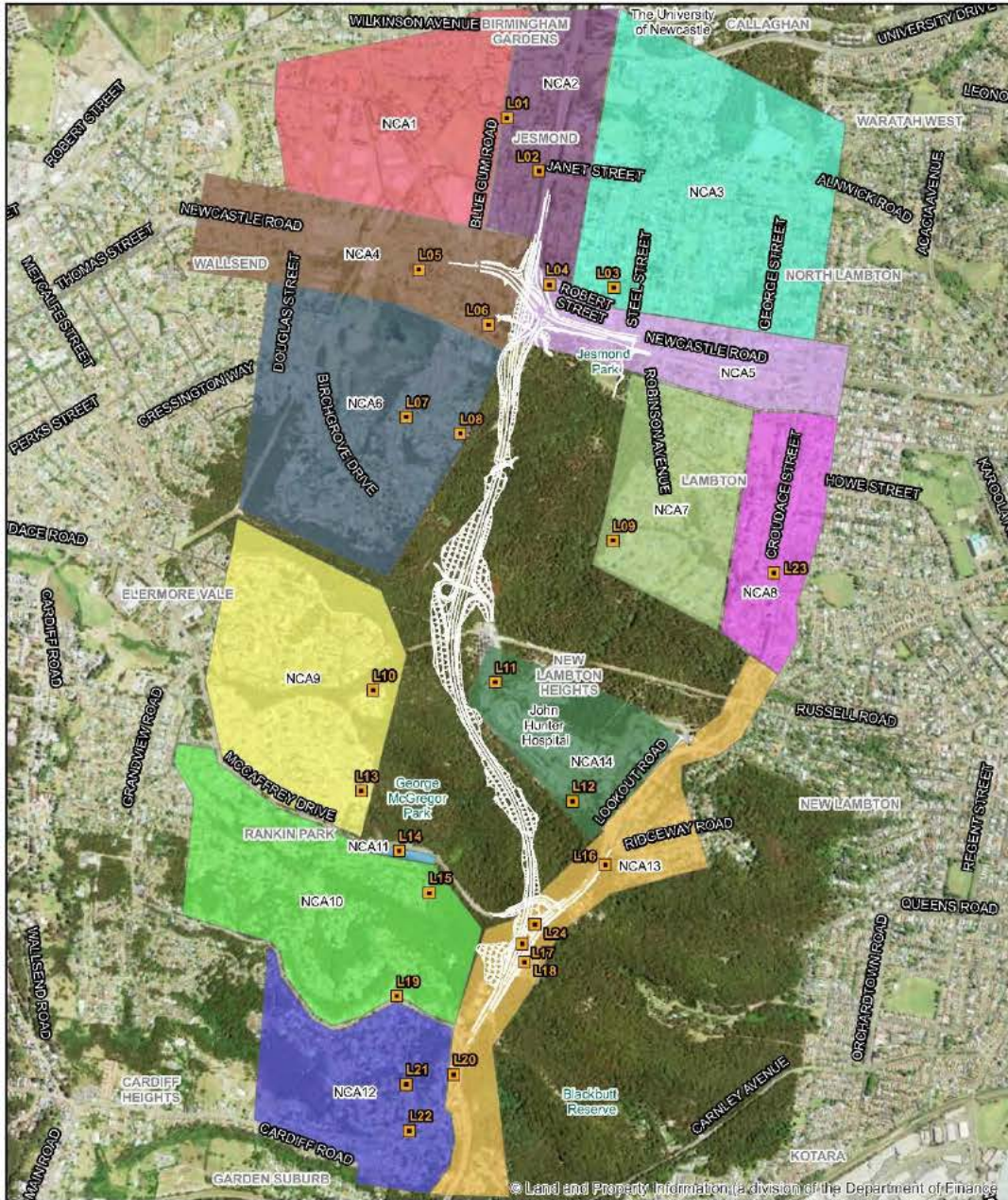
The study has been sub-divided into fourteen noise catchment areas (NCAs). These NCAs have been created based on the ambient noise characteristics with respect to the major roads. The following NCAs were created:

- NCA 1: Receivers located west of Blue Gum Road in the suburb of Jesmond. The nearest receivers are about 150 metres north of Newcastle Road.
- NCA 2: Receivers located next to the existing Jesmond to Shortland section of the Newcastle Inner City Bypass. The nearest receivers are about 20 metres from the existing bypass section. This area is bounded by Blue Gum Road to the west and Ralph Street to the east in the suburbs of Jesmond and New Lambton. The existing noise environment is dominated by traffic on the existing bypass and Newcastle Road.
- NCA 3: This area is to the east of Ralph Street and north of Robert Street in the suburb of North Lambton. The nearest receivers are about 130 metres to the north of Newcastle Road and 150 metres east of the Jesmond to Shortland section of the Newcastle Inner City Bypass.
- NCA 4: Receivers located along Newcastle Road to the west of the existing Jesmond roundabout. The existing noise environment is dominated by traffic on Newcastle Road.
- NCA 5: Receivers located along Newcastle Road to the east of the existing Jesmond roundabout. The existing noise environment is dominated by traffic on Newcastle Road.
- NCA 6: This area includes receivers south-west of the existing Jesmond roundabout on Newcastle Road. It includes receivers around Birchgrove Drive and south of Victory Parade in the suburb of Wallsend. The nearest receivers are about 200 metres to the south of Newcastle Road.
- NCA 7: This area includes receivers to the south of Newcastle Road to the east of the existing Jesmond roundabout. It includes receivers in Robinson Avenue, Drysdale Drive, Roberts Circuit and other local roads west of Pangari Place in the suburb of Lambton. The nearest receivers are about 120 metres to the south of Newcastle Road.
- NCA 8: This area includes receivers along Croudace Street. It is bounded by Mirral Crescent to the south and De Vitre Street and Carlton Street to the north.
- NCA 9: This area includes receivers to the west of the project and north of McCaffrey Drive. It includes residences in Dangerfield Drive and Cambridge Drive in the suburbs of Elernmore Vale and Rankin Park.
- NCA 10: Receivers located to the west of Lookout Road and bounded by McCaffrey Drive to the north and Grandview Drive to the south in the suburb of Rankin Park.
- NCA 11: This area includes receivers on McCaffrey Drive to the east of Elbrook Drive in the suburb of Rankin Park. The existing noise environment is dominated by traffic on McCaffrey Drive.
- NCA 12: Receivers located to the west of Lookout Road and between Grandview Drive and Cardiff Road in the suburbs of New Lambton and Cardiff Heights. The nearest receivers are about 70 metres from Lookout Road.
- NCA13: Receivers located along Lookout Road between Cardiff Road and Florida Avenue/Mirral Crescent, in the suburb of New Lambton Heights. The existing noise environment is dominated by traffic on Lookout Road.
- NCA 14: This area comprises the John Hunter Hospital Precinct.

Figure 4 shows the noise catchment areas.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



LEGEND

	Design		Noise logger location		NCA4		NCA6		NCA12
	NCA1		NCA5		NCA9		NCA10		NCA13
	NCA2		NCA6		NCA11		NCA14		
	NCA3		NCA7		NCA8				



Rankin Park to Jesmond

Figure 6-5 Noise catchment areas

G:\2\1760\GIS\Map\3\Submissions\Report\021706_C108_S1021_NoiseCatchments_01.mxd
 Data source: Basemap: Aerial Imagery, 2016/03/31; Arcswat: Design / cydemaps / toolpaths, 2016; LPI: D100, 2012.

Figure 4: Noise catchment areas and baseline noise logger locations

4.3. Background noise and vibration monitoring

Existing ambient and background noise monitoring was undertaken at several locations in the study area between 5 June 2015 and 26 June 2015. A minimum of two weeks of monitoring was carried out at each location. The objectives of the monitoring were to:

- Determine the existing ambient and background noise levels across each noise catchment area.
- Derive construction noise management levels and operational road traffic noise criteria to be applied to the assessment of the project.
- Validate noise models used in the assessment of the project.

Baseline logger location considerations included land topography and contributions from other noise activities, such as road noise. The logger locations were considered representative of the existing background and ambient noise environment in the study area.

Unattended noise monitoring was conducted using calibrated Type 1 SVAN 955 and SVAN 977 environmental noise loggers. These loggers are capable of measuring continuous sound pressure levels and are able to record L_{A90} , L_{A10} , L_{Aeq} , L_{Amax} and L_{Amin} noise descriptors. The instruments were programmed to accumulate environmental noise data continuously over sampling periods of 15 minutes for the entire monitoring period.

Pre-measurement calibration checks were performed on the noise monitoring equipment using a Bruel and Kjaer 4231 sound level calibrator (serial number 2542101) with a sound pressure level of 94 dB(A) at one kilohertz (kHz). At completion of the measurements, the meter's calibration was re-checked to ensure that the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable variation of less than one dB.

The data collected by the loggers was downloaded and analysed, and any invalid data removed. Invalid data generally refers to periods where average wind speeds were greater than five metres per second at ground level or when rainfall occurred in accordance with the NSW EPQ Industrial Noise Policy 2000 (INP) (replaced by NPI). Concurrent weather data for every 15 minutes for the entire monitoring period was sourced from the Newcastle Nobbys Bureau of Meteorology automatic weather station about 10 kilometres to the east of the site.

All sampling activities were carried out with consideration to the specifications outlined in AS 1055 *Acoustics–Description and Measurement of Environmental Noise* and the NPI.

No background monitoring was undertaken as part of the EIS to determine baseline/ existing ambient vibration levels and therefore, baseline vibration data is not available as at the date of Revision 6 of this NVMP. Notwithstanding, background monitoring will be undertaken during construction to confirm baseline/ existing ambient vibration levels as identified in Section 9.4.2.

4.3.1. Summary of baseline noise

A summary of the calculated background L_{A90} (day, evening and night) noise levels, ambient L_{Aeq} (day, evening and night) noise levels and descriptors for the monitoring period at the unattended logger locations with invalid weather affected data removed are provided in Table 5. Day ($L_{Aeq(15hr)}$) and night ($L_{Aeq(9hr)}$) road traffic noise levels have been included only for the logger locations deployed for the purpose of measuring traffic noise. Detailed noise monitoring tables and charts are provided in the EIS (page 35 to 39).

This baseline data is deemed sufficient and therefore, no further baseline data is required.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 5: Summary of baseline noise monitoring

Noise monitoring location ID	Address	Rating background level (RBL)			Ambient noise levels, $L_{Aeq}(\text{period})$					Ambient noise observations
		Day	Evening	Night	Day	Evening	Night	Day (15 hour)	Night (9 hour)	
L01	77 Blue Gum Road	45	39	33	60	57	57	60	51	Road traffic on Blue Gum Road/trucks
L02	18 Janet Street	49	43	35	59	55	51	58	52	Road traffic on Janet Street/distant road traffic/helicopter
L03	16 Shereline Avenue	37	37	30	56	43	43			Birds/local traffic/residential sounds/distant road traffic
L04	53 Robert Street	55	51	41	61	62	55			Road traffic/car horns/truck engine accelerating
L05	4 Crest Road	47	46	36	58	57	56	62	56	Road traffic/dog barking near microphone/cockatoos in yard
L06	11 Myall Street	46	44	35	54	55	55	58	54	Road traffic at roundabout/neighbour using power tools
L07	110 Birchgrove Drive	38	35	30	56	53	50	53	48	Local road traffic/bus/residential sounds/distant road traffic
L08	17 Minimbah Street	33	37	29	50	44	43			Residential sounds/birds/distant road traffic
L09	40 Roberts Circuit	39	36	34	67	50	57			Power tools next door/voices/hammering next

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Noise monitoring location ID	Address	Rating background level (RBL)			Ambient noise levels, $L_{Aeq(periode)}$					Ambient noise observations	
											door/residential sounds/distant road traffic
L10	12 Sygna Close	34	34	29	53	47	51				Loud music/birds/distant road traffic/distant road tyre noise/residential sounds/birds
L11	Yallarwah Cottage	38	37	35	51	43	45				Birds/cars in car park/air conditioner fans
L12	Ronald McDonald House	42	40	35	59	53	55				Construction noise/distant road traffic/birds
L13	15 Cambridge Drive	35	32	25	52	47	43				Residential sounds/birds/McCaffrey Drive road traffic
L14	319 McCaffrey Drive	50	42	33	67	64	60	67	60		Road traffic/trucks
L15	45 Kingsway Avenue	38	35	26	52	55	41				Nearby voices/McCaffrey Drive road traffic/birds/distant chainsaw/McCaffrey Drive road traffic/birds
L16	71 Lookout Road	57	53	37	68	67	63	67	63		Road traffic/trucks
L17	110 Lookout Road	59	50	33	68	66	63	68	63		Road traffic/motorbike/arborists across road
L18	121 Lookout Road	56	49	34	66	63	60	66	60		Road traffic/buses/trucks

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Noise monitoring location ID	Address	Rating background level (RBL)			Ambient noise levels, $L_{Aeq}(\text{period})$					Ambient noise observations
L19	32 Grandview Road	38	36	28	57	53	48	57	48	Road traffic/domestic noises/dog/birds
L20	180 Lookout Road	60	56	35	68	66	64	68	64	Road traffic/motorbike/garbage truck/trucks
L21	27A Marshall Street	36	36	27	58	51	48	57	48	Local traffic/neighbors talking/dogs barking/schoolchildren's voices
L22	28 Cardiff Road	48	42	31	66	62	58	66	59	Road traffic/trucks/buses/birds/residential noises
L23	86 Croudace Street	52	48	33	67	65	65	67	62	Road traffic/trucks/ambulance siren
L24	100 Lookout Road	62	55	35	70	68	66	69	65	Road traffic/truck breaking/truck air release

Note 1: For the rating background and ambient noise levels, the periods are defined as per the NPI (EPA, 2017):

- Day: the period from 7.00 am to 6.00 pm Monday to Saturday or 8.00 am to 6.00 pm on Sundays and public holidays
- Evening: the period from 6.00 pm to 10.00 pm
- Night: the remaining periods.

For the fifteen hour and nine hour noise levels, as per the NSW Road Noise Policy (RNP) (DECCW, 2011), day refers to the 7.00 am to 10.00 pm time period while night refers to 10.00 pm to 7.00 am

5. Construction noise and vibration criteria

The construction noise and vibration criteria for the project are outlined in this section. The criteria are referenced to the relevant noise and vibration guidelines. The predicted noise and vibration levels (refer to Section 7.4 and 7.5) are compared with the criteria outlined in this section. If the predicted construction noise and vibration levels exceed the criteria, potential noise and vibration mitigation measures need to be considered.

5.1. Noise criteria

The *Interim Construction Noise Guideline* (ICNG) (DECC 2009) applies to the management of construction noise in NSW. The guideline provides recommendations on construction noise management levels (NMLs) and standard construction periods.

5.1.1. Construction working hours

The standard construction hours as defined in CoA E26 and OOHW periods are provided in Table 6.

Table 6: Construction working hours

Construction hours	Monday to Friday	Saturday	Sunday/Public holiday
Standard hours	7.00 am to 6.00 pm	8.00 am to 5.00 pm	No work
OOHW Period 1 (Day)	-	7.00 am to 8.00 am 5.00 pm to 6.00 pm	8.00 am to 6.00 pm
OOHW Period 1 (Evening)	6.00 pm to 10.00 pm	6.00 pm to 10.00 pm	-
OOHW Period 2 (Night)	10.00 pm to 7.00 am	10.00 pm to 7.00 am	6.00 pm to 8.00 am

The standard hours for construction periods are not mandatory and the ICNG acknowledges that some activities can be carried out outside standard construction hours, assuming that all reasonable and feasible mitigation measures are implemented to minimise impacts on the surrounding sensitive land uses. These activities may include the following:

- the delivery of oversized plant or structures that police or other authorities determine are required for special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard construction hours
- work where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.

5.1.2. Construction noise management levels (NMLs)

Construction NMLs at sensitive residential receivers are provided in Table 7. Construction NMLs at non-residential receivers are provided in Table 8.

The construction NMLs during recommended standard hours represent a noise level that, if exceeded, would require management measures including the following:

- reasonable and feasible work practices
- contact with residences to inform them of the nature of works to be carried out, the expected noise levels and durations and contact details.

The management measures aim to reduce noise impacts on the residential receivers; however, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level. The construction NMLs during recommended standard hours are not intended as a noise limit but rather a level where noise management is required.

CoA E33 requires that noise generating work in the vicinity of sensitive receivers and land uses resulting in noise levels above the NMLs at critical working areas (refer to Section 4.1.1) must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected receivers are made at no cost to the affected receivers. Given the various critical working areas within the John Hunter Hospital precinct (refer to Section 4.1.1), the ‘sensitive periods’ and ‘other reasonable arrangements’ will be made on a case by case basis in consultation with Health Administration Corporation at no cost to Health Administration Corporation.

Table 7: Noise management levels (NMLs) for residential land uses (ICNG)

Time of day	Noise Management Level, $L_{Aeq(15-minute)}$ *	How to apply
Recommended standard hours: 7 am to 6 pm, Monday to Friday 8 am to 5 pm, Saturday	Noise affected RBL +10 dB(A)	May be some community reaction to noise. Actions: Where the predicted or measured construction noise level exceeds the noise-affected level, all feasible and reasonable work practices should be applied to meet the noise affected level. All residents potentially impacted by the works should be informed of the nature of the works, the expected noise levels and duration, and provided with site contact details.
	Highly noise affected >= 75 dB(A)	May be strong community reaction to noise. Actions: Where construction noise is predicted or measured to be above the highly noise affected level, the relevant authority may require respite periods that restrict the hours that the very noisy activities can occur. Respite activities would be determined taking into account times identified by the community when they are less sensitive to noise, and if the community is prepared to accept a longer period of construction to accommodate respite periods.
Outside recommended standard hours (OOHW)	Noise affected RBL + 5 dB(A)	Actions: Strong justification typically required for these works. All feasible and reasonable work practices should be adopted to meet the noise affected level. Where all feasible and reasonable work practices have been adopted and noise level is more than 5 dB(A) above the noise affected NML, negotiation should be undertaken with the community.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 8: Noise management levels (NMLs) for other land uses (ICNG)

Land use	Noise management level, $L_{Aeq(15\text{-minute})}$ ¹
Industrial	External noise level – 75 dB(A)
Commercial	External noise level – 70 dB(A)
Classrooms at schools and other educational institutions	Internal noise level – 45 dB(A)
Hospital wards and operating theatres	Internal noise level – 45 dB(A)
Places of worship	Internal noise level – 45 dB(A)
Active recreation areas (characterised by sporting activities and activities that generate their own noise or focus for participants, making them less sensitive to external noise intrusion).	External noise level – 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (i.e. reading and meditation).	External noise level – 60 dB(A)
Community centres	Dependent on the intended use. Refer to the recommended ‘maximum’ internal levels in AS/NZS 2107.

(1) Applies when premises are in use.

5.1.3. Modifying factor adjustments for annoying activities

The ICNG lists a number of activities that have proven to be particularly annoying to sensitive receptors, including the following:

- use of ‘beeper’ style reversing or movement alarms, particularly at night-time
- use of power saws, such as used for cutting timber, masonry, road pavement or steel work
- grinding metal, concrete or masonry
- rock drilling
- line drilling
- vibratory rolling
- bitumen milling or profiling
- jackhammering, rock hammering or rock breaking
- impact piling.

These activities, where required, have been factored into the assessment by adding 5 dB to the predicted noise levels. Refer to Appendix A Table 37.

5.1.4. Sleep disturbance criteria during construction

The sleep disturbance criteria is only relevant to night time construction works. The ICNG recommends that where construction works are planned to extend over two or more consecutive nights, the project should consider maximum noise levels and the extent and frequency of maximum noise level events exceeding the RBL. The potential for both sleep disturbance and awakenings should be considered in the assessment.

The NPI provides the latest Environmental Protection Authority (EPA) guidance for the assessment of sleep disturbance.

As stated in the NPI the potential for sleep disturbance from maximum noise level events (such as material drop noise) generated by construction works during the night-time period needs to be considered. The term “sleep disturbance” is considered to be both awakenings and disturbance to sleep stages.

To evaluate potential sleep disturbance or awakening issues associated with the operation the NPI screening method has been adapted as follows. There is limited potential for sleep disturbance or awakening issues to occur, where:

- The predicted project night-time noise level ($L_{eq, 15 \text{ minute}}$ in dB(A)) at any residential receptor remains below 40 dB(A) (or the prevailing night-time RBL plus 5 dB(A)), whichever is the greater.
- The predicted project night-time noise level (L_{Amax} in dB(A)) at any residential receptor remains below 52 dB(A) (or the prevailing night-time RBL plus 15 dB(A)), whichever is the greater.

A detailed maximum noise level assessment should be carried out if the screening test indicates there is a potential for sleep disturbance. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the maximum noise screening levels.

5.1.5. Construction traffic

Construction traffic relates to light and heavy vehicle movements associated with travel to-and-from construction compounds, transporting construction materials and spoil along defined haulage routes as well as personnel travelling to and from construction sites.

Construction related traffic noise objectives are based on the Road Noise Policy (RNP) (DECCW, 2011). The RNP states that an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

The RNP states that any increase in the total traffic noise level should be limited to 2 dB above the existing road traffic noise levels. This applies for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments.

The RNP has been used to identify potential impacts as a result of noise produced by construction traffic. If road traffic noise increases due to construction works within 2 dBA of current levels, then the RNP objectives would be met and no specific mitigation measures required.

Where construction traffic increases the existing road traffic noise levels by more than 2 dBA, then further assessment against the road traffic noise criteria in Table 9 is required.

Table 9: Construction traffic noise criteria (NSW Road Noise Policy)

Type of development	Day 7.00 am to 10.00 pm	Night 10.00 pm to 7.00 am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{Aeq}(15 \text{ hour})$	55 $L_{Aeq}(9 \text{ hour})$
Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{Aeq}(1 \text{ hour})$	50 $L_{Aeq}(1 \text{ hour})$

5.1.6. Project construction noise criteria

A summary of the project construction NMLs for each identified sensitive receiver type is provided in Table 10 for residential receivers and Table 11 for non-residential receivers (within the study area). The NMLs have been calculated based on the RBLs provided in Table 5 and the calculation procedure outlined in Table 7. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Table 10: Residential construction NMLs, dB(A)

NCA	Noise monitoring location	Standard hours, $L_{Aeq,15min}$	OOHW Period 1, $L_{Aeq,15min}$		OOHW Period 2, $L_{Aeq,15min}$	Sleep disturbance screening level, L_{AFmax}
			Day	Evening	Night	Night
NCA 1	L01	55	50	44	38	52
NCA 2	L02	59	54	48	40	64
NCA 3	L03	47	42	42	35	52
NCA 4	L05	57	52	51	41	52
NCA 5	L04	65	60	56	46	56
NCA 6	L07, L08	43	38	40	35	52
NCA 7	L09	49	44	41	39	52
NCA 8	L23	62	57	53	38	52
NCA 9	L10, L13	44	39	37	35	52
NCA 10	L15, L19	48	43	40	35	52
NCA 11	L14	60	55	47	38	52
NCA 12	L21, L22	46	41	41	35	52
NCA 13	L16, L17, L18, L20, L24	66	61	54	38	52
NCA 14	L11, L12	48	43	42	40	52

Notes: The time periods for Standard hours, OOHW Period 1 (Day), OOHW Period 1 (Evening) and OOHW Period 2 (night) are defined in Table 6.

5.2. Vibration criteria

Construction vibration criteria have been adopted from the following sources, consistent with the EIS:

- Cosmetic and structural damage to buildings: German Standard DIN 4150-3
- Cosmetic and structural damage to buildings: British Standard BS 7385-2
- Human comfort: British Standard BS 6472-11 and BS 6472-22
- Human comfort: Assessing Vibration – a technical guideline (the Guideline).

5.2.1. Construction vibration goals

The project will be constructed with the aim of achieving the following construction vibration goals:

- for structural damage to heritage structures, the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration - effects of vibration on structures
- for damage to other buildings and/or structures, the vibration limits set out in the British Standard BS 7385-2:1993 - Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings (and referenced in Australian Standard 2187.2 – 2006 Explosives – Storage and use – Use of explosives), and
- for human exposure, the acceptable vibration values set out in Environmental Noise Management Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006).

Further details of each of these references are provided below and specific vibration criteria for the project identified.

5.2.2. Heritage structures

The German standard DIN 4150: Part 3 Effects of Vibration on Structure (DIN 4150-3) guideline values for peak particle velocity (mm/s) criteria at heritage structures are summarised in Table 11.

Table 11: Structural damage criteria – heritage structures

Type of structure	Peak particle velocity (PPV) mm/s			
	Vibration at the foundation at a frequency of:			Vibration of horizontal plane of highest floor at all frequencies
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz ¹	
Structures that are particularly sensitive to vibration, e.g. heritage-listed structures.	3	3 to 8	8 to 10	8

(1) For frequencies above 100 Hz, the maximum values specified in this column shall be applied.

Values referred to are at the base of the building

5.2.3. Other buildings and structures

British Standard BS 7385: Part 2: 1993 ‘Evaluation and measurement for vibration in buildings Part 2. Guide to damage levels from ground borne vibration’ gives guidance on the levels of vibration above which building structures could be damaged. These values apply to buildings other than heritage buildings, including residential, industrial and commercial buildings, for the project.

For the purposes of BS 7385 damage is classified as cosmetic (formation of hairline cracks), minor (formation of large cracks) or major (damage to structural elements). Guideline values given in the BS 7385 Standard are associated with the threshold of cosmetic damage only, usually in wall and/or ceiling lining materials. The BS 7385 values for vibration limits above which cosmetic damage could occur are provided in Table 12 and Figure 5.

¹ British Standard BS 6472-1, 2008, *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.*

² British Standard BS 6472-1, 2008, *Guide to evaluation of human exposure to vibration in buildings. Blast induced vibration.*

Table 12: Transient vibration guide values for cosmetic damage (BS 7385: Part 2:1993)

Line (see Figure 5)	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 to 15 Hz	15 Hz and above
1	Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
2	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	

Notes 1. Values referred to are at the base of the building
 2: For line 1, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

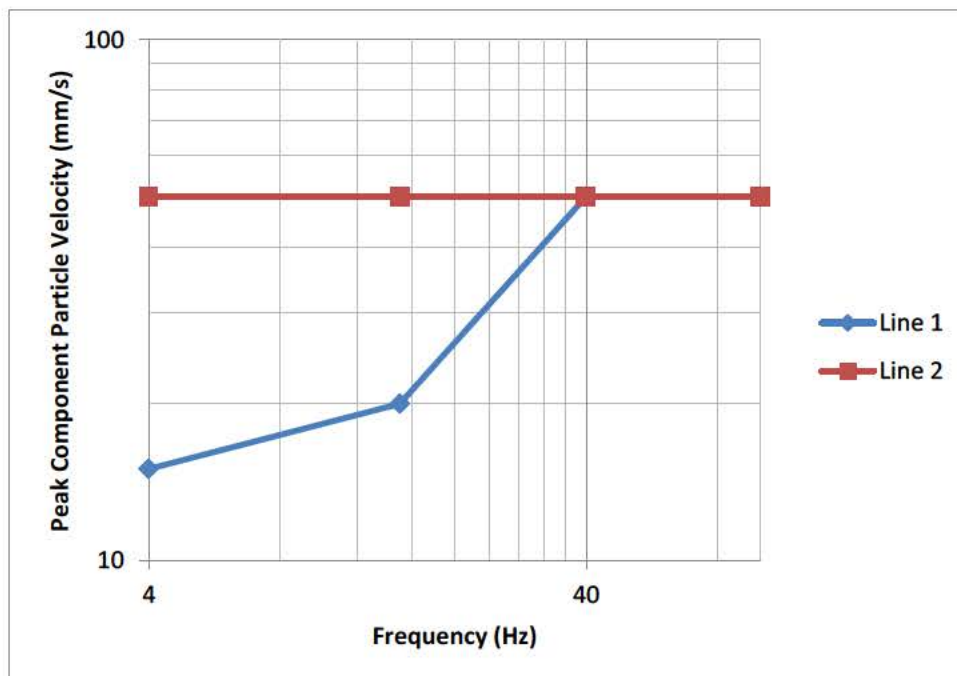


Figure 5: Summary of damage thresholds for transient vibration on domestic structures

The guide values relate mainly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings. In the event that continuous vibration gives rise to magnification of vibration by resonance (specific conditions where the structure can readily store and transfer vibration energy), then the guide values may need to be reduced by up to 50%.

Rock breaking, rock hammering and sheet piling are considered to have the potential to cause dynamic loading in some structures and it may therefore be appropriate to reduce the transient values by 50% for these construction activities.

For most sources of intermittent vibration during construction, such as rock breakers, piling rigs, vibratory rollers and excavators, the predominant vibration energy occurs at frequencies usually in the 10 to 100 Hz range. On this basis a vibration damage screening level of 5 mm/s has been adopted for the purpose of assessing potential impacts from these sources.

In the lower frequency region below 4 Hz the guide values for building types are reduced as a high displacement is associated with relatively low peak component particle velocity. To minimise risk of structural damage a guide value of 3.7 mm/s has been adopted for other sources.

BS 7385 indicates, for example, that for a residential building (line 1) a peak particle velocity (PPV) of greater than 15 mm/s at 4 Hz or greater than 50 mm/s at 40 Hz or above, measured at the base of the building, may be expected to result in cosmetic damage.

Sensitive or vulnerable equipment, activities or processes often has the potential to be adversely impacted by vibration at levels well below the limit of perceptibility for humans. Often, sensitive equipment will have a rated vibration set by the manufacturer which should be used to form a recommended criterion. As no specific construction vibration limits have been provided by Health Administration Corporation for the sensitive equipment at buildings within the John Hunter Hospital precinct, other initial guidance has been considered. BS 5228.2 – 2009 presents guidance for a number of sensitive equipment cases which are shown in Table 13. PPV limits have been approximated from the Root Mean Square (rms) limits assuming sinusoidal vibration. For continuous vibration, the guidance limits are typically set to 40% of the limits of intermittent vibration. As guidance limits may be considered conservative, site investigations will be carried out to determine the baseline/ existing ambient vibration levels at the sensitive equipment locations as outlined in Section 7.5.3.

Table 13: Guidance on effects of vibration levels for sensitive equipment (BS 5228.2 – 2009) – rms vibration velocity and PPV

Facility, equipment or use (class)	rms vibration velocity (mm/s)	PPV (mm/s)
A: Bench Microscopes at up to 400x magnification optical and other precision balances; coordinate measuring machines; metrology laboratories; optical comparators. Microelectronics manufacturing equipment – inspection, probe test and other manufacturing support equipment.	0.05	0.07
B: Micro surgery, eye surgery, neurosurgery; bench microscopes at magnification greater than 400x; optical equipment on isolation tables. Microelectronics manufacturing equipment – aligners, steppers, and other critical equipment for photolithography with line widths of 3 µm or more.	0.025	0.035
C: Electron microscopes at up to 30000x magnification; microtomes; magnetic resonance imagers. Microelectronics manufacturing equipment – aligners, steppers, and other critical equipment for photolithography with line widths of 1 µm.	0.012	0.017
D: Electron microscopes at greater than 30000x magnification; mass spectrometers; cell implant equipment. Microelectronics manufacturing equipment – aligners, steppers, and other critical equipment for photolithography with line widths of 0.5 µm; includes electron-beam systems.	0.006	0.008
E: Microelectronics manufacturing equipment - aligners, steppers, and other critical equipment for photolithography with line widths of 0.25 µm; includes electron-beam systems, un-isolated laser and optical research systems.	0.003	0.004

5.2.4. Human comfort and amenity

For most construction activities that generate perceptible vibration in nearby buildings, the character of the vibration emissions is intermittent. Assessing Vibration: a technical guideline (DEC 2006) nominates preferred and maximum vibration goals for residences and other sensitive receptors as shown in Table 14.

The applicable human comfort vibration goal for intermittent vibration source is defined in terms of Vibration Dose Values (VDVs) where the permissible vibration level corresponding to the VDV varies according to the duration of exposure. The Guideline advises a low probability of adverse comment or disturbance to building occupants would be expected at or below the preferred values.

Table 14: Acceptable vibration dose values (VDV) for intermittent vibration

Building type	Preferred VDV (m/s ^{1.75})	Maximum VDV (m/s ^{1.75})
Residential daytime (7am-10pm)	0.20	0.40
Residential night-time (10pm-7am)	0.13	0.26
Offices, schools, educational institutions and places of worship (day and night-time)	0.40	0.80

In applying the preferred and maximum VDV, the Guideline states that situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short term duration. An example is a construction or excavation project.

The Guideline also advises that where all feasible and reasonable measures have been applied to control potential ground vibration levels the maximum values may be used. For values above the maximum value the Contractor should negotiate directly with the affected community.

6. Environmental aspects and impacts

The key construction activities and the associated potential sources of noise and vibration impact are identified through a risk management approach. The consequence and likelihood of each activity's impact on the environment has been assessed to prioritise its significance. The results of this risk assessment are included in Appendix A3 of the CEMP.

Ongoing environmental risk analysis will be undertaken during construction through regular inspections, monitoring and auditing as described in Chapter 9. This will ensure that issues requiring management (including cumulative impacts) are appropriately managed.

7. Noise and vibration impact assessment

7.1. Construction hours

The following construction hours apply to the Project:

7.1.1. Standard construction hours

Standard construction hours are as per those defined in the CoA E26:

- 7 am to 6 pm Mondays to Fridays
- 8 am to 5 pm Saturdays
- No works on public holidays and Sundays.

7.1.2. Highly noise intrusive work

Except as permitted by EPL Number 21762, highly noise intensive work must only be undertaken:

- between the hours of 8:00 am to 6:00 pm Monday to Friday;
- between the hours of 8:00 am to 5:00 pm Saturday; and
- in continuous blocks not exceeding three (3) hours, with a minimum respite from that work of not less than one (1) hour between each block where the works are likely to impact the same noise sensitive receivers.

For the purposes of CoA E30, 'continuous' includes any period during which there is less than of one (1) hour respite between ceasing and recommencing any of the work that is the subject of this condition.

More generally, the process for scheduling of high noise and/or vibration generating activities during less sensitive noise periods as far as is possible (in accordance with REMM NV06) involves the implementation of the mitigation measures contained in Chapter 8:

- Chapter 8 mitigation measure ID NVMM1 involves undertaking works during standard hours or otherwise assessing the work in accordance with the Out-of-hours work approval procedure contained at Appendix C. As part of the Out-of-hours work approval procedure, the noise and vibration impact assessment requires analysis to justify the scheduling and duration of each activity and work outside the standard construction hours. This includes taking into account the preference that high noise impact works be undertaken during the day.
- Chapter 8 mitigation measure ID NVMM29 requires high noise impact activities to only be undertaken during particular times and imposes restrictions on continuous works.
- Chapter 8 mitigation measure ID NVMM31, NVMM39, OOHMM3, OOHMM4, OOHMM5, OOHMM21 requires consultation with highly noise and/or vibration affected receivers and discussion of specific respite periods and/or alternative accommodation. This promotes consideration of the specific needs of those affected. It is also noted that all consultation is undertaken in accordance with the Community Communication Strategy (CCS).

7.1.3. Out of hours work

Work outside of the standard construction hours would also be required at times – this is called Out-of-Hours Work (OOHW).

The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be subject to an EPL (Number 21762). The process for approving OOHW will therefore be governed by the conditions of that EPL. The procedure in Appendix C of this NVMP details Fulton Hogan's internal process for consideration, management and approval of OOHW for work subject to an EPL. It will be reviewed upon issue of the EPL and any minor amendments will be approved by the ER.

The TfNSW Out-of-Hours Work Protocol approved by the Planning Secretary under CoA E31 for Stages 1 to 3 will not be utilised once the CEMP (for Stage 4) is approved by the Planning Secretary and upon final issue of the EPL.

As per CoA E27 OOHW that may be required could include:

- delivery of materials required to occur outside of standard hours by the NSW Police Force or another authority for safety reasons;
- emergency work to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm;
- where different construction hours are permitted or required under an EPL in force in respect of the SSI;
- work that causes:
 - no more than 5 dB(A) above the RBL at any residence in accordance with the *Interim Construction Noise Guideline* (DECC, 2009), and
 - no more than the 'Noise Affected' noise management levels specified in Table 3 of the *Interim Construction Noise Guideline* (DECC, 2009) at other sensitive land uses, and
 - continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration specified in Table 2.2 of *Assessing Vibration: a technical guideline DEC, 2006*) and
 - intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of *Assessing Vibration: a technical guideline* (DEC, 2006).

In accordance with the SWTC Appendix 4 and CoA E28, on becoming aware of the need for emergency work outside normal working hours, Fulton Hogan must notify TfNSW, the ER and the EPA of the reasons for such work. Fulton Hogan will also use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of the works.

Affected members of the community and local businesses must be notified in regard to each planned occurrence of OOHW at least (5) five working days prior, and not more than 14 days prior, to the commencement of the OOHW.

Where possible, OOHW will be undertaken at less sensitive times where reasonable and feasible, e.g. in the morning period between 6 am and 7 am prior to the commencement of main works.

It is also noted that an advertisement has already been placed in local papers including a reference to night-time noise impacts in accordance with REMM NV07.

7.2. Construction activities

Table 15 provides a summary of construction scenarios (adapted from Table 4-9 of the Volume 6 Technical Paper 3 – Noise and Vibration Assessment, November 2016). Appendix A provides a list of equipment and a correlating sound power level (SWL). A typical overall sound power level for each scenario is also provided which is a typical upper estimate of the SWL for the noisier activities that may occur during each phase over a 15-minute period. This could be considered a worst-case as generally not all activities occur at the same time and location.

The different scenarios represent different equipment noise levels and give an idea how noise levels may change across the project area with different activities being carried out. The construction noise is assessed assuming that the two loudest pieces of construction equipment are operational concurrently for each construction phase scenario. This is considered a typical worst-case scenario.

Construction equipment will likely move about the site altering noise impacts with respect to the identified receivers. During any given period, the construction items to be used in the project area will operate at maximum sound

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



power levels for only brief stages. At other times, the machinery may produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time and certain types of construction machinery will be present in the project area near to the receiver for only brief periods during construction activities.

To ensure any variations within noise predictions are appropriately managed, monitoring of actual impacts as outlined in Section 9.4 will be undertaken and mitigation measures from Chapter 8 applied based on the results of this monitoring.

Table 15: Indicative schedule of construction scenarios/ activities

Construction scenario	Activity	Overall worst-case SWL	Work Period		
			Day	Evening	Night
S1	Establishment of temporary fencing and traffic management	110	Y	Y	N ¹
S2	Installation of erosion and sediment controls	113	Y	N	N
S3	Establishment of construction compound sites	117	Y	N	N
S4	Vegetation clearing and grubbing	122	Y	N	N
S5	Utility relocations	114	Y	Y	Y
S6	Demolition of existing houses	120	Y	N	N
S7	Stripping, stockpiling and management of topsoil and unsuitable materials	122	Y	N	N
S8	Earthworks preparation/bulk earthworks	123	Y	N	N
S9	Earthworks - Hard rock	123	Y	N	N
S10	Compound operation (general)	113	Y	Y	N ¹
S11	Major compound (materials processing)	126	Y	Y	Y
S12	Property adjustment work	117	Y	N	N
S13	Mine remediation work	117	Y	N	N
S14	Bridge construction	116	Y	Y	Y
S15	Drainage work including culverts, subsoil drains, kerb and guttering	115	Y	N	N ¹

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Construction scenario	Activity	Overall worst-case SWL	Work Period		
			Day	Evening	Night
S16	Structural work	111	Y	N	N
S17	Pavement and median construction including compaction and install asphalt	121	Y	Y	Y
S18	Construct tie-ins to existing roads	121	Y	Y	Y
S19	Installation of street lights	118	Y	N	N
S20	Landscaping	113	Y	Y	N
S21	Finishing work including installation of pavement marking and signposting	109	Y	Y	Y
S22	Removal of construction compound and site tidy up	113	Y	N	N

Note 1: Construction activity (including delivery of materials) may be required to occur outside of standard hours (OOWH Night). Work outside standard hours is subject to approval under the EPL (Number 21762).

7.3. Ancillary facilities

Temporary ancillary facility sites are required to support construction of the project. An ancillary facility is defined in the project approval as:

'A temporary facility for construction of the SSI including an office and amenities compound, construction compound, material crushing and screening plant, batch plant, materials storage compound, maintenance workshop, testing laboratory and material stockpile area.'

Note: where an approved CEMP contains a stockpile management protocol, a material stockpile area located within the construction boundary is not considered to be an ancillary facility'

7.3.1. Ancillary facilities identified in the EIS as amended by the documents listed in CoA A1

The EIS identified three potential locations for ancillary facilities (referred to as construction compounds A, B and C). Following exhibition of the EIS and further review of constructability issues for the project, three additional ancillary facility were proposed within the SPIR (referred to as construction compounds D, E and F). An additional three potential ancillary facilities were approved as part of the Modification 1 Submissions Report (referred to as Lookout Road site, Cardiff Road site and Peatties Road site).

The potential ancillary facilities in the EIS as amended by the documents listed in CoA A1 are shaded purple in Figure 6. The figure has been annotated to acknowledge that Fulton Hogan does not intend on using construction compounds A, B, D, and E; nor the Cardiff Road site, or Peatties Road site.

For the avoidance of doubt:

- The Astra Street site proposed as part of the Modification 1 Report was no longer proposed to be used as part of the Modification 1 Submissions Report.
- Fulton Hogan does not intend on using construction compound A. In the event that construction compound A is proposed to be used in the future, this NVMP will be updated and additional consultation undertaken as required.
- Fulton Hogan does not intend on using construction compounds B, D and E, nor the Cardiff Road site, or Peatties Road site. As a result, the potential impacts associated with the use of these sites are no longer applicable to the delivery of the project. In the unlikely event that any of these sites are proposed to be used, this NVMP will be updated and additional consultation undertaken as required.
- Of the nine (9) potential locations for ancillary facilities identified in the EIS as amended by the documents listed in CoA A1, three (3) are proposed for use including:
 - construction compound C – located on the western site of the northern interchange.
 - construction compound F – located at the intersection of McCaffrey Drive and Lookout Drive.
 - Lookout Road site – located to the north of the water tower, north of Grandview Avenue.

Potential construction compounds have been assessed as separate scenarios within the construction sequence.

- Scenario 10 assesses the noise impacts of potential compounds C and F which will have been assessed for the day and evening only. Scenario 10 construction activities (including delivery of materials) may be required to occur outside of standard hours (OOWH Night). Work outside standard hours is subject to the EPL (Number 21762).
- The Lookout Road site was assessed as part of the Modification 1 Submissions Report. A summary of the noise impacts associated with this site is presented in Section 7.4.8.

The final ancillary facility sites selected will be carried out to minimise noise and vibration impacts where possible. Ancillary facilities will be established and managed in accordance with the Ancillary Facility Establishment Management Plan (AFEMP) required under CoA A15. The AFEMP will be submitted to the Planning Secretary for approval one (1) month before the establishment of any construction ancillary facilities.

7.3.2. Ancillary facilities not identified in the EIS as amended by the documents listed in CoA A1

Ancillary facilities not identified in the EIS as amended by the documents listed in CoA A1 can only be established and used in each case if they satisfy the requirements of CoA A14(a) – (d).

Ancillary facilities will be established and managed in accordance with the Ancillary Facility Establishment Management Plan (AFEMP) required under CoA A15.

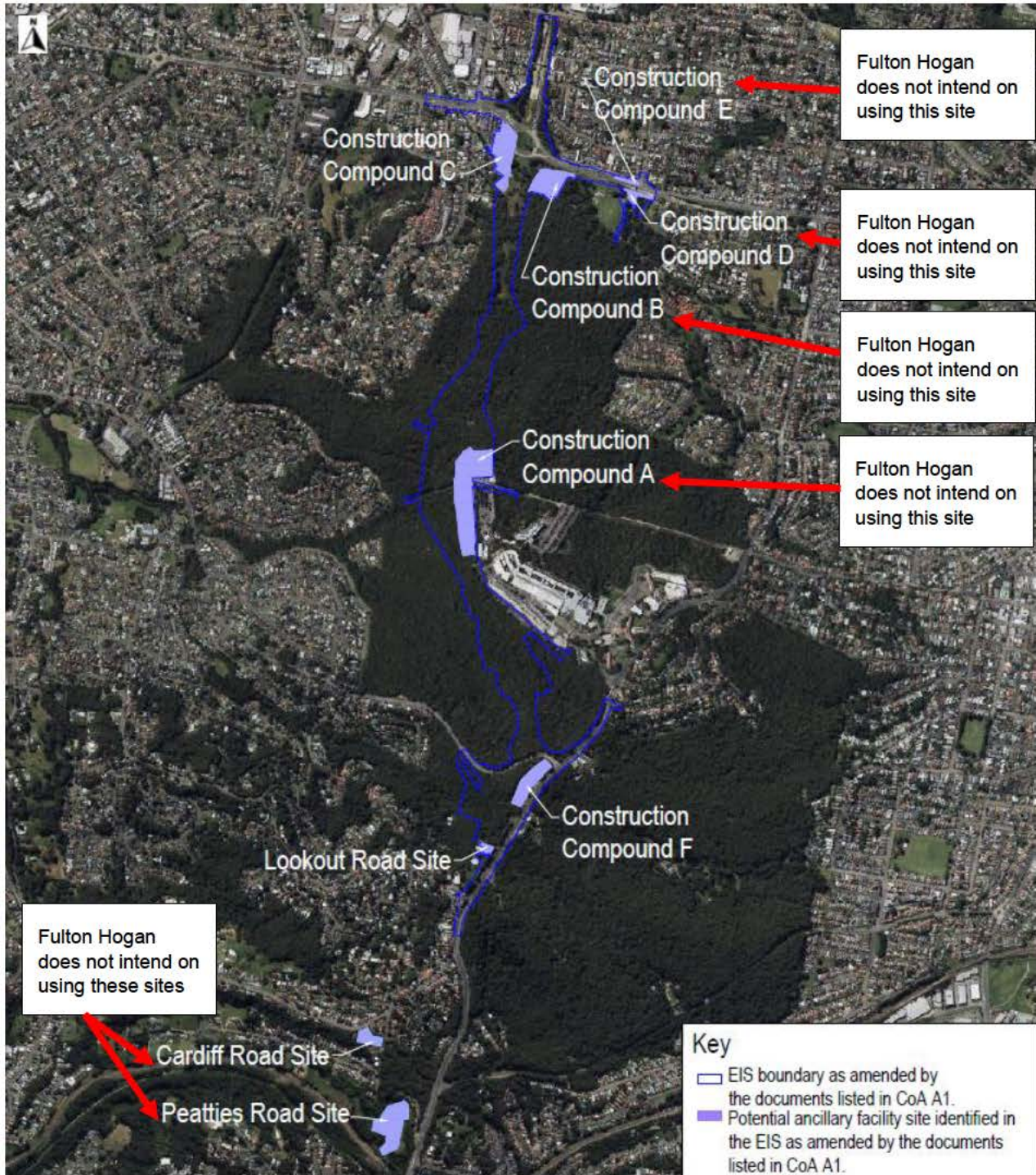


Figure 6: Potential ancillary facility sites identified in the EIS as amended by the documents listed in CoA A1

7.4. Construction noise impact assessment

Based on the SWLs for each construction scenario presented in Table 15, construction noise levels at noise-sensitive land uses have been predicted using a three-dimensional model of the site and surrounds developed in SoundPlan version 7.4 environmental noise prediction software. The noise model was based on:

- predictions conducted using the ISO 9613-2 prediction algorithm, which predicts noise levels typical of light downwind conditions or a moderate ground-based temperature inversion
- construction noise sources being in the worst-case position for each sensitive land use (i.e. the position at which the highest construction noise levels were predicted)
- typical source heights for construction noise sources
- topography, considering both the existing and/or altered topography of the road corridor dependent on the construction scenario
- sensitive receiver locations based on information in the EIS
- ground absorption factor of 75%.

Predicted construction noise level figures for the various scenarios are included in Appendix B. A discussion is provided in the following sections regarding the typical construction noise impact that may occur for each time period and each NCA.

The predicted construction noise impacts are also included within Appendix B and identify individual receivers at risk of noise impacts. The risk factors assigned to the predicted construction noise levels are as follows:

- Low risk – exceedance of 0-10dBA
- Medium risk – exceedance of 10-30dBA
- High risk – exceedance of 30+dBA or 75dBA $LA_{eq}(15\text{-minute})$

Construction noise mitigation and management measures are provided in Chapter 8 that will be implemented to assist in reducing construction noise impacts to receivers.

7.4.1. CNVG noise management approach

The TfNSW CNVG has been adopted to determine potential additional construction noise mitigation measures. The TfNSW CNVG provides additional context to the management of construction noise as shown in Table 16, which summarises the CNVG management approach to noise based on the Predicted Noise Level (PNL) and / or the measured level during noise monitoring and the time for which works are occurring.

Separate additional noise mitigation measures are defined for the following periods:

- Standard hours: works carried out between 7 am and 6 pm Monday to Friday, and 8 am to 5 pm on Saturdays as defined by the CoA;
- OOHW Period 1: works carried out:
 - between 6 pm and 10 pm Monday to Friday,
 - between 7 am and 8 am on Saturdays
 - between 5 pm and 10 pm on Saturdays
 - between 8 am and 6 pm on Sundays and Public Holidays
- OOHW Period 2: works carried out:
 - between 10 pm and 7 am Monday to Friday
 - between 10 pm and 7 am Saturday; and
 - between 6 pm and 8 am on Sundays and Public Holidays.

Further details on the project-specific application of the CNVG construction noise mitigation measures as detailed in Table 16 are provided in Chapter 8 of this NVMP.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 16: CNVG noise management approach

Perception	Predicted airborne LAeq(15min) noise level at receiver		Additional mitigation measures Type	Mitigation Levels
	dB(A) above RBL	dB(A) above NML		
All hours				
75dBA or greater			N, V, PC, RO	Highly Affected
Standard Hours: Mon - Fri (7am – 6pm), Sat (8am – 5pm), Sun/Pub Holidays (Nil)				
Noticeable	5 to 10	0	-	NML
Clearly Audible	10 to 20	< 10	-	NML
Moderately intrusive	20 to 30	10 to 20	N, V	NML+10
Highly intrusive	> 30	> 20	N, V	NML+20
OOH Period 1: Mon – Fri (6pm – 10pm), Sat (7am – 8am & 5pm – 10pm), Sun/Pub Hol (8am – 6pm)				
Noticeable	5 to 10	< 5	-	NML
Clearly Audible	10 to 20	5 to 15	N, R1, DR	NML+5
Moderately intrusive	20 to 30	15 to 25	V, N, R1, DR	NML+15
Highly intrusive	> 30	> 25	V, IB, N, R1, DR, PC, SN	NML+25
OOH Period 2: Mon – Fri (10pm – 7am), Sat (10pm – 8am), Sun/Pub Holidays (6pm – 7am)				
Noticeable	5 to 10	< 5	N	NML
Clearly Audible	10 to 20	5 to 15	V, N, R2, DR	NML+5
Moderately intrusive	20 to 30	15 to 25	V, IB, N, PC, SN, R2, DR	NML+15
Highly intrusive	> 30	> 25	AA, V, IB, N, PC, SN, R2, DR	NML+25

Note 1: AA = Alternative Accommodation R1 = Respite Period 1 V = Verification PC = Phone calls

IB = Individual briefings SN = Specific notifications N = Notification R2 = Respite Period 2

DR = Duration Respite Perception = relates to level above RBL

Note 2: Notifications will occur 5-14 working days prior to noisy works commencing.

Note 3: Specific notifications will occur 7-14 working days prior to noisy works commencing.

7.4.2. General construction during standard construction hours

A summary of predicted construction noise levels for each NCA and each phase of works is included as Table 17 and Table 18. Table 17 presents the predicted noise management level exceedances for each NCA and Table 18 presents the numbers of residential receivers exceeding each management level in each NCA. Note that these are based on the works occurring in the worst case location for each sensitive receiver and the duration of the exceedance will depend upon the duration of the works in front of those receivers.

Based on the assumed construction scenarios and predicted construction noise levels shown in Appendix B, exceedances of the NMLs are predicted at residential receivers within all NCAs during standard construction hours.

In line with the predictions, mitigation measures for construction noise that will be implemented throughout the works are provided in Chapter 8 of this NVMP. The implementation of these measures will ensure consistency with the environmental performance outcomes identified in the EIS.

Standard mitigation measures will be implemented at all times, with increased mitigation measures applied where predicted noise levels exceed the predicted NML by more than 10 dB and with further measures applied where receivers are expected to be highly noise affected. These increased mitigation measures will apply in all NCAs.

In addition, noise mitigation measures for highly noise affected residences will be applied as per Chapter 8 of this NVMP for any residence predicted to exceed the highly noise affected level of 75 dB(A), unless it can be demonstrated through monitoring that construction noise levels are below the highly noise affected level of 75 dB(A). This requirement will apply to all NCAs.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Risk Factors	
Low	Exceedance of 0-10dBA
Medium	Exceedance of 10-30dBA
High	Exceedance of 30+Dba or 75dBA LA _{eq} (15-minute)

Table 17: Construction activity maximum predicted noise management level exceedances, standard construction hours, sensitive residential receivers by NCA, dB(A)

NCA	Construction noise management level	Maximum predicted exceedance of construction management level (dB(A))																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA1	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Standard Hours	55	0	1	0	0	0	0	0	10	2	0	10	11	0	0	0	0	0	0	0	0	0	0	5	0	0	3	0	9	9	6	1	0	0
NCA2	Highly Affected	75	1	4	0	0	0	0	13	5	0	13	14	0	0	0	0	0	0	0	0	0	8	0	0	6	2	12	10	9	4	0	0		
	Standard Hours	59	17	20	0	1	4	0	29	21	0	29	30	0	0	0	0	0	0	0	0	0	24	0	11	22	18	28	26	25	20	16	0		
NCA3	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	47	13	16	0	16	13	17	19	0	25	17	0	25	26	5	0	0	12	9	13	15	0	4	20	7	18	18	14	23	24	20	16	11	12
NCA4	Highly Affected	75	12	15	0	0	35	0	24	16	0	24	25	0	0	0	0	31	0	0	0	0	19	0	0	17	13	21	23	18	15	9	31		
	Standard Hours	56	31	34	0	9	54	0	43	35	0	43	44	0	0	0	5	50	0	0	0	0	38	4	18	36	32	40	42	37	34	28	50		
NCA5	Highly Affected	75	12	15	0	0	6	12	24	16	0	24	25	0	0	0	0	2	8	0	0	19	0	10	17	13	22	27	19	15	10	0			
	Standard Hours	65	22	25	0	10	1	16	22	34	26	0	34	35	0	0	6	0	12	18	0	0	29	0	20	27	23	32	37	29	25	20	6		
NCA6	Highly Affected	75	0	0	0	3	0	0	7	0	0	7	8	0	0	0	0	0	0	0	0	2	0	0	0	0	0	5	0	2	0	0	0		
	Standard Hours	43	27	30	9	19	35	9	39	31	0	39	40	25	0	5	15	31	5	5	0	18	34	22	24	32	28	37	18	34	30	25	31		
NCA7	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Standard Hours	49	8	11	5	6	2	13	12	0	20	12	0	20	21	11	0	1	2	0	9	8	0	14	15	3	11	13	9	16	16	13	11	4	2
NCA8	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA9	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	44	11	14	14	0	0	0	3	23	15	6	23	24	19	8	10	0	0	0	0	0	23	18	0	9	16	12	20	7	17	14	8	10	
NCA10	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	48	11	14	0	0	0	0	9	23	15	12	23	24	18	22	0	0	0	0	0	5	7	18	0	12	16	12	22	22	19	14	10	0	
NCA11	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	60	0	0	0	0	0	0	3	0	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA12	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	46	11	14	0	0	0	0	5	23	15	8	23	24	13	21	0	0	0	0	0	1	4	18	0	4	16	12	21	22	18	14	9	0	
NCA13	Highly Affected	75	15	18	0	0	0	0	27	19	5	27	28	12	13	0	0	0	0	0	0	0	22	0	0	20	16	17	17	14	18	5	0		
	Standard Hours	66	24	27	0	0	0	6	36	28	14	36	37	21	22	0	0	0	0	0	2	0	31	0	4	29	25	26	26	23	27	14	0		
NCA14	Highly Affected	75	0	3	0	0	0	0	12	4	0	12	13	0	0	0	0	0	0	0	0	7	0	0	5	1	0	0	0	3	0	0	0		
	Standard Hours	48	27	30	17	0	0	0	8	39	31	11	39	40	16	5	13	0	0	0	0	4	26	34	0	7	32	28	20	15	17	30	8	13	
REC	Highly Affected	75	0	0	0	0	2	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	65	0	3	0	0	12	4	12	13	0	0	0	0	0	0	7	0	0	5	1	5	5	2	3	0	0	0	0	0	0	0	0	0	

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 18: Number of construction noise management level exceedances, standard construction hours, sensitive residential receivers by NCA

NCA	Construction noise management level	Number of exceedances of construction management level																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA1	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	55	0	2	0	0	0	0	0	80	9	0	80	107	0	0	0	0	0	0	0	0	0	20	0	0	15	0	51	49	22	2	0	0	
NCA2	Highly Affected	75	1	6	0	0	0	0	0	36	8	0	36	42	0	0	0	0	0	0	0	0	14	0	0	9	3	31	18	15	6	0	0		
	Standard Hours	59	68	103	0	1	15	0	0	204	115	0	204	213	0	0	0	0	0	0	0	0	151	0	16	127	75	185	168	156	103	55	0		
NCA3	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Standard Hours	47	194	310	0	304	402	370	317	0	590	366	0	590	594	225	0	0	138	146	179	155	0	143	491	127	373	406	229	585	572	508	310	138	171
NCA4	Highly Affected	75	12	15	0	0	11	0	0	46	20	0	46	53	0	0	0	0	8	0	0	0	29	0	0	23	12	34	34	27	15	11	8		
	Standard Hours	56	99	136	0	17	65	0	0	195	144	0	195	207	0	0	0	5	34	0	0	0	171	8	36	156	112	184	189	169	136	81	34		
NCA5	Highly Affected	75	21	22	0	0	0	3	10	0	50	25	0	50	59	0	0	0	0	1	8	0	0	33	0	6	28	22	38	30	30	22	19	0	
	Standard Hours	65	42	59	0	20	1	29	40	0	112	67	0	112	118	0	0	0	5	0	16	20	0	0	85	0	37	78	45	90	84	77	59	32	5
NCA6	Highly Affected	75	0	0	0	0	1	0	0	0	3	0	0	3	5	0	0	0	0	0	0	0	2	0	0	0	0	2	0	1	0	0	0		
	Standard Hours	43	243	282	143	208	228	134	166	0	333	312	0	333	335	330	0	39	145	162	31	65	0	315	327	229	227	318	256	329	320	323	282	214	191
NCA7	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Standard Hours	49	23	75	17	37	8	120	121	0	175	91	0	175	175	148	0	1	2	0	29	28	0	158	163	45	106	123	38	174	170	168	75	8	3
NCA8	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Standard Hours	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA9	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Standard Hours	44	114	194	212	0	0	0	0	27	215	204	133	215	215	215	150	178	0	0	0	0	0	215	211	0	143	206	145	215	198	214	194	68	178
NCA10	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Standard Hours	48	68	96	0	0	0	0	0	87	153	108	124	153	154	151	115	0	0	0	0	0	23	92	129	0	76	117	81	137	138	115	96	8	0
NCA11	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Standard Hours	60	0	0	0	0	0	0	0	7	0	0	7	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NCA12	Highly Affected	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Standard Hours	46	36	78	0	0	0	0	13	189	89	63	189	193	125	191	0	0	0	0	0	1	60	136	0	12	106	48	174	185	141	78	22	0	
NCA13	Highly Affected	75	9	9	0	0	0	0	0	18	9	4	18	20	5	2	0	0	0	0	0	0	11	0	0	9	9	14	7	10	9	7	0	0	
	Standard Hours	66	13	18	0	0	0	0	5	50	20	8	50	51	13	10	0	0	0	0	0	2	0	26	0	2	23	14	39	31	24	18	10	0	
NCA14	Highly Affected	75	0	1	0	0	0	0	0	1	1	0	1	2	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0
	Standard Hours	48	3	3	2	0	0	0	1	3	3	1	3	3	3	1	2	0	0	0	0	1	3	3	0	3	3	3	3	2	3	3	3	2	2
REC	Highly Affected	75	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Standard Hours	65	0	1	0	0	1	1	0	1	2	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0

7.4.3. Proposed shoulder period construction hours

Background noise levels obtained through the logging survey show that shoulder periods exist before and after standard daytime hours where background noise levels rise due to the morning peak and fall later in the afternoon peak period. RBLs have been calculated for each shoulder period and NCA based on the logged noise data.

For residential sensitive receivers, NMLs for shoulder periods are based on the RBL. As the shoulder periods are outside of standard construction hours the residential NML for a given period is the RBL + 5 dB. For non-residential sensitive receivers, the NML for standard construction hours and shoulder periods are identical and apply when the property is in use. The NMLs for residential sensitive receivers during shoulder period construction works are summarised in Table 19.

Table 19: Shoulder period construction works, Residential sensitive receiver construction noise management levels

NCA	Shoulder Period RBL dB(A)				Shoulder Period NML (RBL+5)			
	Weekday	Weekday	Saturday	Saturday	Weekday	Weekday	Saturday	Saturday
	6 am – 7 am	6 pm – 7 pm	7 am – 8 am	1 pm – 5 pm	6 am – 7 am	6 pm – 7 pm	7 am – 8 am	Saturday 1 pm – 5 pm
NCA1	42	45	42	46	47	50	47	51
NCA2	49	48	47	50	54	53	52	55
NCA3	38	40	39	36	43	45	44	41
NCA4	49	50	46	46	54	55	51	51
NCA5	54	55	53	56	59	60	58	61
NCA6	37	38	34	32	42	43	39	37
NCA7	39	40	42	37	44	45	47	42
NCA8	52	53	48	54	57	58	53	59
NCA9	32	36	35	31	37	41	40	36
NCA10	37	38	37	40	42	43	42	45
NCA11	44	49	43	50	49	54	48	55
NCA12	37	37	36	37	42	42	41	42
NCA13	51	55	49	55	56	60	54	60
NCA14	37	40	39	36	42	45	44	41

Noise management level exceedances have been identified for each shoulder period based on the NMLs presented in Table 19 and the modelled construction scenarios discussed in Section 7.2. The predicted noise management level exceedances for each NCA and activity are shown in Table 20 while the numbers of sensitive receivers exceeding each management level are presented in Table 21.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Risk Factors	
Low	Exceedance of 0-10dBA
Medium	Exceedance of 10-30dBA
High	Exceedance of 30+Dba or 75dBA LA _{eq(15-minute)}

Table 20: Construction activity maximum predicted noise management level exceedances, shoulder construction hours, sensitive residential receivers by NCA, dB(A)

NCA	Construction noise management level	Maximum predicted exceedance of construction management level (dB(A))																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA1	Weekday 6 am - 7 am	47	6	9	0	3	6	0	0	0	18	10	0	18	19	3	0	0	0	2	0	0	0	1	13	1	4	11	7	17	17	14	9	5	2
	Weekday 6 pm - 7 pm	50	3	6	0	0	3	0	0	0	15	7	0	15	16	0	0	0	0	0	0	0	0	0	10	0	1	8	4	14	14	11	6	2	0
	Saturday 7 am - 8 am	47	6	9	0	3	6	0	0	0	18	10	0	18	19	3	0	0	0	2	0	0	0	1	13	1	4	11	7	17	17	14	9	5	2
	Saturday 1 pm - 5 pm	51	2	5	0	0	2	0	0	0	14	6	0	14	15	0	0	0	0	0	0	0	0	0	9	0	0	7	3	13	13	10	5	1	0
NCA2	Weekday 6 am - 7 am	54	22	25	0	6	9	0	0	0	34	26	0	34	35	0	0	0	2	5	0	0	0	29	0	16	27	23	33	31	30	25	21	5	
	Weekday 6 pm - 7 pm	53	23	26	0	7	10	1	1	0	35	27	0	35	36	0	0	0	3	6	0	0	0	30	0	17	28	24	34	32	31	26	22	6	
	Saturday 7 am - 8 am	52	24	27	0	8	11	2	2	0	36	28	0	36	37	0	0	0	4	7	0	0	0	31	1	18	29	25	35	33	32	27	23	7	
	Saturday 1 pm - 5 pm	55	21	24	0	5	8	0	0	0	33	25	0	33	34	0	0	0	1	4	0	0	0	28	0	15	26	22	32	30	29	24	20	4	
NCA3	Weekday 6 am - 7 am	43	17	20	0	20	17	21	23	0	29	21	0	29	30	9	0	0	16	13	17	19	0	8	24	11	22	22	18	27	28	24	20	15	16
	Weekday 6 pm - 7 pm	45	15	18	0	18	15	19	21	0	27	19	0	27	28	7	0	0	14	11	15	17	0	6	22	9	20	20	16	25	26	22	18	13	14
	Saturday 7 am - 8 am	44	16	19	0	19	16	20	22	0	28	20	0	28	29	8	0	0	15	12	16	18	0	7	23	10	21	21	17	26	27	23	19	14	15
	Saturday 1 pm - 5 pm	41	19	22	1	22	19	23	25	0	31	23	0	31	32	11	0	0	18	15	19	21	0	10	26	13	24	24	20	29	30	26	22	17	18
NCA4	Weekday 6 am - 7 am	54	33	36	0	11	56	0	0	0	45	37	0	45	46	2	0	0	7	52	0	0	0	0	40	6	20	38	34	42	44	39	36	30	52
	Weekday 6 pm - 7 pm	55	32	35	0	10	55	0	0	0	44	36	0	44	45	1	0	0	6	51	0	0	0	0	39	5	19	37	33	41	43	38	35	29	51
	Saturday 7 am - 8 am	51	36	39	0	14	59	1	2	0	48	40	0	48	49	5	0	0	10	55	0	0	0	1	43	9	23	41	37	45	47	42	39	33	55
	Saturday 1 pm - 5 pm	51	36	39	0	14	59	1	2	0	48	40	0	48	49	5	0	0	10	55	0	0	0	1	43	9	23	41	37	45	47	42	39	33	55
NCA5	Weekday 6 am - 7 am	59	28	31	0	16	7	22	28	0	40	32	0	40	41	0	0	0	12	3	18	24	0	0	35	0	26	33	29	38	43	35	31	26	12
	Weekday 6 pm - 7 pm	60	27	30	0	15	6	21	27	0	39	31	0	39	40	0	0	0	11	2	17	23	0	0	34	0	25	32	28	37	42	34	30	25	11
	Saturday 7 am - 8 am	58	29	32	0	17	8	23	29	0	41	33	0	41	42	0	0	0	13	4	19	25	0	0	36	0	27	34	30	39	44	36	32	27	13
	Saturday 1 pm - 5 pm	61	26	29	0	14	5	20	26	0	38	30	0	38	39	0	0	0	10	1	16	22	0	0	33	0	24	31	27	36	41	33	29	24	10
NCA6	Weekday 6 am - 7 am	42	28	31	10	20	36	10	10	0	40	32	1	40	41	26	1	6	16	32	6	6	0	19	35	23	25	33	29	38	19	35	31	26	32
	Weekday 6 pm - 7 pm	43	27	30	9	19	35	9	9	0	39	31	0	39	40	25	0	5	15	31	5	5	0	18	34	22	24	32	28	37	18	34	30	25	31
	Saturday 7 am - 8 am	39	31	34	13	23	39	13	13	1	43	35	4	43	44	29	4	9	19	35	9	9	0	22	38	26	28	36	32	41	22	38	34	29	35
	Saturday 1 pm - 5 pm	37	33	36	15	25	41	15	15	3	45	37	6	45	46	31	6	11	21	37	11	11	0	24	40	28	30	38	34	43	24	40	36	31	37
NCA7	Weekday 6 am - 7 am	44	13	16	10	11	7	18	17	0	25	17	0	25	26	16	0	6	7	3	14	13	0	19	20	8	16	18	14	21	21	18	16	9	7
	Weekday 6 pm - 7 pm	45	12	15	9	10	6	17	16	0	24	16	0	24	25	15	0	5	6	2	13	12	0	18	19	7	15	17	13	20	20	17	15	8	6
	Saturday 7 am - 8 am	47	10	13	7	8	4	15	14	0	22	14	0	22	23	13	0	3	4	0	11	10	0	16	17	5	13	15	11	18	18	15	13	6	4
	Saturday 1 pm - 5 pm	42	15	18	12	13	9	20	19	0	27	19	2	27	28	18	2	8	9	5	16	15	0	21	22	10	18	20	16	23	23	20	18	11	9
NCA8	Weekday 6 am - 7 am	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Weekday 6 pm - 7 pm	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Saturday 7 am - 8 am	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Saturday 1 pm - 5 pm	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Risk Factors	
Low	Exceedance of 0-10dBA
Medium	Exceedance of 10-30dBA
High	Exceedance of 30+DbA or 75dBA LAeq[15-minute]

NCA	Construction noise management level	Maximum predicted exceedance of construction management level (dB(A))																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA9	Weekday 6 am - 7 am	37	18	21	21	1	2	1	2	10	30	22	13	30	31	26	15	17	0	0	0	0	6	30	25	4	16	23	19	27	14	24	21	15	17
	Weekday 6 pm - 7 pm	41	14	17	17	0	0	0	0	6	26	18	9	26	27	22	11	13	0	0	0	0	2	26	21	0	12	19	15	23	10	20	17	11	13
	Saturday 7 am - 8 am	40	15	18	18	0	0	0	0	7	27	19	10	27	28	23	12	14	0	0	0	0	3	27	22	1	13	20	16	24	11	21	18	12	14
	Saturday 1 pm - 5 pm	36	19	22	22	2	3	2	3	11	31	23	14	31	32	27	16	18	0	0	0	0	7	31	26	5	17	24	20	28	15	25	22	16	18
NCA10	Weekday 6 am - 7 am	42	17	20	4	0	0	0	0	15	29	21	18	29	30	24	28	0	0	0	0	0	11	13	24	0	18	22	18	28	28	25	20	16	0
	Weekday 6 pm - 7 pm	43	16	19	3	0	0	0	0	14	28	20	17	28	29	23	27	0	0	0	0	0	10	12	23	0	17	21	17	27	27	24	19	15	0
	Saturday 7 am - 8 am	42	17	20	4	0	0	0	0	15	29	21	18	29	30	24	28	0	0	0	0	0	11	13	24	0	18	22	18	28	28	25	20	16	0
	Saturday 1 pm - 5 pm	45	14	17	1	0	0	0	0	12	26	18	15	26	27	21	25	0	0	0	0	0	8	10	21	0	15	19	15	25	25	22	17	13	0
NCA11	Weekday 6 am - 7 am	49	2	5	2	0	0	0	0	3	14	6	6	14	15	10	5	0	0	0	0	0	11	9	0	3	7	3	10	9	7	5	0	0	
	Weekday 6 pm - 7 pm	54	0	0	0	0	0	0	0	0	9	1	1	9	10	5	0	0	0	0	0	0	6	4	0	0	2	0	5	4	2	0	0	0	
	Saturday 7 am - 8 am	48	3	6	3	0	0	0	0	4	15	7	7	15	16	11	6	0	0	0	0	0	12	10	0	4	8	4	11	10	8	6	0	0	
	Saturday 1 pm - 5 pm	55	0	0	0	0	0	0	0	0	8	0	0	8	9	4	0	0	0	0	0	0	5	3	0	0	1	0	4	3	1	0	0	0	
NCA12	Weekday 6 am - 7 am	42	15	18	0	0	0	0	0	9	27	19	12	27	28	17	25	0	0	0	0	0	5	8	22	0	8	20	16	25	26	22	18	13	0
	Weekday 6 pm - 7 pm	42	15	18	0	0	0	0	0	9	27	19	12	27	28	17	25	0	0	0	0	0	5	8	22	0	8	20	16	25	26	22	18	13	0
	Saturday 7 am - 8 am	41	16	19	0	0	0	0	0	10	28	20	13	28	29	18	26	0	0	0	0	0	6	9	23	0	9	21	17	26	27	23	19	14	0
	Saturday 1 pm - 5 pm	42	15	18	0	0	0	0	0	9	27	19	12	27	28	17	25	0	0	0	0	0	5	8	22	0	8	20	16	25	26	22	18	13	0
NCA13	Weekday 6 am - 7 am	56	34	37	0	0	0	0	0	16	46	38	24	46	47	31	32	0	0	0	0	0	12	0	41	0	14	39	35	36	36	33	37	24	0
	Weekday 6 pm - 7 pm	60	30	33	0	0	0	0	0	12	42	34	20	42	43	27	28	0	0	0	0	0	8	0	37	0	10	35	31	32	32	29	33	20	0
	Saturday 7 am - 8 am	54	36	39	0	0	0	0	0	18	48	40	26	48	49	33	34	0	0	0	0	0	14	0	43	0	16	41	37	38	38	35	39	26	0
	Saturday 1 pm - 5 pm	60	30	33	0	0	0	0	0	12	42	34	20	42	43	27	28	0	0	0	0	0	8	0	37	0	10	35	31	32	32	29	33	20	0
NCA14	Weekday 6 am - 7 am	42	33	36	23	0	0	0	0	14	45	37	17	45	46	22	11	19	0	0	0	0	10	32	40	4	13	38	34	26	21	23	36	14	19
	Weekday 6 pm - 7 pm	45	30	33	20	0	0	0	0	11	42	34	14	42	43	19	8	16	0	0	0	0	7	29	37	1	10	35	31	23	18	20	33	11	16
	Saturday 7 am - 8 am	44	31	34	21	0	0	0	0	12	43	35	15	43	44	20	9	17	0	0	0	0	8	30	38	2	11	36	32	24	19	21	34	12	17
	Saturday 1 pm - 5 pm	41	34	37	24	0	1	1	1	15	46	38	18	46	47	23	12	20	0	0	0	0	11	33	41	5	14	39	35	27	22	24	37	15	20

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 21: Number of construction noise management level exceedances, shoulder construction hours, sensitive residential receivers by NCA

NCA	Construction noise management level	Number of exceedances of construction management level																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA1	Weekday 6 am - 7 am	47	22	54	0	6	71	0	0	0	196	80	0	196	196	9	0	0	4	0	0	0	3	168	5	18	107	24	196	195	186	54	20	4	
	Weekday 6 pm - 7 pm	50	15	22	0	0	10	0	0	193	24	0	193	195	0	0	0	0	0	0	0	0	0	80	0	2	41	17	186	184	107	22	9	0	
	Saturday 7 am - 8 am	47	22	54	0	6	71	0	0	0	196	80	0	196	196	9	0	0	0	4	0	0	0	3	168	5	18	107	24	196	195	186	54	20	4
	Saturday 1 pm - 5 pm	51	9	20	0	0	4	0	0	0	188	22	0	188	193	0	0	0	0	0	0	0	0	54	0	0	24	15	168	159	78	20	1	0	
NCA2	Weekday 6 am - 7 am	54	127	158	0	19	70	0	0	292	168	0	292	303	0	0	0	4	24	0	0	0	0	204	0	48	179	137	271	247	210	158	116	25	
	Weekday 6 pm - 7 pm	53	137	168	0	21	81	1	1	0	303	179	0	303	306	0	0	0	7	33	0	0	0	213	0	57	191	151	289	268	230	168	126	36	
	Saturday 7 am - 8 am	52	151	179	0	31	91	3	3	0	306	191	0	306	308	0	0	0	11	41	0	0	0	238	2	67	204	158	301	289	255	179	135	44	
	Saturday 1 pm - 5 pm	55	115	151	0	14	61	0	0	0	270	158	0	270	292	0	0	0	1	15	0	0	0	191	0	40	168	127	255	229	199	151	103	15	
NCA3	Weekday 6 am - 7 am	43	366	491	0	469	564	448	415	0	600	521	0	600	600	507	0	0	304	402	370	317	0	475	586	379	479	556	406	598	596	590	491	282	413
	Weekday 6 pm - 7 pm	45	273	406	0	408	502	430	378	0	596	450	0	596	598	380	0	0	209	271	279	226	0	355	556	238	439	491	310	594	587	566	406	208	282
	Saturday 7 am - 8 am	44	310	450	0	449	534	442	394	0	598	491	0	598	600	466	0	0	254	335	328	273	0	443	575	302	458	521	366	596	593	585	450	243	349
	Saturday 1 pm - 5 pm	41	450	556	6	507	579	468	443	0	600	575	0	600	600	569	0	0	408	502	430	378	0	539	594	495	522	586	491	600	598	596	556	364	506
NCA4	Weekday 6 am - 7 am	54	126	156	0	25	97	0	0	0	221	166	0	221	237	3	0	0	9	46	0	0	0	0	180	17	59	171	136	199	206	178	156	100	46
	Weekday 6 pm - 7 pm	55	112	144	0	20	80	0	0	0	207	156	0	207	221	1	0	0	6	42	0	0	0	0	176	11	39	166	126	191	195	177	144	92	42
	Saturday 7 am - 8 am	51	156	176	0	65	134	1	4	0	256	180	0	256	256	37	0	0	20	80	0	0	0	4	195	40	104	185	166	245	252	199	176	136	80
	Saturday 1 pm - 5 pm	51	156	176	0	65	134	1	4	0	256	180	0	256	256	37	0	0	20	80	0	0	0	4	195	40	104	185	166	245	252	199	176	136	80
NCA5	Weekday 6 am - 7 am	59	81	93	0	39	12	83	72	0	168	102	0	168	182	0	0	0	28	3	57	45	0	0	118	0	95	105	85	139	140	112	93	63	31
	Weekday 6 pm - 7 pm	60	78	88	0	37	8	77	64	0	154	93	0	154	168	0	0	0	25	2	44	43	0	0	112	0	85	102	81	131	132	104	88	53	27
	Saturday 7 am - 8 am	58	85	102	0	44	19	87	82	0	182	105	0	182	187	0	0	0	33	5	63	49	0	0	125	0	103	112	88	150	153	123	102	67	36
	Saturday 1 pm - 5 pm	61	67	85	0	35	6	67	58	0	139	88	0	139	154	0	0	0	20	1	29	40	0	0	105	0	69	93	78	123	123	99	85	48	21
NCA6	Weekday 6 am - 7 am	42	256	312	177	229	240	153	183	0	335	318	1	335	335	332	5	57	156	177	50	104	0	320	328	249	251	323	267	333	329	326	312	223	215
	Weekday 6 pm - 7 pm	43	243	282	143	208	228	134	166	0	333	312	0	333	335	330	0	39	145	162	31	65	0	315	327	229	227	318	256	329	320	323	282	214	191
	Saturday 7 am - 8 am	39	312	327	234	267	282	226	263	2	335	328	55	335	335	335	114	143	208	228	134	166	0	330	333	274	295	331	318	335	334	333	327	267	284
	Saturday 1 pm - 5 pm	37	323	331	288	282	302	281	297	29	335	332	145	335	335	335	217	208	250	258	176	204	0	333	335	303	316	333	327	335	335	335	331	309	302
NCA7	Weekday 6 am - 7 am	44	123	171	79	162	168	169	171	0	175	175	0	175	175	174	0	27	69	28	127	136	0	173	175	166	173	175	149	175	175	175	171	64	96
	Weekday 6 pm - 7 pm	45	91	163	60	148	150	162	167	0	175	171	0	175	175	174	0	17	37	8	120	121	0	171	175	154	173	175	123	175	175	174	163	31	54
	Saturday 7 am - 8 am	47	52	123	37	97	67	142	150	0	175	149	0	175	175	173	0	3	9	0	61	68	0	171	175	102	153	163	75	175	173	173	123	13	12
	Saturday 1 pm - 5 pm	42	163	175	110	173	175	173	174	0	175	175	5	175	175	175	7	44	115	112	154	159	0	173	175	174	175	175	171	175	175	175	175	133	151
NCA8	Weekday 6 am - 7 am	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Weekday 6 pm - 7 pm	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Saturday 7 am - 8 am	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
	Saturday 1 pm - 5 pm	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



NCA	Construction noise management level	Number of exceedances of construction management level																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA9	Weekday 6 am - 7 am	37	211	215	215	9	17	1	26	208	215	215	214	215	215	215	215	0	0	0	0	140	215	215	48	208	215	214	215	215	215	215	215	212	215
	Weekday 6 pm - 7 pm	41	194	208	215	0	0	0	0	140	215	211	203	215	215	215	208	207	0	0	0	0	13	215	215	0	204	214	204	215	214	215	208	161	207
	Saturday 7 am - 8 am	40	204	211	215	0	0	0	0	167	215	214	208	215	215	215	213	212	0	0	0	0	27	215	215	1	205	215	206	215	215	215	211	187	212
	Saturday 1 pm - 5 pm	36	214	215	215	28	34	17	66	214	215	215	214	215	215	215	215	0	0	0	0	167	215	215	80	209	215	215	215	215	215	215	215	213	215
NCA10	Weekday 6 am - 7 am	42	125	142	45	0	0	0	0	147	158	147	152	158	158	158	134	0	0	0	0	115	125	154	0	142	153	129	158	154	153	142	75	0	
	Weekday 6 pm - 7 pm	43	117	134	15	0	0	0	0	144	158	142	152	158	158	158	124	0	0	0	0	97	117	153	0	131	147	125	157	153	151	134	64	0	
	Saturday 7 am - 8 am	42	125	142	45	0	0	0	0	147	158	147	152	158	158	158	134	0	0	0	0	115	125	154	0	142	153	129	158	154	153	142	75	0	
	Saturday 1 pm - 5 pm	45	96	125	2	0	0	0	0	122	158	129	147	158	158	157	121	0	0	0	0	73	106	147	0	109	134	108	153	148	137	125	25	0	
NCA11	Weekday 6 am - 7 am	49	4	12	4	0	0	0	0	7	17	15	17	17	17	17	17	0	0	0	0	0	17	17	0	6	17	7	17	17	17	12	0	0	
	Weekday 6 pm - 7 pm	54	0	0	0	0	0	0	0	0	17	3	1	17	17	17	0	0	0	0	0	0	17	9	0	0	4	0	9	9	5	0	0	0	
	Saturday 7 am - 8 am	48	7	15	8	0	0	0	0	11	17	17	17	17	17	17	0	0	0	0	0	0	17	17	0	9	17	9	17	17	15	0	0	0	
	Saturday 1 pm - 5 pm	55	0	0	0	0	0	0	0	0	17	0	17	17	17	16	0	0	0	0	0	0	14	7	0	0	3	0	6	7	3	0	0	0	
NCA12	Weekday 6 am - 7 am	42	89	136	0	0	0	0	0	83	203	158	139	203	204	182	203	0	0	0	0	13	176	185	0	47	166	106	196	198	179	136	61	0	
	Weekday 6 pm - 7 pm	42	89	136	0	0	0	0	0	83	203	158	139	203	204	182	203	0	0	0	0	13	176	185	0	47	166	106	196	198	179	136	61	0	
	Saturday 7 am - 8 am	41	106	158	0	0	0	0	0	93	204	166	144	204	207	190	207	0	0	0	0	28	182	189	0	66	178	116	201	201	189	158	68	0	
	Saturday 1 pm - 5 pm	42	89	136	0	0	0	0	0	83	203	158	139	203	204	182	203	0	0	0	0	13	176	185	0	47	166	106	196	198	179	136	61	0	
NCA13	Weekday 6 am - 7 am	56	39	51	0	0	0	0	0	14	116	56	20	116	128	51	36	0	0	0	0	11	0	83	0	12	63	44	101	84	84	51	25	0	
	Weekday 6 pm - 7 pm	60	24	32	0	0	0	0	0	11	88	39	14	88	96	19	25	0	0	0	0	7	0	51	0	11	44	26	73	56	51	32	20	0	
	Saturday 7 am - 8 am	54	50	63	0	0	0	0	0	19	136	71	38	136	139	83	54	0	0	0	0	13	0	96	0	14	83	51	120	105	96	63	39	0	
	Saturday 1 pm - 5 pm	60	24	32	0	0	0	0	0	11	88	39	14	88	96	19	25	0	0	0	0	7	0	51	0	11	44	26	73	56	51	32	20	0	
NCA14	Weekday 6 am - 7 am	42	3	3	3	0	0	0	0	2	3	3	2	3	3	3	2	2	0	0	0	0	1	3	3	2	3	3	3	3	3	3	3	3	2
	Weekday 6 pm - 7 pm	45	3	3	2	0	0	0	0	1	3	3	2	3	3	3	1	2	0	0	0	0	1	3	3	2	3	3	3	3	3	3	3	3	2
	Saturday 7 am - 8 am	44	3	3	3	0	0	0	0	1	3	3	2	3	3	3	1	2	0	0	0	0	1	3	3	2	3	3	3	3	3	3	3	3	2
	Saturday 1 pm - 5 pm	41	3	3	3	0	2	1	2	2	3	3	2	3	3	3	2	2	0	0	0	0	1	3	3	2	3	3	3	3	3	3	3	3	2

7.4.4. Out-of-hours work

Where activities occur outside of the standard construction hours, this is called Out-of-Hours Work (OOHW). For residential receivers there is an OOHW criteria for each time period of day, evening or night. For non-residential noise sensitive receivers, the criteria do not vary at different time periods, therefore the assessment of impacts for standard hours is applicable for activities being undertaken during OOHW periods. For sensitive residential receivers, the predicted noise management level exceedances for each NCA and activity are shown in Table 22. The number of sensitive residential receivers exceeding each management level are presented in Table 23. It demonstrates that noise-sensitive receivers in most NCAs may be exposed to construction noise levels above the relevant OOHW NMLs at times.

To manage potential construction noise impacts of any OOHW, the works will be undertaken in accordance with the EPL (Number 21762) and the OOHW approval procedure outlined in Appendix C of this NVMP which includes additional noise assessment of the proposed OOHW. Specific OOHW mitigation measures will be applied in accordance with Chapter 8 of this NVMP.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Risk Factors	
Low	Exceedance of 0-10dBA
Medium	Exceedance of 10-30dBA
High	Exceedance of 30+Dba or 75dBA LA _{eq(15-minute)}

Table 22: Construction activity maximum predicted noise management level exceedances, out of hours, sensitive residential receivers by NCA, dB(A)

NCA	Construction noise management level	Maximum predicted exceedance of construction management level (dB(A))																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA1	OOHW Day	50	3	6	0	0	3	0	0	0	15	7	0	15	16	0	0	0	0	0	0	0	0	10	0	1	8	4	14	14	11	6	2	0	
	OOHW Evening	44	9	-	-	-	-	-	-	-	13	-	-	-	-	0	0	2	5	0	0	0	4	16	-	7	-	20	20	-	12	8	-		
	OOHW Night	38	-	-	-	-	-	-	-	-	19	-	-	-	-	0	-	-	-	-	-	-	10	22	-	13	-	26	26	-	-	14	-		
NCA2	OOHW Day	54	22	25	0	6	9	0	0	0	34	26	0	34	35	0	0	0	2	5	0	0	0	29	0	16	27	23	33	31	30	25	21	5	
	OOHW Evening	48	28	-	-	-	-	-	-	-	32	-	-	-	-	0	0	8	11	2	2	0	2	35	-	22	-	39	37	-	31	27	-		
	OOHW Night	40	-	-	-	-	-	-	-	-	40	-	-	-	-	0	-	-	-	-	-	-	10	43	-	30	-	47	45	-	-	35	-		
NCA3	OOHW Day	42	18	21	0	21	18	22	24	0	30	22	0	30	31	10	0	0	17	14	18	20	0	9	25	12	23	23	19	28	29	25	21	16	17
	OOHW Evening	42	18	-	-	-	-	-	-	-	22	-	-	-	-	0	0	17	14	18	20	0	9	25	-	23	-	28	29	-	21	16	-		
	OOHW Night	35	-	-	-	-	-	-	-	-	29	-	-	-	-	4	-	-	-	-	-	-	16	32	-	30	-	35	36	-	-	23	-		
NCA4	OOHW Day	51	36	39	0	14	59	1	2	0	48	40	0	48	49	5	0	0	10	55	0	0	0	1	43	9	23	41	37	45	47	42	39	33	55
	OOHW Evening	49	38	-	-	-	-	-	-	-	42	-	-	-	-	0	0	12	57	0	0	0	3	45	-	25	-	47	49	-	41	35	-		
	OOHW Night	40	-	-	-	-	-	-	-	-	51	-	-	-	-	0	-	-	-	-	-	-	12	54	-	34	-	56	58	-	-	44	-		
NCA5	OOHW Day	60	27	30	0	15	6	21	27	0	39	31	0	39	40	0	0	0	11	2	17	23	0	0	34	0	25	32	28	37	42	34	30	25	11
	OOHW Evening	56	31	-	-	-	-	-	-	-	35	-	-	-	-	0	0	15	6	21	27	0	0	38	-	29	-	41	46	-	34	29	-		
	OOHW Night	46	-	-	-	-	-	-	-	-	45	-	-	-	-	0	-	-	-	-	-	-	6	48	-	39	-	51	56	-	-	39	-		
NCA6	OOHW Day	38	32	35	14	24	40	14	14	2	44	36	5	44	45	30	5	10	20	36	10	10	0	23	39	27	29	37	33	42	23	39	35	30	36
	OOHW Evening	40	30	-	-	-	-	-	-	-	34	-	-	-	-	3	8	18	34	8	8	0	21	37	-	27	-	40	21	-	33	28	-		
	OOHW Night	35	-	-	-	-	-	-	-	-	39	-	-	-	-	8	-	-	-	-	-	-	26	42	-	32	-	45	26	-	-	33	-		
NCA7	OOHW Day	44	13	16	10	11	7	18	17	0	25	17	0	25	26	16	0	6	7	3	14	13	0	19	20	8	16	18	14	21	21	18	16	9	7
	OOHW Evening	41	16	-	-	-	-	-	-	-	20	-	-	-	-	3	9	10	6	17	16	0	22	23	-	19	-	24	24	-	19	12	-		
	OOHW Night	39	-	-	-	-	-	-	-	-	22	-	-	-	-	5	-	-	-	-	-	-	24	25	-	21	-	26	26	-	-	14	-		
NCA8	OOHW Day	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OOHW Evening	53	0	-	-	-	-	-	-	-	0	-	-	-	-	0	0	0	0	0	0	0	1	0	-	0	-	0	0	-	0	0	-		
	OOHW Night	38	-	-	-	-	-	-	-	-	5	-	-	-	-	6	-	-	-	-	-	-	16	8	-	7	-	12	12	-	-	0	-		
NCA9	OOHW Day	39	16	19	19	0	0	0	0	8	28	20	11	28	29	24	13	15	0	0	0	0	4	28	23	2	14	21	17	25	12	22	19	13	15
	OOHW Evening	37	18	-	-	-	-	-	-	-	22	-	-	-	-	15	17	0	0	0	0	6	30	25	-	16	-	27	14	-	21	15	-		
	OOHW Night	35	-	-	-	-	-	-	-	-	24	-	-	-	-	17	-	-	-	-	-	-	32	27	-	18	-	29	16	-	-	17	-		
NCA10	OOHW Day	43	16	19	3	0	0	0	0	14	28	20	17	28	29	23	27	0	0	0	0	0	10	12	23	0	17	21	17	27	27	24	19	15	0
	OOHW Evening	40	19	-	-	-	-	-	-	-	23	-	-	-	-	30	2	0	0	0	0	13	15	26	-	20	-	30	30	-	22	18	-		
	OOHW Night	35	-	-	-	-	-	-	-	-	28	-	-	-	-	35	-	-	-	-	-	-	20	31	-	25	-	35	35	-	-	23	-		
NCA11	OOHW Day	55	0	0	0	0	0	0	0	8	0	0	8	9	4	0	0	0	0	0	0	0	5	3	0	0	1	0	4	3	1	0	0	0	
	OOHW Evening	47	4	-	-	-	-	-	-	-	8	-	-	-	-	7	0	0	0	0	0	1	13	11	-	5	-	12	11	-	7	0	-		
	OOHW Night	38	-	-	-	-	-	-	-	-	17	-	-	-	-	16	-	-	-	-	-	-	22	20	-	14	-	21	20	-	-	9	-		

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Risk Factors	
Low	Exceedance of 0-10dB(A)
Medium	Exceedance of 10-30dB(A)
High	Exceedance of 30+Db(A) or 75dB(A) LA _{eq(15-minute)}

NCA	Construction noise management level	Maximum predicted exceedance of construction management level (dB(A))																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S08b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA12	OOHW Day	41	16	19	0	0	0	0	0	10	28	20	13	28	29	18	26	0	0	0	0	0	6	9	23	0	9	21	17	26	27	23	19	14	0
	OOHW Evening	41	16	-	-	-	-	-	-	-	20	-	-	-	-	26	0	0	0	0	0	6	9	23	-	9	-	-	26	27	-	19	14	-	
	OOHW Night	35	-	-	-	-	-	-	-	-	-	26	-	-	-	-	32	-	-	-	-	-	15	29	-	15	-	-	32	33	-	-	20	-	
NCA13	OOHW Day	61	29	32	0	0	0	0	0	11	41	33	19	41	42	26	27	0	0	0	0	0	7	0	36	0	9	34	30	31	31	28	32	19	0
	OOHW Evening	54	36	-	-	-	-	-	-	-	40	-	-	-	-	34	0	0	0	0	0	14	0	43	-	16	-	-	38	38	-	39	26	-	
	OOHW Night	38	-	-	-	-	-	-	-	-	56	-	-	-	-	50	-	-	-	-	-	-	16	59	-	32	-	50	54	54	-	-	42	-	
NCA14	OOHW Day	43	32	35	22	0	0	0	0	13	44	36	16	44	45	21	10	18	0	0	0	0	9	31	39	3	12	37	33	25	20	22	35	13	18
	OOHW Evening	42	33	-	-	-	-	-	-	-	37	-	-	-	-	11	19	0	0	0	0	10	32	40	-	13	-	-	26	21	-	36	14	-	
	OOHW Night	40	-	-	-	-	-	-	-	-	39	-	-	-	-	13	-	-	-	-	-	-	34	42	-	15	-	-	28	23	-	-	16	-	

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 23: Number of construction noise management level exceedances, out of hours, sensitive residential receivers by NCA

NCA	Construction noise management level	Number of exceedance of construction management level																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA1	OOHW Day	50	15	22	0	0	10	0	0	0	193	24	0	193	195	0	0	0	0	0	0	0	80	0	2	41	17	186	184	107	22	9	0		
	OOHW Evening	44	54	0	0	0	0	0	0	0	168	0	0	0	0	0	0	1	47	0	0	0	55	195	0	83	0	0	196	195	0	149	39	0	
	OOHW Night	38	0	0	0	0	0	0	0	0	196	0	0	0	0	0	0	0	0	0	0	0	188	196	0	195	0	0	196	196	0	0	186	0	
NCA2	OOHW Day	54	127	158	0	19	70	0	0	0	292	168	0	292	303	0	0	0	4	24	0	0	0	204	0	48	179	137	271	247	210	158	116	25	
	OOHW Evening	48	191	0	0	0	0	0	0	0	258	0	0	0	0	0	0	31	91	3	3	0	15	303	0	137	0	0	310	309	0	238	176	0	
	OOHW Night	40	0	0	0	0	0	0	0	0	310	0	0	0	0	0	0	0	0	0	0	0	291	310	0	307	0	0	310	310	0	0	301	0	
NCA3	OOHW Day	42	406	521	0	498	573	459	433	0	600	556	0	600	600	535	0	0	360	454	408	352	0	498	590	454	497	575	450	600	597	594	521	322	459
	OOHW Evening	42	406	0	0	0	0	0	0	0	556	0	0	0	0	0	0	0	360	454	408	352	0	498	590	0	497	0	0	600	597	0	521	322	0
	OOHW Night	35	0	0	0	0	0	0	0	0	600	0	0	0	0	235	0	0	0	0	0	0	0	591	600	0	595	0	0	600	600	0	0	585	0
NCA4	OOHW Day	51	156	176	0	65	134	1	4	0	256	180	0	256	256	37	0	0	20	80	0	0	0	4	195	40	104	185	166	245	252	199	176	136	80
	OOHW Evening	49	171	0	0	0	0	0	0	0	189	0	0	0	0	0	0	0	34	107	0	0	0	32	221	0	144	0	0	254	256	0	185	159	0
	OOHW Night	40	0	0	0	0	0	0	0	0	258	0	0	0	0	0	0	0	0	0	0	0	0	243	260	0	258	0	0	260	260	0	0	226	0
NCA5	OOHW Day	60	78	88	0	37	8	77	64	0	154	93	0	154	168	0	0	0	25	2	44	43	0	0	112	0	85	102	81	131	132	104	88	53	27
	OOHW Evening	56	93	0	0	0	0	0	0	0	118	0	0	0	0	0	0	0	37	8	77	64	0	0	139	0	127	0	0	179	181	0	112	77	0
	OOHW Night	46	0	0	0	0	0	0	0	0	214	0	0	0	0	0	0	0	0	0	0	0	0	231	220	0	217	0	0	229	230	0	0	150	0
NCA6	OOHW Day	38	318	328	269	272	293	263	283	7	335	331	96	335	335	335	162	177	229	240	153	183	0	331	333	286	307	332	323	335	335	334	328	303	297
	OOHW Evening	40	282	0	0	0	0	0	0	0	327	0	0	0	0	54	117	183	218	111	156	0	326	332	0	283	0	0	335	332	0	323	253	0	
	OOHW Night	35	0	0	0	0	0	0	0	0	333	0	0	0	0	0	294	0	0	0	0	0	0	335	335	0	325	0	0	335	335	0	0	322	0
NCA7	OOHW Day	44	123	171	79	162	168	169	171	0	175	175	0	175	175	174	0	27	69	28	127	136	0	173	175	166	173	175	149	175	175	175	171	64	96
	OOHW Evening	41	171	0	0	0	0	0	0	0	175	0	0	0	0	19	60	148	150	162	167	0	173	175	0	175	0	0	175	175	0	175	153	0	
	OOHW Night	39	0	0	0	0	0	0	0	0	175	0	0	0	0	68	0	0	0	0	0	0	0	175	175	0	175	0	0	175	175	0	0	172	0
NCA8	OOHW Day	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OOHW Evening	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
	OOHW Night	38	0	0	0	0	0	0	0	0	94	0	0	0	0	0	59	0	0	0	0	0	0	105	105	0	103	0	0	105	105	0	0	0	0
NCA9	OOHW Day	39	206	214	215	0	0	0	0	193	215	215	214	215	215	215	213	212	0	0	0	0	56	215	215	22	205	215	208	215	215	215	214	206	212
	OOHW Evening	37	211	0	0	0	0	0	0	0	215	0	0	0	0	215	215	0	0	0	0	0	140	215	215	0	208	0	0	215	215	0	215	212	0
	OOHW Night	35	0	0	0	0	0	0	0	0	215	0	0	0	0	215	0	0	0	0	0	0	0	215	215	0	215	0	0	215	215	0	0	214	0
NCA10	OOHW Day	43	117	134	15	0	0	0	0	144	158	142	152	158	158	124	0	0	0	0	0	97	117	153	0	131	147	125	157	153	151	134	64	0	
	OOHW Evening	40	134	0	0	0	0	0	0	0	153	0	0	0	0	145	3	0	0	0	0	0	135	144	158	0	148	0	0	158	156	0	153	106	0
	OOHW Night	35	0	0	0	0	0	0	0	0	158	0	0	0	0	158	0	0	0	0	0	0	0	158	158	0	157	0	0	158	158	0	0	146	0
NCA11	OOHW Day	55	0	0	0	0	0	0	0	17	0	0	17	17	16	0	0	0	0	0	0	0	14	7	0	0	3	0	6	7	3	0	0	0	
	OOHW Evening	47	9	0	0	0	0	0	0	0	17	0	0	0	0	17	0	0	0	0	0	0	4	17	17	0	13	0	0	17	17	0	17	0	0
	OOHW Night	38	0	0	0	0	0	0	0	0	17	0	0	0	0	17	0	0	0	0	0	0	17	17	0	17	0	0	17	17	0	0	17	0	0

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



NCA	Construction noise management level	Number of exceedance of construction management level																																	
		S01	S02	S03a	S03b	S03c	S03d	S03e	S03f	S04	S05	S06	S07	S08	S09	S09b	S10a	S10b	S10c	S10d	S10e	S10f	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	
NCA12	OOHW Day	41	106	158	0	0	0	0	0	93	204	166	144	204	207	190	207	0	0	0	0	0	28	182	189	0	66	178	116	201	201	189	158	68	0
	OOHW Evening	41	106	0	0	0	0	0	0	0	0	166	0	0	0	0	207	0	0	0	0	0	28	182	189	0	66	0	0	201	201	0	158	68	0
	OOHW Night	35	0	0	0	0	0	0	0	0	0	201	0	0	0	0	207	0	0	0	0	0	0	205	207	0	153	0	0	207	207	0	0	166	0
NCA13	OOHW Day	61	23	28	0	0	0	0	0	10	83	32	13	83	88	16	22	0	0	0	0	6	0	50	0	8	39	24	62	47	48	28	17	0	
	OOHW Evening	54	50	0	0	0	0	0	0	0	0	71	0	0	0	0	54	0	0	0	0	13	0	96	0	14	0	0	120	105	0	63	39	0	
	OOHW Night	38	0	0	0	0	0	0	0	0	0	153	0	0	0	0	150	0	0	0	0	0	143	153	0	144	0	0	153	153	0	0	139	0	
NCA14	OOHW Day	43	3	3	3	0	0	0	0	1	3	3	2	3	3	3	1	2	0	0	0	0	1	3	3	2	3	3	3	3	3	3	3	3	2
	OOHW Evening	42	3	0	0	0	0	0	0	0	0	3	0	0	0	0	2	2	0	0	0	0	1	3	3	0	3	0	0	3	3	0	3	3	0
	OOHW Night	40	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	3	3	0	3	0	0	3	3	0	0	3	0

7.4.5. Construction compounds - Standard construction hours

Operation of construction compounds during standard construction hours are predicted to exceed the daytime NMLs at nearby sensitive residential receivers. The highly affected level is predicted to be exceeded due to the operation of compound C. Numbers of impacted sensitive residential receivers and maximum level of exceedance for standard construction hours is presented in Table 24.

Table 24: Predicted construction compound impacts, standard construction hours, sensitive residential receivers

Construction assessment scenario	Number of potentially impacted sensitive residential receivers		Highest exceedance of construction criterion, dB(A)	
	Highly affected level	Standard hours	Highly affected level	Standard hours
Compound C operations (S10c)	8	342	31	50
Compound F operations (S10f)	0	27	0	5

Compound C operations (S10c) are predicted to exceed construction management levels at eight commercial/industrial receivers (Executive Villas Jesmond) in NCA4.

Compound F operations (S10f) are predicted to exceed standard construction management levels at 27 residential receivers, however the highest exceedance of the management levels at these receivers is up to 5dBA, and no residential receivers are expected to be highly affected. No non-residential receivers are expected to be above the construction noise management levels.

7.4.6. Construction compounds – shoulder periods

Operation of all construction compounds are predicted to exceed the relevant criteria at nearby sensitive residential receivers. Numbers of impacted sensitive residential receivers and maximum level of exceedance is presented in Table 25.

Table 25: Predicted construction compound impacts

Construction assessment scenario	Number of potentially impacted sensitive residential receivers				Highest exceedance of construction criterion, dB(A)			
	Weekday	Weekday	Saturday	Saturday	Weekday	Weekday	Saturday	Saturday
	6am - 7am	6pm - 7pm	7am - 8am	1pm - 5pm	6am - 7am	6pm - 7pm	7am - 8am	1pm - 5pm
Compound C operations (S10c)	684	518	693	968	19	16	17	20
Compound F operations (S10f)	280	131	184	261	18	17	19	19

Compound C operations (S10c) are predicted to exceed construction management levels at eight commercial/industrial receivers (Executive Villas Jesmond) in NCA4. It is noted that the potential for maximum noise level events to occur simultaneously is unlikely for this scenario as the majority of equipment in any 15- minute period would be parked and not operational.

No non-residential receivers are expected to be above the construction noise management levels for Compound F operations.

7.4.7. Construction compounds – Out of hours

Operation of all construction compounds during out of hours periods are predicted to exceed the relevant criteria at nearby sensitive residential receivers. Numbers of impacted sensitive residential receivers and maximum level of exceedance for standard hours is presented Table 26. Night time impacts have not been assessed for standard compound operations (S10).

Table 26: Predicted Construction Compounds Assessment Scenario

Construction assessment scenario	Number of potentially impacted sensitive residential receivers			Highest exceedance of construction criterion , dB(A)		
	day	evening	night	day	evening	night
Compound C operations (S10c)	828	1075	1845	55	57	66
Compound F operations (S10f)	188	321	636	10	14	30

Compound C operations (S10c) are predicted to exceed construction management levels at eight commercial/industrial receivers (Executive Villas Jesmond) in NCA4.

No non-residential receivers are expected to be above the construction noise management levels for Compound F operations.

7.4.8. Additional construction compounds – Summary of noise impacts

Noise impacts are predicted for sensitive residential and non-residential receivers from the establishment, operation and decommissioning of additional construction compounds. The provided results and following summary are to be interpreted with consideration that the level of impact would vary over the duration of the activity as the demand and intensity of these activities varies during the project's construction.

Noise impacts predicted in relation to the Lookout Road compound are summarised as:

- During standard construction hours:
 - One residential receiver adjacent to the compound was identified with potential exceedances of the construction noise management level. Predicted levels exceed the construction noise management level by up to 14 dB(A) at this receiver. No other exceedances of the daytime construction noise management level are predicted.
 - The predicted worst-case activity for level and extent of impact during standard construction hours is general compound activities, which would occur over the duration of the 30 month construction period.
 - No impacts are predicted at non-residential receivers.
 - One receiver adjacent to the compound was identified with potential exceedances of the 75 dB(A) highly affected noise management level with impacts of up to 5 dB(A) over the management level. The predicted worst-case activity is general compound activities, which would occur over the duration of the 30 month construction period.
- During OOHW period 1 day, up to 48 residential receivers were identified with potential exceedances of the construction noise management level. Predicted levels exceed the construction noise management level by up to 19 dB(A) at the residential receiver adjacent to the compound. The next highest exceedance is predicted to be 4 dB(A) over the construction noise management level for this period. The predicted worst-case activity during this period is general compound activities, which would occur over the duration of the 30 month construction period.
- During OOHW period 1 evening, up to 93 residential receivers were identified with potential exceedances of the construction noise management level. Predicted levels exceed the construction noise management level by up to 26 dB(A) at the residential receiver adjacent to the compound. The next highest exceedance is predicted to be 7 dB(A) over the construction noise management level for this period. The predicted worst-case activity during this period is general compound activities, which would occur over the duration of the 30 month construction period.
- During OOHW period 2 night, up to 160 residential receivers were identified with potential exceedances of the construction noise management level. Predicted levels exceed the construction noise management level by up to 42 dB(A) at the residential receiver adjacent to the compound. The next highest exceedance is predicted to be 21 dB(A) over the construction noise management level for this period. The predicted worst-case activity during this period is general compound activities, which would occur over the duration of the 30 month construction period.

7.4.9. Sleep disturbance

The Interim Construction Noise Guideline (DECC, 2009) states that 'where construction works are planned to extend over more than two consecutive nights, the impact assessment should cover the maximum noise level from the proposed works.

Construction scenarios with the potential for sleep disturbance impacts in each potentially impacted NCA are presented in Table 27 with reference to the sleep disturbance screening levels provided in Section 5.1.4.

Given the high potential for sleep disturbance impacts, construction activities likely to generate the highest levels of noise and/or vibration will be scheduled to occur at the beginning of the shift (before 11 pm) to minimise the potential for sleep disturbance. All workers should be briefed on the need to minimise noise as a result of their activities during the night-time period.

The noise and vibration mitigation measures detailed Chapter 8 of this NVMP are to be implemented to manage potential sleep disturbance impacts during construction.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 27: Construction scenario potential sleep disturbance per NCA

Scenario	NCA													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
S01		X	X	X	X	X	X			X		X	X	X
S02	X	X	X	X	X	X	X		X	X		X	X	X
S03a									X					X
S03b		X	X	X	X	X								
S03c		X	X	X	X	X								
S03d			X		X		X							
S03e			X		X		X							
S03f										X			X	X
S04	X	X	X	X	X	X	X		X	X	X	X	X	X
S05	X	X	X	X	X	X	X		X	X		X	X	X
S06										X			X	X
S07	X	X	X	X	X	X	X		X	X	X	X	X	X
S08	X	X	X	X	X	X	X		X	X	X	X	X	X
S09				X		X	X		X	X	X	X	X	X
S09b										X		X	X	
S10a														X
S10b		X	X	X	X	X								
S10c		X	X	X	X	X								
S10d			X		X		X							
S10e			X		X		X							
S10f													X	
S11						X	X		X		X			X
S12	X	X	X	X	X	X	X		X	X	X	X	X	X
S13				X	X	X								
S14		X	X	X	X	X	X			X			X	
S15	X	X	X	X	X	X	X		X	X	X	X	X	X
S16		X	X	X	X	X	X		X	X		X	X	X
S17	X	X	X	X	X	X	X		X	X	X	X	X	X
S18	X	X	X	X	X	X	X			X	X	X	X	X
S19	X	X	X	X	X	X	X		X	X	X	X	X	X
S20	X	X	X	X	X	X	X		X	X		X	X	X
S21		X	X	X	X	X				X			X	X
S22		X	X	X	X	X								X

7.4.10. Construction traffic

Construction would generate heavy vehicle movements associated with the transportation of construction machinery, equipment and materials to the site. Light vehicle movements would be associated with employees and smaller deliveries. Predicted volumes of construction traffic generated by the project are small when compared to existing road traffic volumes and are therefore unlikely to noticeably increase noise in the local area.

Vehicle movements, deliveries routes and workforce site access are to be via major roads where possible to minimise the potential for adverse traffic noise impacts. The specific details of these routes and vehicle volumes are in the early stages of development, therefore to evaluate the potential for noise increase due to construction traffic, the full number of average daily construction traffic movements has been assumed for each route, while volumes on Kookaburra Circuit are based on preliminary haulage requirements. Predicted noise increases were modelled using the CoRTN algorithm developed by the UK Department of Transport. This method incorporates consideration of traffic flow volume, average speed, percentage of heavy vehicles, and road gradient and includes attenuation via spherical spreading (or cylindrical in the case of a line source such as a road), soft ground, atmospheric absorption and screening from buildings or barriers. Assumed construction traffic volumes and predicted noise increases using are presented in Table 28.

Table 28: Predicted increase in noise due to construction traffic

Road	Existing (2014) 24 hour traffic volumes (average weekday)	Existing (2014/15) daytime traffic volumes (average weekday)	Existing heavy vehicle percentage	Construction generated light vehicles (average per day)	Construction generated heavy vehicles (average per day)	Predicted relative increase in total traffic noise (dB)
Lookout Road, south of McCaffrey	47,200	42,578	1.5%	200	355	0.4
Lookout Road, north of McCaffrey Drive	49,400	43,907	1.0%	200	355	0.3
McCaffrey Drive, west of Lookout Road	18,600	16,913	0.4%	200	355	0.8
Kookaburra Circuit (John Hunter Hospital)	15,300	13,693	0.4%	200	144	0.6
Croudace Street, north of Elder Street	41,800	36,264	1.4%	200	355	0.4
Newcastle Road, east of Newcastle Inner City Bypass	60,200	53,493	1.6%	200	355	0.2

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Newcastle Road, west of Newcastle Inner City Bypass	44,300	39,674	1.6%	200	355	0.3
---	--------	--------	------	-----	-----	-----

Traffic noise on public roads is assessed using the time periods detailed in the Road Noise Policy, which are day (7 am to 10 pm) and night (10 pm to 7 am). These time periods differ from weekday standard construction hours (7 am to 6 pm). To assess the potential for construction traffic impacts during the night time road traffic noise assessment period the following assumptions have been made:

- Half of daily light vehicle movements during the night time period to represent workers arriving to site prior to 7 am.
- 15% of daily heavy vehicle movements prior to 7 am. This considers an even split throughout the day of 7.7% of daily heavy vehicles per hour plus an allowance for additional morning deliveries.

Assumed construction traffic volumes and predicted noise increases using the CoRTN algorithm are presented in Table 29.

Table 29: Predicted increase in noise due to construction traffic (night period)

Road	Existing (2014/15) night traffic volumes (average weekday)	Existing heavy vehicle percentage	Construction generated light vehicles (average per day)	Construction generated heavy vehicles (average per day)	Predicted relative increase in total traffic noise (dB)
Lookout Road, south of McCaffrey Drive	4622	1.5%	100	53	0.5
Lookout Road, north of McCaffrey Drive	5493	1.0%	100	53	0.4
McCaffrey Drive, west of Lookout Road	1687	0.4%	100	53	1.3
Kookaburra Circuit (John Hunter Hospital access)	1607	0.4%	100	22	0.9
Croudace Street, north of Elder Street	5536	1.4%	100	53	0.4
Newcastle Road, east of Newcastle Inner City Bypass	6707	1.6%	100	53	0.3

Newcastle Road, west of Newcastle Inner City Bypass	4626	1.6%	100	53	0.4
---	------	------	-----	----	-----

While out of hours noise impact from construction traffic on public roads is predicted to be negligible, adverse noise impacts are possible from traffic within the construction boundary including at site access locations.

7.5. Vibration impact assessment

Due to complicated ground conditions and other variables associated with construction vibration, an exact vibration assessment result is generally not expected from available prediction methods. Rather, regular monitoring of vibration levels at receivers is required to quantify the vibration effect. This is particularly the case with activities such as pile driving and operation of heavy vibratory compaction plant, where avoidance of damage or other disruption is critical.

Table 30 outlines typical vibration levels for different plant activities sourced from the Environmental Noise Management Manual (ENMM) (2001), British Standard BS 5228.1 Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration and the Construction Noise Strategy (Transport for NSW 2012).

Table 30: Vibration safe working distances

Item	Peak Particle Velocity at 10 m (mm/s)
Roller	5 - 6
15 tonne roller	7 - 8
Loader breaking kerbs	6 - 8
7 tonne compactor	5 - 7
Pavement Breaker	4.5 - 6
Dozer	2.5 - 4
Backhoe	1
Excavators, Scrapers, Graders etc.	2.5 ¹
Piling (bored) ²	7.4

Note 1: Based on levels derived at 8 m from: Tyan, A. E. Ground Vibrations. Damaging effects to Buildings. Road Research Board 1973

Note 2: based on levels derived from BS5228-2. Bored piling through stones or other obstruction.

As stated in the ENMM (2001), it can be assumed that the vibration level is inversely proportional to distance. Field variations show that the distance relationship generally varies between $d^{-0.8}$ and $d^{-1.6}$, rather than d^{-1} . On that basis, maximum vibration levels were estimated at each receiver using a factor of $d^{-0.8}$ which provides a measure of conservatism.

Based on the vibration levels stated in Table 30 and the list of construction equipment detailed in Appendix A Table 37, the maximum potential vibration impacts of the sources associated with the project at various distances are shown in Table 31.

Table 31: Estimated vibration levels at distance from activity

Vibration source	Distance to Source (m)/PPV (mm/s)			
	10	20	50	100
Roller	6.0	3.4	1.7	1.0
15 tonne vibratory roller	8.0	4.6	2.2	1.3
Loader breaking kerbs	7.0	4.0	1.9	1.1
7 tonne compactor	6.0	3.4	1.7	1.0
Pavement breaker	6.0	3.4	1.7	1.0
Dozer	4.0	2.3	1.1	0.6
Backhoe	1.0	0.6	0.3	0.2
Excavator	2.1	1.2	0.6	0.3
Piling (bored/CFA)	7.4	4.3	2.1	1.2

Safe working buffer distances to comply with the human comfort, cosmetic damage, standard dwelling and heritage building structural damage criteria were calculated for typical intermittent vibration values and are listed in Table 32. This table is based on advice given in BS 7385: 1993 – Evaluation and measurement of vibration in buildings. Additional site investigations will be carried out to determine the buffer distances for vibration sensitive equipment in the John Hunter hospital precinct as outlined in Section 7.5.3. As there are no anticipated sources of continuous or impulsive vibration, assessment for human comfort impacts has been carried out for intermittent vibration only.

Vibration may be amplified in multi-level buildings through the structure to the upper floors. A doubling of the buffer distances provided in Table 32 would provide a conservative allowance for this possible effect in multi-level buildings.

The risk factors assigned to the predicted construction vibration levels are as follows:

- Low risk – Works occurring outside safe working distances
- Medium risk – Works occurring within safe working distances for human comfort
- High risk – Works occurring within safe working distances for sensitive equipment and cosmetic damage to buildings

Construction vibration mitigation and management measures are provided in Chapter 8 that will be implemented to assist in reducing construction vibration impacts to receivers.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 32: Vibration (estimated) safe working buffer distances

Activity	Human comfort	Structural damage		Sensitive equipment ²	
	BS 5228-2 criteria ¹	Heritage structure DIN 4150-3 criteria	Standard dwellings DIN 4150-3 criteria	Class A (0.07 mm/s)	Class B (0.035 mm/s)
Roller	90 m	24 m	13 m	410 m	730 m
15 tonne vibratory roller	140 m	35 m	18 m	520 m	930 m
Loader breaking kerbs	120 m	30 m	16 m	470 m	830 m
7 tonne compactor	90 m	24 m	13 m	410 m	730 m
Pavement Breaker	90 m	24 m	13 m	410 m	730 m
Dozer	60 m	15 m	8 m	300 m	520 m
Backhoe	10 m	3 m	2 m	100 m	170 m
Jackhammer	4 m	2 m	1 m	60 m	100 m
Excavator	25 m	7 m	4 m	160 m	290 m
Piling (bored/CFA)	120 m	35 m	17 m	490 m	870 m

Note 1: based on levels derived from BS 5228-2. Bored piling through stones or other obstruction.

Note 2: As stated in the RTA's Environmental Noise Management Manual, it can be assumed that the vibration level is inversely proportional to distance. Field variations show that the distance relationship generally varies between $d^{-0.8}$ and $d^{-1.5}$, rather than d^{-1} . For prediction of approximate safe working distance for sensitive equipment the mid-value of $d^{-1.2}$ has been used as a guide.

7.5.1. Structural damage

Where desktop estimates or pre-construction monitoring indicates that vibration levels from construction activities will exceed the target levels, a Pre-construction Building and Structure Condition Survey must be undertaken of all buildings, structures, and utilities and the like, identified in the documents listed in CoA A1 as per CoA E54 and must be conducted in accordance with G36 Clause 4.7.2.1 to enable post-construction verification that construction activities did not cause existing structural damage. The surveys will be undertaken by a suitably qualified structural engineer before the commencement of any work that could cause damage to buildings, structures, and utilities and the like in accordance with CoA E54. The results of the surveys must be documented in a Pre-construction Building and Structure Condition Survey Report for each building, structure and utility surveyed. Copies of the Preconstruction Building and Structure Condition Survey Reports must be provided to the owners of the buildings, structures and utilities surveyed no later than one (1) month before the commencement of work in the vicinity of the impacted buildings, structures and utilities.

The building and structure condition survey reports prepared by the Contractor must be prepared in accordance with AS 4349.0. In addition to the requirements of AS 4349.0, every building and structure condition survey report must document and contain:

- the type of construction(s) proposed.
- site conditions and their propensity to contribute to environmental damage (for example, the presence of reactive soils).
- a full record of every visible defect including description, photos with crack gauge, size and extent.
- categorisation of each defect as either a “Major Defect” or “Minor Defect” and “cosmetic” or “structural”.
- an assessment of whether the defect is likely to alter due to environmental movement of the building or structure.
- identification of poor building practice that may be exacerbated by environmental movement.

With consideration to structural damage vibration impacts for general construction activities, the expected magnitude of ground vibrations should not be sufficient to cause damage if the equipment operates at distances greater than 18 metres from standard residential buildings or structures of similar construction. Heritage buildings and structures may be impacted up to 35 metres from the work. It is also noted that the John Hunter Hospital is outside of the safe working distance, therefore cosmetic damage is unlikely to occur.

The noise and vibration mitigation measures detailed in Section 8 are to be implemented to manage potential construction vibration impacts. The Proponent, where liable, must rectify any damage caused directly or indirectly (for example from vibration) by the construction or operation of the SSI at no cost to the landowner.

Vibration impacts due to piling activities have the potential to exceed structural vibration values for standard dwellings at distances from the activity of 17 metres for bored piling. Heritage buildings and structures may be impacted up to 35 metres for bored piling.

In the event that these buffer distances are not practical, other methods may be investigated such as press-in hydraulic piling or jacked-in piling. These methods generally exhibit much lower vibration levels compared to impact, vibratory and bored piling.

After completion of construction of the SSI, a follow-up condition survey of all items for which building and structure condition surveys were undertaken in accordance with CoA E54, will be undertaken by a suitably qualified structural engineer in accordance with CoA E55. The results of the surveys will be documented in a Post-construction Building and Structure Condition Survey Report for each building, structure and utility surveyed. Copies of the Post-construction Building and Structure Condition Survey Reports will be provided to the owners of the buildings, structures and utilities surveyed no later than three (3) months following the completion of construction.

7.5.2. Human comfort

With consideration to human comfort vibration impacts, where rolling and compacting activities occur within 140 metres of nearby receivers including residences, schools and places of worship, there is the potential that vibration

levels could be intrusive for some activities. Where reasonable and feasible, buffer distances are to be implemented as per values shown in Table 32 for the corresponding activities.

Piling activities may cause adverse reaction from sensitive residential receivers up to 120 metres from the activity where bored piling is used. Press-in hydraulic piles or jacked-in piles may also provide alternatives with negligible vibration levels by comparison.

The noise and vibration mitigation measures detailed in Section 8 are to be implemented to manage potential construction vibration impacts.

7.5.3. Sensitive equipment

As the guidance limits for sensitive equipment and uses in Table 32 may be considered conservative, site investigations will be carried out to determine the baseline/ existing ambient vibration levels at the sensitive equipment locations which may indicate safe and stable operations at levels higher than the limits presented in Table 32. Vibration monitoring will be conducted at the commencement of vibratory activities and background monitoring will be conducted prior to works in the area commencing. The results will assist to set the limitations of construction activities and guide suitable work methods.

Where vibration is found to exceed safe levels, refer to Section 9.4.2

7.5.4. Ground-borne noise

Ground-borne noise results from the transmission of vibration rather than the direct transmission of noise through the air. Ground-borne (or regenerated) construction noise is often of primary concern on tunnelling projects when vibration from activities such as rock-breaking, road heading, rotary cutting, tunnel boring and rock drilling/sawing can be transmitted through the ground and into the habitable areas of nearby buildings. Ground-borne noise occurs when this vibration in the ground and/or building elements is regenerated as audible noise within areas of occupancy inside the building.

The ICNG and CoA E35 define internal ground-borne noise goals for residential receivers of 40 dB(A) $L_{Aeq,15min}$ during the evening (6 pm to 10 pm) and 35 dB(A) $L_{Aeq,15min}$ during the night-time (10 pm to 7 am). These goals are only applicable when ground-borne noise levels are higher than airborne noise levels.

The nature of the project works (surface works, as opposed to underground works, with minimal screening effects) means that ground-borne noise impacts (CoA E35) are expected to be negligible in comparison to airborne noise impacts. Blasting poses the potential to generate ground-borne noise however the open nature of the site would again lead to air-borne noise exceeding ground-borne noise. Furthermore it would be extremely unlikely for blasting to occur within the periods identified in CoA E35 and this would be addressed within the Blast Management Strategy (prepared separately to this NVMP). For this reason, ground-borne noise is not anticipated to be the controlling factor for these proposed works and therefore further assessment is not warranted.

Application of mitigation measures for the control of airborne noise emissions and vibration in accordance with Chapter 8 of this NVMP is expected to adequately address ground-borne noise.

8. Environmental mitigation measures

Specific mitigation measures to address impacts on noise and vibration for standard construction hours are outlined in Table 33 and in Table 34 for OOHW.

Table 33: Noise and vibration mitigation measures

ID No.	Revised environmental management measure	Timing		Responsibility
		PC ¹	C ²	
NOISE				
NOISE: Standard Working Hours measures applied at all times (including OOHW)				
NVMM1	Undertake works during Standard Hours. Where works must occur outside of Standard Hours, assess Out of hours work in accordance with the Out-of-hours work approval procedure (for work subject to an EPL) contained at Appendix C.	✓	✓	Construction Manager
NVMM2	Implement a hot line and complaints handling procedure for noise and other construction related complaints.	✓	✓	Community Relations Manager
NVMM3	Ensure all mobile construction equipment on site have non-tonal reversing alarms.	✓	✓	Foreman, Operators
NVMM4	Plan and conduct works in a manner to minimise the reversing of vehicles with audible reversing alarms.		✓	Construction Manager, Foreman
NVMM5	Ensure trucks travel via internal haul roads and major roads where practicable to minimise use of local roads.		✓	Foreman
NVMM6	Position site compounds, access points and roads as far as practicable away from residential receivers. Position stationary or mobile equipment within site compounds as far as possible from sensitive receivers, to take advantage of natural shielding and shielding provided by buildings.		✓	Foreman
NVMM7	Ensure that truck tailgates are cleared and locked at the point of unloading.		✓	Foreman, Operators
NVMM8	Use two way radios at the minimum effective volume. Avoid slamming of doors, shouting and whistling.		✓	Foreman, Operators
NVMM9	Use quieter work methods and equipment, including the use of mufflers and silencers where practicable.		✓	Construction Manager
NVMM10	Consider compliance of plant and equipment noise levels with Appendix A and Table 2 of the CNVG in rental decisions.	✓	✓	Construction Manager

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID No.	Revised environmental management measure	Timing		Responsibility
		PC ¹	C ²	
NVMM11	Ensure vehicle warning devices, such as horns, are not used as signalling devices.		✓	Foreman, Operators
NVMM12	Undertake regular maintenance of plant and equipment, including silencers, to ensure that noise emissions do not increase over time. Servicing, refuelling and warm-up to be undertaken during standard construction hours. Machines found to produce excessive noise compared to normal industry expectations will be removed from the site or stood down until repairs or modifications can be made in accordance with REMM NV13.		✓	Foreman, Operators
NVMM13	Turn vehicles and machinery off when not in use.		✓	Foreman, Operators
NVMM14	Only use necessary equipment, of an appropriate size and power, on site.		✓	Construction Manager
NVMM15	Limit the use of engine compression brakes near residential areas where practicable.		✓	Foreman, Operators
NOISE: Standard Hours where PNL exceeds NML by more than 10 dB				
	Implement all feasible and reasonable mitigation measures NVMM1 to NVMM15 inclusive.	✓	✓	As noted above
NVMM16	<i>Verification:</i> Measure noise levels from noise intensive plant prior to use and check against manufacturer's specifications and/or the sound power levels listed in Appendix A.		✓	Construction Manager
NVMM17	<i>Notification:</i> Sensitive receivers will be notified of construction activities to be undertaken through letterbox drops (or equivalent) five (5) to fourteen (14) working days prior to commencement of the proposed work.	✓	✓	Community Relations Manager, Construction Manager
NVMM18	Maximise the offset distance between noisy items of plant and sensitive receivers for each task and activity.		✓	Foreman, Operators
NVMM19	Locate plant and equipment to take advantage of barriers provided by existing site features and structures.		✓	Foreman, Operators
NVMM20	Orient plant and equipment known to emit noise strongly in one direction so that noise is directed away from noise sensitive areas.		✓	Foreman, Operators

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID No.	Revised environmental management measure	Timing		Responsibility
		PC ¹	C ²	
NVMM21	Use traffic controllers to minimise occurrences of vehicles queuing, idling or reversing near noise sensitive receivers as much as is practical.		✓	Construction Manager, Foreman
NVMM22	Avoid metal-to-metal contact on equipment where feasible.		✓	Foreman, Operators
NVMM23	Avoid dropping material from a height into unlined metal trays (line trays with soil or similar to reduce noise).		✓	Foreman, Operators
NVMM24	Ensure stockpiles of excavated material are positioned to provide shielding to noise-sensitive land uses where possible.		✓	Construction Manager, Foreman, Operators
NVMM25	Use noise screens/ shields/ barriers where possible to mitigate noise from stationary or mobile equipment.		✓	Construction Manager, Foreman
NVMM26	Where possible, avoid or otherwise minimise the occurrence of consecutive works within the same locality, and coincidence of noisy plant/equipment working close together (and adjacent to sensitive receivers).		✓	Construction Manager, Foreman
NVMM27	Ensure loading and unloading is carried out as far as practical away from sensitive receivers.		✓	Construction Manager, Foreman
NVMM28	Ensure no queuing of trucks near sensitive receivers prior to 7.00 am Monday to Friday and prior to 8.00 am on Saturday.		✓	Construction Manager, Foreman
NOISE: Standard Hours work where residences are predicted to be Highly Noise Affected (PNL > 75 dB(A))				
	Implement all feasible and reasonable mitigation measures NVMM1 to NVMM28 inclusive.	✓	✓	As noted above
NVMM29	Undertake high noise impact activities only: <ul style="list-style-type: none"> ▪ Between 8:00am to 6:00pm Mondays to Fridays; ▪ Between 8:00am to 5:00pm Saturdays; and ▪ In continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block. 		✓	Construction Manager

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID No.	Revised environmental management measure	Timing		Responsibility
		PC ¹	C ²	
NVMM30	<p><i>Phone calls:</i></p> <p>Phone calls detailing relevant information will be made to identified residences within seven (7) calendar days of proposed work. Phone calls will provide affected residences with specific contact details and advice regarding noise management measures to be implemented. If the resident is not able to be reached via phone, door knocking and/or personalised letterbox drops (or equivalent) will be used.</p>	✓	✓	Community Relations Manager
NVMM31	<p><i>Respite offers:</i></p> <p>Consultation with highly noise affected residences will involve discussion of specific respite periods. If specific respite periods are not agreed, then NVMM29 will be followed.</p> <p><i>Note: In accordance with CoA E32, all work undertaken for the delivery of the project, including that undertaken by third parties (such as utility relocation), must be coordinated to ensure respite periods are provided.</i></p>	✓	✓	Community Relations Manager, Construction Manager, Foreman
VIBRATION				
VIBRATION: Standard Hours Works occurring within safe working distances for human comfort				
NVMM32	Undertake works during standard construction hours. Where works must occur outside of standard hours, assess Out of Hours works in accordance with the Out-of-hours work approval procedure (for work subject to an EPL) contained at Appendix C.	✓	✓	Construction Manager
NVMM33	Implement a hot line and complaints handling procedure for vibration and other construction related complaints.	✓	✓	Community Relations Manager
NVMM34	<p>Avoid vibration intensive works within the safe working distances specified in Table 32 unless necessary.</p> <p>Ensure a Hold Point is released prior to commencement of any impact piling, hammering or ripping, demolition operations or any other activities which may cause damage through vibration.</p>	✓	✓	Foreman Construction Manager
NVMM35	Restrict construction traffic speed to 20 km/h across the site, or 40 km/h for haul roads. Signpost the speed limit.		✓	Foreman
NVMM36	Restrict construction traffic to designated roadways.		✓	Foreman
NVMM37	Run plant that has high and low vibration operating settings on the lowest effective vibration setting, including static rolling where feasible.		✓	Foreman

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID No.	Revised environmental management measure	Timing		Responsibility
		PC ¹	C ²	
NVMM38	<p><i>Notification:</i></p> <p>Occupied sensitive receivers within 18 m of vibration generating activities (or as per the plant specific safe working distances if greater than 18 m specified in Table 32 for cosmetic damage) will be notified of construction activities to be undertaken through letterbox drops (or equivalent) five (5) to fourteen (14) working days prior to commencement of the proposed work.</p>	✓	✓	Community Relations Manager, Construction Manager
NVMM39	<p><i>Respite offers:</i></p> <p>Consultation with highly affected residences will involve discussion of specific respite periods. If specific respite periods are not agreed, then works will not be carried out for continuous blocks of more than three hours without a minimum respite period of one hour.</p> <p><i>Note: In accordance with CoA E32, all work undertaken for the delivery of the project, including that undertaken by third parties (such as utility relocation), will be coordinated to ensure respite periods are provided.</i></p>	✓	✓	Community Relations Manager, Construction Manager, Foreman
VIBRATION: Where works are occurring within safe working distances for sensitive equipment and cosmetic damage to buildings				
	Implement all feasible and reasonable mitigation measures NVMM32 to NVMM45 inclusive.			
NVMM40	<p>If vibration intensive plant is to be used within 18 m of vibration generating activities (or as per the plant specific safe working distances for sensitive equipment and cosmetic damage specified in Table 32), works would not proceed until attended vibration measurements are undertaken (i.e. vibration monitoring will be carried out at the beginning of the given construction activity in accordance with REMM NV10). Where measurements indicate building damage criteria are exceeded, vibration generating activities are to immediately halt and alternative low-vibration work practices will be investigated and implemented prior to restarting work. The investigation/review of alternative low-vibration work practices will be undertaken and documented in accordance with REMM NV11.</p>		✓	Foreman, Environment Coordinator

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID No.	Revised environmental management measure	Timing		Responsibility
		PC ¹	C ²	
NVMM41	<p>Where vibration intensive works are occurring for a period of more than one day continuously within the safe working distances for sensitive equipment and cosmetic damage (specified in Table 32), install a permanent (unattended) vibration monitoring system to warn operators (via flashing light, audible alarm, SMS etc.) when vibration levels are approaching the cosmetic damage objective.</p> <p>If warning levels or alerts are triggered, stop works immediately. Assess the cause of the warnings and determine if there are any additional mitigation measures required. Ensure that these mitigation measures are implemented prior to restarting work.</p>		✓	Environment Coordinator Operators Foreman
NVMM42	<p>Undertake <u>pre-construction building and structure condition</u> surveys at residential receivers within 18 m of proposed vibration generating activities.</p> <p>Also undertake pre-construction building and structure condition surveys at non-residential receivers (including utilities and the like) where modelling (or desktop estimates), or monitoring indicates that vibration levels will be exceeded.</p>	✓	✓	Environment Coordinator
NVMM43	<p>Undertake <u>post-construction building and structure condition</u> surveys at residential receivers within 18 m of proposed vibration generating activities.</p> <p>Also undertake post-construction building and structure condition surveys at non-residential receivers (including utilities and the like) where modelling (or desktop estimates), or monitoring indicates that vibration levels will be exceeded.</p>		✓	Environment Coordinator
NVMM44	Undertake surveys of buildings and structures immediately following a monitored exceedance of the relevant vibration criteria.		✓	Environment Coordinator
NVMM45	Carry out background vibration monitoring at the sensitive equipment locations in the John Hunter Hospital precinct as identified in Section 9.4.3 to confirm the baseline/ existing ambient vibration levels.		✓	Environment Coordinator

Table 34: Out of hours noise and vibration mitigation measures

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHW NOISE				
OOHW STAGE 1				

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
ANY OOHW: NML EXCEEDANCE ≤ 5 dB(A) & NO EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA				
	Implement all feasible and reasonable mitigation measures NVMM1 to NVMM15 inclusive.	✓	✓	As noted in Table 33
OOHW STAGE 2				
OOHW PERIOD 1: NML EXCEEDANCE > 5 dB(A) AND ≤ 25 dB(A)				
OOHW PERIOD 2: NML EXCEEDANCE > 5 dB(A) AND ≤ 15 dB(A) AND NO EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA				
	Implement all feasible and reasonable mitigation measures NVMM1 to NVMM15 and OOHMM1 to OOHMM12.	✓	✓	As noted in Table 33
OOHMM1	<i>Verification:</i> Measure noise levels from noise intensive plant prior to use and check against manufacturer's specifications and/or the SWLs listed in Appendix A.		✓	Construction Manager
OOHMM2	<i>Notification:</i> Sensitive receivers will be notified of construction activities to be undertaken through letterbox drops (or equivalent) five (5) to fourteen (14) working days prior to commencement of the proposed work.	✓	✓	Community Relations Manager Construction Manager
OOHMM3	<i>Respite Period 1 (OOHW Period 1 only):</i> Out of hours construction noise will be limited to no more than three consecutive periods per week impacting particular sensitive receivers except where there is a Duration Respite (OOHMM5) and as permitted by the EPL (Number 21762). <i>Note: In accordance with CoA E32, all work undertaken for the delivery of the project, including that undertaken by third parties (such as utility relocation), will be coordinated to ensure respite periods are achieved in accordance with CoA E29 and documentary evidence in support of this respite or mitigation provided to the ER).</i>	✓	✓	Community Relations Manager Construction Manager
OOHMM4	<i>Respite Period 2 (OOHW Period 2 only):</i> Out of hours construction noise will be limited to no more than two consecutive periods per week impacting particular sensitive receivers except where there is a Duration Respite (OOHMM5) and as permitted by the EPL (Number 21762). <i>Note: In accordance with CoA E32, all work undertaken for the delivery of the project, including that undertaken by third parties (such as utility relocation), will be coordinated to ensure respite periods are achieved in accordance with CoA E29 and documentary evidence in support of this respite or mitigation provided to the ER).</i>	✓	✓	Community Relations Manager Construction Manager

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM5	<p><i>Duration Respite:</i></p> <p>Engagement will be undertaken with the affected community to offer an alternative respite period and as permitted by the EPL (Number 21762).</p> <p><i>Note: In accordance with CoA E32, all work undertaken for the delivery of the project, including that undertaken by third parties (such as utility relocation), will be coordinated to ensure respite periods are achieved in accordance with CoA E29 and documentary evidence in support of this respite or mitigation provided to the ER).</i></p>	✓	✓	Community Relations Manager Construction Manager
OOHMM6	Maximise the offset distance between noisy items of plant and sensitive receivers for each task and activity.		✓	Foreman Operators
OOHMM7	Locate plant and equipment to take advantage of barriers provided by existing site features and structures.		✓	Foreman
OOHMM8	Orient plant and equipment known to emit noise strongly in one direction so that noise is directed away from noise sensitive areas. Consider the use of temporary hoarding where reasonable for impulsive and tonal activities.		✓	Operators
OOHMM9	Use traffic controllers to minimise occurrences of vehicles queuing, idling or reversing near noise sensitive receivers as much as is practical.		✓	Construction Manager Foreman
OOHMM10	Position site access points and roads as far as practicable away from residential receivers.		✓	Foreman Operators
OOHMM11	Avoid metal-to-metal contact on equipment where feasible.		✓	Foreman Operators
OOHMM12	Avoid dropping material from a height into unlined metal trays (line trays with soil or similar to reduce noise).		✓	Foreman Operators
<p>OOHW STAGE 3</p> <p>OOHW PERIOD 1: NML EXCEEDANCE > 25 dB(A)</p> <p>OOHW PERIOD 2: NML EXCEEDANCE > 15 dB(A) AND ≤ 25 dB(A), AND/OR EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA</p>				
	Implement all feasible and reasonable mitigation measures NVMM1 to NVMM15 and OOHMM1 to OOHMM15.	✓	✓	As noted in Table 33
OOHMM13	<p><i>Individual briefings:</i></p> <p>Where possible with agreement, individual visits made with identified stakeholders at least 48 hours ahead of potentially disturbing construction activities.</p>	✓	✓	Community Relations Manager

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM14	<p><i>Phone calls:</i></p> <p>Phone calls detailing relevant information will be made to identified residences within seven (7) calendar days of proposed work. Phone calls will provide affected residences with specific contact details and advice regarding noise management measures to be implemented. If the resident is not able to be reached via phone, door knocking and/or personalised letterbox drops will be used.</p>	✓	✓	Community Relations Manager
OOHMM15	<p><i>Specific notification:</i></p> <p>Personalised letterbox drops made to identified residences at least seven (7) calendar days ahead of works with specific details on works and management measurements in place.</p>	✓	✓	Community Relations Manager
<p>OOHW STAGE 4</p> <p>OOHW PERIOD 2: NML EXCEEDANCE > 25 dB(A) AND EXCEEDANCE OF SLEEP DISTURBANCE CRITERIA</p>				
	<p>Implement all feasible and reasonable mitigation measures NVMM1 to NVMM15 and OOHMM1 to OOHMM17.</p>	✓	✓	As noted in Table 33
OOHMM16	<p>Install temporary hoarding where feasible to shield noise to affected sensitive receivers.</p>		✓	Construction Manager
OOHMM17	<p><i>Alternative Accommodation</i></p> <p>Consider temporary relocation of receivers where the construction noise level exceeds the night-time NML by more than 25 dB(A) for an extended period of time. The specifics of any offer will be considered on a case-by-case basis.</p>	✓	✓	Community Relations Manager
<p>OOHW VIBRATION</p>				
<p>VIBRATION: Works occurring within safe working distances for human comfort</p>				
	<p>Implement all feasible and reasonable mitigation measures NVMM32 to NVMM44 and OOHMM18 to OOHMM21.</p>	✓	✓	As noted in Table 33
OOHMM18	<p><i>Individual briefings:</i></p> <p>Where possible with agreement, individual visits made with identified stakeholders at least 48 hours ahead of potentially disturbing construction activities.</p>	✓	✓	Community Relations Manager

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
OOHMM19	<p><i>Phone calls:</i></p> <p>Phone calls detailing relevant information will be made to identified residences within seven (7) calendar days of proposed work. Phone calls will provide affected residences with specific contact details and advice regarding noise management measures to be implemented. If the resident is not able to be reached via phone, door knocking and/or personalised letterbox drops will be used.</p>	✓	✓	Community Relations Manager
OOHMM20	<p><i>Specific notification:</i></p> <p>Personalised letterbox drops made to identified residences at least seven calendar days ahead of works with specific details on works and management measurements in place.</p>	✓	✓	Community Relations Manager
OOHMM21	<p><i>Alternative Accommodation (OOHW Period 2 only)</i></p> <p>Consider temporary relocation of receivers where the vibration levels will considerably exceed the night-time human comfort criteria for extended periods of time and where respite periods may not be feasible. The specifics of any offer will be considered on a case-by-case basis.</p>	✓	✓	Community Relations Manager
VIBRATION: Where works are occurring within safe working distances for sensitive equipment and cosmetic damage to buildings				
	Implement all feasible and reasonable mitigation measures NVMM32 to NVMM45 inclusive.	✓	✓	As noted in Table 33

9. Compliance management

9.1. Roles and responsibilities

Fulton Hogan’s Project Team organisational structure and overall roles and responsibilities are outlined in Section 4.1 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Table 33 and Table 34 of this NVMP.

9.2. Training

All employees, subcontractors and utility staff working on site will undergo site induction training relating to noise and vibration management issues, including:

- the potential for noise and vibration impacts on local residents and advice on practical and reasonable measure to minimise these impacts
- incident response, management and reporting
- standard construction hours
- the process for seeking approval for out of hours works, including consultation
- noise management measures during night works
- location of noise and vibration sensitive areas

- complaints response and reporting
- general noise and vibration management controls
- specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works.

Targeted training in the form of toolbox talks or specific environmental training will also be provided to personnel with a key role in noise and vibration management. An example of a training topic could include noise meter operation for environment or designated staff.

Further details regarding staff induction and training are outlined in Chapter 5 of the CEMP.

9.3. Complaints

Complaints will be recorded and addressed in accordance with Section 6.2.3 of the CEMP and the Community Communication Strategy (CCS).

9.4. Inspections and monitoring

This section of the NVMP specifically addresses requirements for a noise and vibration construction monitoring in accordance with CoA C9 to C15. General requirements and responsibilities in relation to inspections and monitoring are documented in Sections 8.1 and 8.2 of the CEMP respectively.

Where actual noise levels are found to consistently exceed the predicted worst-case levels, the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented to either reduce noise emissions or reduce the impacts on receivers. Vibration generating activities with potential impact on buildings and heritage items require vibration monitoring before and during the activities. Minimum working distances are to be identified to prevent cosmetic damage.

In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, review of the construction methodology is required. Additional mitigation measurements have to be implemented.

The results of the Construction Monitoring Program will be submitted to the Planning Secretary and relevant public authorities for information, in the form of a Construction Monitoring Report as documented in Chapter 9 of the CEMP (main section).

9.4.1. Noise monitoring

The following noise monitoring will be undertaken:

- Monthly noise monitoring at nominated sensitive receiver locations to determine the effectiveness of mitigation measures against predicted impacts. The nominated locations are identified in Section 1.1.1. These locations have been selected considering the proximity of each NCA to key construction zones. They are considered to be representative of the most potentially affected sensitive receivers based on the outcomes of the EIS construction noise assessment;
- Where complaints are received, additional noise monitoring may be undertaken at sensitive receivers to determine if the actual construction noise generated exceeds the predicted construction noise levels identified in Section 7 and Appendix B of this NVMP;
- Noise monitoring may be carried out for the purpose of refining construction methods or techniques to minimise noise
- Ongoing spot checks of noise intensive plant and equipment will be undertaken throughout construction to ensure compliance with manufacturer's specifications.
- OOHW noise monitoring to confirm compliance with the noise model will be confirmed for each OOHW activity onsite.

Where actual noise levels are found to exceed the predicted worst-case levels, the source of excessive noise generations will be identified, and any additional feasible and reasonable measures available will be implemented

to either reduce noise emissions or reduce the impacts on receivers. At a minimum, the noise mitigation measures detailed in Chapter 8 for the measured exceedance of the relevant NML will be applied.

Details of site activity and equipment usage will be noted during construction noise monitoring.

Acoustic instrumentation employed in the noise monitoring surveys will comply with the requirements of AS IEC 61672-2019 Electroacoustics – Sound Level Meters.

9.4.2. Vibration monitoring

The following attended vibration monitoring will be undertaken:

- Background monitoring at the sensitive equipment locations in the John Hunter Hospital precinct as identified in Section 9.4.3 to confirm the baseline/ existing ambient vibration levels
- For the protection of buildings, monitoring will be carried out at the commencement of vibratory compaction work and any rock-breaking within 18 metres of buildings (or as per the plant specific safe working distances) to ensure that safe vibration working distances specified in Table 32 are not exceeded and to confirm safe working distances
- When vibration intensive activities are required, vibration monitoring will be carried out within the established buffer zones, or where there is considered to be a risk that levels may exceed the relevant structural damage goals
- Vibration monitoring may be carried out in response to complaints, exceedances, or for the purpose of confirming safe working distances and refining construction methods or techniques to minimise vibrations
- Vibration monitoring will continue throughout construction, where appropriate, at nominated sensitive receiver locations to determine the effectiveness of mitigation strategies.

Where vibration is found to exceed safe levels, work at the site will cease/ halt immediately. If the exceedance relates to vibration sensitive equipment within the John Hunter hospital precinct, Health Administration Corporation will be notified immediately. The Environmental Manager will investigate the cause of the exceedance and determine if there are any additional mitigation measures required. Examples of these measures include work methodology and/ or equipment reviews. It is the responsibility of the relevant Foreman to ensure that the identified additional mitigation measures are implemented prior to restarting work. In the event a complaint relating to property damage is received, an inspection of the property would be undertaken and an interim building condition survey prepared.

Longer-term unattended monitoring may be conducted in situations where there is a requirement to work within safe working distances and attended monitoring has demonstrated that there is a reasonable risk of exceeding the established vibration criteria at sensitive receivers or structures. These monitors would have the capability to send automated alerts or include audible or visual alarms.

If the potential exceedance is to occur more than once or extend over a period of 24 hours, landowner(s) and occupier(s) must be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the landowner and occupier in accordance with the requirements of CoA E36.

Vibration monitoring will be carried out in accordance with:

- For structural damage vibration – German Standard DIN 4150-3 and BS 7385: Part 2 – 1993
- For human exposure to vibration – the evaluation criteria presented in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DECC 2006).

9.4.3. Monitoring program summary

In accordance with CoA C9, a noise monitoring program summary is included in Table 35. Additionally, a vibration monitoring program summary is included in Table 36. The nominated noise and vibration monitoring locations are outlined below.

Noise

The nominated monthly attended noise monitoring locations:

- Location L04: 53 Robert Street
- Location L05: 4 Crest Road
- Location L06: 11 Myall Street
- Location L08: 17 Minimbah Street
- Location L09: 40 Roberts Circuit
- Location L10: 12 Sygna Close
- Location L11: Yallarwah Cottage (John Hunter Hospital precinct)
- Location L12: Ronald McDonald House (John Hunter Hospital precinct)
- Location L15: 45 Kingsway Avenue
- Location L18: 121 Lookout Road

The nominated monthly construction noise monitoring locations are shown on Figure 7.

The monitoring locations are selected to cover each NCA and proximity to key construction zones and most potentially affected sensitive receivers. Location L06 has been selected due to its proximity to construction compound C (located on the western side of the northern interchange). Location L18 has been selected due to its proximity to both construction compound F (located at the intersection of McCaffrey Drive and Lookout Drive) and the Lookout Road site (located to the north of the water tower, north of Grandview Avenue).

These monitoring locations will be reviewed during construction and amended if necessary.

These locations have also been selected to coincide with the approximate locations where previous baseline monitoring occurred during the EIS. For these locations, the EIS baseline noise monitoring data will be used as the baseline data for the construction noise monitoring.

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)

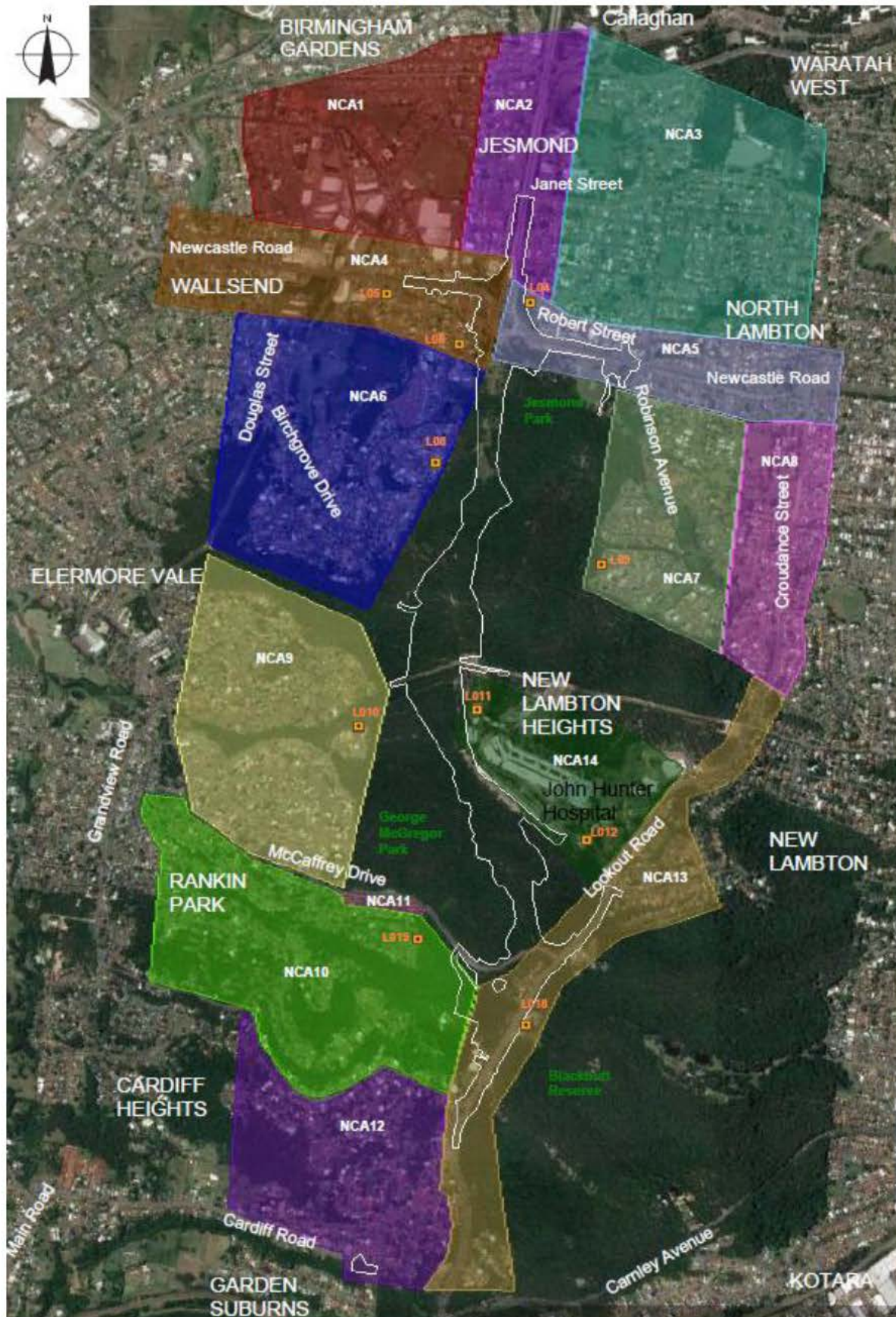


Figure 7: Nominated construction noise monitoring locations

Vibration

The nominated background vibration monitoring locations (at the sensitive equipment locations in the John Hunter Hospital precinct) to confirm the baseline/ existing ambient vibration levels:

- Location V1: HMRI Building
- Location V2: Level 2 Allied Health – Speech Pathology and Level 2 Sleep Lab
- Location V3: Level 3 Theatres (i.e. above Level 2 Emergency Department – Medical Imaging and Level 2 Medical Imaging)
- Location V4: Level 3 Theatres
- Location V5: Level 2 Hunter Area Pathology Service (HAPS)
- Location V6: Forensic Medicine.

The nominated background vibration monitoring locations are shown on Figure 8.

The background monitoring locations are selected for proximity to Fulton Hogan's key construction zones and most potentially affected sensitive equipment locations. It is noted that NEXUS (refer to Figure 1) is not a monitoring location as other more conservative monitoring locations closer to Fulton Hogan's construction activities have been selected (i.e. V1, V5 and V6).

These locations will be reviewed during construction and amended if necessary.

Information regarding non-conformances and reporting requirements are documented in Section 9.7 and 9.6 respectively of this NVMP



Figure 8: Background vibration monitoring locations (at the sensitive equipment locations in the John Hunter Hospital precinct)

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 35: Noise Monitoring Procedure

Monitoring Details	Frequency	Test Procedure
Attended noise monitoring at sensitive receiver locations identified in Section 9.4.3	Monthly	Test method to comply with AS 1055:2018 and includes; <ul style="list-style-type: none"> • Sound level meter configured for “Fast” time weighting and “A” frequency weighting • To minimise the influence of reflected sound, the measurement will be carried out at least 3.5 m from any reflecting surface (other than the ground) where possible. • Tests will not be carried out during rain or when the wind speed at the test site exceeds 5m/s • Conditions such as wind velocity, wind direction, temperature, relative humidity and cloud cover will be recorded. • Monitoring period should be sufficient such that the measured noise levels are representative of the noise over a 15-minute period • At a minimum Leq, Lmax, L10 and L90 levels will be measured and reported • The observations of the person undertaking the measurements will be reported including audibility of construction noise, other noise in the environment and any discernible construction activities contributing to the noise at the receiver
OOHW noise monitoring at sensitive receivers	As required: during OOHW	
In response to a noise complaint; <ul style="list-style-type: none"> • If monitoring is considered an appropriate response to determine if noise levels exceed predicted ‘worst case’ construction noise levels 	As required	

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



<p>Spot checks of noise intensive plant unless previously measured</p>	<p>Monthly – for construction activities predicted to exceed NML's</p>	<p>The test procedure for construction plant will follow the stationary test procedures according to Australian Standard AS 1055:2018:</p> <ul style="list-style-type: none"> • Sound level meter configured for “Fast” time weighting and “A” frequency weighting • The test environment will be free from reflecting objects • Tests will not be carried out during rain or when the wind speed at the test site exceeds 5 m/s • The influence of noise from sources other than the source of interest shall be minimised and quantified in accordance with the methodology outlined in AS1055:2018. • Leq and L10 levels will be measured and reported
<p>Where required;</p> <ul style="list-style-type: none"> • Refining construction methods • To reduce noise levels 	<p>As required</p>	
<p>To manage cumulative impacts from the RP2J and John Hunter Health and Innovation Precinct (JHHIP) projects</p>	<p>As required</p>	<p>Continuous (unattended) noise monitoring to manage cumulative impacts in consultation with Health Administration Corporation if deemed necessary during the ongoing RP2J JHHIP Project Control Group (PCG) meetings.</p>

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Table 36: Vibration Monitoring Procedure

Monitoring Details	Frequency	Test Procedure
Background monitoring at the sensitive equipment locations in the John Hunter Hospital precinct as identified in Section 9.4.3 to confirm the baseline/ existing ambient vibration levels	Prior to construction works in the area	<p>Attended vibration monitoring will be undertaken when checking the safe working distances from construction plant or in response to a complaint. The testing method includes:</p> <ul style="list-style-type: none"> • Transducer to be affixed to ground or building in general accordance with AS 2775- 2004 • Monitoring to be conducted for at least three distances from the plant, including a representative distance for the nearest sensitive structures and/or receivers • The testing will be conducted at each location to obtain a suitable representation of the range of vibration levels that would occur from the tested plant • Peak (PPV) vibration levels and the dominant frequency of the vibration will be recorded for assessment against the structural and cosmetic damage criteria. In situations in which human comfort is also of concern then the rms vibration level should also be recorded
At the commencement of vibratory compaction work within 18 m of residential buildings	As required	
Where a valid complaint is received in relation to human exposure to vibration levels and monitoring is considered an appropriate response	As required	
Where a valid complaint is received in relation to suspected property damage due to vibration impacts and monitoring is considered an appropriate response	As required	
Where an activity may occur within safe working distances for cosmetic damage for no more than one day continuously	As required	
To confirm safe working distances and refine construction methods if vibration levels exceed guideline values/ limits for sensitive equipment	As required	

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



<p>Where an activity may occur within safe working distances for sensitive equipment or cosmetic damage (specified in Table 32) for a period of more than one day continuously</p>	<p>As required</p>	<ul style="list-style-type: none"> • Continuous (unattended) vibration monitoring will be undertaken in situations where there is a risk that vibration from a particular construction activity may exceed the sensitive equipment or cosmetic damage criteria at a sensitive structure. This will be where activities may occur within the safe working distances for sensitive equipment or cosmetic damage identified in Table 32 (NVMP). • Transducer to be affixed to ground or building in general accordance with AS 2775-2004 • Vibration logger to continuously measure vibration level while the relevant works are occurring within the safe working distance for sensitive equipment or cosmetic damage • Measurement to be conducted as close as possible to the sensitive equipment/ structure. • A warning system will be implemented with the monitoring system including one or both of the following: <ul style="list-style-type: none"> ○ audible and/or visual warning alarm ○ SMS and/or email alerts to site personnel
<p>To manage cumulative impacts from the RP2J and JHHIP projects</p>	<p>As required</p>	<p>Continuous (unattended) vibration monitoring to manage cumulative impacts in consultation with Health Administration Corporation if deemed necessary during the ongoing RP2J JHHIP Project Control Group (PCG) meetings.</p>

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



<p>Dilapidation surveys of buildings and structures (also known as Building and Structure Condition Surveys) where construction works occurs within the safe working distance for cosmetic damage, or if modelling (or desktop estimates), or monitoring indicates that vibration levels will be exceeded.</p>	<p>Prior to construction works / Post construction</p>	<p>At a minimum, dilapidation surveys and reports will comprise:</p> <ul style="list-style-type: none">• A visual inspection of the structure, including all internal and external walls, ground level floors and external pavements, all connections of other structures above ground level and their connection at ground level and any exposed foundations at 18 m from buildings, within the minimum working distances for sensitive equipment or areas in the John Hunter Hospital precinct or if monitoring indicates that vibration levels are exceeded.• Full written building Condition Survey Report outlining the condition of the internal and external components of each property• A series of photographs of each identified defect/crack• Identification of any condition changes relative to Pre-Construction and the likely cause of the change (Post-construction only)
--	--	---

9.5. Auditing

Auditing (both internal and external) will be undertaken to assess the effectiveness of environmental mitigation measures, compliance with this NVMP, TfNSW specifications and other relevant approvals, permits and licences. Auditing requirements are detailed in Section 8.4 of the CEMP.

9.6. Reporting

An Annual Construction Noise and Vibration Monitoring Report will be prepared and submitted to the ER, Planning Secretary and relevant public authorities for information in accordance with CoA C15. The report will include analysis of the results within the reporting timeframe against the relevant criteria.

General reporting requirements and responsibilities are documented in Chapter 9 of the CEMP.

9.7. Non-conformances

Non-conformances will be dealt with and documented in accordance with Chapter 10 of the CEMP.

10. Review and improvement of NVMP

The NVMP will be reviewed to ensure compliance with legislative requirements and its suitability and effectiveness for the project.

The review may be in the form of:

- A formal management review
- An audit, and/or
- An inclusion as a separate item at a site meeting.

The Environmental Manager may review and update the NVMP more regularly where:

- Significant changes in construction activities occur
- Where targets are not being achieved, or
- In response to audits and non-conformance reports.

Any minor changes to the NVMP will be approved by the ER and the remainder approved by the Planning Secretary in accordance with CoA C8. For additional information about the document review process, refer to Section 1.6 of the CEMP.

Appendix A: Indicative plant and equipment sound power levels

Appendix A: Indicative plant and equipment sound power levels (SWLs)

Maximum SWL for the typical operation of construction plant and equipment applied in noise modelling are listed in Table 37.

The overall activity SWLs are based on the typical loudest combination of equipment likely occurring for each activity. Note that the overall sound power levels have not generally been obtained by combining predicted noise levels for all items of equipment listed as this is not a typical operating scenario.

Table 37: SWLs

General tasks	Representative equipment	Equipment individual SWL, LW dB(A)	Adopted activity SWL, LW dB(A)
Establishment of temporary fencing and traffic management	Truck (medium rigid)	103	110
	Road truck	108	
	Scissor Lift	98	
	Franna crane	98	
Installation of erosion and sediment controls	Road Truck	108	113
	Backhoe	111	
Establishment of construction compound sites	Hand tools (electric)	102	117
	Crane	110	
	Grader	110	
	Vibratory roller ¹	113	
	Road Truck	108	
Vegetation clearing and grubbing	Dozer	116	122
	Chainsaw	114	
	Excavator 30T	110	
	Dump truck	117	
	Tub Grinder & Mulcher	116	
Utility relocations	Crane	110	114
	Road truck	108	
	Excavator 30T	110	
Demolition of existing houses	Dozer	116	120
	Hand tools (pneumatic) ¹	116	
	Crane	110	
	Road truck	108	
	Excavator 30T	110	
Stripping, stockpiling and management of topsoil and unsuitable materials	Excavator 30T	110	122
	Dump truck	117	
	Dozer	116	
	Road truck	108	
	Scraper	116	
Earthworks preparation/bulk earthworks	Dozer	116	123
	Scraper	116	
	Dump truck	117	
	Excavator 30T	110	
	Road truck	108	
	Compactor	113	
	Vibratory roller ¹	113	
Earthworks - Hard rock	Excavator with pulveriser	108	123

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



	Excavator with rock hammer/breaker ¹	123	
Compound operation (general)	Light vehicle	106	113
	Franna crane	98	
	Compressor	110	
	Road truck	108	
Major compound	Rock crusher	124	126
	Batching Plant (Asphalt)	108	
	Batching Plant (Concrete)	108	
	Excavator 30T	110	
	Dump truck	117	
	Dozer	116	
Property adjustment work	Hand tools (pneumatic) ¹	116	117
	Road truck	108	
	Excavator 30T	110	
Mine remediation work	Batching Plant (Concrete)	108	117
	Drilling Rig	111	
	Crane	110	
	Concrete truck	112	
	Concrete pump truck	108	
Bridge construction	Concrete truck	112	116
	Crane	110	
	Concrete pump truck	108	
	Hand tools (electric)	102	
	Excavator 30T	110	
Drainage work including culverts, subsoil drains, kerb and guttering	Excavator 30T	110	115
	Concrete truck	112	
	Road truck	108	
	Hand tools (electric)	102	
Structural work	Hand tools (electric)	102	111
	Crane	110	
Pavement and median construction including compaction and install asphalt	Vibratory roller ¹	113	121
	Compactor	113	
	Grader	110	
	Road truck	108	
	Asphalt paver	108	
	Concrete truck	112	
	Hand tools (pneumatic) ¹	116	
Construct tie-ins to existing roads	Asphalt Rotormill	111	121
	Asphalt paver	108	
	Dump truck	117	

Appendix B2: Noise and Vibration Management Sub-Plan

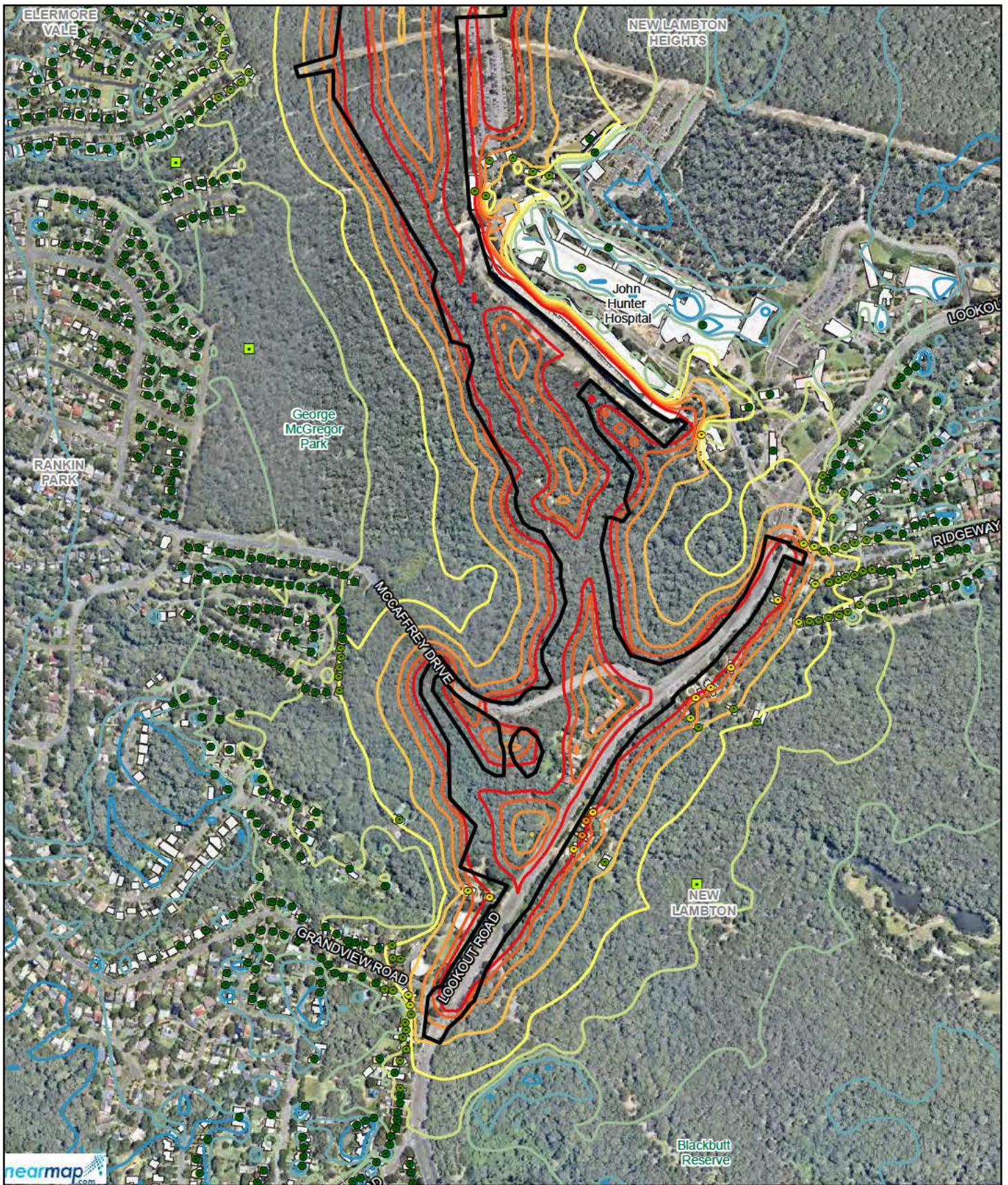
Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



	Excavator 30T	110	
	Road truck	108	
	Grader	110	
	Vibratory roller	113	
Installation of street lights	Crane	110	118
	Road truck	108	
	Piling rig (bored or CFA) ¹	116	
	Hand tools (electric)	102	
Landscaping	Excavator 30T	110	113
	Road truck	108	
	Hand tools (electric)	102	
Finishing work including installation of pavement marking and signposting	Hand tools (electric)	102	109
	Road truck	108	
Removal of construction compound and site tidy up	Hand tools (electric)	102	113
	Crane	110	
	Excavator 30T	110	

¹ This includes a 5 dB addition as the ICNG states that this activity is proven to be particularly annoying to nearby residences and a 5 dB penalty should be factored into the predicted noise levels.

Appendix B: Construction scenario noise prediction figures



LEGEND

- Construction footprint
- Building
- Active recreation receiver

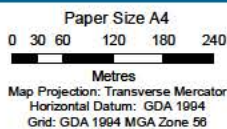
Noise contour

- 35 dBA L_{Aeq} (15-minute)
- 40 dBA L_{Aeq} (15-minute)
- 45 dBA L_{Aeq} (15-minute)
- 50 dBA L_{Aeq} (15-minute)
- 55 dBA L_{Aeq} (15-minute)
- 60 dBA L_{Aeq} (15-minute)
- 65 dBA L_{Aeq} (15-minute)
- 70 dBA L_{Aeq} (15-minute)
- 75 dBA L_{Aeq} (15-minute)

Exceedance

- 0 - 10 dBA
- 10 - 20 dBA
- 20 - 30 dBA
- 30 - 40 dBA

- 40 - 50 dBA

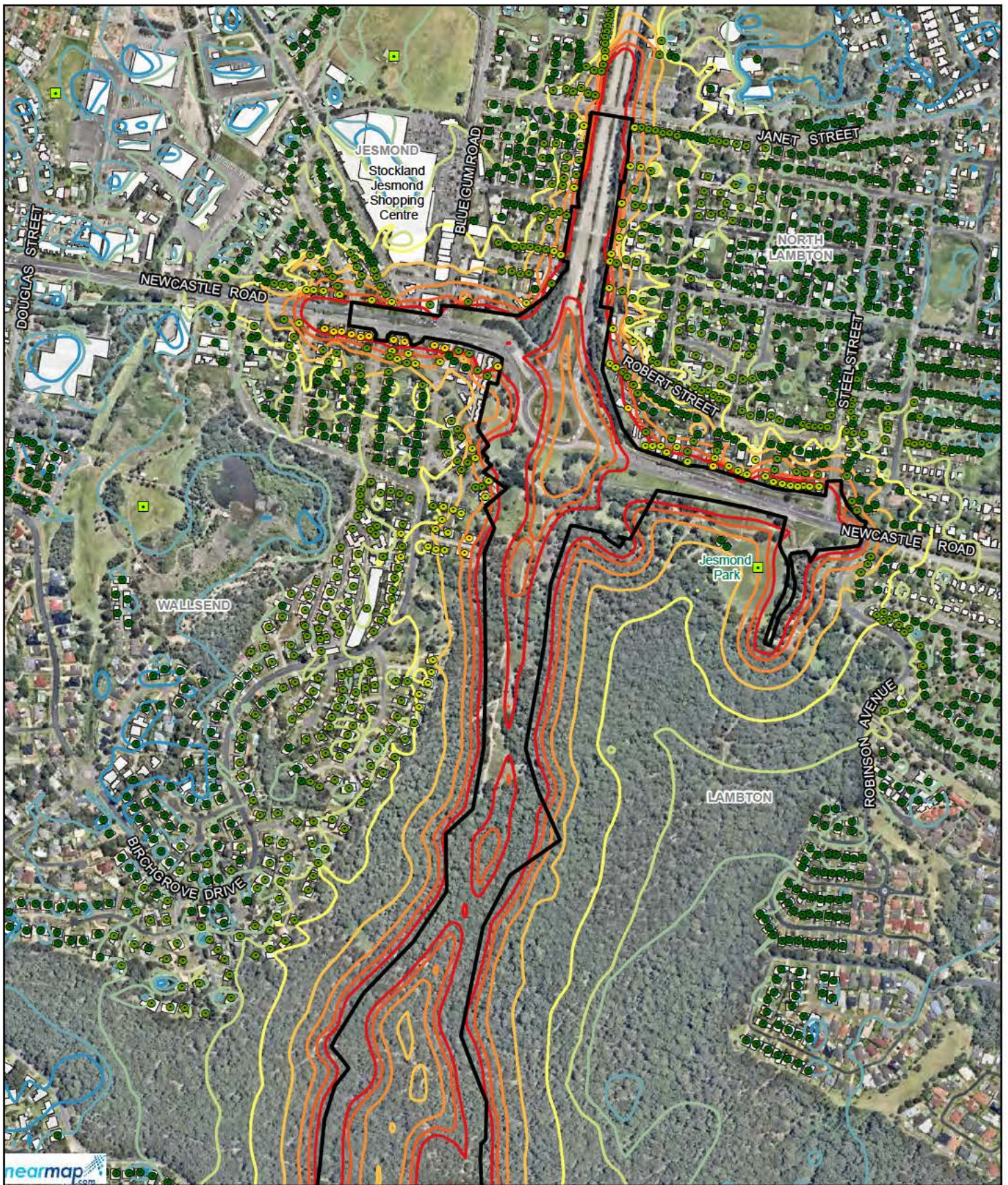


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Predicted construction noise levels,
Scenario 1 - sheet 1 of 2

Figure E-1a



LEGEND

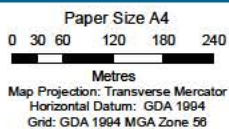
- Construction footprint
- Building
- Active recreation receiver

Noise contour

- 35 dBA L_{Aeq} (15-minute)
- 40 dBA L_{Aeq} (15-minute)
- 45 dBA L_{Aeq} (15-minute)
- 50 dBA L_{Aeq} (15-minute)
- 55 dBA L_{Aeq} (15-minute)
- 60 dBA L_{Aeq} (15-minute)
- 65 dBA L_{Aeq} (15-minute)
- 70 dBA L_{Aeq} (15-minute)
- 75 dBA L_{Aeq} (15-minute)

Exceedance

- 0 - 10 dBA
- 10 - 20 dBA
- 20 - 30 dBA
- 30 - 40 dBA

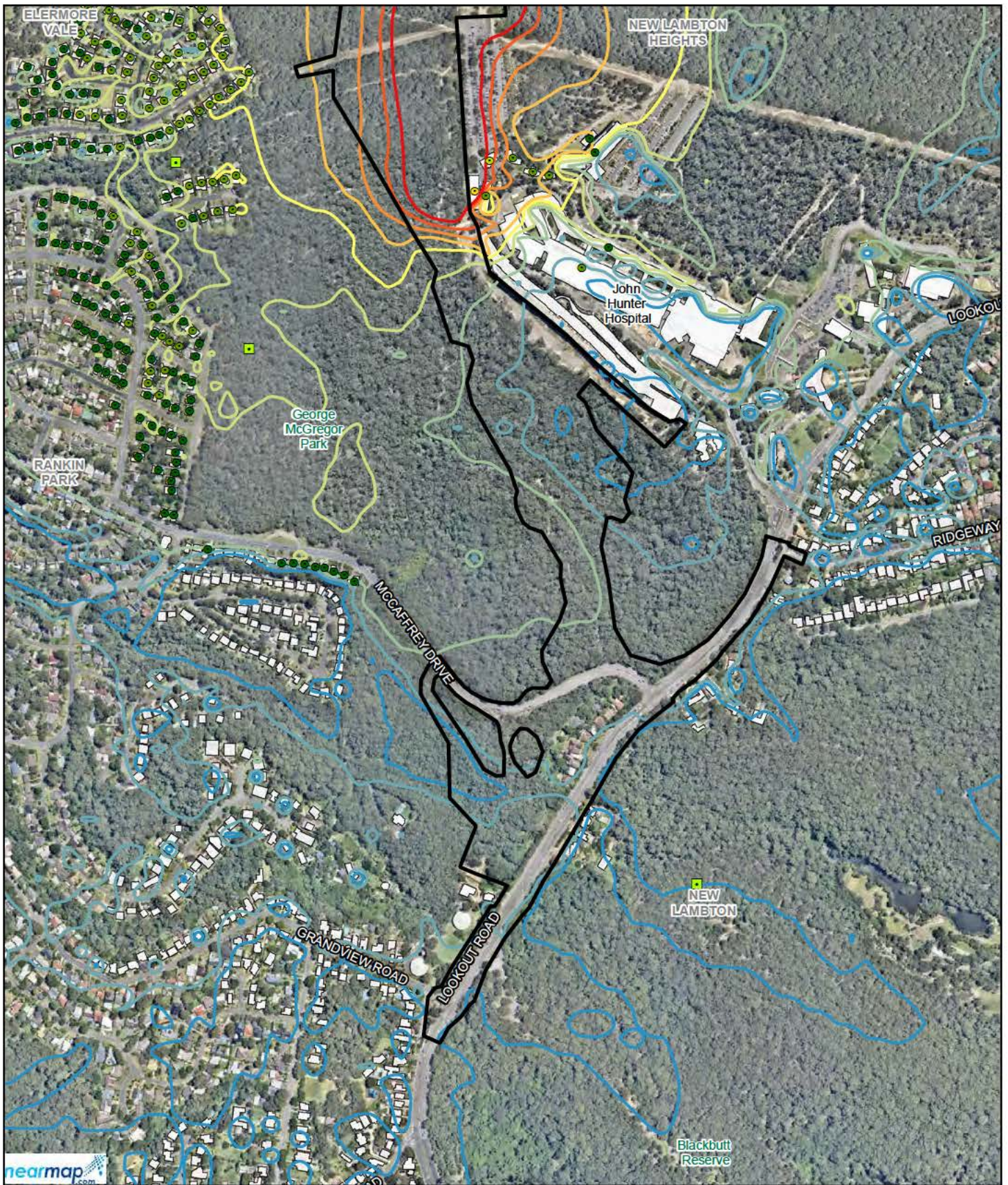


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

Predicted construction noise levels,
Scenario 1 - sheet 2 of 2

Figure E-1b



LEGEND

Construction footprint	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	0 - 10 dBA
Building	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Active recreation receiver	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	30 - 40 dBA
		75 dBA L _{Aeq} (15-minute)	

Paper Size A4
 0 30 60 120 180 240
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



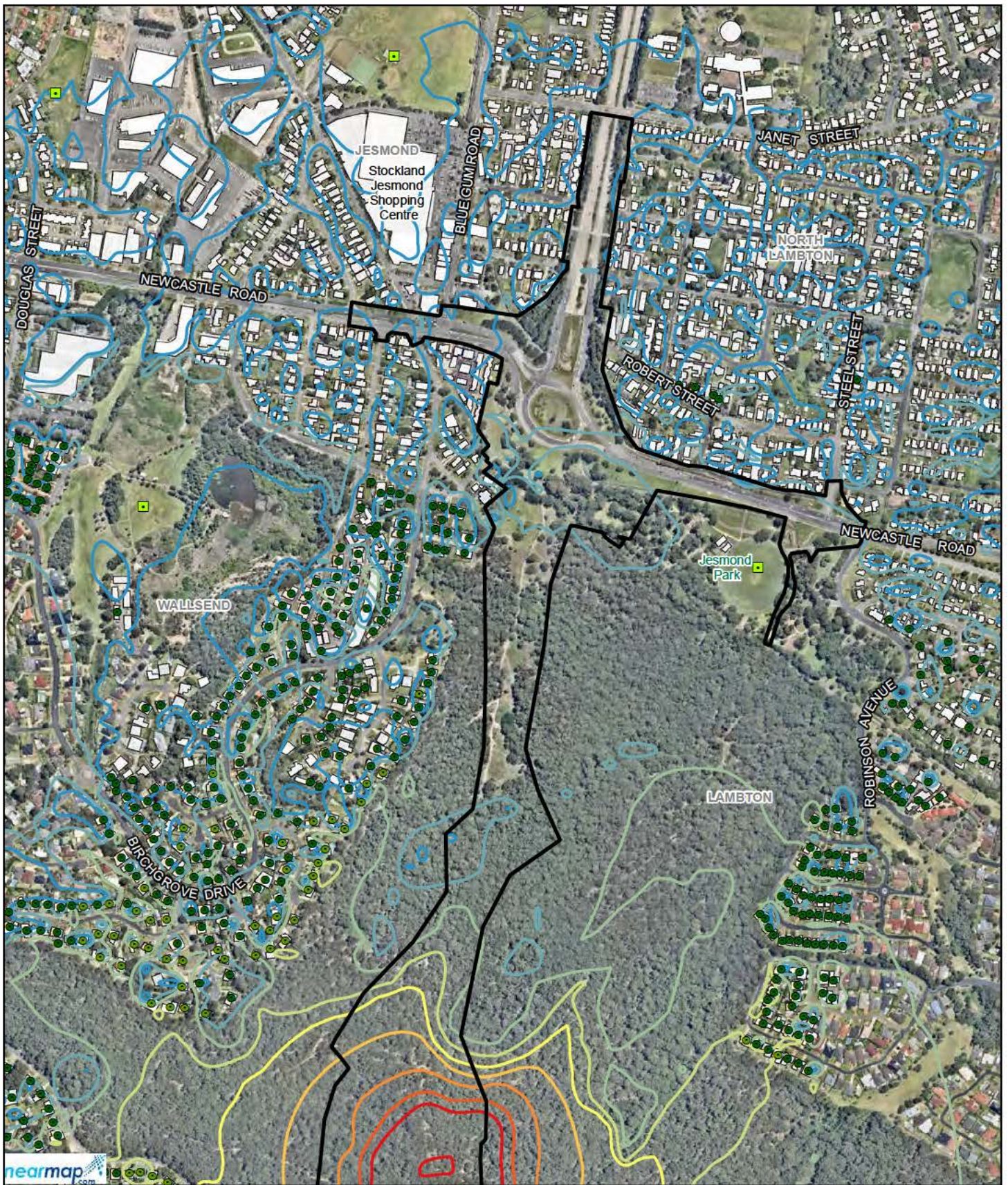
Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number | 22-17656
 Revision | 0
 Date | 16 Apr 2018

Predicted construction noise levels,
 Scenario 3a - sheet 1 of 2

Figure E-2a

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntmail@ghd.com W www.ghd.com.au
 G:\2217656\GIS\Maps\Deliverables\Supplementary_NoiseConstruction\2217656_SNC002_DDP_ConstructionNoise_Scen3a_0.mxd
 © 2018. Whilst every care has been taken to prepare this map, GHD, Nearmap, Aurecon and LPI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.
 Data source: Nearmap: Aerial Imagery, 20180331; Aurecon: Construction footprint, 2016; LPI: DTDB, 2012. Created by: fmackay, tmorton



LEGEND

- | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------|
| Construction footprint | Noise contour | 55 dBA L _{Aeq} (15-minute) | Exceedance |
| Building | 35 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | 0 - 10 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | |
| | 50 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | |

Paper Size A4
 0 30 60 120 180 240
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56

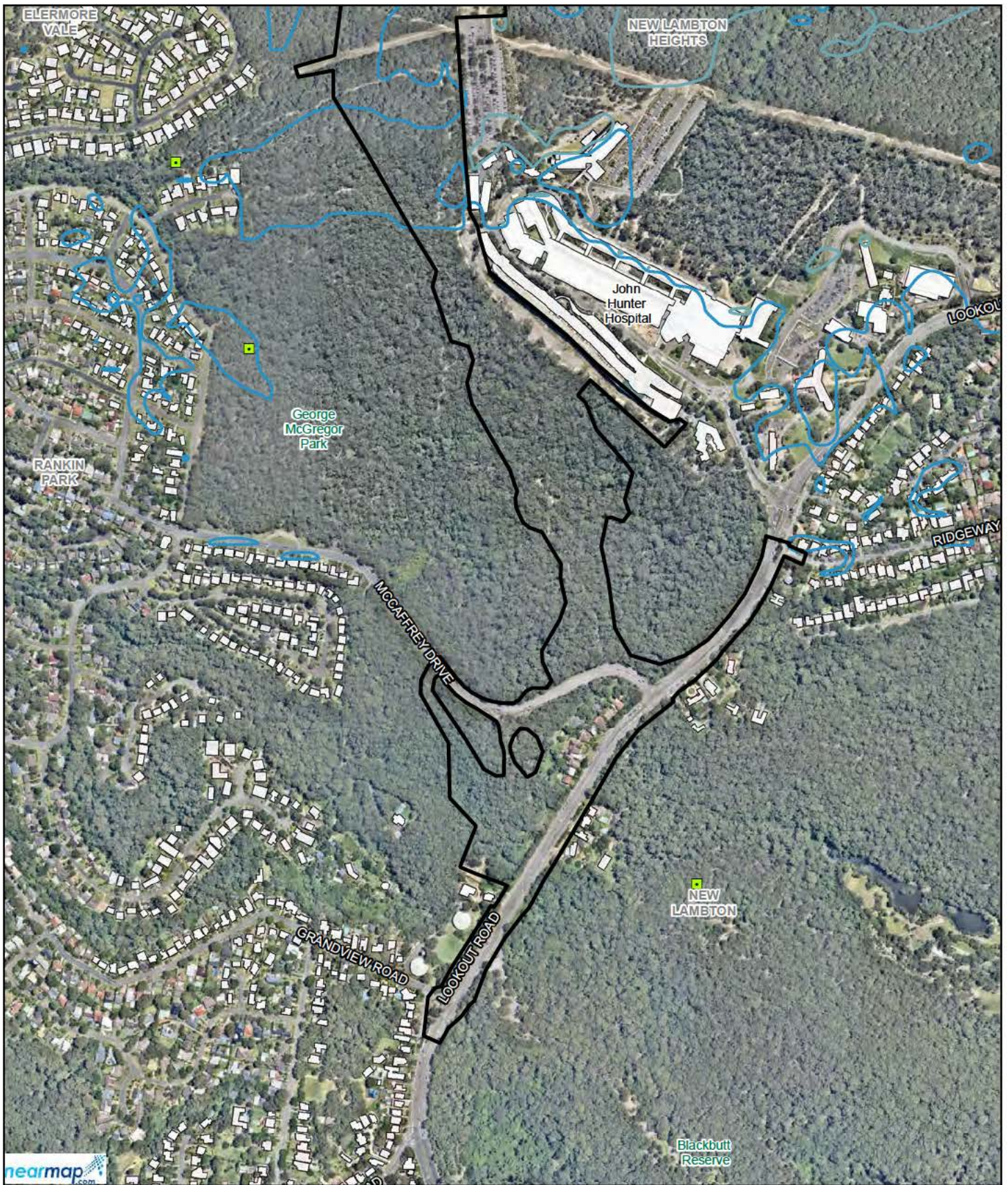


Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

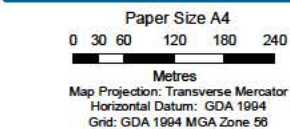
Predicted construction noise levels,
 Scenario 3a - sheet 2 of 2

Figure E-2b



LEGEND

-  Construction footprint
-  Building
-  Receiver
-  Active recreation receiver
- Noise contour**
-  35 dBA L_{Aeq} (15-minute)
-  40 dBA L_{Aeq} (15-minute)

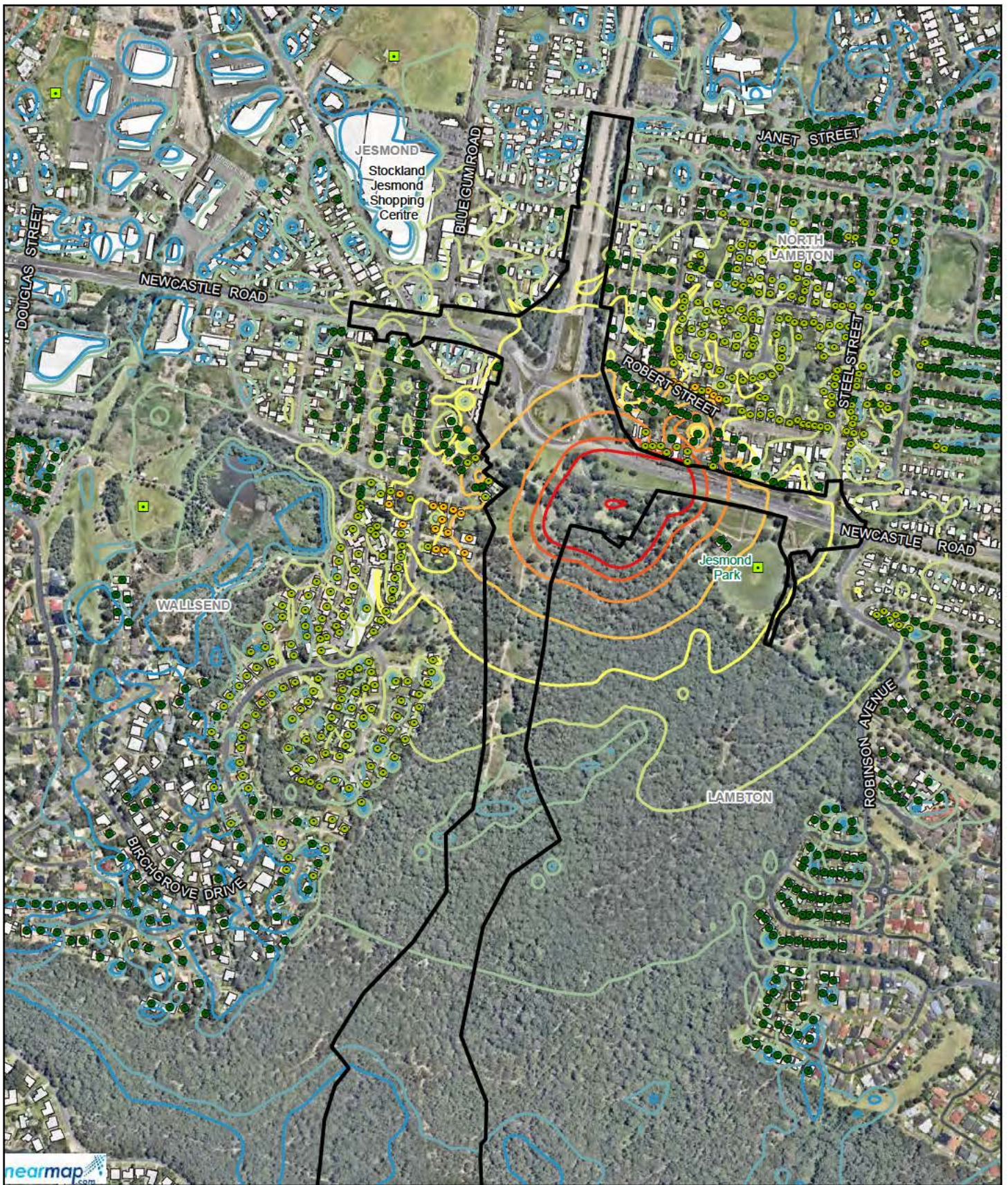


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

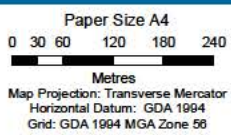
Predicted construction noise levels,
Scenario 3b - sheet 1 of 2

Figure E-3a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	

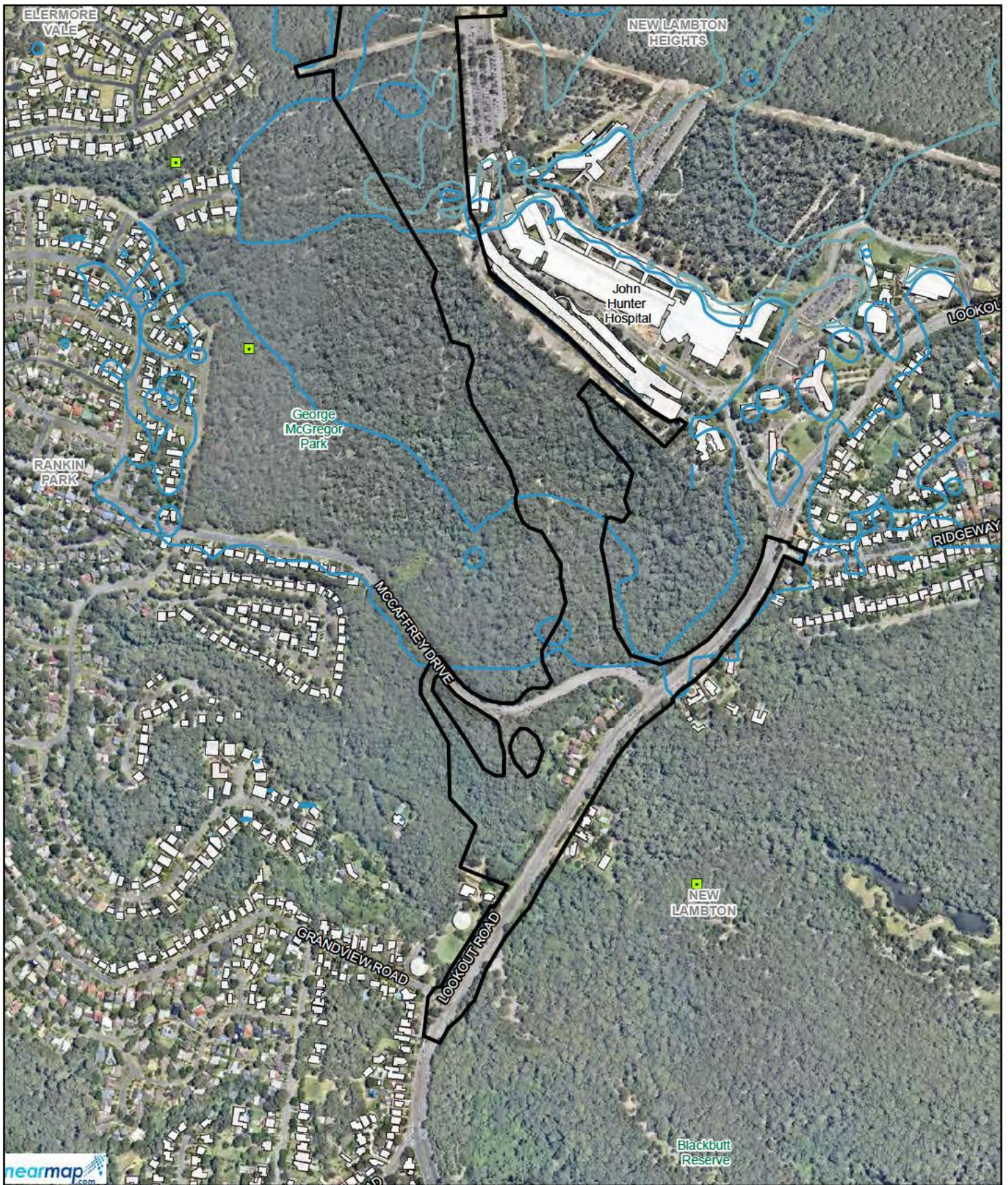


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

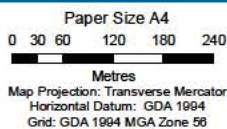
Predicted construction noise levels,
Scenario 3b - sheet 2 of 2

Figure E-3b



LEGEND

- Construction footprint
- Building
- Receiver
- Active recreation receiver
- Noise contour**
- 35 dBA L_{Aeq} (15-minute)
- 40 dBA L_{Aeq} (15-minute)

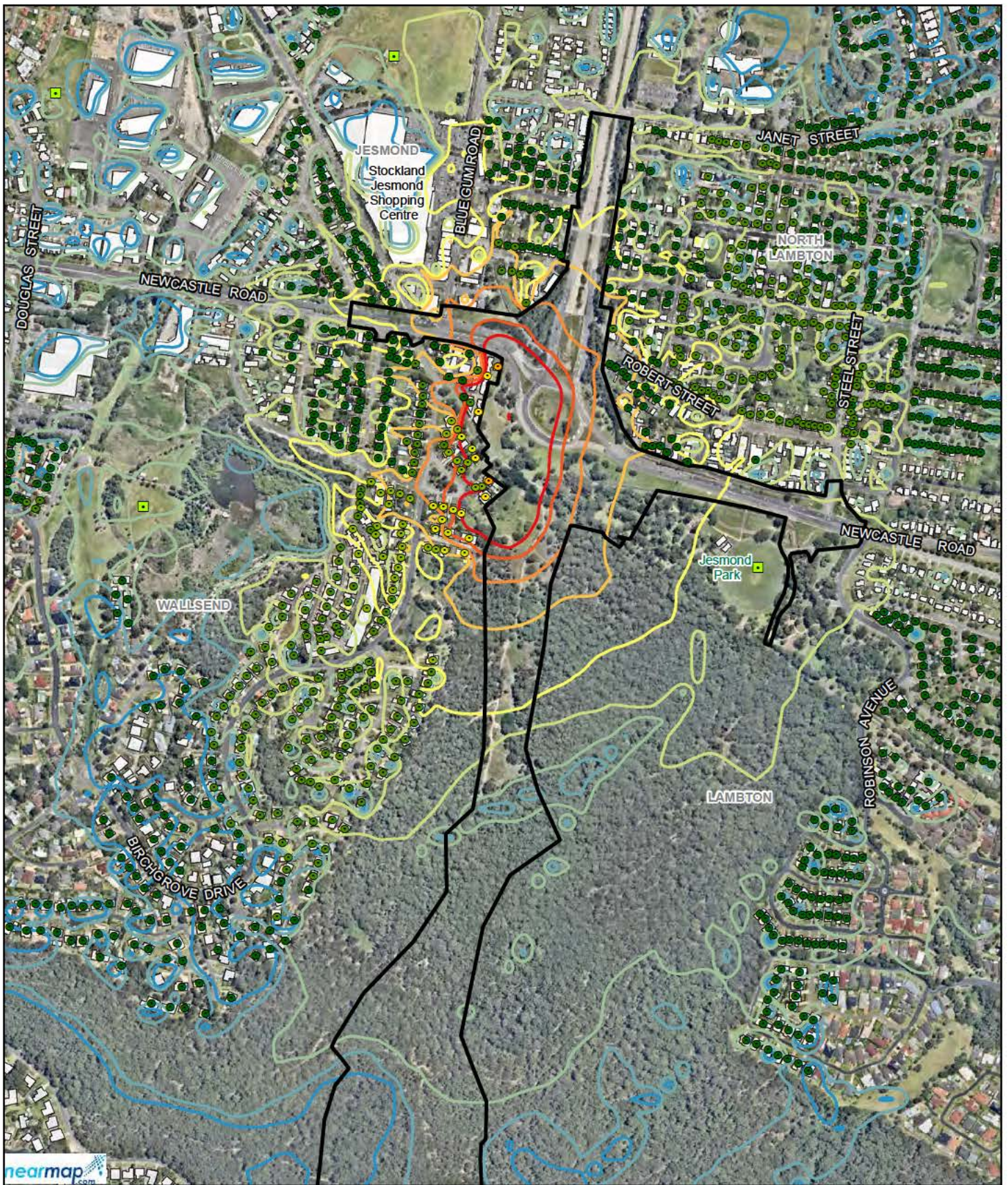


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

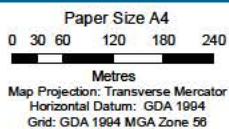
Predicted construction noise levels,
Scenario 3c - sheet 1 of 2

Figure E-4a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

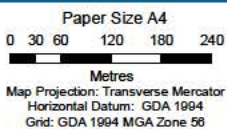
Predicted construction noise levels,
Scenario 3c - sheet 2 of 2

Figure E-4b



LEGEND

- | | |
|----------------------------|-------------------------------------|
| Construction footprint | 35 dBA L _{Aeq} (15-minute) |
| Building | 40 dBA L _{Aeq} (15-minute) |
| Receiver | |
| Active recreation receiver | |

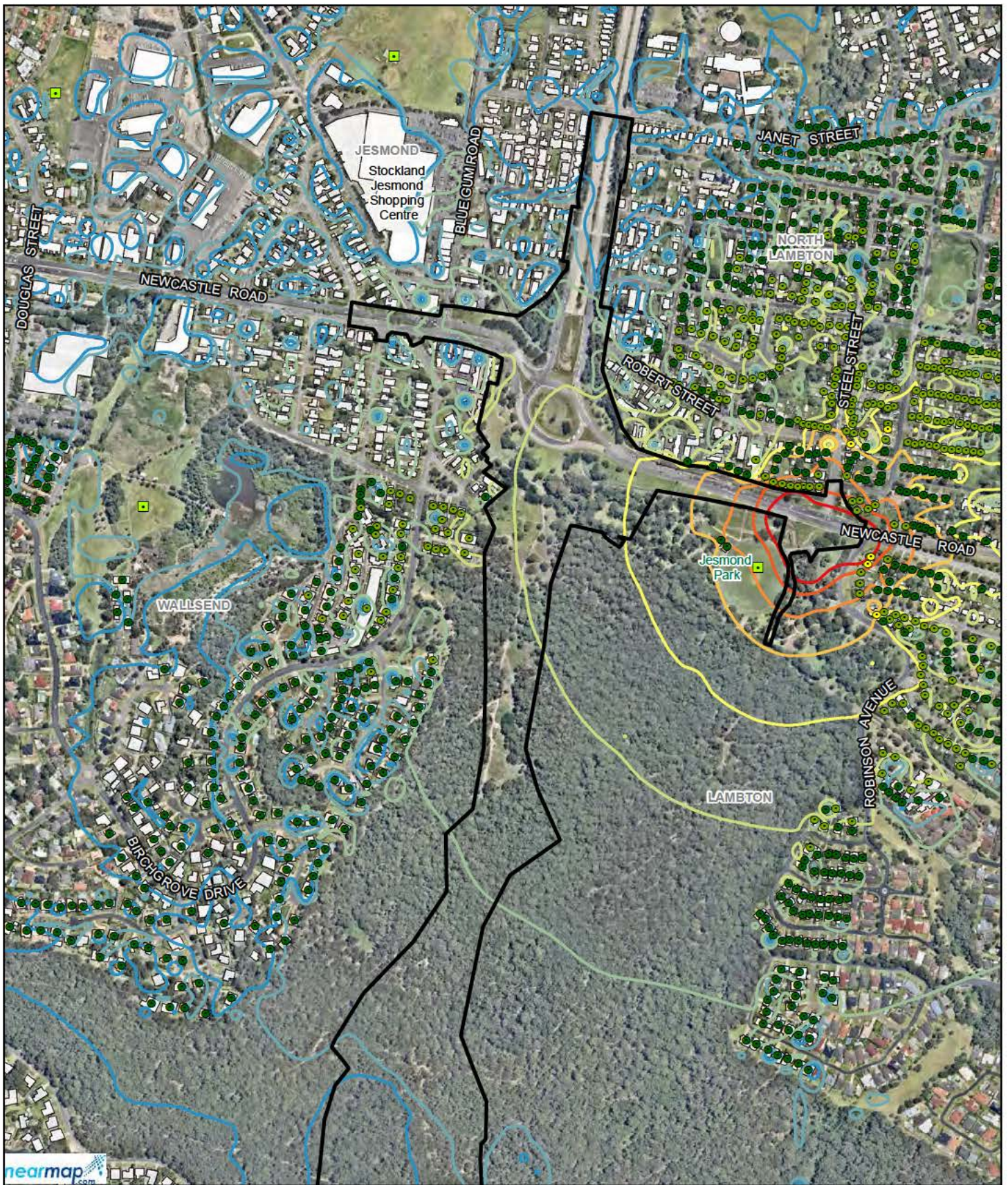


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

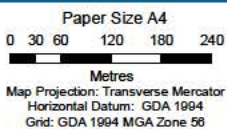
Predicted construction noise levels,
Scenario 3d - sheet 1 of 2

Figure E-5a



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |



Rankin Park to Jesmond
Noise and Vibration Assessment







Job Number 22-17656
Revision 0
Date 16 Apr 2018

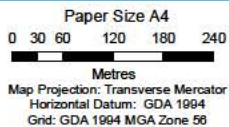
Predicted construction noise levels,
Scenario 3d - sheet 2 of 2

Figure E-5b



LEGEND

-  Construction footprint
-  Building
-  Receiver
-  Active recreation receiver
- Noise contour**
-  35 dBA L_{Aeq} (15-minute)
-  40 dBA L_{Aeq} (15-minute)

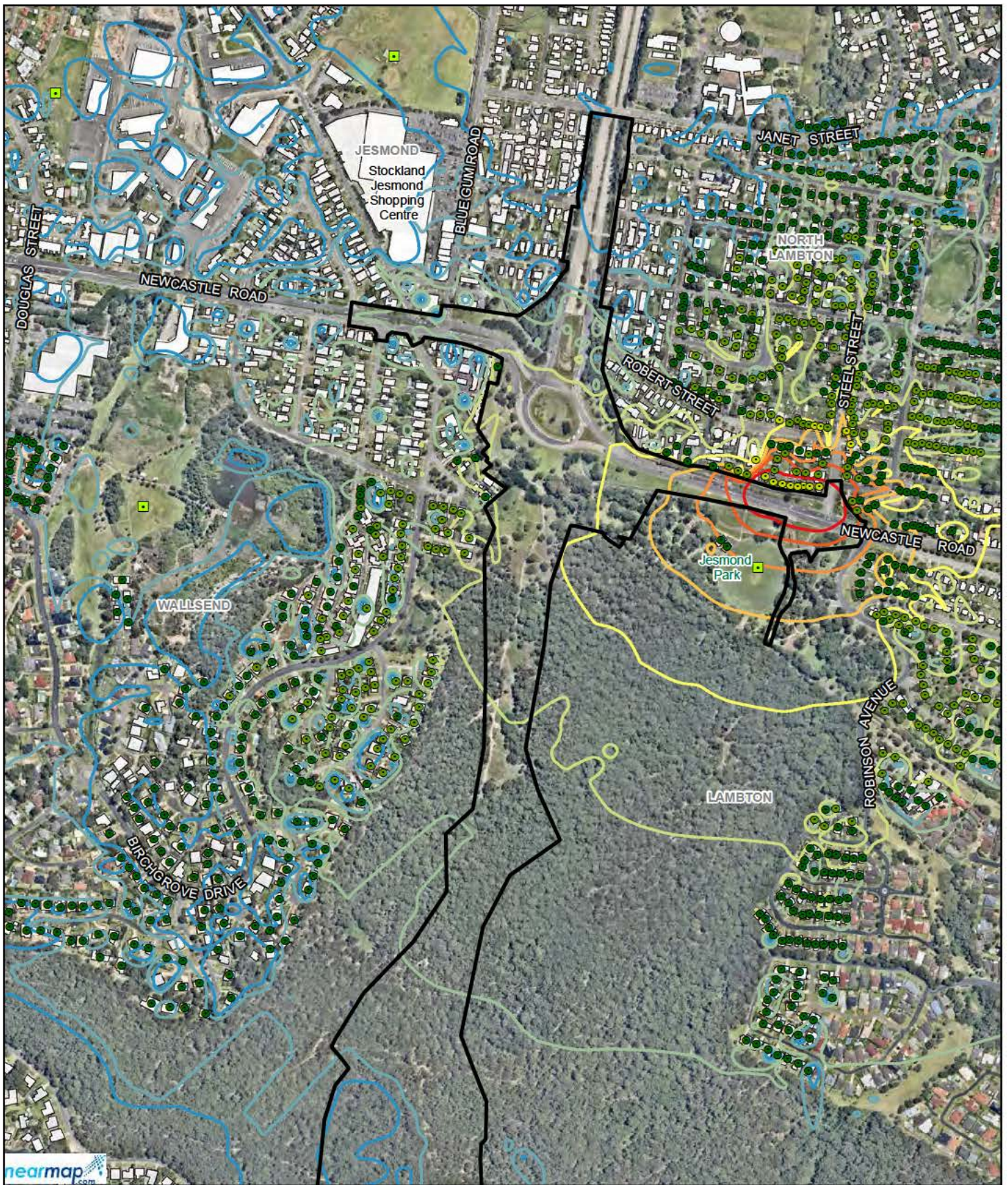


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

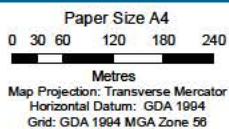
Predicted construction noise levels,
Scenario 3e - sheet 1 of 2

Figure E-6a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	

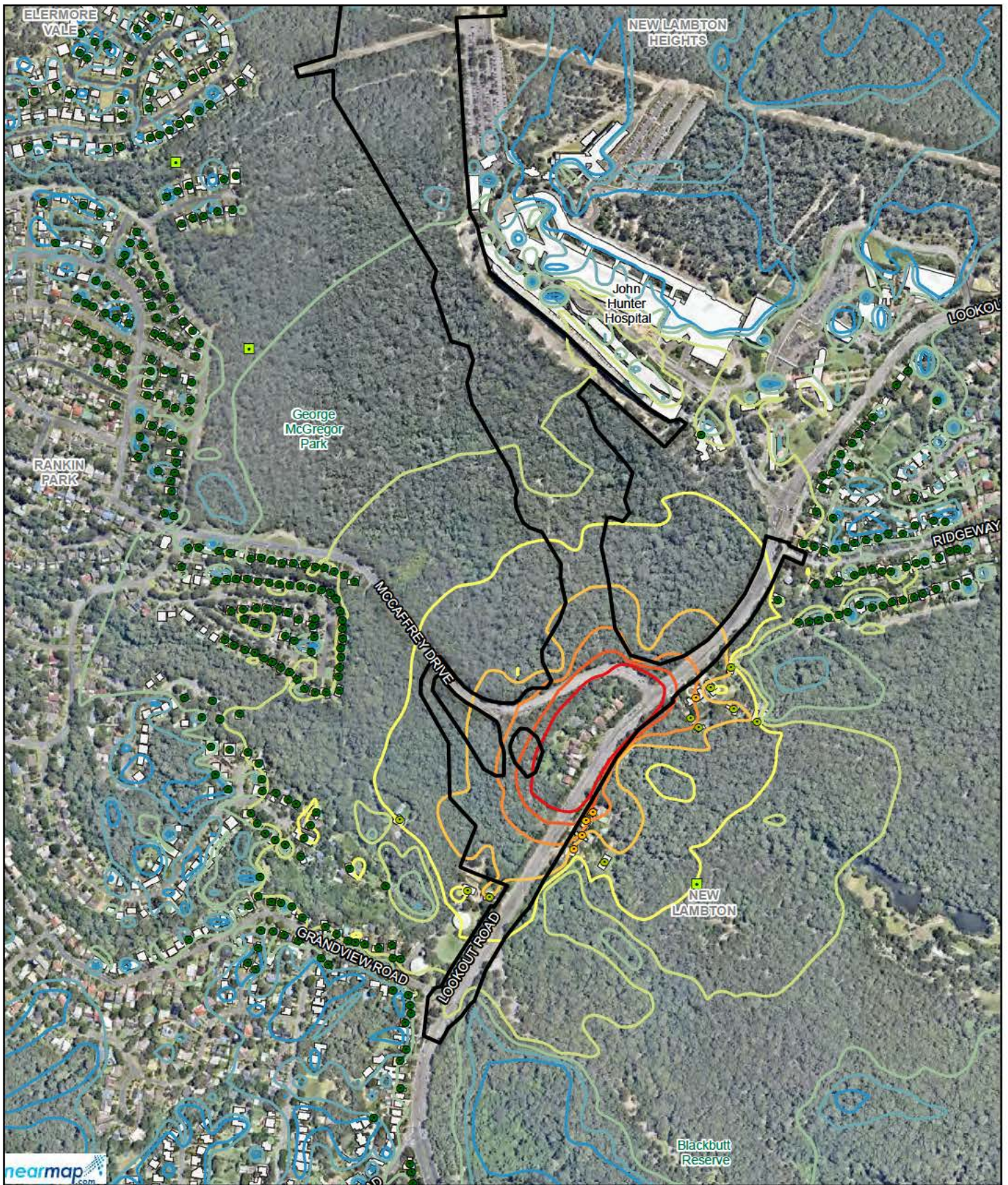


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

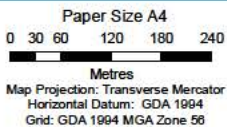
Predicted construction noise levels,
Scenario 3e - sheet 2 of 2

Figure E-6b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	

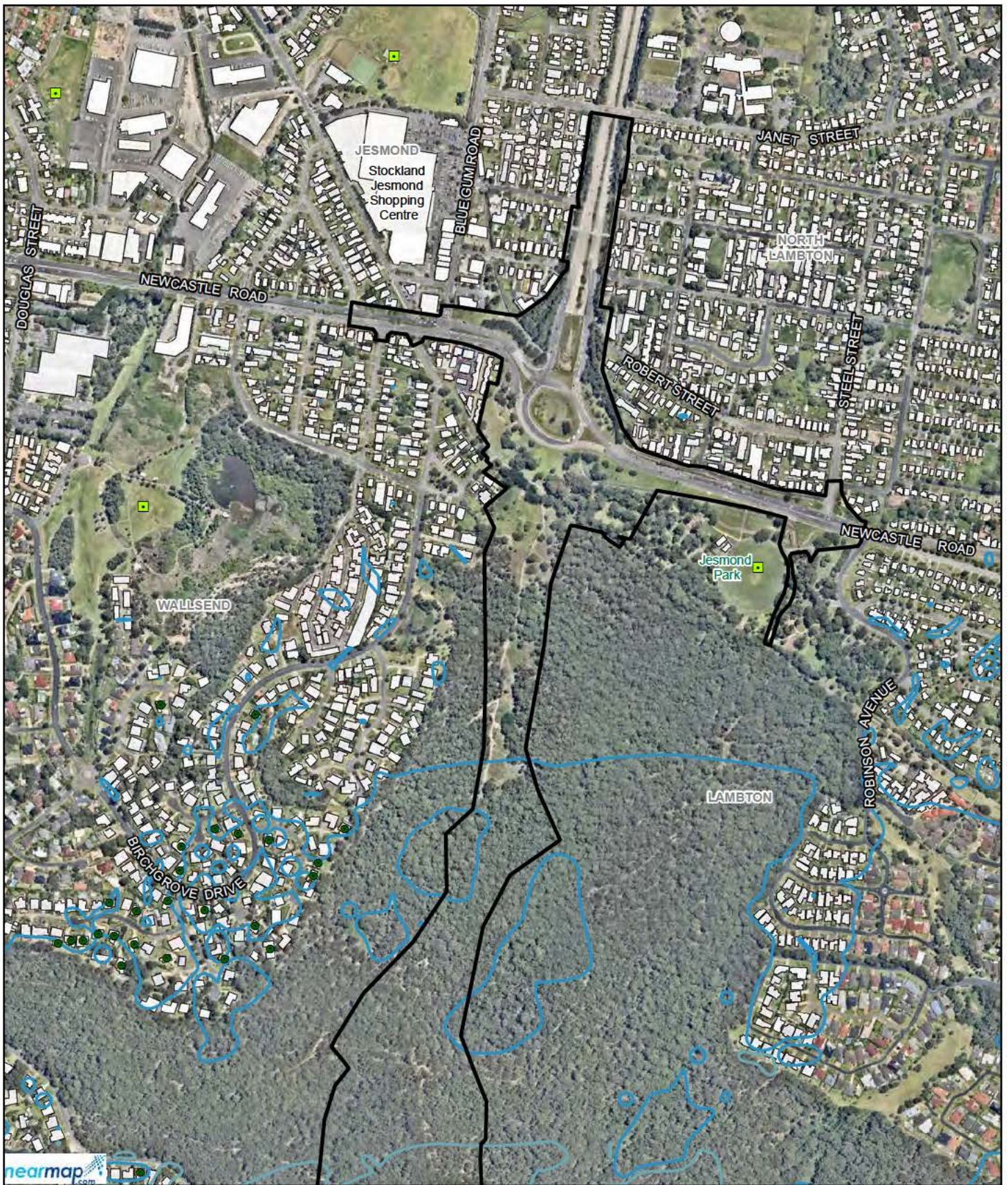


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

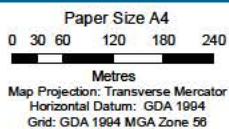
Predicted construction noise levels,
Scenario 3f - sheet 1 of 2

Figure E-7a



LEGEND

- | | | |
|----------------------------|-------------------------------------|-------------------|
| Construction footprint | Noise contour | Exceedance |
| Building | 35 dBA L _{Aeq} (15-minute) | 0 - 10 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | |
| Active recreation receiver | | |

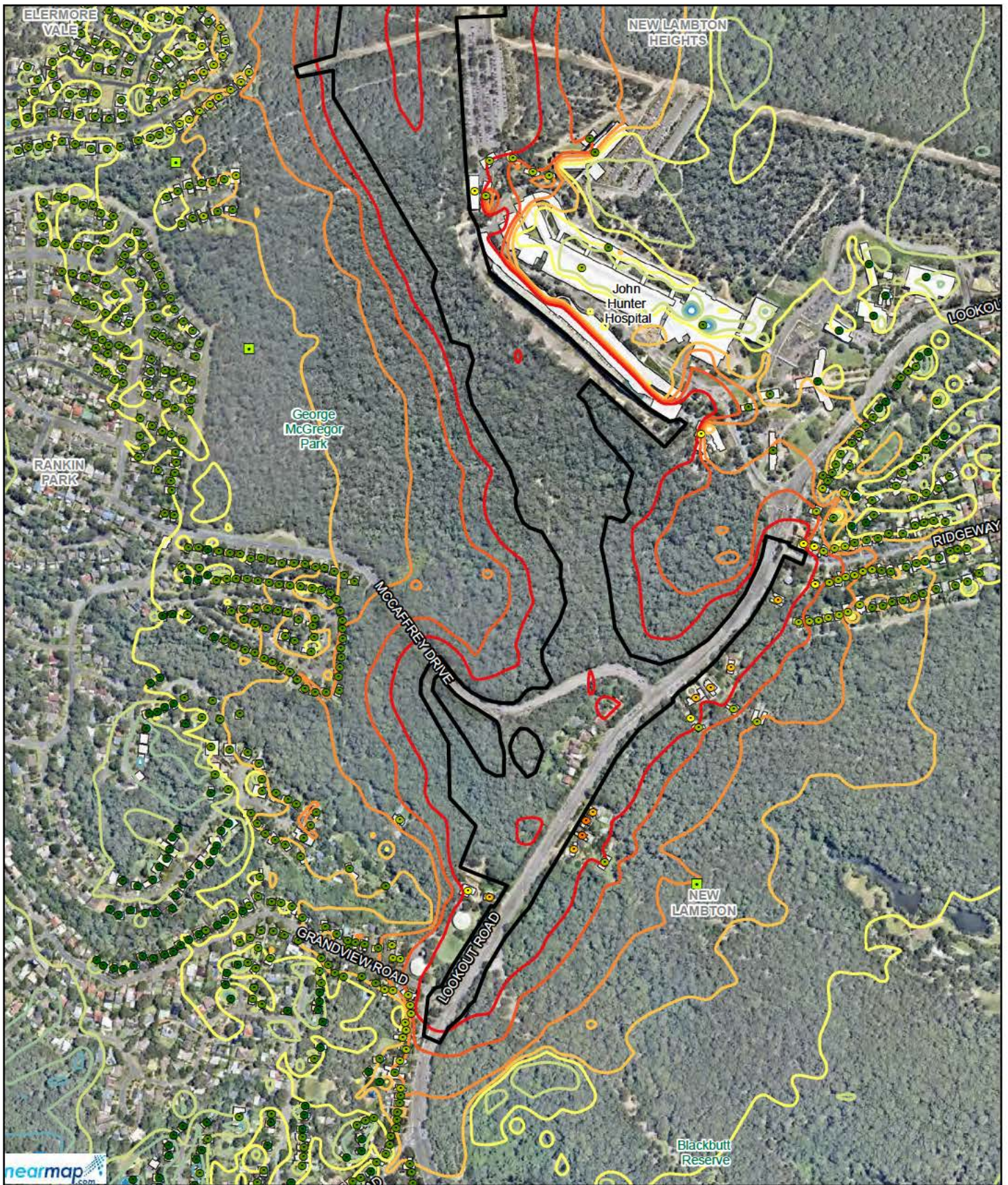


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

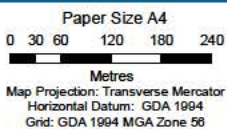
Predicted construction noise levels,
Scenario 3f - sheet 2 of 2

Figure E-7b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Active recreation receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	

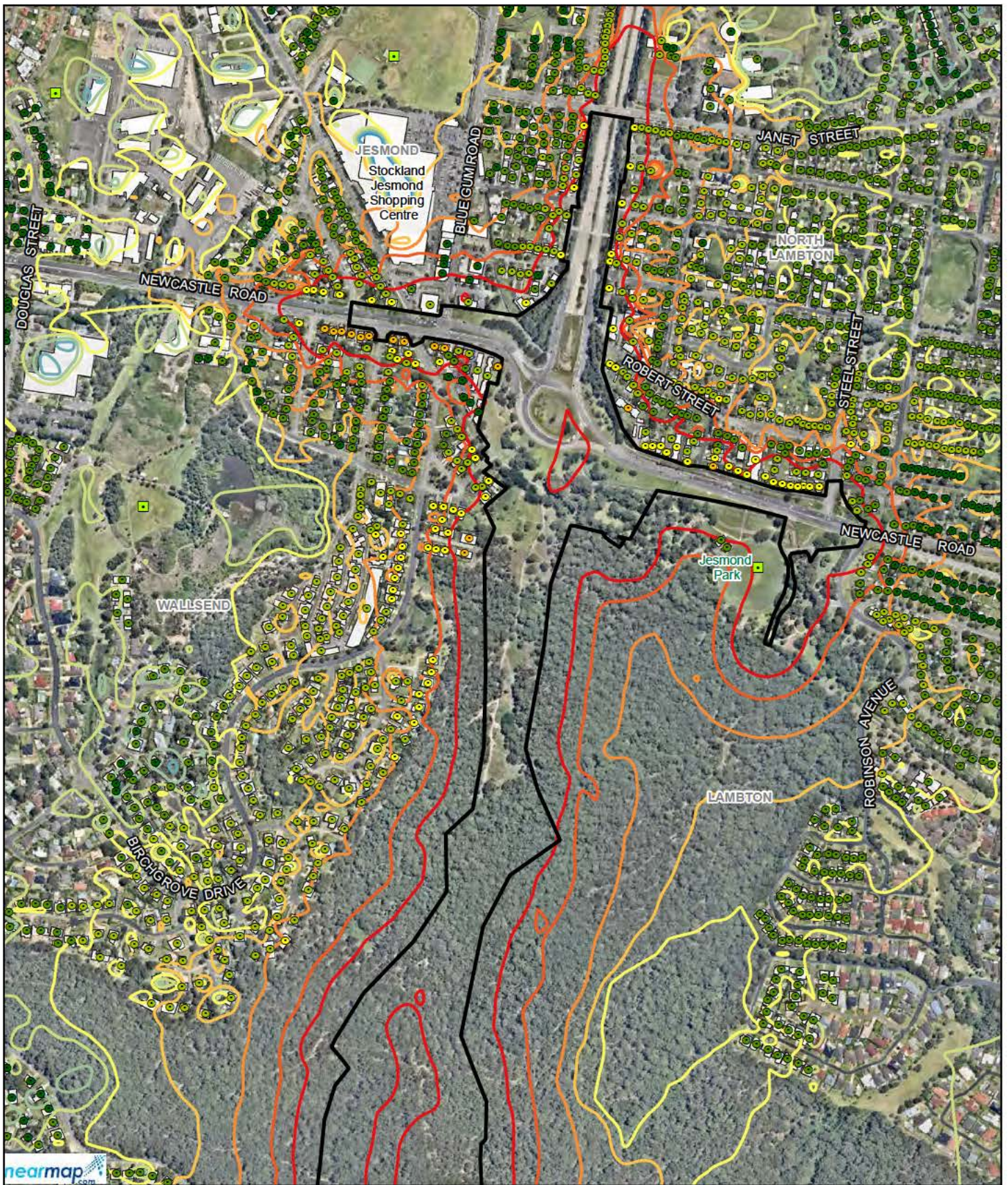


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

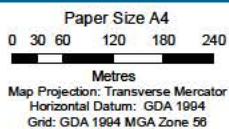
Predicted construction noise levels,
Scenario 4 - sheet 1 of 2

Figure E-8a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Active recreation receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA
	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA

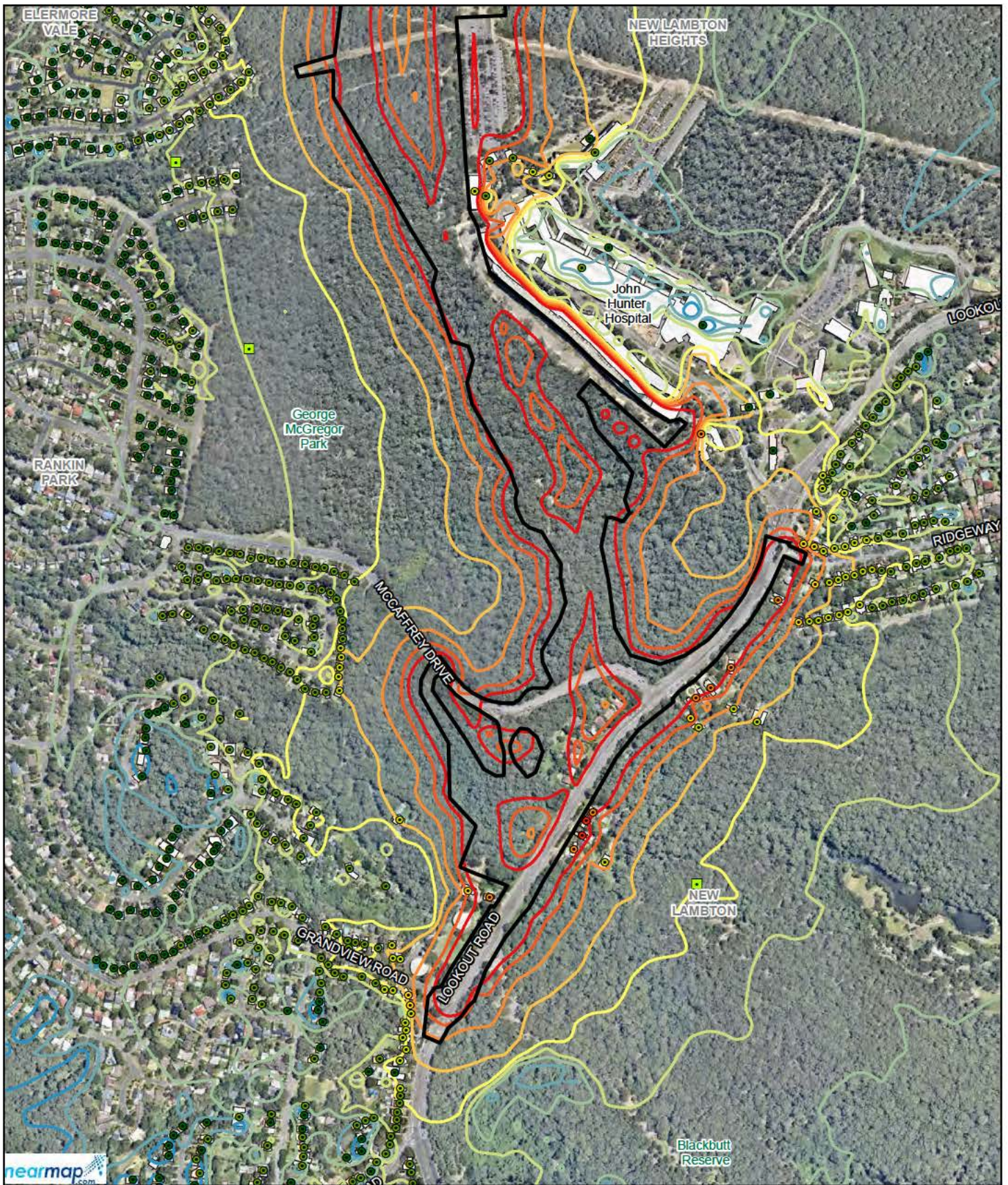


Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

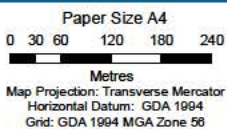
Predicted construction noise levels,
 Scenario 4 - sheet 2 of 2

Figure E-8b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	

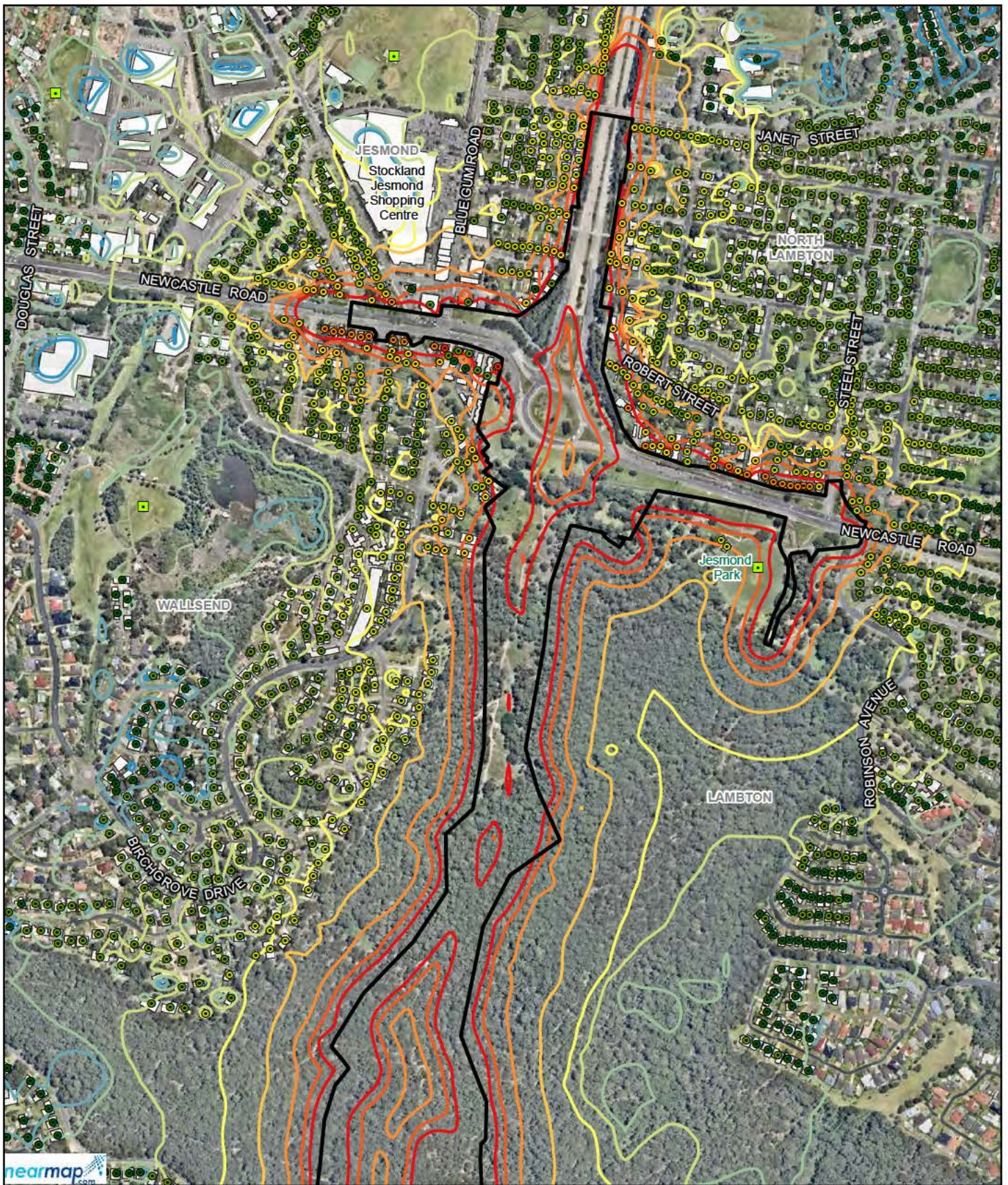


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

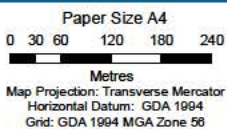
Predicted construction noise levels,
Scenario 5 - sheet 1 of 2

Figure E-9a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	

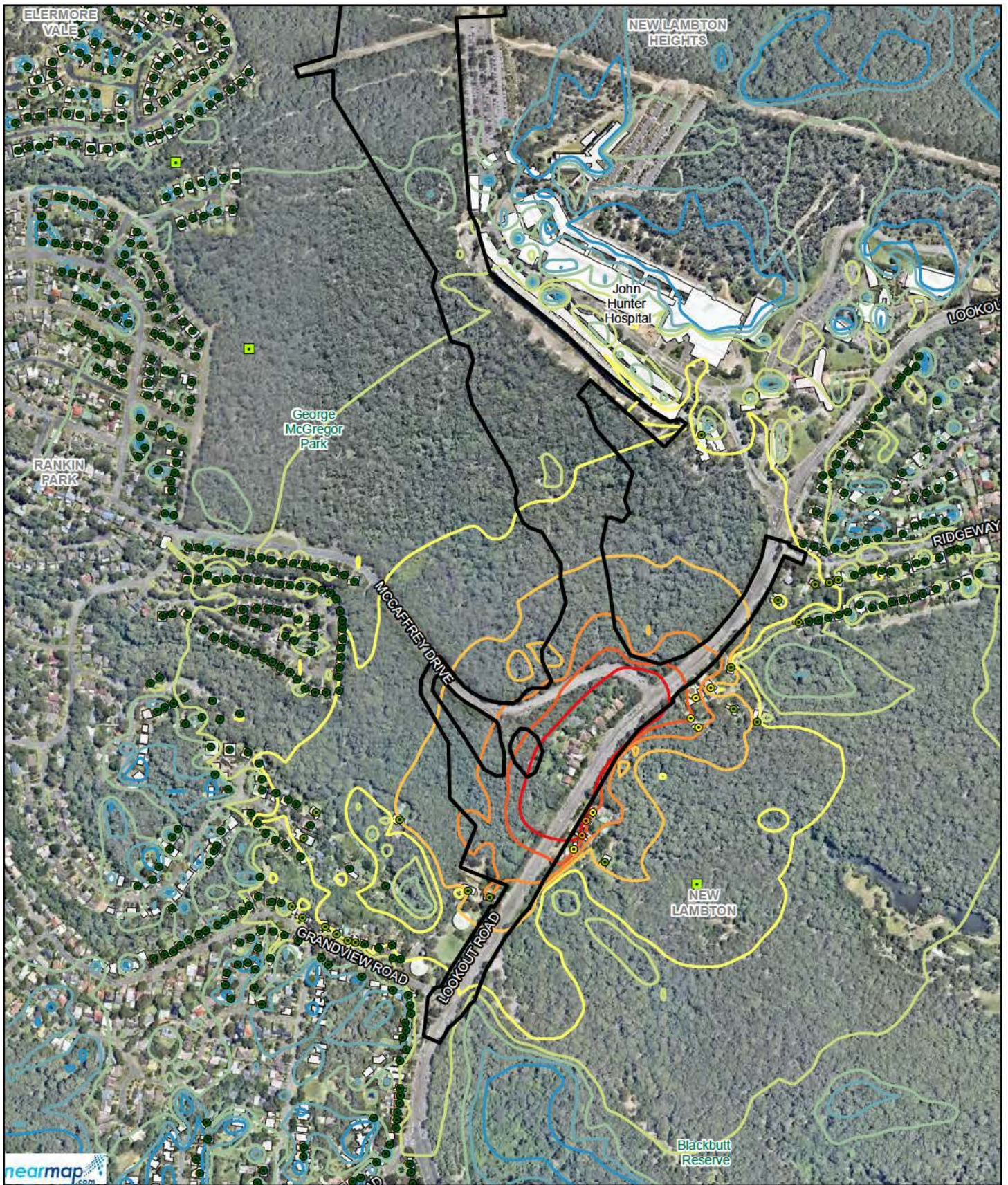


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

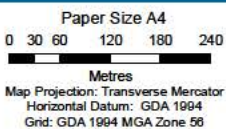
Predicted construction noise levels,
Scenario 5 - sheet 2 of 2

Figure E-9b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	

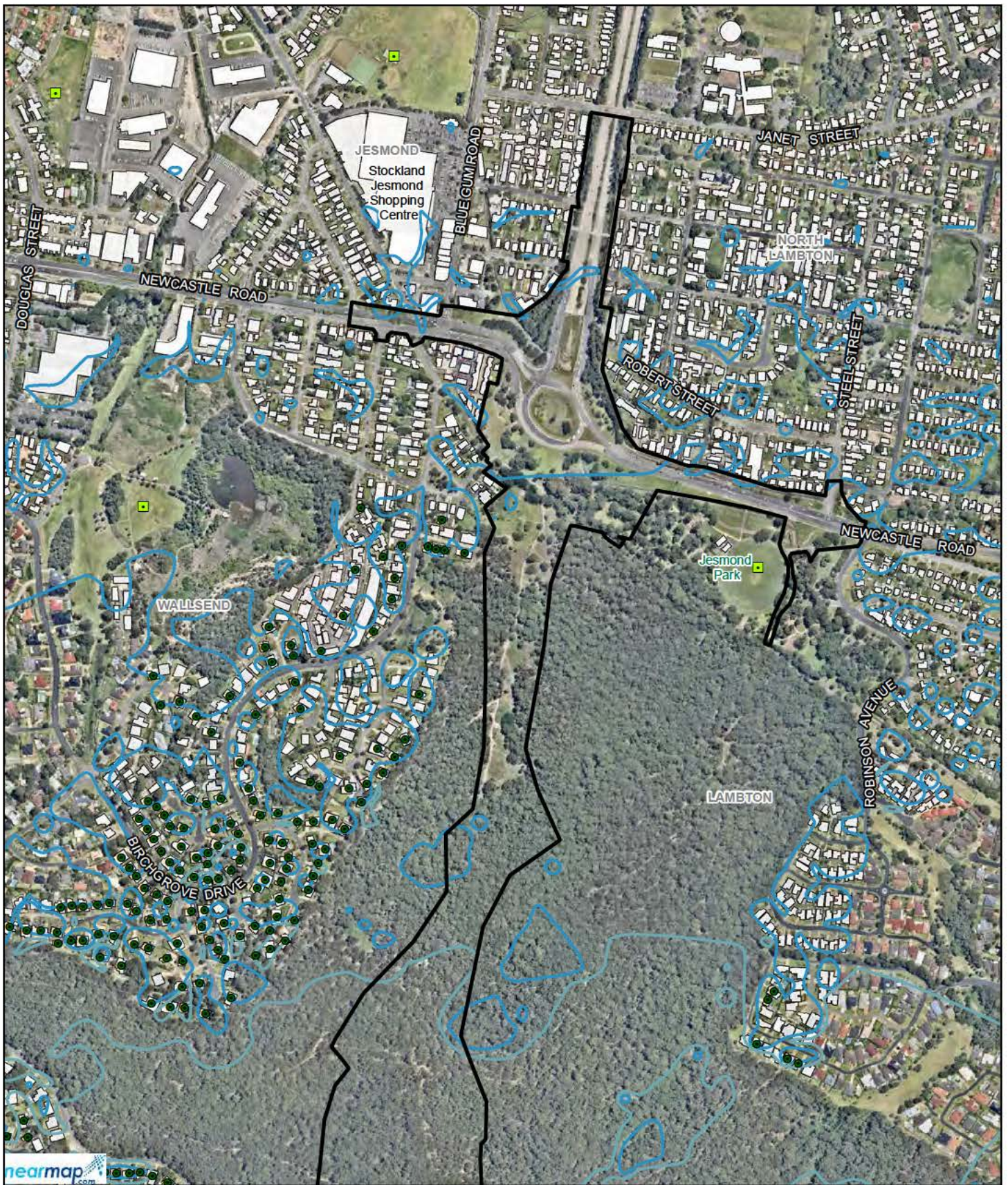


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

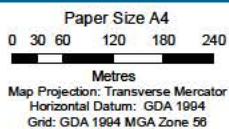
Predicted construction noise levels,
Scenario 6 - sheet 1 of 2

Figure E-10a



LEGEND

- | | | |
|----------------------------|-------------------------------------|-------------------|
| Construction footprint | Noise contour | Exceedance |
| Building | 35 dBA L _{Aeq} (15-minute) | 0 - 10 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | |
| Active recreation receiver | | |

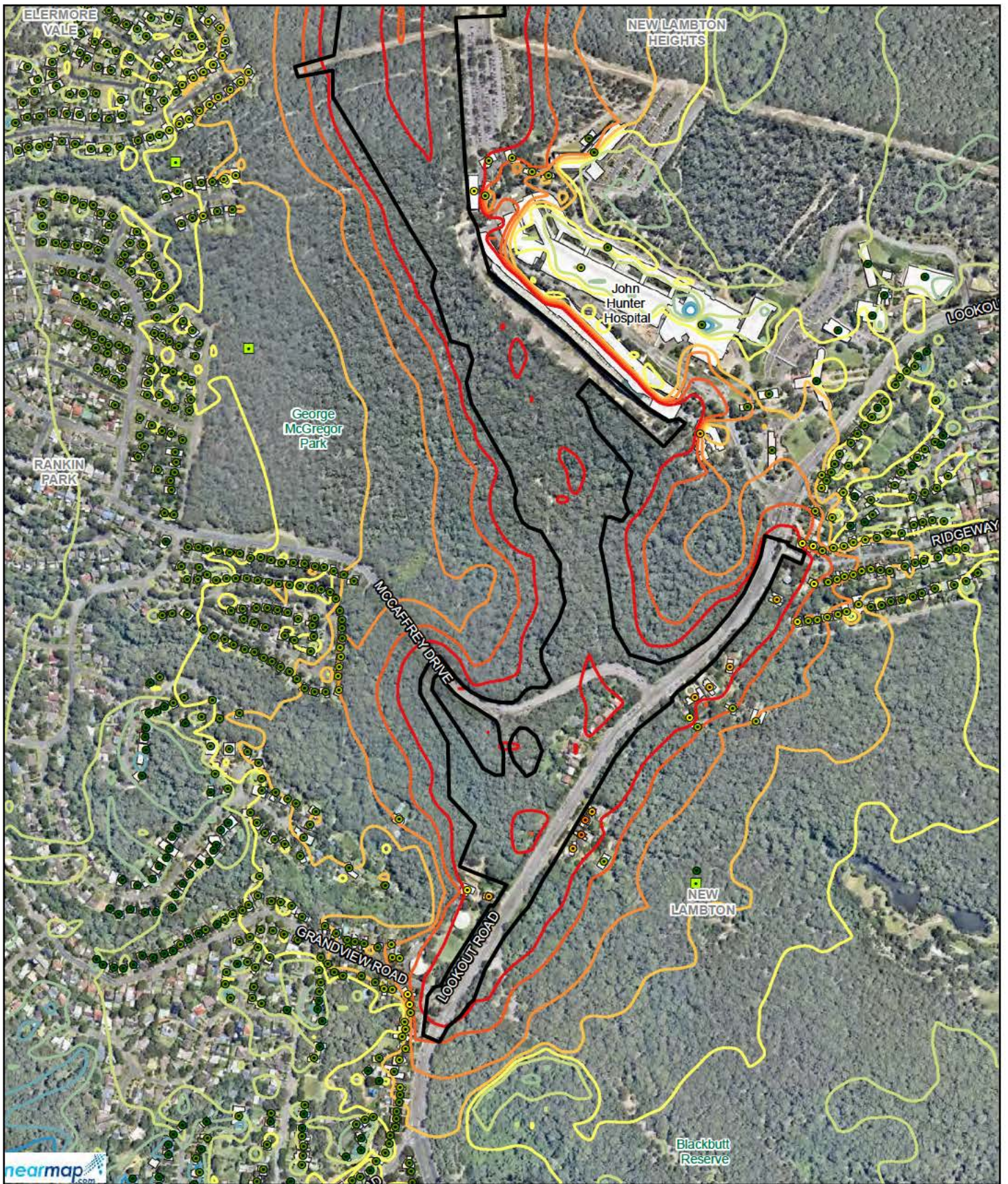


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

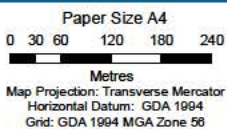
Predicted construction noise levels,
Scenario 6 - sheet 2 of 2

Figure E-10b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Active recreation receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	

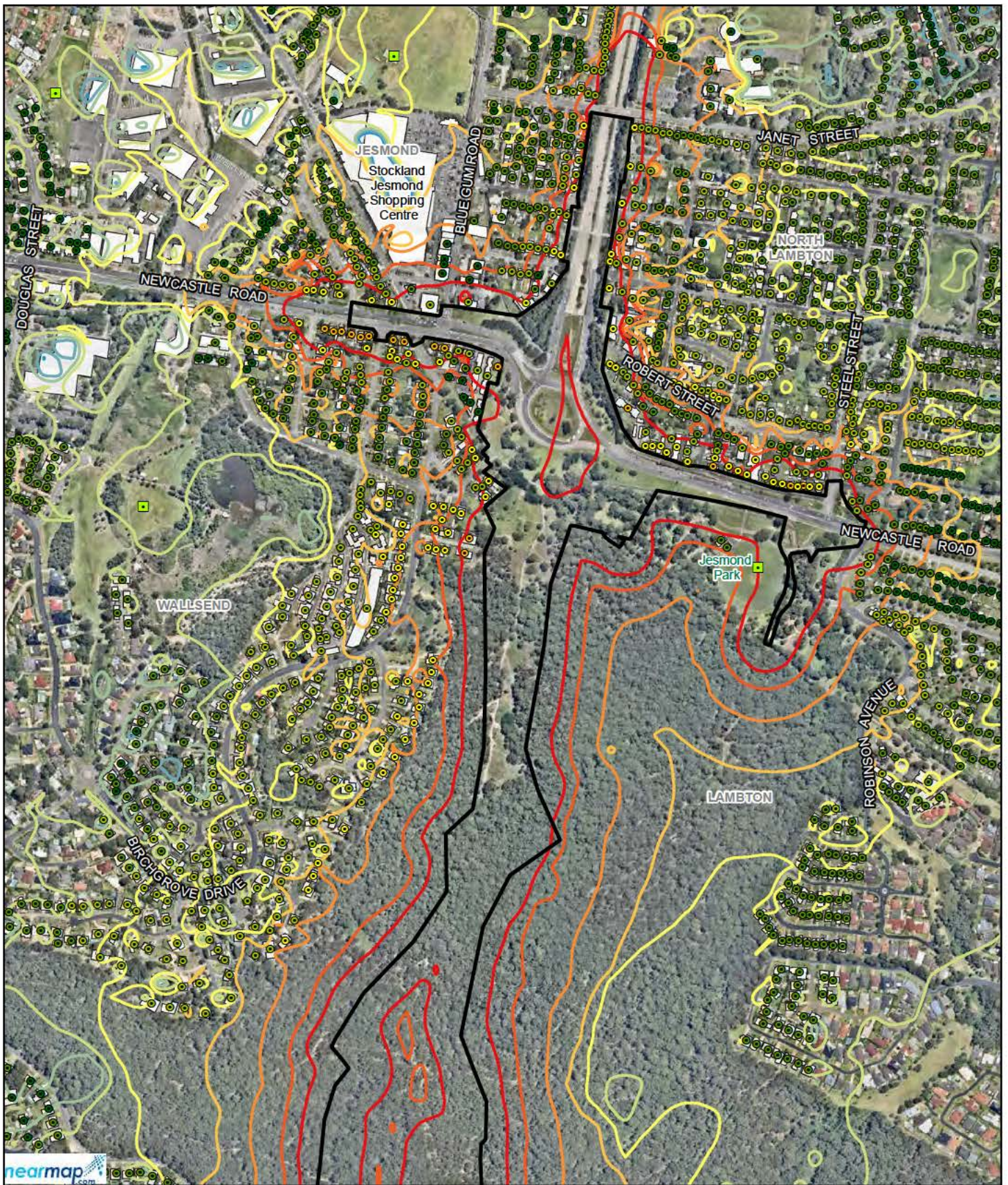


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

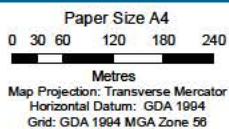
Predicted construction noise levels,
Scenario 8 - sheet 1 of 2

Figure E-11a



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Active recreation receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | 30 - 40 dBA |
| | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | 40 - 50 dBA |

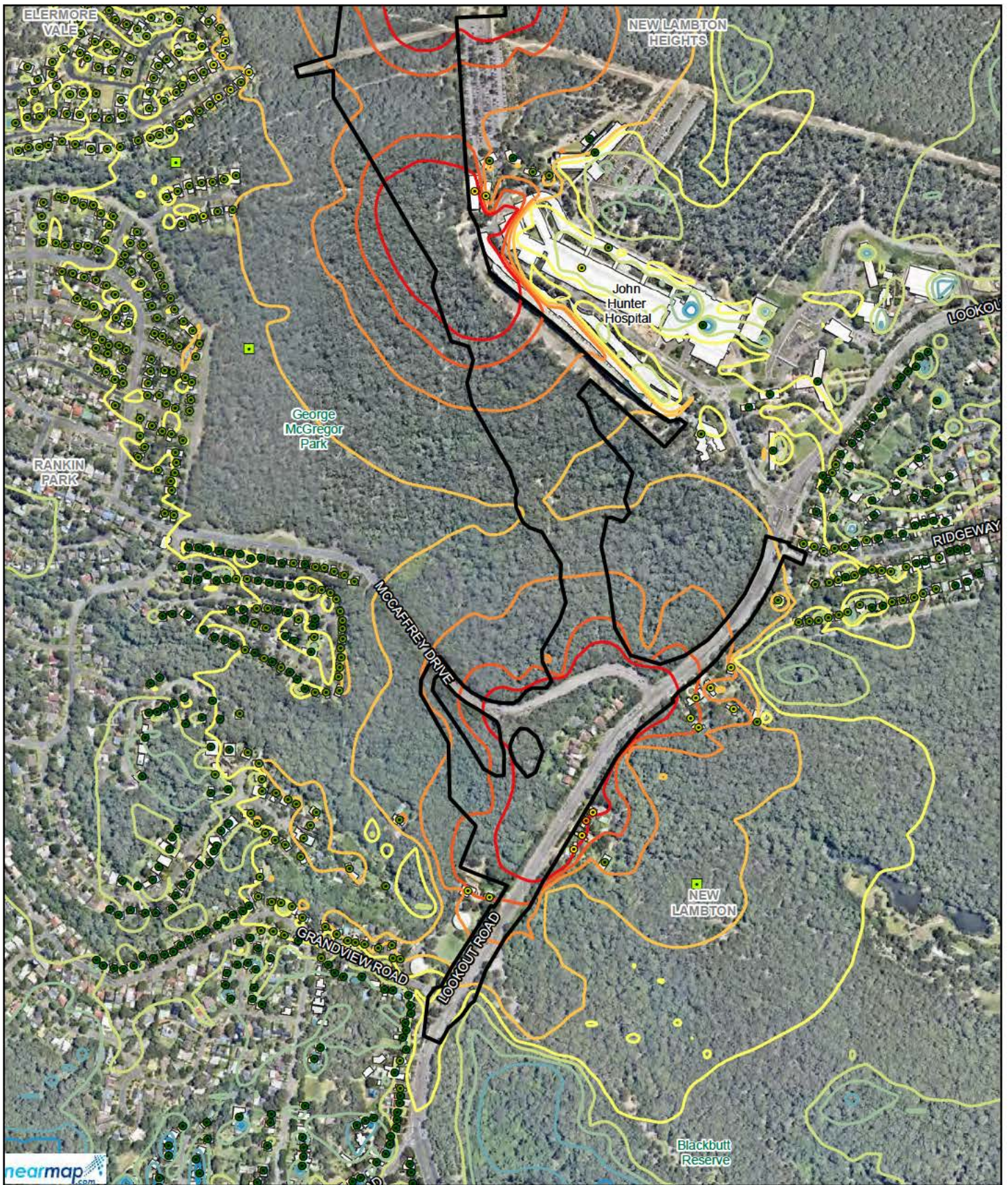


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

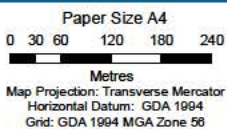
Predicted construction noise levels,
Scenario 8 - sheet 2 of 2

Figure E-11b



LEGEND

Construction footprint	Noise contour	50 dBA LAeq (15-minute)	70 dBA LAeq (15-minute)	10 - 20 dBA
Building	35 dBA LAeq (15-minute)	55 dBA LAeq (15-minute)	75 dBA LAeq (15-minute)	20 - 30 dBA
Receiver	40 dBA LAeq (15-minute)	60 dBA LAeq (15-minute)	Exceedance	30 - 40 dBA
Active recreation receiver	45 dBA LAeq (15-minute)	65 dBA LAeq (15-minute)	0 - 10 dBA	40 - 50 dBA

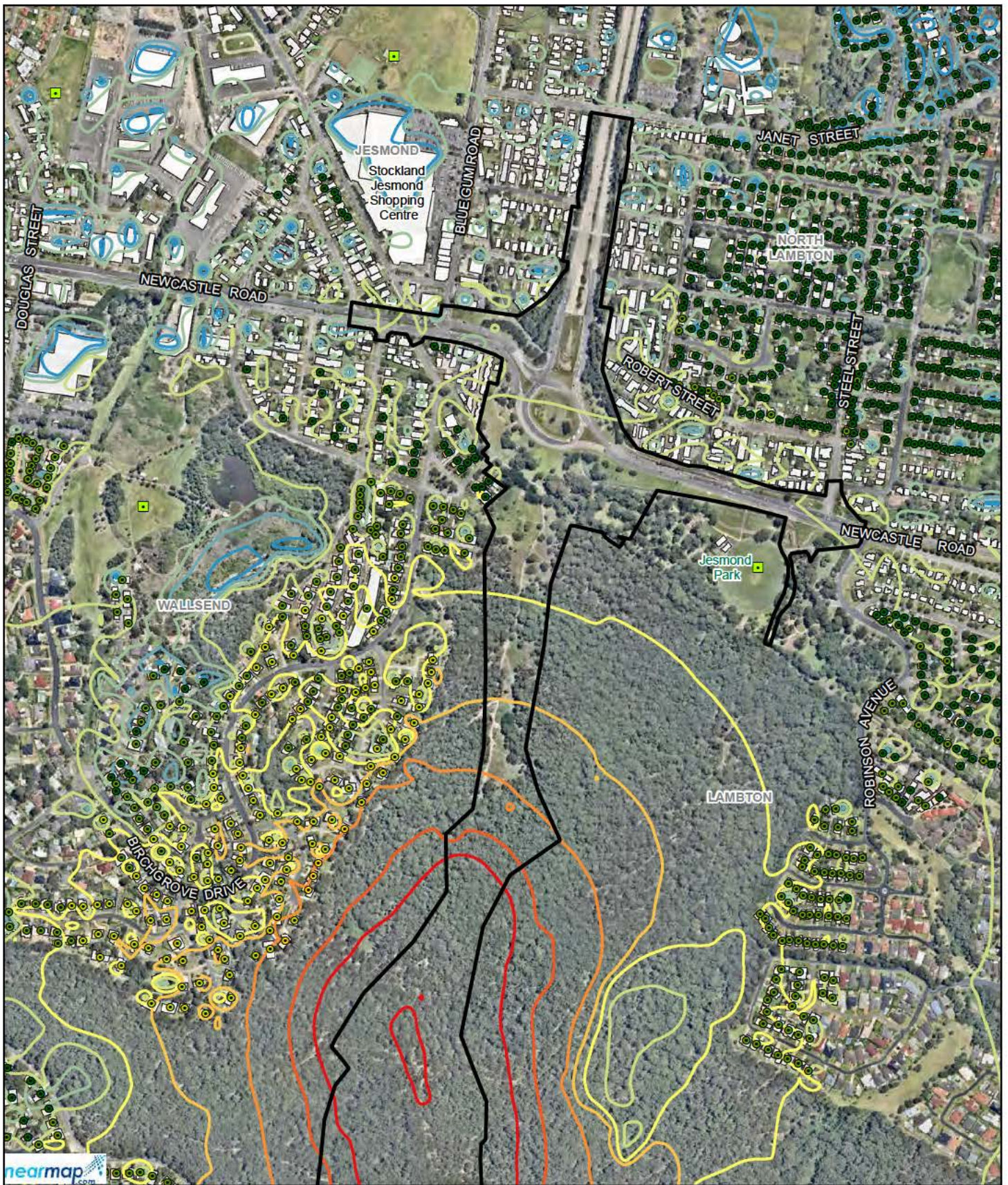


Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

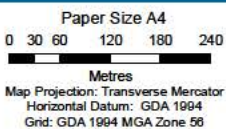
Predicted construction noise levels,
 Scenario 9 - sheet 1 of 2

Figure E-12a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	

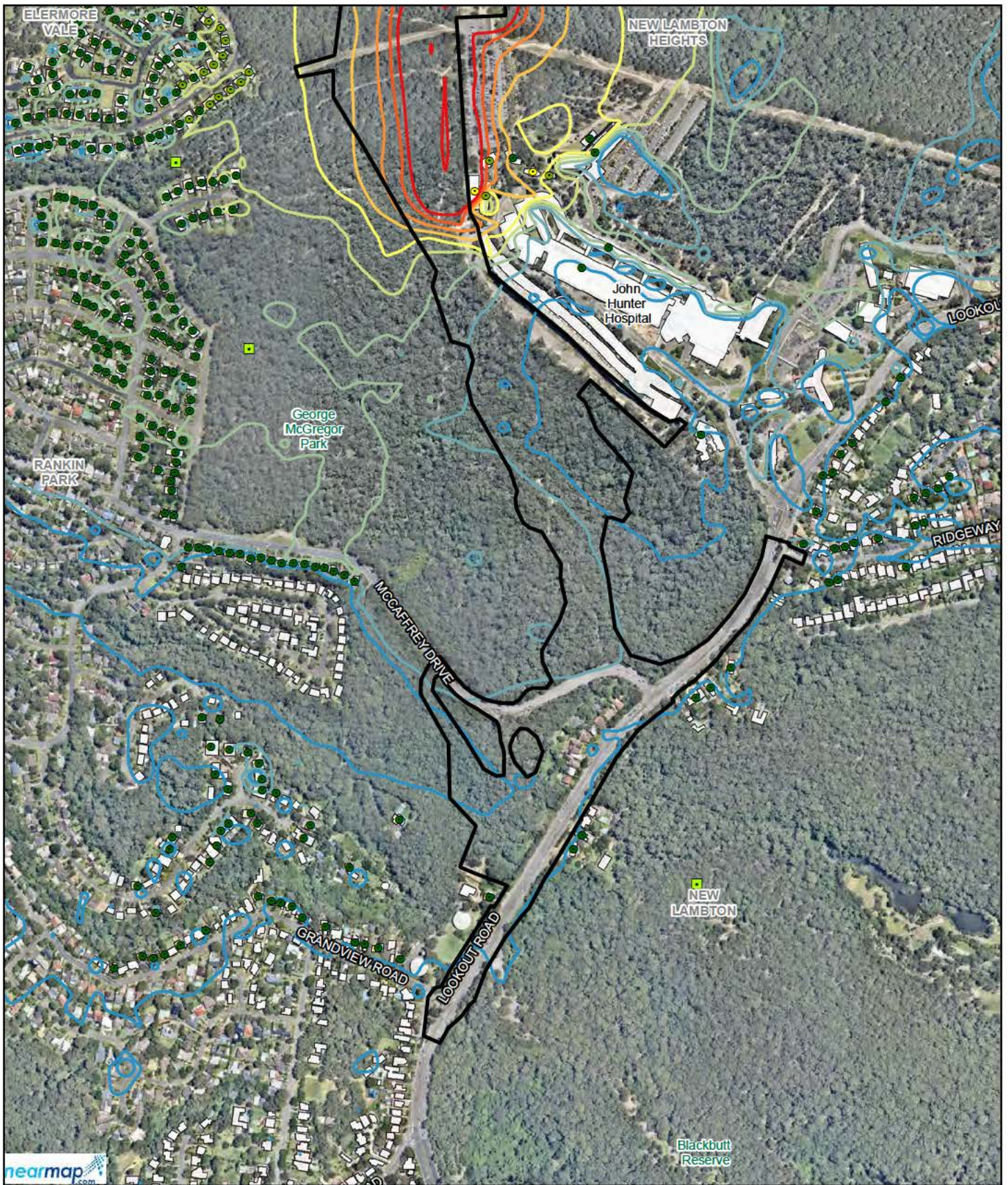


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

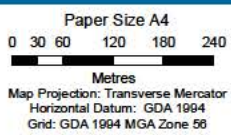
Predicted construction noise levels,
Scenario 9 - sheet 2 of 2

Figure E-12b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Active recreation receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	
	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	



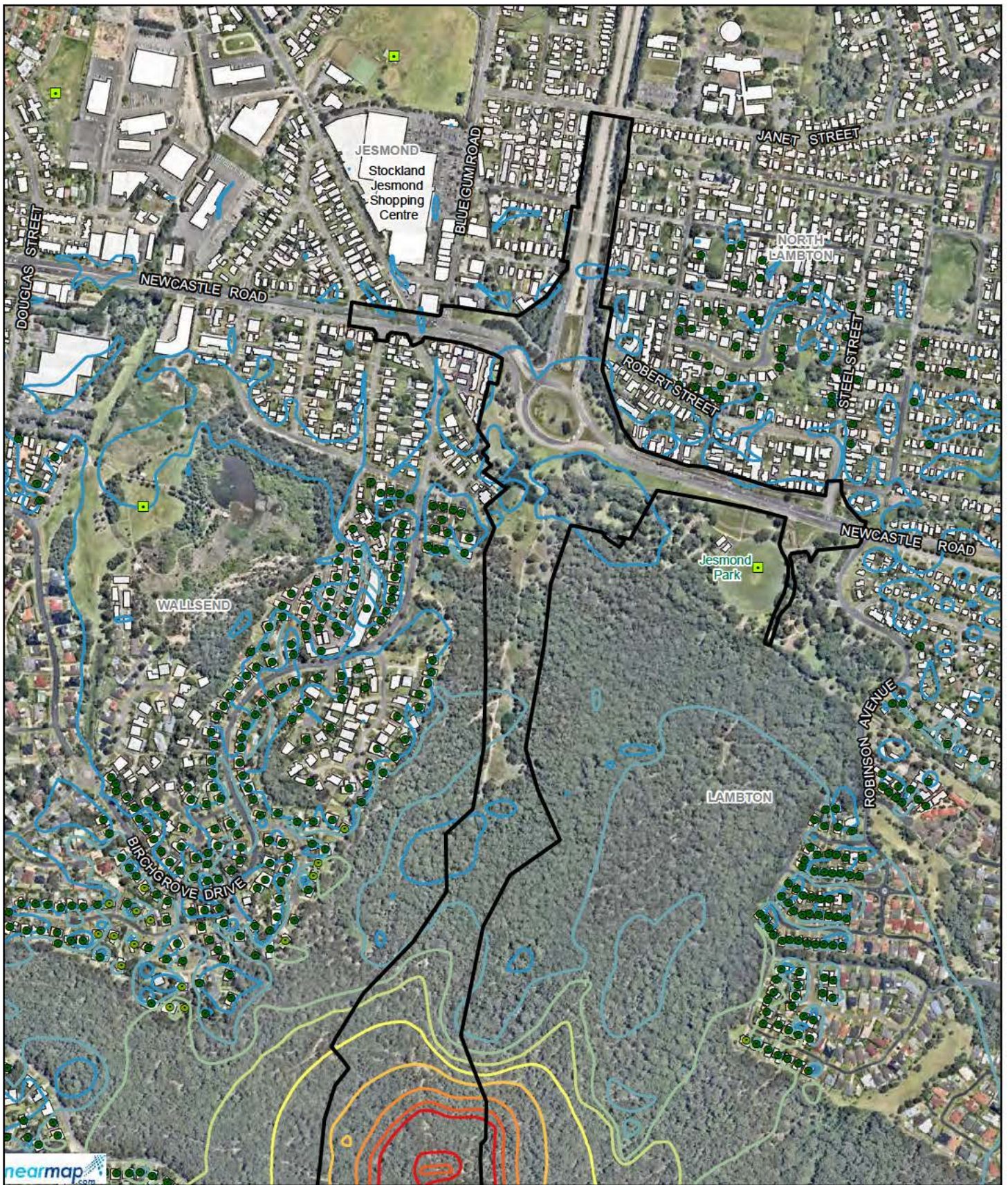
Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Predicted construction noise levels,
Scenario 10a - sheet 1 of 2

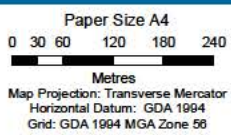
Figure E-13a

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntm@mail@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_NoiseConstruction\2217656_SNC013_DDP_ConstructionNoise_Scen10a_0.mxd
© 2018. Whilst every care has been taken to prepare this map, GHD, Nearmap, Aurecon and LPI make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.
Data source: Nearmap: Aerial Imagery, 20180331; Aurecon: Construction footprint, 2016; LPI: DTDB, 2012. Created by: fmackay, tmorton



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | |
| Active recreation receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | |
| | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

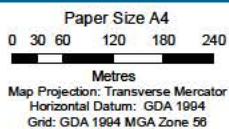
Predicted construction noise levels,
Scenario 10a - sheet 2 of 2

Figure E-13b



LEGEND

- Construction footprint
- Noise contour
- Building
- Receiver
- Active recreation receiver
- 35 dBA L_{Aeq} (15-minute)

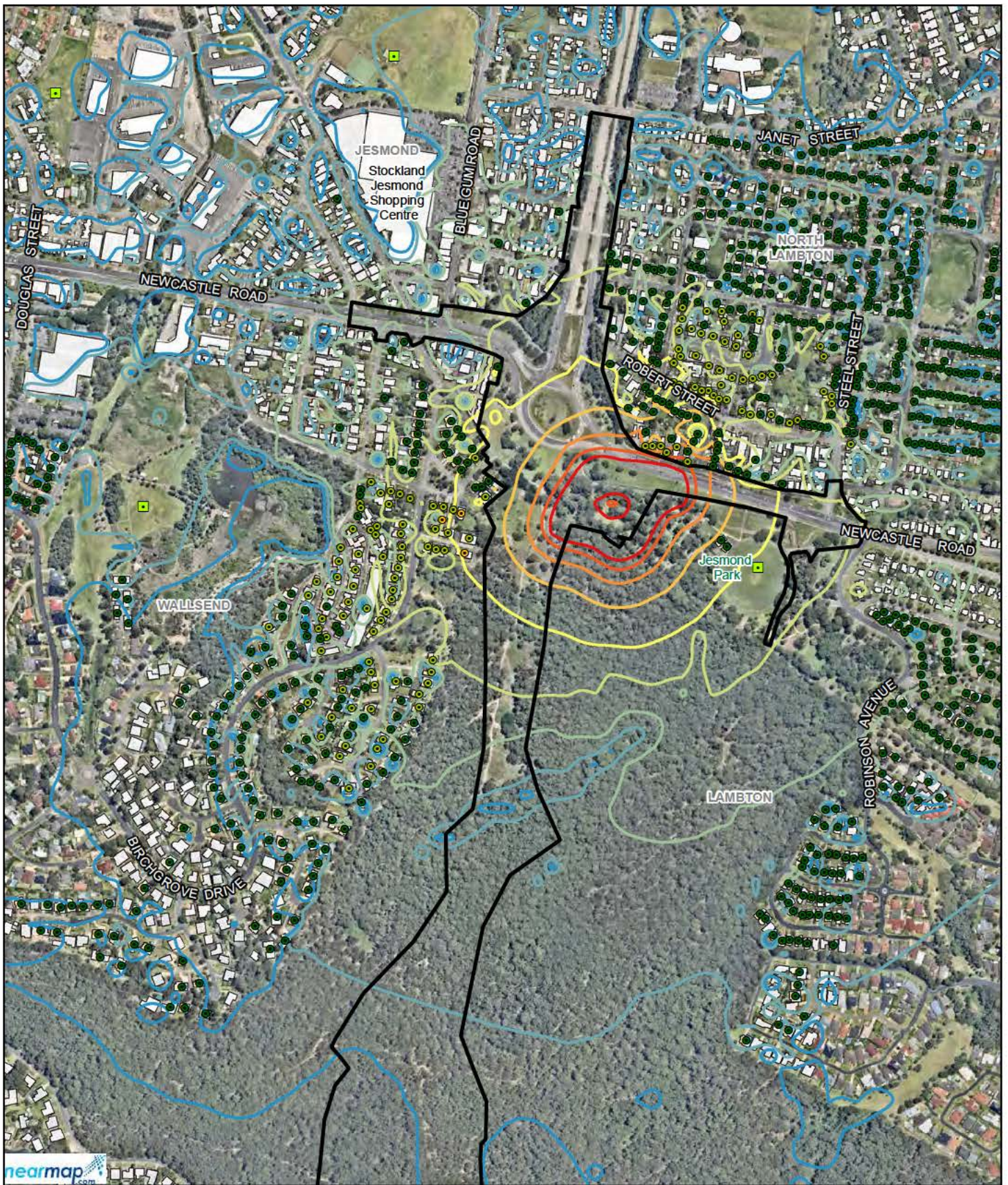


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

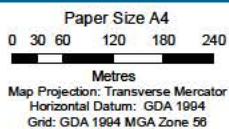
Predicted construction noise levels,
Scenario 10b - sheet 1 of 2

Figure E-14a



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |



Rankin Park to Jesmond
Noise and Vibration Assessment






Job Number 22-17656
Revision 0
Date 16 Apr 2018

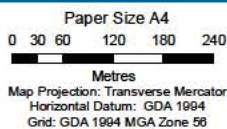
Predicted construction noise levels,
Scenario 10b - sheet 2 of 2

Figure E-14b



LEGEND

-  Construction footprint
-  Building
-  Receiver
-  Active recreation receiver
-  Noise contour
- 35 dBA L_{Aeq} (15-minute)**



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

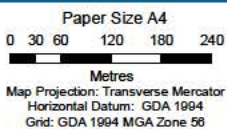
Predicted construction noise levels,
Scenario 10c - sheet 1 of 2

Figure E-15a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

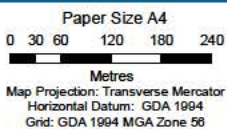
Predicted construction noise levels,
Scenario 10c - sheet 2 of 2

Figure E-15b



LEGEND

- Construction footprint
- Building
- Receiver
- Active recreation receiver
- Noise contour
- 35 dBA L_{Aeq} (15-minute)

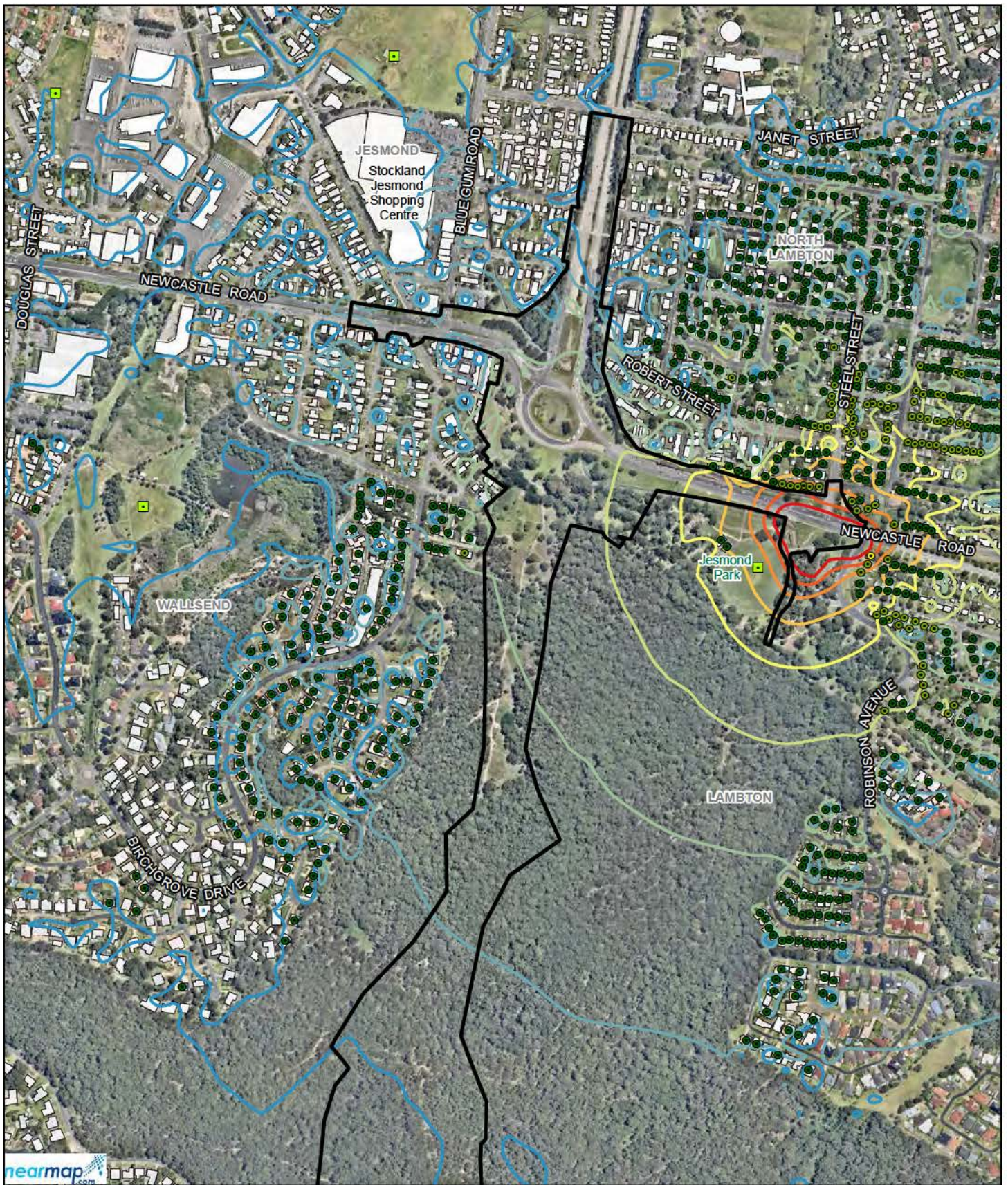


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

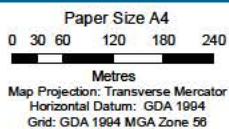
Predicted construction noise levels,
Scenario 10d - sheet 1 of 2

Figure E-16a



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

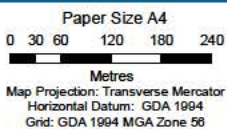
Predicted construction noise levels,
Scenario 10d - sheet 2 of 2

Figure E-16b



LEGEND

- Construction footprint
- Building
- Receiver
- Active recreation receiver
- Noise contour**
- 35 dBA L_{Aeq} (15-minute)

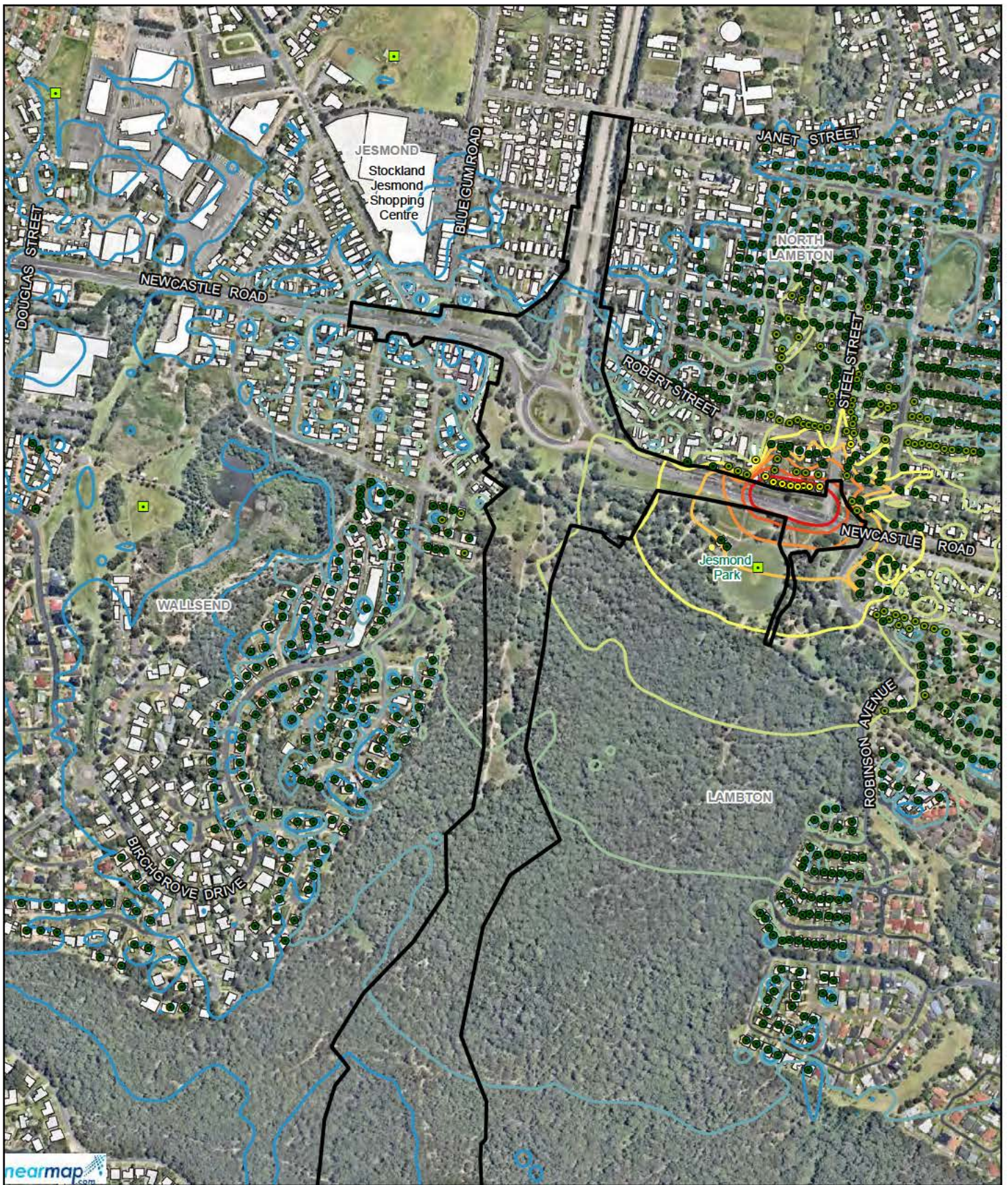


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

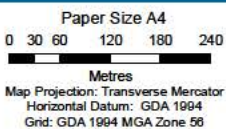
Predicted construction noise levels,
Scenario 10e - sheet 1 of 2

Figure E-17a



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |

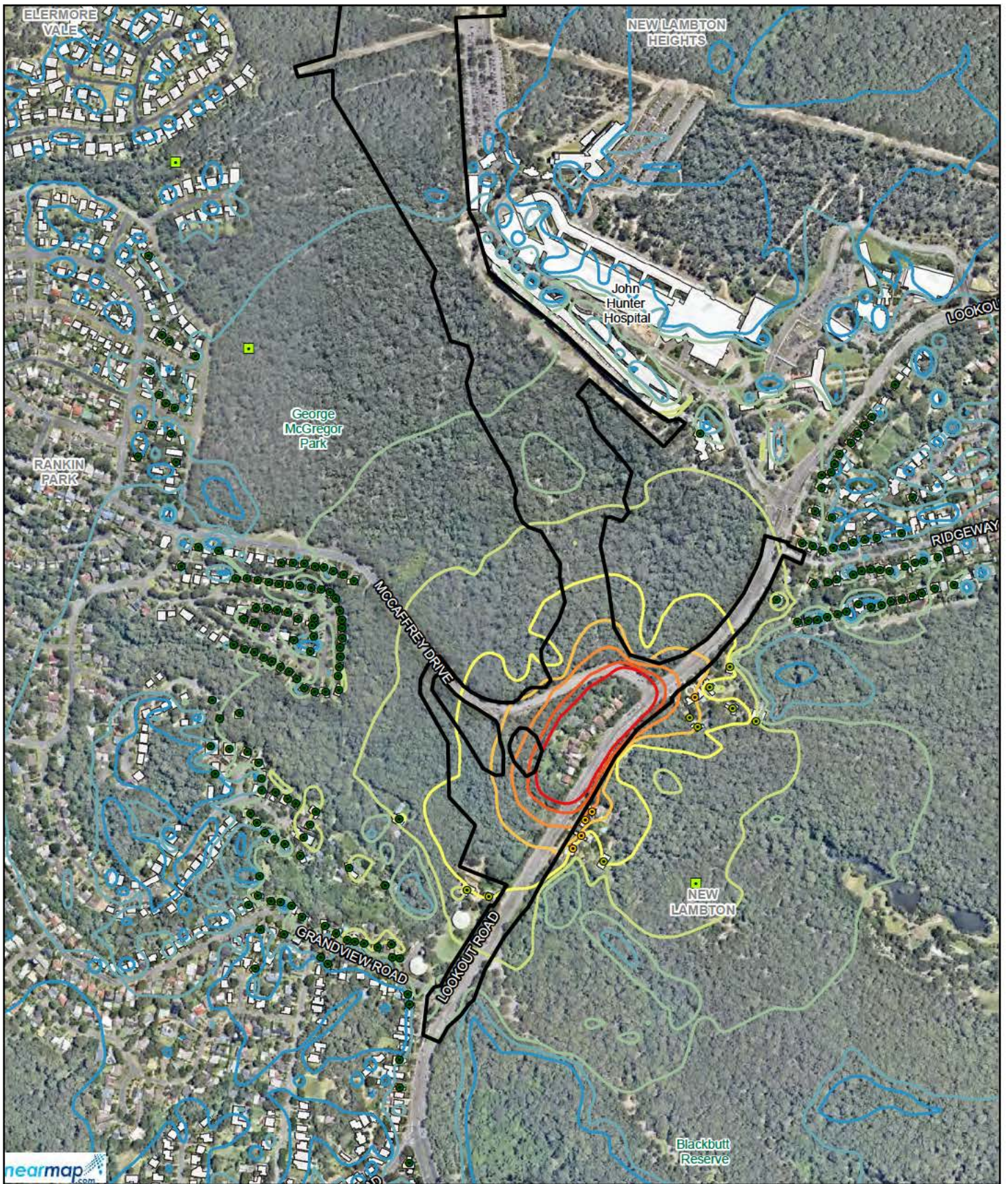


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

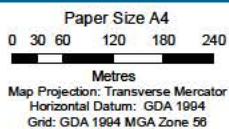
Predicted construction noise levels,
Scenario 10e - sheet 2 of 2

Figure E-17b



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |

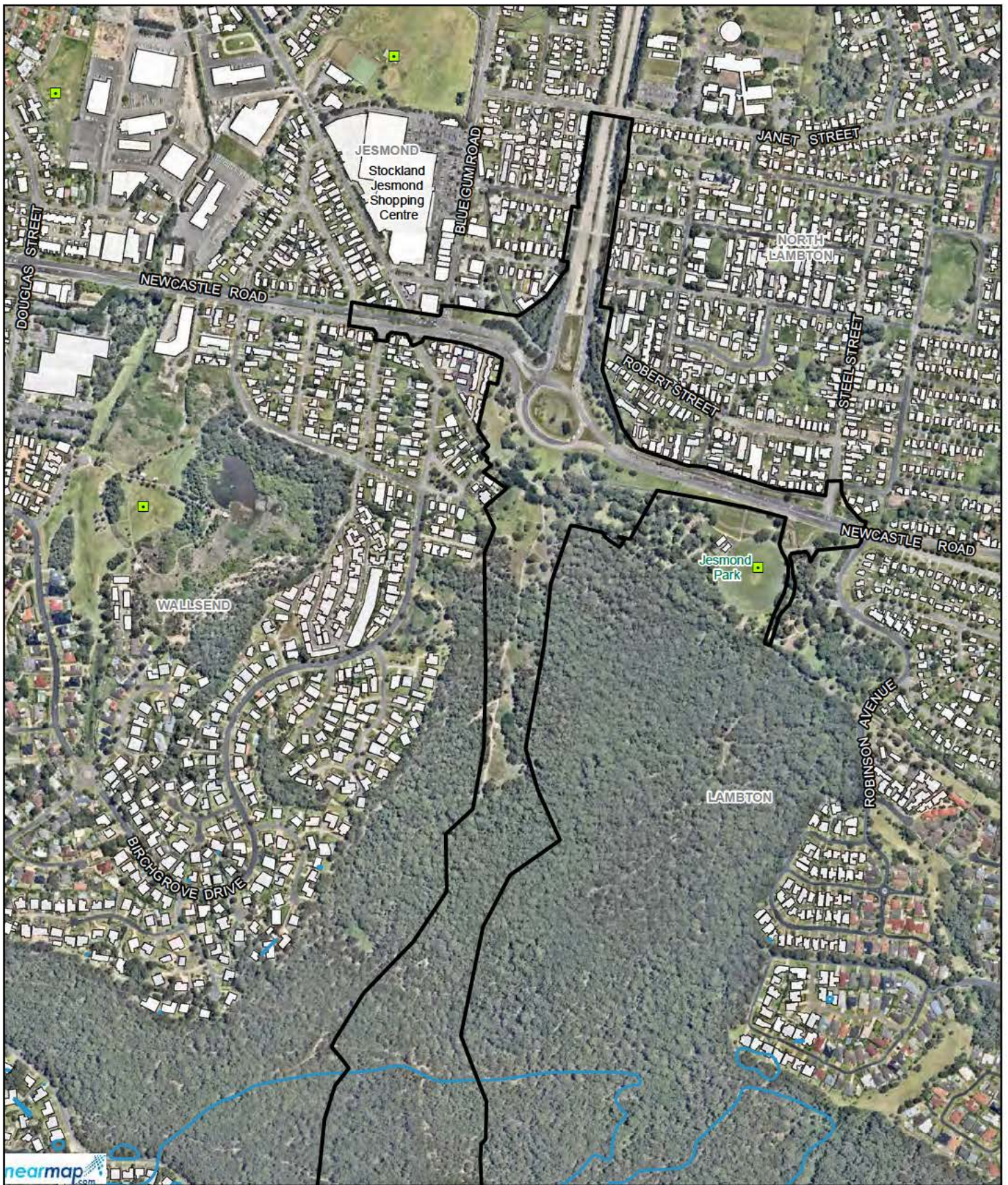


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

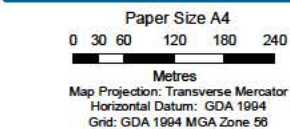
Predicted construction noise levels,
Scenario 10f - sheet 1 of 2

Figure E-18a



LEGEND

- Construction footprint
- Building
- Receiver
- Active recreation receiver
- Noise contour
- 35 dBA L_{Aeq} (15-minute)

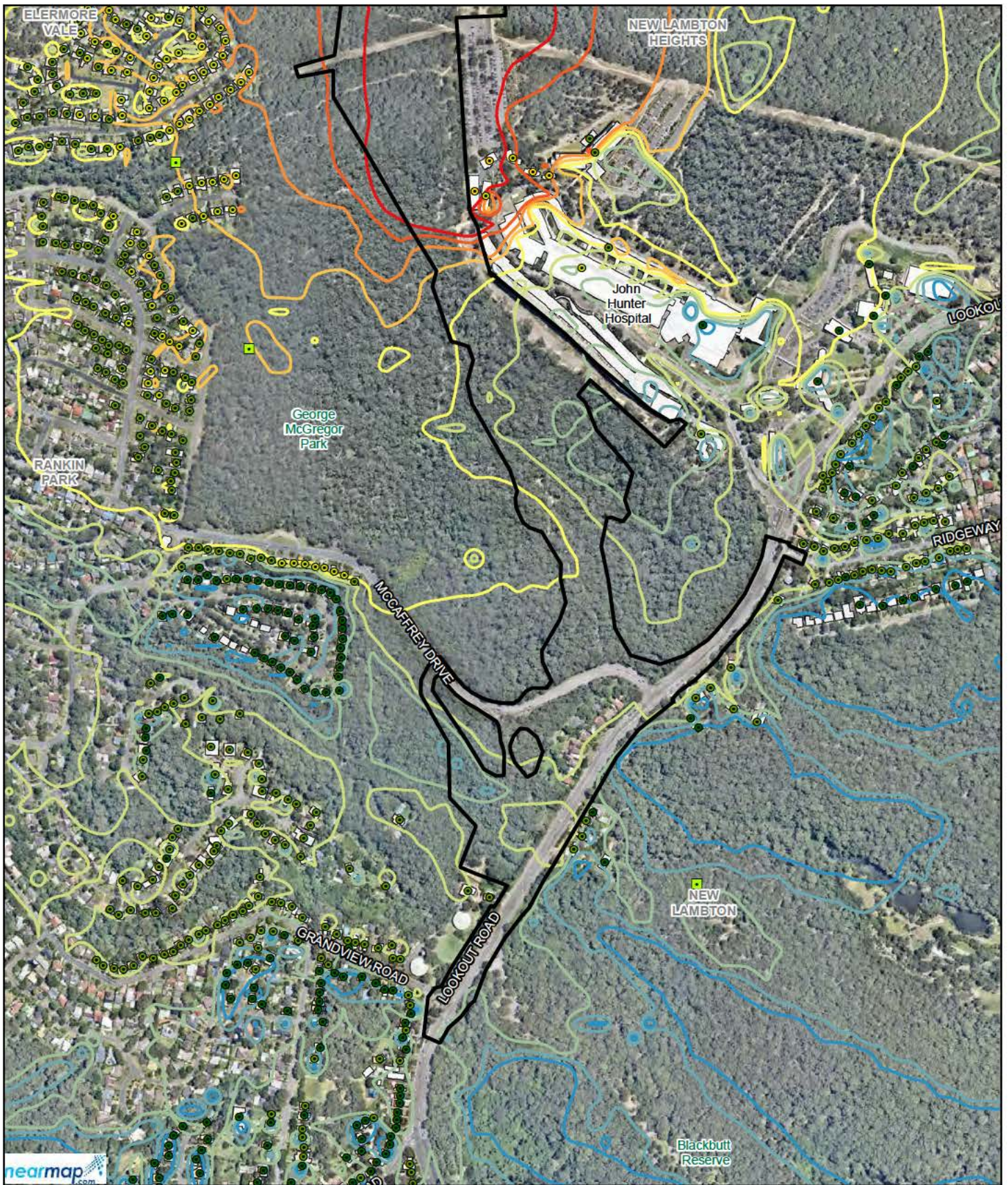


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Predicted construction noise levels,
Scenario 10f - sheet 2 of 2

Figure E-18b



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | 30 - 40 dBA |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |

Paper Size A4
 0 30 60 120 180 240
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56

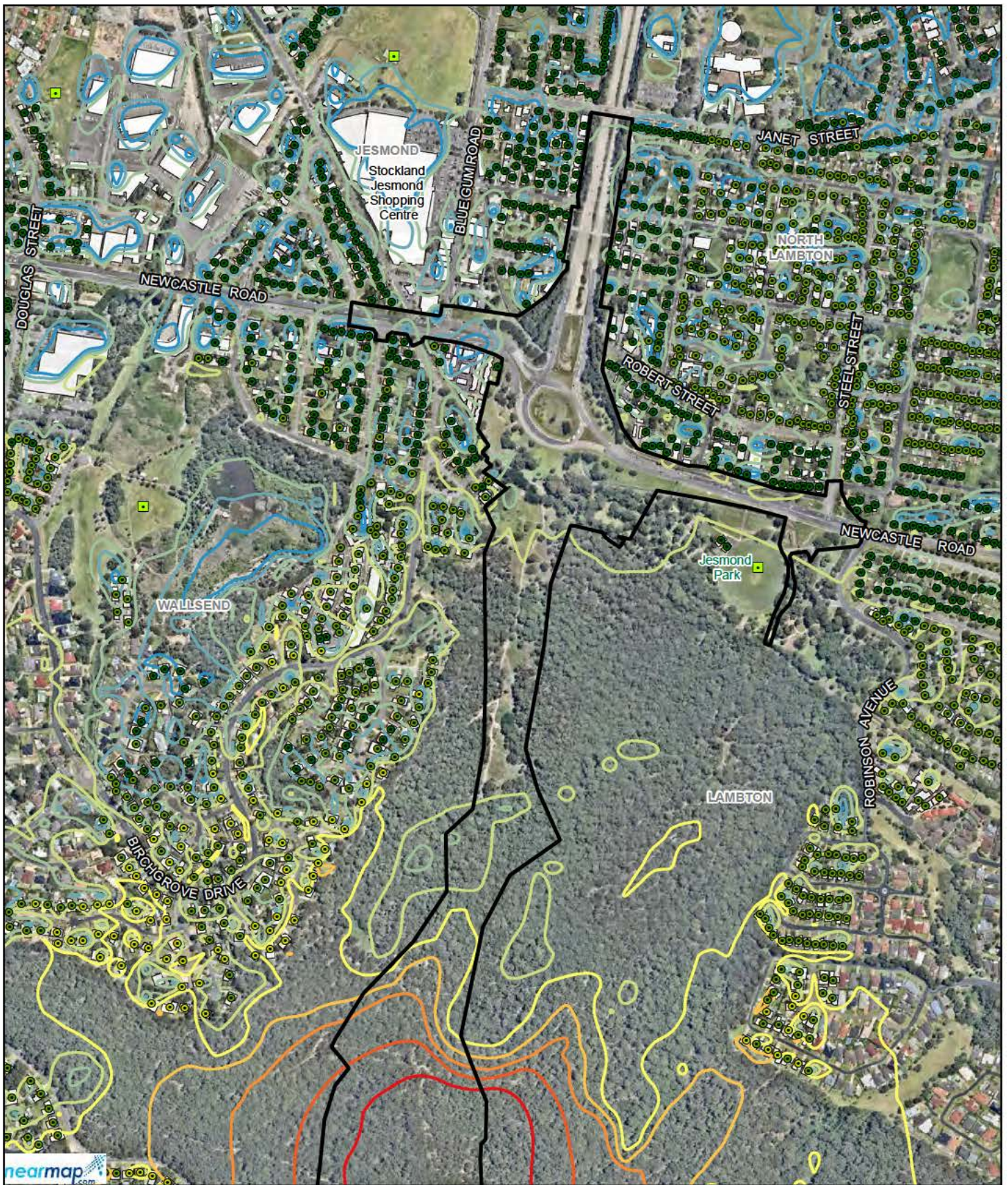


Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

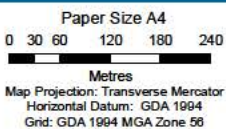
Predicted construction noise levels,
 Scenario 11 - sheet 1 of 2

Figure E-19a



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | |

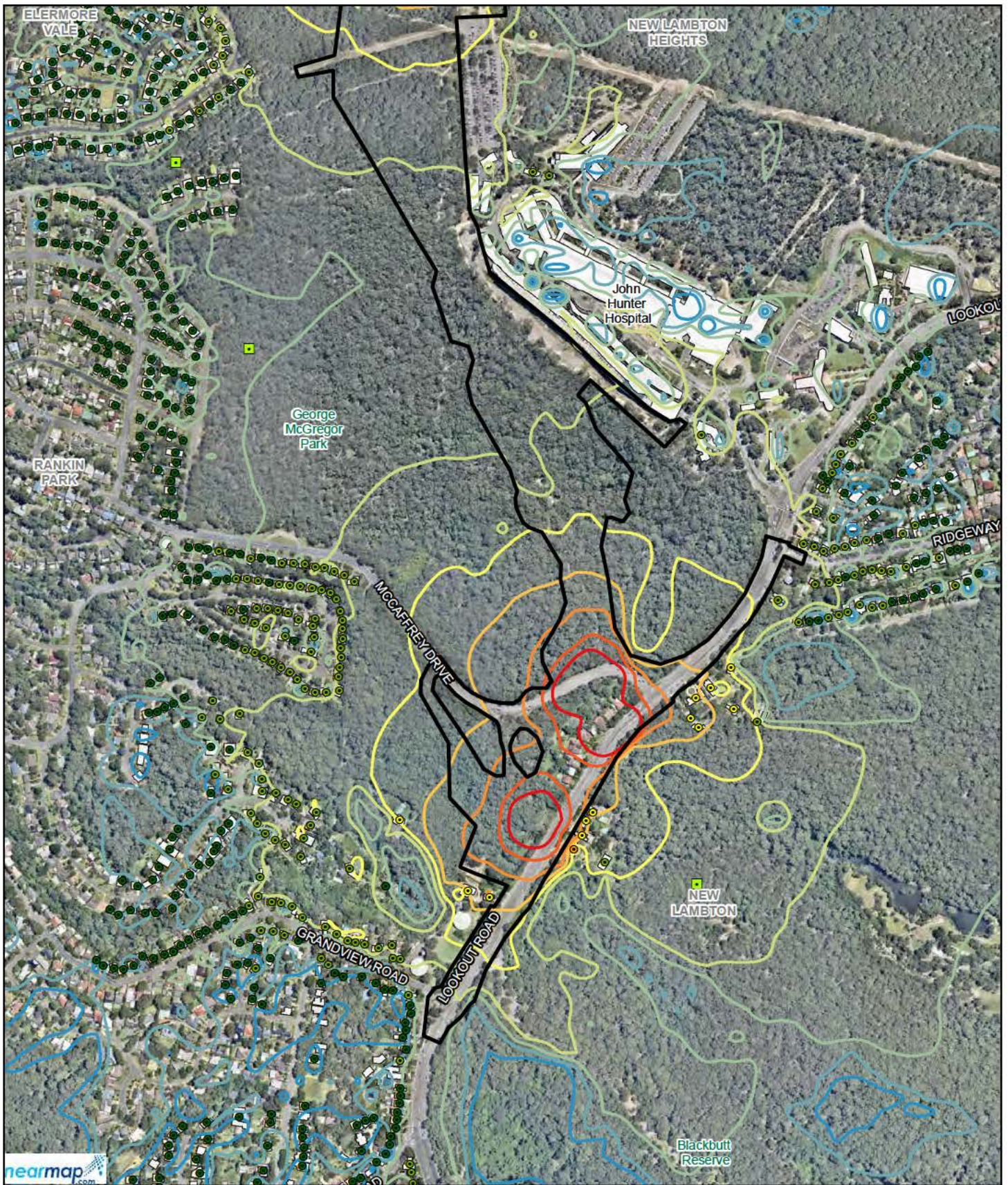


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

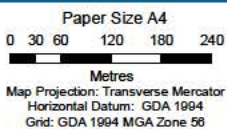
Predicted construction noise levels,
Scenario 11 - sheet 2 of 2

Figure E-19b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	

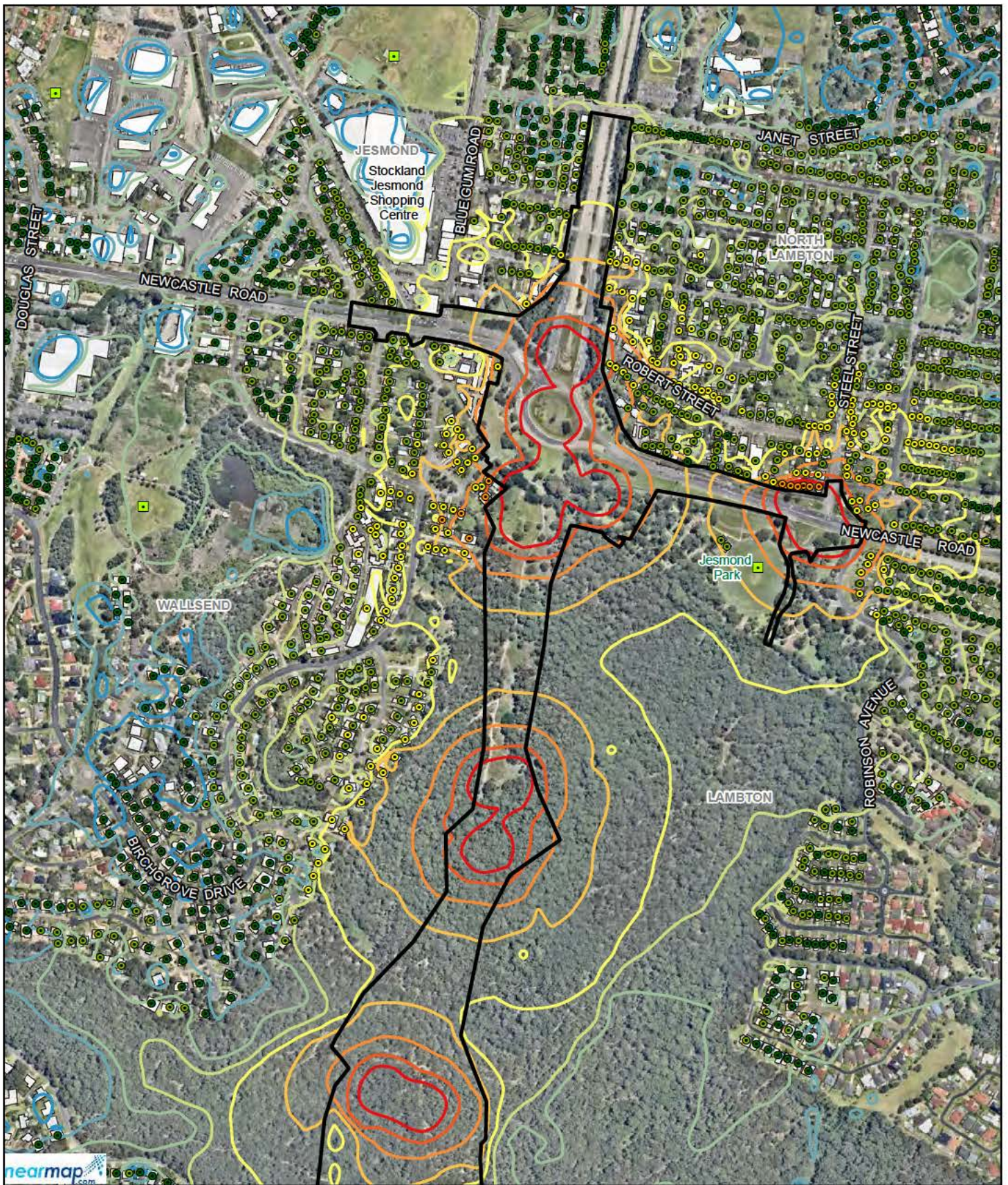


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

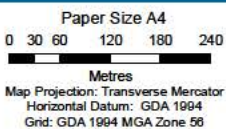
Predicted construction noise levels,
Scenario 14 - sheet 1 of 2

Figure E-20a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	

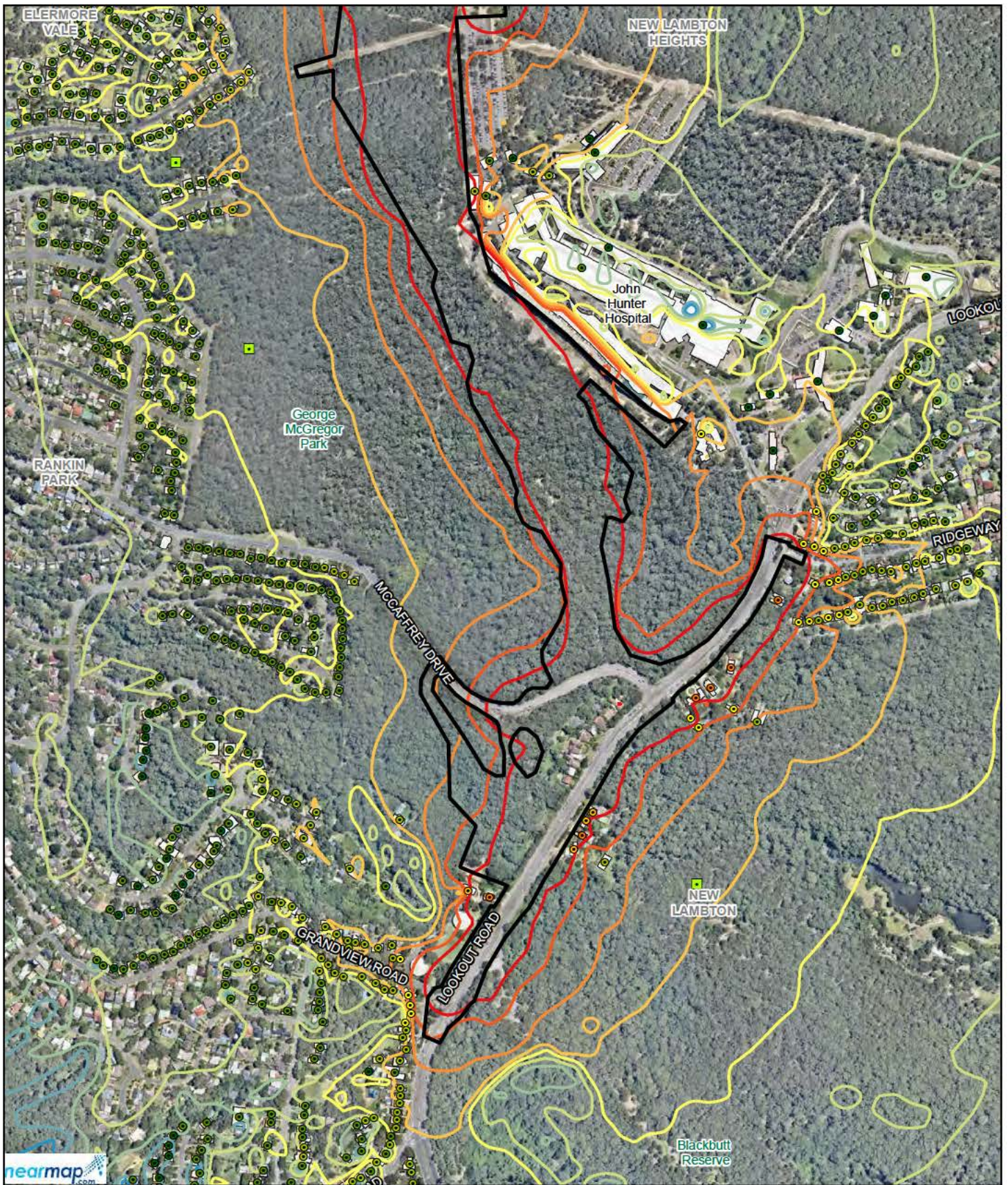


Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

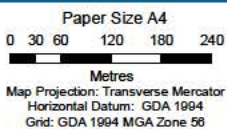
Predicted construction noise levels,
 Scenario 14 - sheet 2 of 2

Figure E-20b



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	

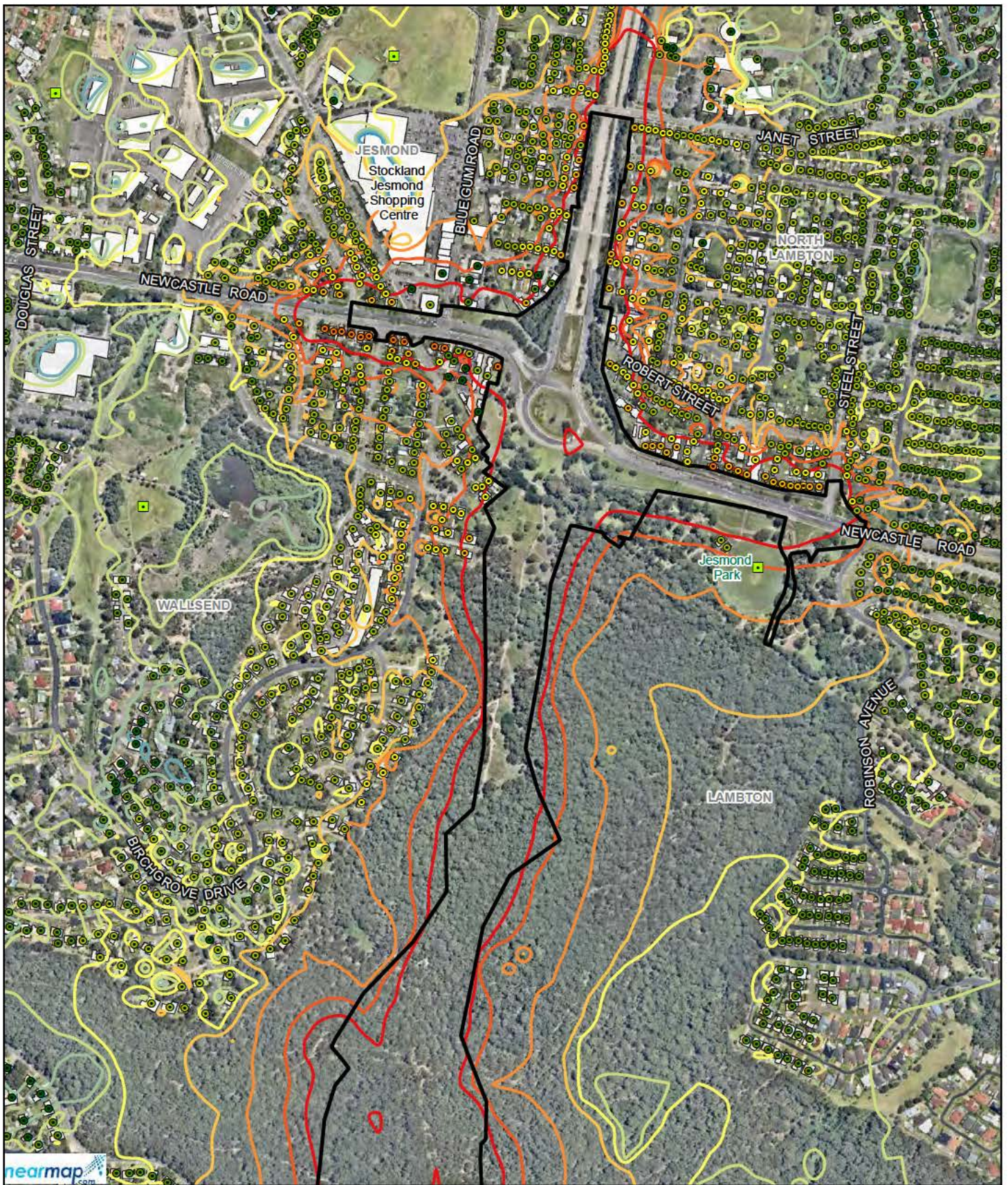


Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

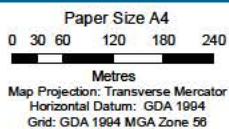
Predicted construction noise levels,
 Scenario 17 - sheet 1 of 2

Figure E-21a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA	50 - 60 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA	
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA	
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA	

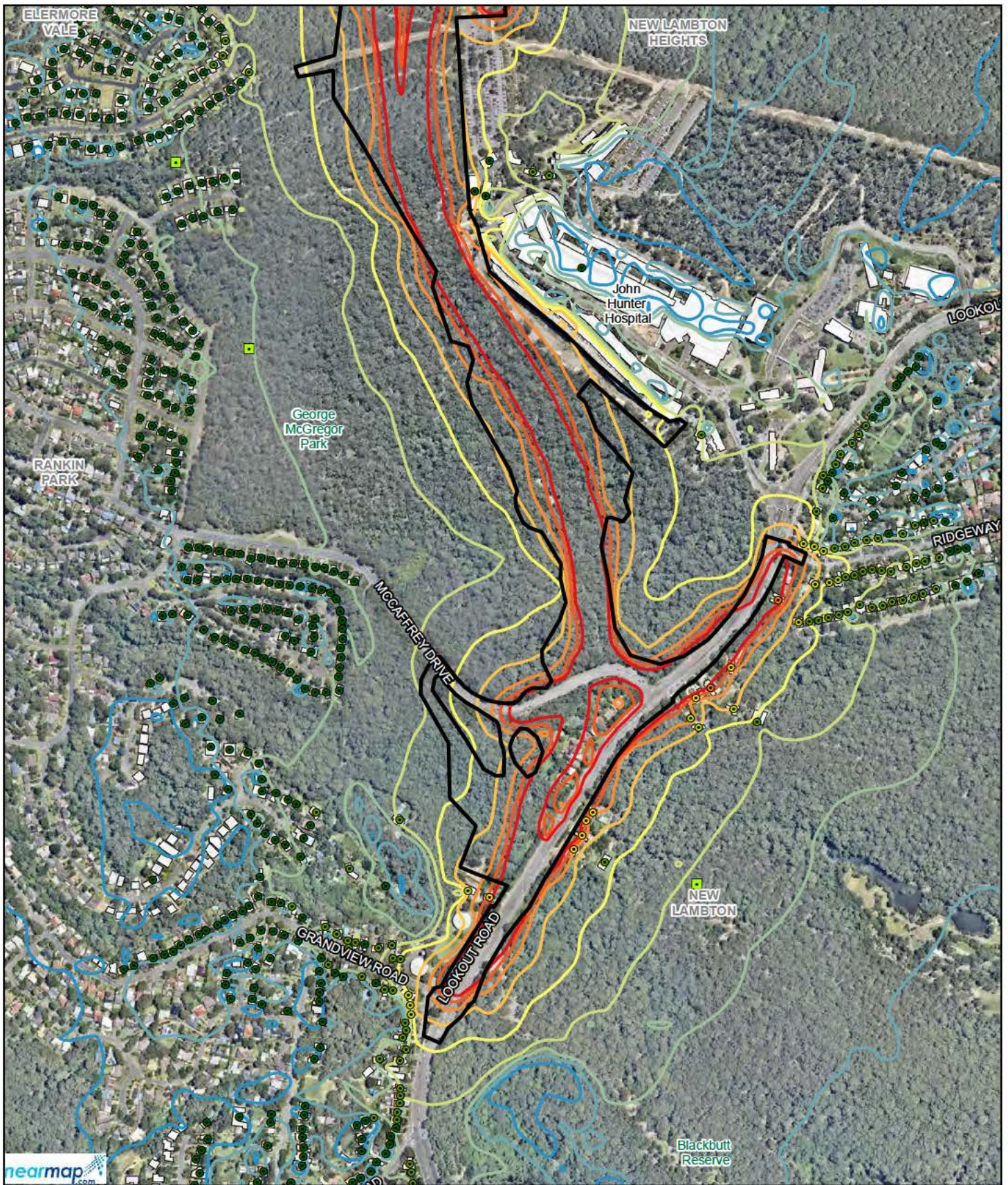


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Predicted construction noise levels,
Scenario 17 - sheet 2 of 2

Figure E-21b



LEGEND

- | | | | | |
|----------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------|
| Construction footprint | Noise contour | 50 dBA L _{Aeq} (15-minute) | 70 dBA L _{Aeq} (15-minute) | 10 - 20 dBA |
| Building | 35 dBA L _{Aeq} (15-minute) | 55 dBA L _{Aeq} (15-minute) | 75 dBA L _{Aeq} (15-minute) | 20 - 30 dBA |
| Receiver | 40 dBA L _{Aeq} (15-minute) | 60 dBA L _{Aeq} (15-minute) | Exceedance | 30 - 40 dBA |
| Active recreation receiver | 45 dBA L _{Aeq} (15-minute) | 65 dBA L _{Aeq} (15-minute) | 0 - 10 dBA | 40 - 50 dBA |

Paper Size A4
 0 30 60 120 180 240
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56

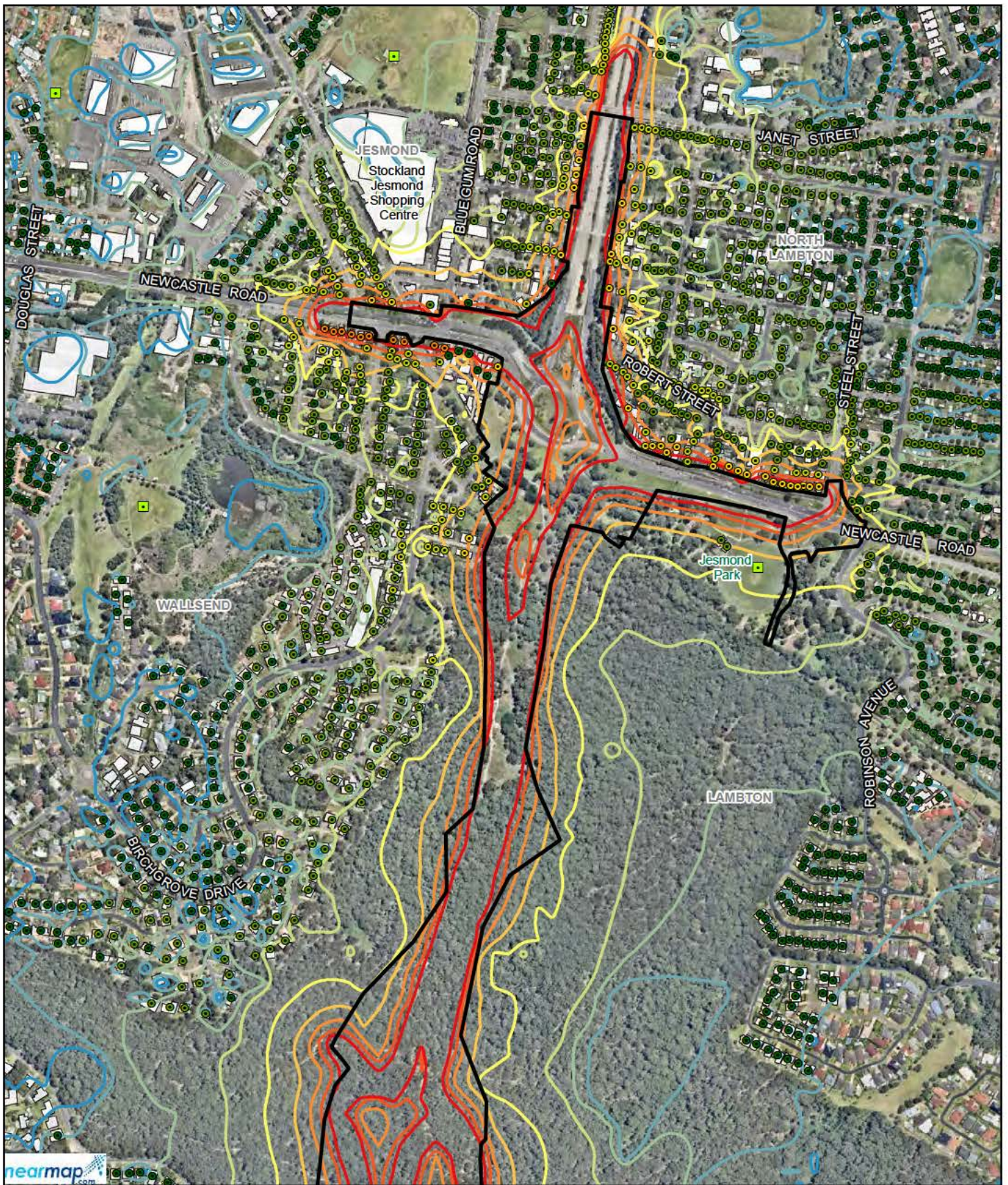


Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

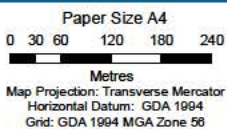
Predicted construction noise levels,
 Scenario 21 - sheet 1 of 2

Figure E-22a



LEGEND

Construction footprint	Noise contour	50 dBA L _{Aeq} (15-minute)	70 dBA L _{Aeq} (15-minute)	10 - 20 dBA
Building	35 dBA L _{Aeq} (15-minute)	55 dBA L _{Aeq} (15-minute)	75 dBA L _{Aeq} (15-minute)	20 - 30 dBA
Receiver	40 dBA L _{Aeq} (15-minute)	60 dBA L _{Aeq} (15-minute)	Exceedance	30 - 40 dBA
Active recreation receiver	45 dBA L _{Aeq} (15-minute)	65 dBA L _{Aeq} (15-minute)	0 - 10 dBA	40 - 50 dBA



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

Predicted construction noise levels,
Scenario 21 - sheet 2 of 2

Figure E-22b

Appendix C: Out-of-hours work approval procedure (for work subject to an EPL)

Appendix C Out-of-hours work approval procedure (for work subject to an EPL)

Purpose

This procedure details Fulton Hogan's internal process for consideration, management and approval of OOHW for work subject to an EPL. It will be reviewed upon issue of the EPL and any minor amendments will be approved by the ER.

Works not subject to an EPL (i.e. CoA E31) are not applicable to the project (Stage 4) and are not considered further in this procedure.

All work will be carried out in accordance with EPL (Number 21762), project approval (such as CoA E27), ICNG and NVMP.

Objectives

This procedure outlines the project requirements for construction working hours and documents a process to be implemented when OOHW is required. The key objective of the procedure is to ensure that impacts to the local community are avoided.

Specific objectives include:

- Minimise potential adverse noise impacts to the community
- Identify sensitive receivers and ensure appropriate noise control measures are implemented during construction activities
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in the NVMP
- Ensure appropriate measures are implemented to meet the CoA, EPL (Number 21762) and the intent of the ICNG.

OOHW approval pathway

The project (Stage 4) is a 'scheduled' activity under the POEO Act and will therefore be subject to an EPL. The process for approving OOHW for works subject to an EPL will be governed by the conditions of the EPL (Number 21762). Refer to the flowchart provided in Figure 9.

Assessment of planned OOHW works for compliance with the EPL (Number 21762) will be undertaken by Fulton Hogan. Notification will be provided to the EPA, TfNSW and the ER for all OOHW under the EPL.

Fulton Hogan's internal OOHW application process and request form is contained at Attachment 1. When external approval is required, the internally approved request form (Attachment 1) will be submitted as part of the supporting documentation for the external OOHW application.

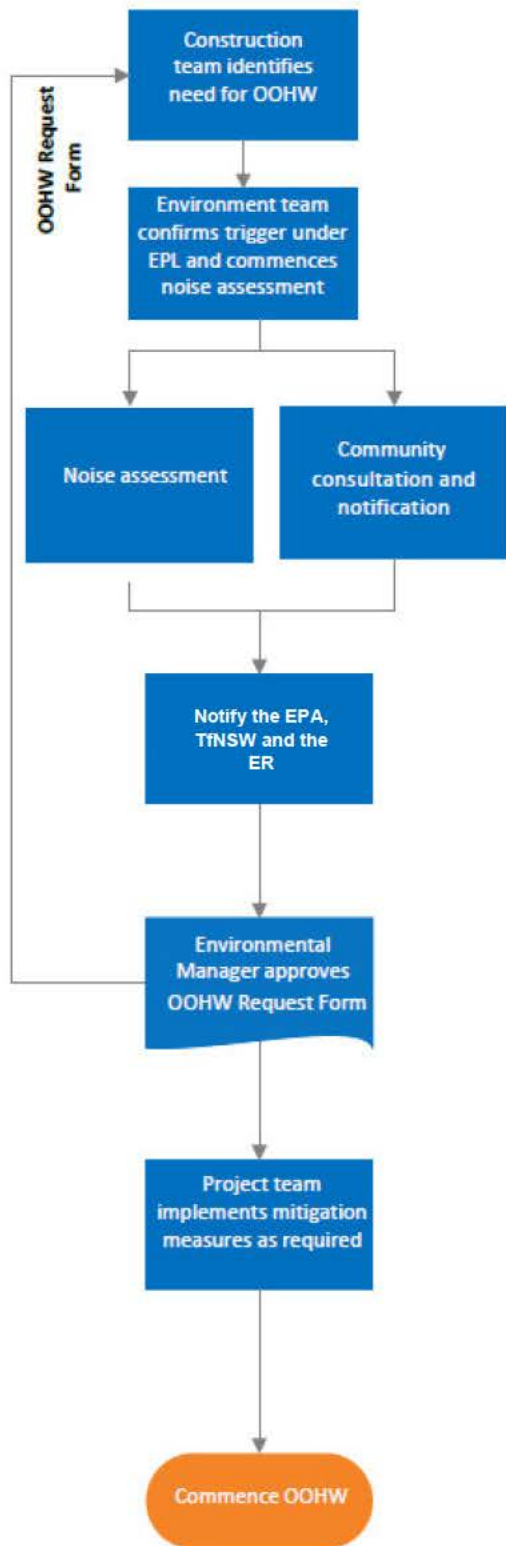


Figure 9: OOHW approval pathway flowchart for the project (for work subject to an EPL)

Expected OOHW

It is likely that, from time to time, work outside of standard working hours will be required. OOHW that are expected as part of the project may include but not necessarily be limited to those detailed in Section 7.1.3 of the NVMP.

OOHW assessment and application process

To enable the OOHW detailed in Section 7.1.3 to occur outside of standard construction hours, the following process will be implemented:

1. Project Engineers will consult with the Environmental Manager (EM) and Community Relations Manager about six (6) weeks in advance of proposed OOHW. The engineer is to submit an OOHW request form at this time (refer to Attachment 1) which will allow the EM to determine the justification for the OOHW and the predicted noise and vibration level (if required).
2. The EM will assess the OOHW request and determine:
 - a. If the proposed works are likely to achieve noise levels within RBL + 5 dB(A) or the Noise Management Levels (NMLs) specified in Table 3 of the Interim Construction Noise Guideline (refer to section Table 7 of the NVMP) or if they will occur within the safe working distances for human comfort from vibration (refer to Section 7.5 of the NVMP).
 - b. If a negotiated agreement has been reached with the majority of affected sensitive receivers for works where the prescribed noise and vibration levels cannot be achieved (where permitted by an EPL).
 - c. If the works are for the delivery of materials required outside of standard hours by the NSW Police Force or other authorities for safety reasons.
 - d. If the proposed works are 'justified' OOHW where:
 - i. carrying out those works and activities during standard hours would cause unacceptable risks to one or more of the following:
 1. construction personnel safety
 2. road user and public safety
 3. road network operational performance as may be notified from time to time by the TfNSW; or
 4. quality/material/design e.g. constraints such as ambient temperature, pour rate, etc. require OOHW
 - ii. a public utility provider (i.e. electricity, gas, water, sewer or telecommunications) refuse to allow work on an existing service during the standard construction hours; or
 - iii. the TfNSW Transport Management Centre (or other road authority) refuse to issue a road occupancy licence for work during standard construction hours.
3. If item 2c) applies and/or where it is required in an emergency to avoid injury or the loss of life, property and/or to prevent environmental harm, then works will be applied for without a specific noise assessment. An initial noise assessment will be conducted to determine impact and identify any appropriate mitigation measures. In accordance with the SWTC Appendix 4 and CoA E28, on becoming aware of the need for emergency work outside normal working hours, Fulton Hogan must notify TfNSW, the ER and the EPA of the reasons for such work. Fulton Hogan will also use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of the works.
4. If the EM determines, based on initial noise assessment, that the works will generate $L_{Aeq,15min}$ noise levels that will be less than the NML and no vibration impacts are expected, the OOHW approval form will be submitted to the EM and Community Relations Manager for approval. Standard OOHW noise management measures, in accordance with Chapter 8 of the NVMP, will be included in the OOHW approval and noise monitoring undertaken.
5. If there is a risk that the noise levels will exceed the relevant NMLs and/or works may occur within the

safe working distances for vibration (determined by employing a Construction Noise Quantifier Tool which provides buffer zones based on construction activities), a Noise and/or Vibration Impact Assessment will be undertaken as described below to assess compliance with the OOHW NMLs and vibration management levels and assess the relevant mitigation measures and approval process.

Noise and vibration impact assessment

Where there is a risk that the proposed OOHW will exceed RBL + 5 dB(A) and/or works may occur within the safe working distance for vibration, a noise and vibration impact assessment for the works will be undertaken and include the following:

- Details of the nature and scope of each activity and work, including details of times, vehicles, plant and equipment to be used to undertake that activity or work.
- Analysis to justify the scheduling and duration of each activity and work outside the standard construction hours, including taking into account:
 - the predicted impact on noise sensitive receivers of any activities and works undertaken outside the hours; and
 - the preference that high noise impact works be undertaken during the day.
- Analysis to justify use of the selected construction and work methods, plant and equipment compared to alternatives taking into consideration noise and vibration impacts.
- A table showing details of the noise and vibration mitigation measures for each activity and work, including respite periods, proposed to be adopted to minimise noise and vibration impacts on surrounding noise sensitive receivers in each locality. To satisfy CoA E32, all OOHW undertaken for the delivery of the project, including that undertaken by third parties (such as utility relocation), will be coordinated to ensure respite periods are provided. Where this is unable to be achieved, provision of alternative accommodation or mitigation to impacted noise sensitive receivers would be considered. A table showing for each activity and work in each noise catchment:
 - the addresses of the most affected noise sensitive receivers;
 - the background noise level for each of the noise sensitive receivers listed in the table;
 - noise management levels as described in Section 4 of the ICNG and Section 5.1.6 of the NVMP;
 - the predicted $L_{Aeq,15min}$ noise level, incorporating any 5 dB correction for particularly annoying activities as listed on page 16 of the ICNG; and
 - an assessment of sleep disturbance as set out in Section 4.3 of the ICNG (DECC, 2009), where works are planned to extend over more than two consecutive nights.
- Details of the specific noise mitigation measures to be adopted in respect of any activity or work predicted to generate noise levels at any noise sensitive receiver exceeding the noise affected $L_{Aeq,15min}$ level of background plus 5 dB outside the standard hours.
- A diagram showing the location of noise and vibration monitoring locations in relation to each of the most affected noise sensitive receivers for each activity and work in each noise catchment.
- Community notification requirements as per the CCS and OOHW mitigation measures detailed in Chapter 8 of the NVMP that are dependent on the predicted noise level.
- Details of the approval pathway utilised to ensure the OOHW is compliant with the EPL (Number 21762).

Following completion of the noise and vibration impact assessment, the EM will document the assessment required by this condition in a report.

The assessment will be included as part of the OOHW application for EM and CRM approval. The ER will then be provided with the approved OOHW application form for information. This will satisfy the CoA E32(c) requirement to provide documentary evidence to the ER in support of any decision made in relation to respite or mitigation.

Noise and vibration monitoring

The EM will ensure that the following noise and vibration monitoring is undertaken for all OOHW where the NMLs are predicted to be exceeded by at least 10 dB during daytime OOHW or 5 dB for night-time OOHW and/or where vibration levels are predicted to exceed human comfort criteria:

- Undertake attended noise and/or vibration monitoring at representative stages of the activity or work to confirm whether the noise and vibration predictions in its noise and vibration assessment were accurate.
- Where noise monitoring indicates that the activity, work or combination of simultaneous activities or works has caused or is causing noise or vibration levels higher than the predicted levels at any noise sensitive receiver, mitigation and management measures will be re-evaluated and re-assessed.

Monitoring will also be undertaken at any location where two (2) or more complaints are received about the specific OOHW activity or works on the telephone complaints line.

Community notification

The Community Relations Manager will notify the community in accordance with the Community Communication Strategy (CCS) and in accordance with the OOHW mitigation measures listed in Chapter 8 of the NVMP. This notification will:

- Be made by targeted letterbox drop, door knock, phone call or email to noise sensitive receivers as detailed in the CNVG.
- Be posted on the project website.
- Be made within the timeframes as detailed in the NVMP and the EPL (Number 21762) before commencement of any OOHW and include:
 - identification of respite periods in consultation with the community (at each affected location on a monthly basis in accordance with CoA E29);
 - a schedule of likely OOHW for a period of no less than three (3) months in advance (CoA E29(a));
 - a diagram that clearly identifies the location of the proposed OOHW in relation to nearby cross streets and local landmarks or geographical features;
 - details of the timing, nature, scope and duration of the proposed works and activities;
 - detail of why the proposed works and activities are being undertaken outside of standard construction hours;
 - details of the predicted noise and vibration impacts of the works on identified sensitive receivers;
 - details of all proposed mitigation measures, including respite periods and proposed scheduling. To satisfy CoA E32, all OOHW undertaken for the delivery of the project, including that undertaken by third parties (such as utility relocation), will be coordinated to ensure respite periods are provided. Where this is unable to be achieved, provision of alternative accommodation or mitigation to impacted noise sensitive receivers would be considered;
 - details of the types of plant and equipment that will be used to undertake the work;
 - details of how complaints may be made and additional information obtained about the work;
 - contact details in community languages relevant to the locality; and include notification of any upcoming project community meetings / forums.

The outcomes of the community consultation, the identified respite periods and the scheduling of likely OOHW will be provided to the ER, EPA and the Planning Secretary in accordance with CoA E29. The same information will also be provided to TfNSW.

Negotiation with stakeholders

Where permitted by the EPL (Number 21762), negotiation may be undertaken with affected residents for OOHW that may have a considerable noise and/or vibration impact on residences. Following the assessment of OOHW, this may be undertaken for those works that:

- Are not required in accordance with Step 2c) and/or 2d) of the Application Process; and
- Result in predicted noise levels more than 5 dB above the relevant Night NMLs OR

- May result in vibration levels in excess of the human comfort vibration management levels.

Negotiation with stakeholders will include:

- A discussion of the reasons that OOHW are proposed and where possible alternatives that would occur if the OOHW could not proceed as planned (e.g. significantly longer duration of works at other times).
- A discussion of noise and vibration mitigation and management measures proposed for the works, and alternatives proposed by the stakeholders.
- A discussion of potential scheduling that could be undertaken considering the particular needs of the stakeholders.
- Documentation of the outcomes of the negotiation and submission to relevant authorities.

If agreement is not received for the proposed OOHW with the majority of affected stakeholders, then the EM will consult with relevant approval authorities regarding the works to obtain approval and feedback on the implemented management measures. If approval for these works is not received from the approval authority and agreement has not been reached with the potentially affected stakeholders, the works will not proceed until the proposal has been suitably altered to obtain stakeholder and/or authority approval.

If agreement is not received for the proposed OOHW with the majority of affected stakeholders, then the EM will determine if there is a suitable alternative approval pathway to ensure the works are compliant with the EPL (Number 21762) which may include seeking further approval from the EPA.

Complaints

Any complaints received as a result of the OOHW are to be managed in accordance with the Community Communication Strategy (CCS). On receipt of two or more complaints regarding OOHW in a particular area, noise monitoring will be undertaken to confirm compliance with the predicted noise levels.

If the noise monitoring determines construction noise levels greater than predicted, the construction process will be reviewed and additional noise mitigation measures will be implemented prior to works recommencing.

Record keeping

All OOHWs applications are recorded electronically and documented with a unique identification number.

All noise monitoring results will be recorded using "Noise Monitoring Field Sheet" and data entered into the noise monitoring database.

ATTACHMENT 1 – OUT OF HOURS WORK REQUEST FORM

NEWCASTLE INNER CITY BYPASS RANKIN PARK TO JESMOND (STAGE 4 – MAIN WORKS)	
Out of Hours Request No:	
Application Date:	
Name of Person Requesting Work:	
Justification, why work outside of standard hours is required? <i>Include any alternatives considered</i>	

CONTACT DETAILS	Name	Mobile number	Email
Engineer:			
Environmental Manager:			
Contractor’s 24 Hour Contact:			

OUT OF HOURS WORK DETAILS						
Location:						
Description of the Work:						
Proposed Dates / Duration:						
Start Time of Works (each day):						
Finish Time of Works (each day):						
OOHW Period Classification: <i>OOHW Period 1, and/or OOHW Period 2</i>						
Plant and Equipment to be Used:	Plant	Qty	SWL	Plant	Qty	SWL

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



<p>List all plant and noise generating equipment / activities to be used</p> <p>Where plant is not used for entire OOHW period, note when it will be used</p>						
Map Attached showing worksites and nearest noise sensitive receivers	<input type="checkbox"/> Yes					
Name of Foremen Supervising Work:						
Subcontractor Details (if applicable):						
Details on any concurrent OOHW being undertaken in same Precinct:						

NOISE AND VIBRATION	
Distance from works to nearest sensitive receivers:	
Are there any shielding features (barriers / buildings) between works and receivers that can be used to reduce noise levels?	
<p>Could the works generate audible noise or perceptible vibration at the nearest sensitive receivers?</p> <p><i>Describe plant / equipment / activities that may generate audible noise or perceptible vibration</i></p>	
Noise assessment completed	<input type="checkbox"/> No? Complete Noise assessment <input type="checkbox"/> Yes? Proceed
Preliminary vibration assessment <i>If unsure, vibration report should be prepared</i>	<input type="checkbox"/> Works occurring outside safe working distance for human comfort <input type="checkbox"/> Works occurring inside safe working distance for human comfort (VIBRATION REPORT REQUIRED)
Noise and/or Vibration report attached <i>Check all that apply</i>	<input type="checkbox"/> Noise <input type="checkbox"/> Vibration <input type="checkbox"/> Not required

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



<p>Programming measures to be implemented</p> <p><i>Detail work programming that will be adopted to minimise impacts on particular receivers (e.g. respite)</i></p>									
<p>Noise mitigation measures to be implemented</p> <p><i>Refer to NVMP and provide specific measures for equipment to be used</i></p>									
<p>Vibration mitigation measures to be implemented</p> <p><i>Refer to NVMP and provide specific measures for equipment to be used</i></p>									
<p>Noise and vibration monitoring to be undertaken?</p> <p><i>Provide details of location and frequency</i></p>									
<p>OTHER CONSIDERATIONS</p>									
<p>Identify other potential impacts of the works:</p>	<table border="0"> <tr> <td><input type="checkbox"/> Dust</td> <td><input type="checkbox"/> Public transport e.g. <i>schedule changes</i></td> </tr> <tr> <td><input type="checkbox"/> Lighting</td> <td><input type="checkbox"/> Parking</td> </tr> <tr> <td><input type="checkbox"/> Pedestrian access</td> <td><input type="checkbox"/> Property access</td> </tr> <tr> <td><input type="checkbox"/> Other (specify)</td> <td></td> </tr> </table>	<input type="checkbox"/> Dust	<input type="checkbox"/> Public transport e.g. <i>schedule changes</i>	<input type="checkbox"/> Lighting	<input type="checkbox"/> Parking	<input type="checkbox"/> Pedestrian access	<input type="checkbox"/> Property access	<input type="checkbox"/> Other (specify)	
<input type="checkbox"/> Dust	<input type="checkbox"/> Public transport e.g. <i>schedule changes</i>								
<input type="checkbox"/> Lighting	<input type="checkbox"/> Parking								
<input type="checkbox"/> Pedestrian access	<input type="checkbox"/> Property access								
<input type="checkbox"/> Other (specify)									
<p>Describe mitigation measures to be implemented to address these potential impacts</p>									
<p>What lighting is to be provided for night work?</p>									

Appendix B2: Noise and Vibration Management Sub-Plan

Newcastle Inner City Bypass Rankin Park to Jesmond (Stage 4 – Main Works)



Does the work team comprise a minimum of two persons?	
---	--

CONSULTATION & NOTIFICATION STRATEGY

Detail consultation and notification strategy for works <i>Ensure strategy is in accordance with CCS and NVMP requirements</i>	
Is negotiation required with affected receivers? <i>Refer to situations under which this is required in the Out-of-hours work approval procedure (for work subject to an EPL)</i>	<input type="checkbox"/> Yes (Attach negotiation summary) <input type="checkbox"/> No
Is the ER aware of these works and will they be provided with a copy of this application if approved?	<input type="checkbox"/> Yes, proceed. <input type="checkbox"/> No, communicate OOHW to the ER.
Has TfNSW G36 Clause 3.6 Hold Point been submitted?	<input type="checkbox"/> Yes <input type="checkbox"/> No

CONTRACTOR APPROVALS

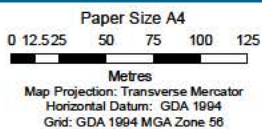
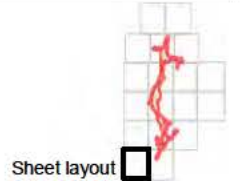
ENVIRONMENTAL MANAGER	NAME: _____ DATE: _____ SIGNATURE: _____
COMMUNITY RELATIONS MANAGER	NAME: _____ DATE: _____ SIGNATURE: _____

Appendix D: Detailed land use survey



LEGEND

- Design
- Building
- Residential sensitive receiver
- Noise logger location



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 1 of 18

Figure 2-2a

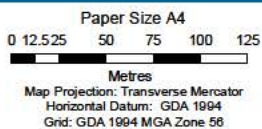
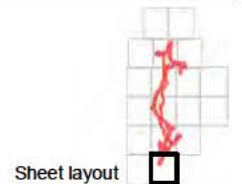
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntmil@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd
© 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.



© Land and Property Information (a division of the Department of Finance)

LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- Active recreation receiver
- Noise logger location
- Building
- Construction footprint



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 2 of 18

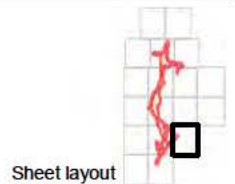
Figure 2-2b

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SNO05_NoiseReceivers_DDP_0.mxd
© 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.



LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- Noise logger location
- Building
- Construction footprint



Paper Size A4
 0 12.5 25 50 75 100 125
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

Noise receivers and logger locations
 sheet 3 of 18

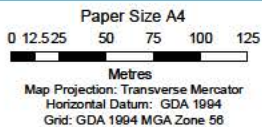
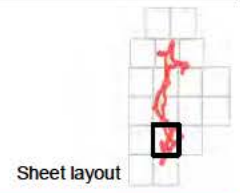
Figure 2-2c

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au
 G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd
 © 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.



LEGEND

- Design
- Residential sensitive receiver
- Active recreation receiver
- Noise logger location
- Building
- Construction footprint



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 4 of 18

Figure 2-2d

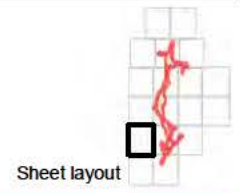
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd
© 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.



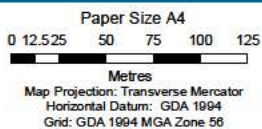
© Land and Property Information (a division of the Department of Finance)

LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- Noise logger location
- Building



Sheet layout



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 5 of 18

Figure 2-2e

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntmil@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SNO05_NoiseReceivers_DDP_0.mxd
© 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

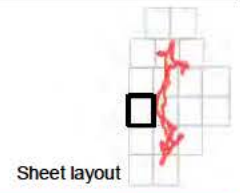
Data source: Aurecon: Design / construction footprint, 2016; LPI: Aerial Imagery, 2016; LPI: DTDB, 2012. Created by: tmorton, fmacKay



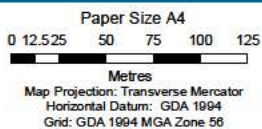
© Land and Property Information (a division of the Department of Finance

LEGEND

- Design
- Residential sensitive receiver
- Active recreation receiver
- Noise logger location
- Building
- Construction footprint



Sheet layout



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

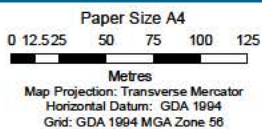
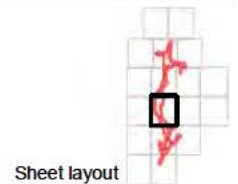
Noise receivers and logger locations
sheet 6 of 18

Figure 2-2f



LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- Noise logger location
- Building
- Construction footprint



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 7 of 18

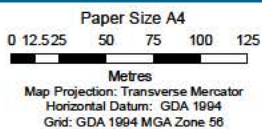
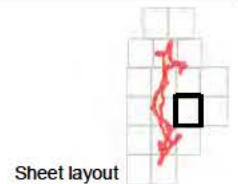
Figure 2-2g

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E entmail@ghd.com W www.ghd.com.au
 G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd
 © 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.



LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- Noise logger location
- Building



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

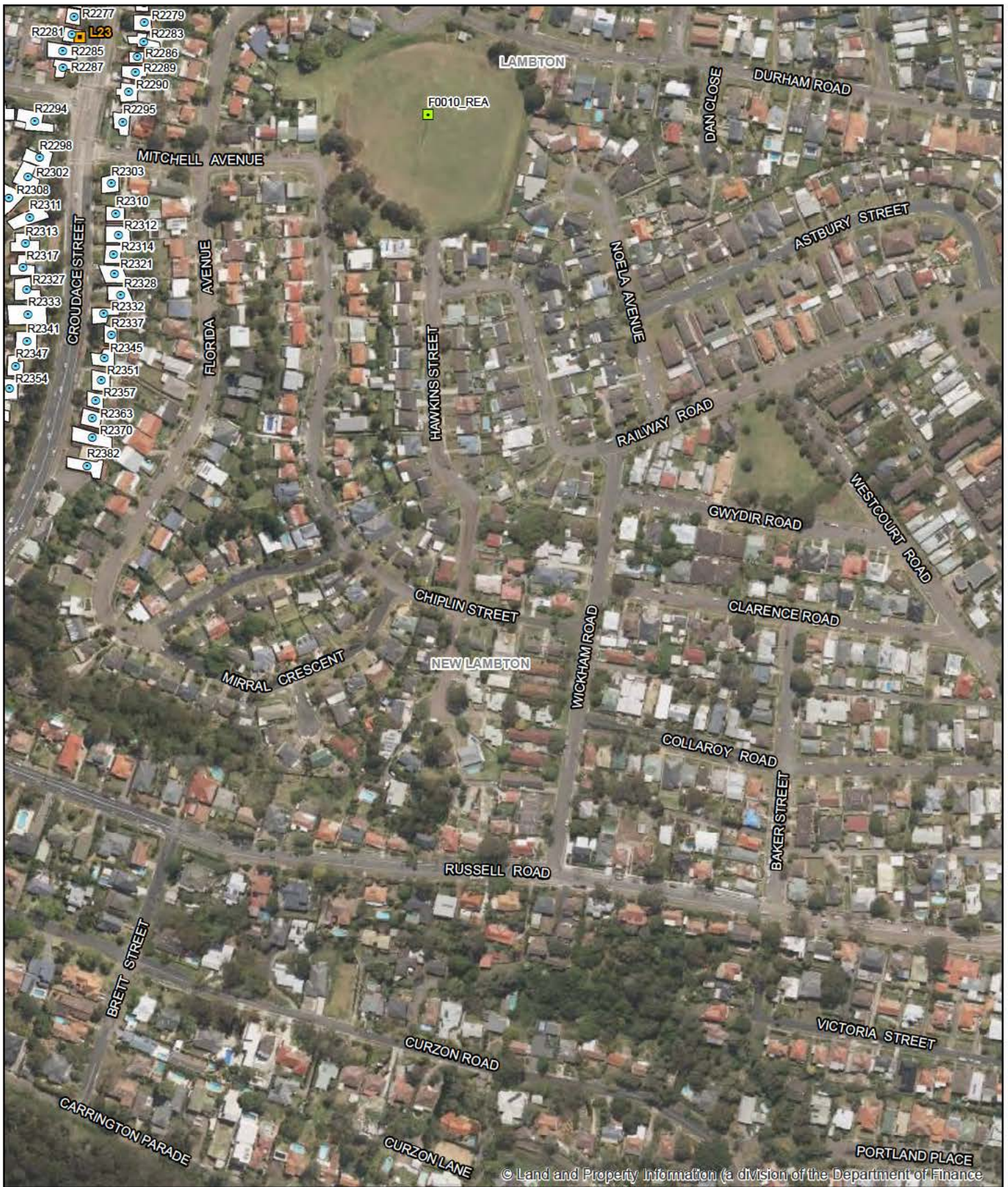
Noise receivers and logger locations
sheet 8 of 18

Figure 2-2h






Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E entlmail@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd

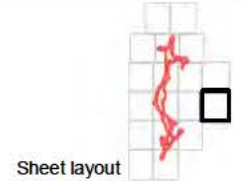
© 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Aurecon: Design / construction footprint, 2016; LPI: Aerial Imagery, 2016; LPI: DTDB, 2012. Created by: tmorton, fmacKay



LEGEND

-  Design
-  Residential sensitive receiver
-  Active recreation receiver
-  Noise logger location
-  Building



Paper Size A4
 0 12.5 25 50 75 100 125
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Rankin Park to Jesmond
 Noise and Vibration Assessment

Job Number 22-17656
 Revision 0
 Date 16 Apr 2018

Noise receivers and logger locations
 sheet 9 of 18

Figure 2-2i

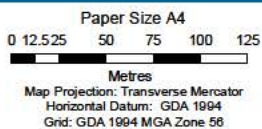
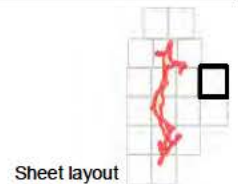
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au
 G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd
 © 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.
 Data source: Aurecon: Design / construction footprint, 2016; LPI: Aerial Imagery, 2016; LPI: DTDB, 2012. Created by: tmorton, fmacKay



© Land and Property Information (a division of the Department of Finance)

LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- Noise logger location
- Building



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 10 of 18

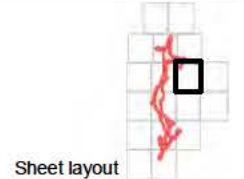
Figure 2-2j



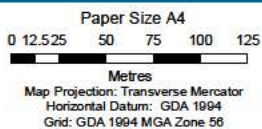
© Land and Property Information (a division of the Department of Finance)

LEGEND

- Design
- Residential sensitive receiver
- Active recreation receiver
- Noise logger location
- Building
- Construction footprint



Sheet layout



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 11 of 18

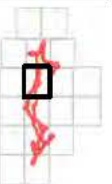
Figure 2-2k



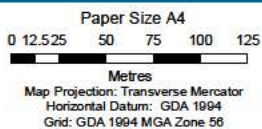
© Land and Property Information (a division of the Department of Finance)

LEGEND

- Design
- Residential sensitive receiver
- Noise logger location
- Building
- Construction footprint



Sheet layout



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number | 22-17656
Revision | 0
Date | 16 Apr 2018

Noise receivers and logger locations
sheet 12 of 18

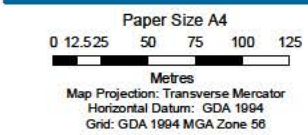
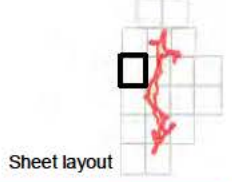
Figure 2-21

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd
© 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.



© Land and Property Information (a division of the Department of Finance)

- LEGEND**
- Design
 - Residential sensitive receiver
 - △ Commercial / industrial receiver
 - Active recreation receiver
 - Noise logger location
 - Building



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 13 of 18

Figure 2-2m

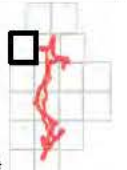
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au
G:\2217656\GIS\Maps\Deliverables\Supplementary_Noise\2217656_SN005_NoiseReceivers_DDP_0.mxd
© 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.
Data source: Aurecon: Design / construction footprint, 2016; LPI: Aerial Imagery, 2016; LPI: DTDB, 2012. Created by: tmorton, fmacKay



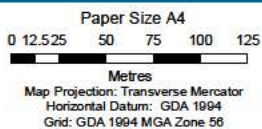
© Land and Property Information (a division of the Department of Finance)

LEGEND

- Design
- Residential sensitive receiver
- ▲ Commercial / industrial receiver
- Active recreation receiver
- Noise logger location
- Building



Sheet layout

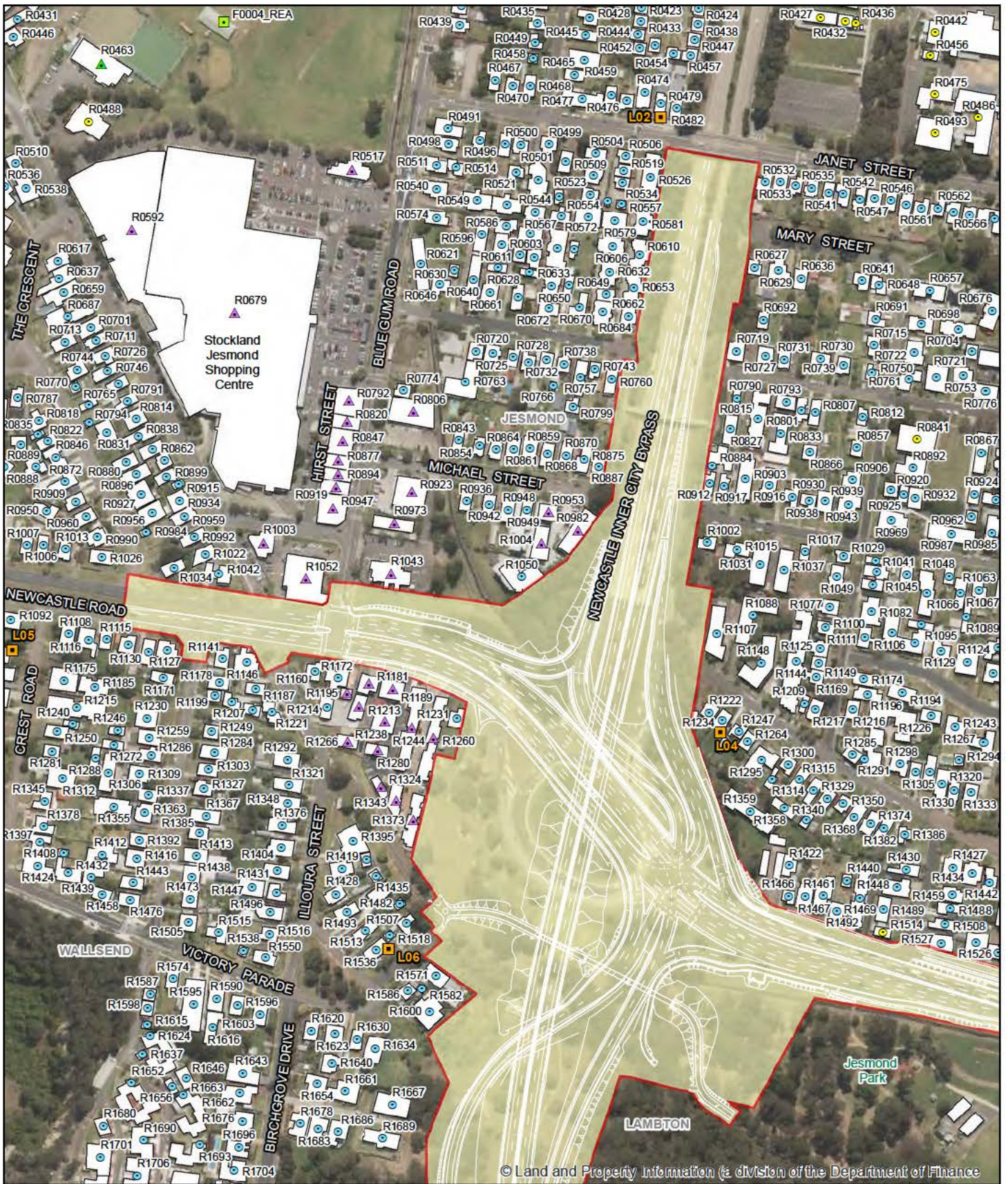


Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 14 of 18

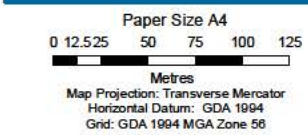
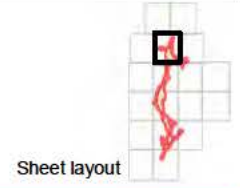
Figure 2-2n



© Land and Property Information (a division of the Department of Finance)

LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- ▲ Commercial / industrial receiver
- ▲ Recreational receiver
- Active recreation receiver
- Noise logger location
- Building
- Construction footprint



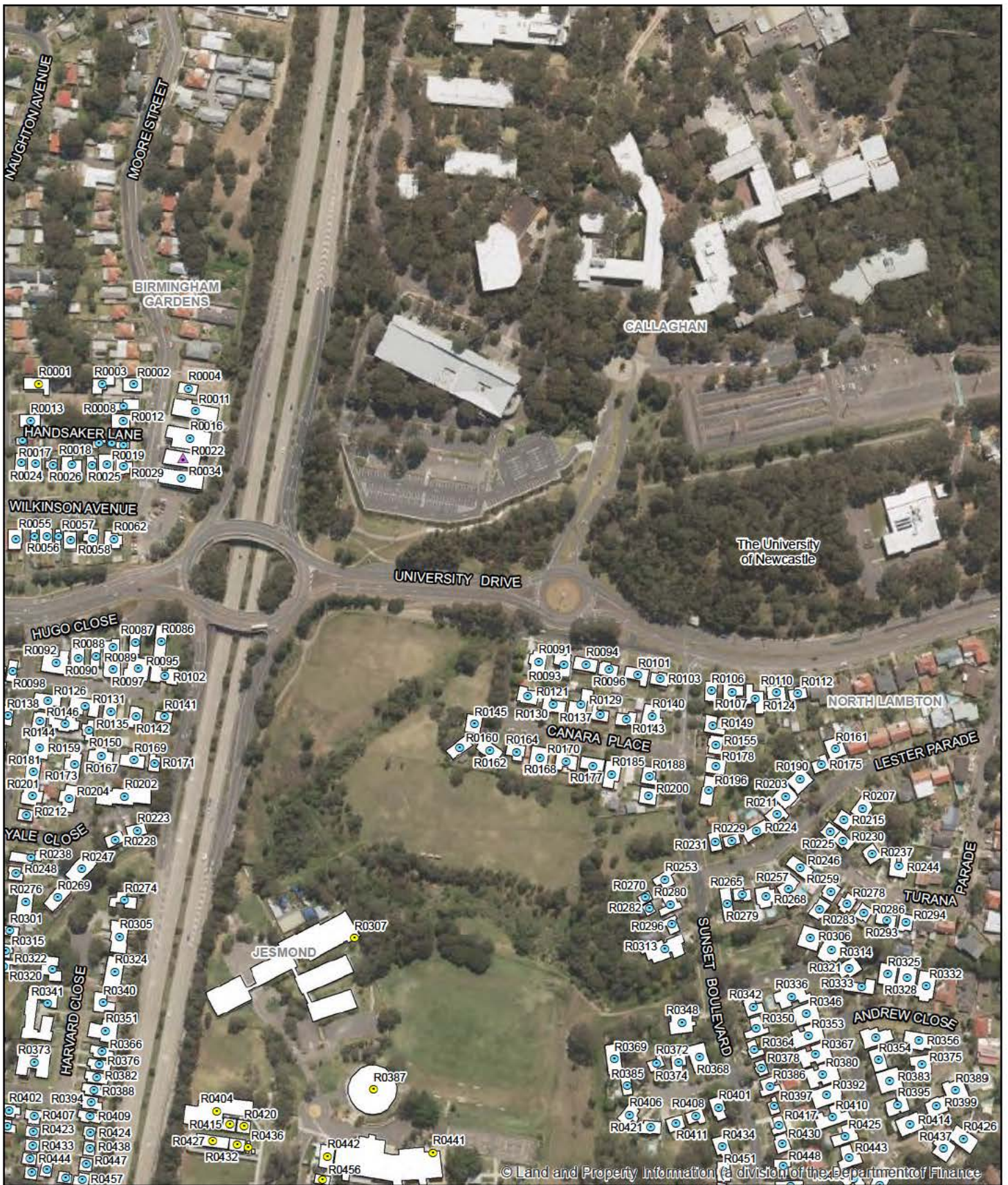
Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 15 of 18

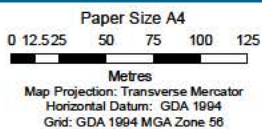
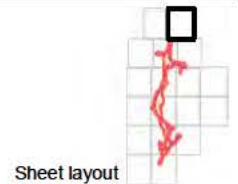
Figure 2-20

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E nt@mail@ghd.com W www.ghd.com.au
 © 2018. Whilst every care has been taken to prepare this map, GHD, LPI and Aurecon make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.
 Data source: Aurecon: Design / construction footprint, 2016; LPI: Aerial Imagery, 2016; LPI: DTDB, 2012. Created by: tmorton, fmacKay



LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- ▲ Commercial / industrial receiver
- Noise logger location
- Building



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

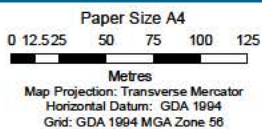
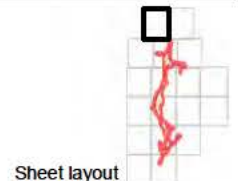
Noise receivers and logger locations
sheet 17 of 18

Figure 2-2q



LEGEND

- Design
- Residential sensitive receiver
- Non-residential sensitive receiver
- ▲ Commercial / industrial receiver
- ▲ Recreational receiver
- Active recreation receiver
- Noise logger location
- Building



Rankin Park to Jesmond
Noise and Vibration Assessment

Job Number 22-17656
Revision 0
Date 16 Apr 2018

Noise receivers and logger locations
sheet 18 of 18

Figure 2-2r