

CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

Moorebank Precinct East Stage 1, Package 2

22 OCTOBER 2019

SYDNEY INTERMODAL TERMINAL ALLIANCE

Moorebank Precinct East Stage 1, Package 2

Current Revision
Author

[REDACTED]

[REDACTED]

Checker

[REDACTED]

[REDACTED]

Reviewer

[REDACTED]

[REDACTED]

Report No IMEX-QPMS-EN-PLN-0007

Date 22/10/2019

Revision Text 15

Original Author Details

Original Author Details	Qualifications and Experience
<p>[REDACTED]</p> <p>Principal Consultant</p> <p>ERM</p> <p>Level 15, 309 Kent Street</p> <p>Sydney NSW 2000</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>W: www.erm.com</p>	<p>Master of Design Science. (Audio & Acoustics) University of Sydney, Australia, 2007.</p> <p>Member Australian Acoustical Society (MAAS).</p> <hr/> <p>[REDACTED] has over eight years of professional experience specialising in noise, overpressure and vibration environmental impact assessment, assessment and management.</p>

REVISIONS

Revision	Date	Description	Prepared by	Approved by
0	12/05/16	1 st Issue to SIMTA (Draft for comment)		
1	17/06/16	Addressed comments from SIMTA on V.01		
2	27/01/17	Update CoC for consultation		
3	21/02/17	Update based on stakeholder consultation for submission to DP&E		
4	6/04/2017	Update to in DPE comments		
5	26/04/2017	Amended as per DPE comments		
6	21/06/2017	Updated in response to DP&E Approval Letter dated 9 May 2017		
7	19/09/2017	Update to figure 6 to show heritage structures within MPE Stage 2 site. Update to include HEIC dynamic compaction works and ER comments		
8	07/11/2017	Updated figures to reflect revised construction boundary associated with RfMA 003		
9	21/11/2017	Update to include site HEIC works		
10	10/01/2018	Updates to construction boundary and site activities in accordance with RfMA 004 & 005		
11	23/05/2018	Amended conditions as per the Land and Environment Court Ruling (March 2018)		
12	16/08/2018	Revisions associated with the internal environmental and sustainability audit & RfMA 008		
13	20/12/2018	Minor updates associated with 'non-conformance,' 'non-compliance' and 'corrective and preventative actions'		
14	11/07/2019	Revisions associated with RfMA 011		
15	22/10/2019	Minor revisions associated with: <ul style="list-style-type: none"> RfMA 016 – Moorebank Precinct EPL updates RfMA 018 – Additional construction compound to enable installation of gantry cranes for the IMEX terminal 		

ACRONYMS AND DEFINITIONS

The following general terms, abbreviations and definitions are used in this plan.

Terms	Explanation
A1055	Standards Australia AS1055–1997™ – Description and Measurement of Environmental Noise
AMMM	Additional Mitigation Measures Matrix
AS2436	Standards Australia AS 2436–2010™ – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.
AS61672 or AS1259	Standards Australia AS IEC 61672.1–2004™ – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device.
BS 7385	British Standard BS7385: Part 2-1993 - Evaluation and Measurement for Vibration in Buildings — Part 2 – Guide to Damage Levels from Ground-borne Vibration, dated 1993.
CBD	Central Business District
CMM	Commonwealth Mitigation Measures
CNS	Construction Noise Strategy
CNS	NSW Government – Transport for NSW (TfNSW) Construction Noise Strategy (CNS), April 2013.
CNVIS	Construction Noise and Vibration Impact Statement
CNVMP	Construction Noise and Vibration Management Plan
CoC	Conditions of Consent
CPCoA	Concept Plan Conditions of Approval
CTTAMP	Construction Traffic, Transport and Access Management Plan
DIN4150:3	German Institute for Standardisation – DIN 4150 (1999-02) Part 3 – Structural Vibration - Effects of Vibration on Structures.
EDO	Environmental Defenders Office
DNSDC	Defence National Storage and Distribution Centre
DoF	Department of Finance
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	NSW Environment Protection Authority
ER	Environmental Representative
ERAP	Environmental Risk Action Plan
ERM	Environmental Resources Management Australia Pty Ltd
EWB	Early Works Brief
FCMM	Final Compilation of Mitigation Measures
HEIC	High Energy Impact Compaction

Terms	Explanation
ICNG	NSW Department of Environment and Climate Change – NSW Interim Construction Noise Guideline, July 2009.
IEC60942	Standards Australia AS/IEC 60942:2004/IEC 60942:2003 – Australian Standard™ – Electroacoustic – Sound Calibrators.
IMEX	Import Export Terminal. Includes the following key components: <ul style="list-style-type: none"> • Truck processing, holding and loading areas - entrance and exit from Moorebank Avenue • Rail loading and container storage areas – installation of four rail sidings with adjacent container storage area serviced by manual handling equipment initially and overhead gantry cranes progressively • Administration facility and associated car parking- light vehicle access from Moorebank Avenue.
IMT facility	MPE Stage 1 Package 2 including the construction of the following key components together comprising the intermodal terminal (IMT): <ul style="list-style-type: none"> • Truck processing and loading areas. • Rail loading and container storage areas. • Administration facility and associated car parking • Rail Link.
INP	NSW Environment Protection Authority – NSW Environmental Noise Management – Industrial Noise Policy, January 2000 and relevant application notes.
Contractor	Principal Contractor
LGA	Local Government Area
L&EC	Land and Environment Court
MC	Managing Contractor
Minister, the	NSW Minister for Planning
MPE	Moorebank Precinct East as approved by the Concept Plan (MP_10_0913)
MPE Site	The site at Moorebank as approved by the Concept Plan (MP_10_0913)
MPE Stage 1, Package 1	The construction of the Rail Link connecting the Southern Sydney Freight Line to the IMEX, traversing across the Boot land, RailCorp Land, Moorebank Avenue, the MPW Golf Course, Georges River, and Glenfield Waste Facility
MPE Stage 1, Package 2	Construction of the IMEX Terminal (Figure 1) including the following key components: <ol style="list-style-type: none"> 1. Truck processing, holding and loading areas - entrance and exit from Moorebank Avenue 2. Rail loading and container storage areas – installation of four rail sidings with adjacent container storage area serviced by manual handling equipment initially and overhead gantry cranes progressively 3. Administration facility and associated car parking- light vehicle access from Moorebank Avenue
MPE Stage 2 Project Site	The whole of the land to which the MPE Stage 2 Project approval SSD 7628 relates
NCA	Noise Catchment Area
Non-compliance	An occurrence, set of circumstances, or development that results in a non-compliance or is non-compliant with Development Consent SSD 6766 Conditions of Consent or EPBC Act Approval (EPBC 2011/6229) Conditions of Approval but is not an incident

Terms	Explanation
Non-conformance	Observations or actions that are not in strict accordance with the CEMP and the aspect specific sub-plan.
NSW Vibration Guideline, the	NSW Department of Environment and Conservation – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW Vibration Guideline), February 2006.
NVIA	Noise and Vibration Impact Assessment
OEH	Office of Environment and Heritage
OOHW	Out of Hours Works
PEM	Project Environment Manager
POEO Act	Protection of the Environment Operations Act 1997.
PPP	Public Private Partnership
RNP	NSW Department of Environment, Climate Change and Water – NSW Road Noise Policy, March 2011.
RSoC	Revised Statement of Commitments
SIMTA	Sydney Intermodal Terminal Alliance
SME	School of Military Engineering
SSD	State Significant Development
SSFL	Southern Sydney Freight Line
Stage 1 site	The subject of this CNVMP includes all work areas of the Stage 1 Proposal (including the Operational area and Indicative Construction area). This area does not include the Rail Corridor.
TfNSW	Transport for New South Wales
the Project	The Project is the MPE Stage 1 Package 2 Project i.e. the IMEX Terminal construction site as depicted in Figure 1.

The following technical terms, abbreviations and definitions are used in this plan. A glossary of relevant acoustical concepts and terminology is provided in Appendix A.

Terms	Explanation
LAeq	Equivalent Continuous Sound Level
LAeq, 15minute	Equivalent Continuous Sound Level, over a period of 15 minutes
LA90	Background Noise Level
RBL	Rating Background Level
LW or SWL	Sound Power Level
LP or SPL	Sound Pressure Level
PPV	Peak Particle Velocity (in mm/s)
VDV	Vibration Dose Value (in $\text{m/s}^{1.75}$)
mm/s	Millimetres per second
m/s	Metres per second

COMPLIANCE MATRICES

Table 1 Ministers Conditions of Consent (CoC) as amended (amended CoC are in red).

CoC	Requirement	Document Reference
C3 c)	The Applicant shall prepare and implement an Urban Design and Landscape Plan for the project. The plan shall present an integrated urban design for the project. The Plan shall include but not necessarily be limited to: Strategies for progressive landscaping of other environmental controls such as erosion and sedimentation controls, drainage and noise mitigation.	NV16
C27	The Applicant shall design the rail link to accommodate the installation of trackside noise barriers for the full length of the rail link in the event they may be required at some future time to comply	RALP only condition
E2 c)	The approved hours of work, the name of the site/project manager, the responsible managing company (if any), its address and 24 hour contact phone number for any inquiries, including construction/noise complaint are to be displayed on the site notice.	NV1
E19	Construction shall be undertaken during the following standard construction hours: a) 7:00am to 6:00pm Mondays to Fridays, inclusive; and b) 8:00am to 1:00pm Saturdays; c) at no time on Sundays or public holidays.	Section 6.1 / NV6
E20	Activities resulting in a high noise impact shall only be undertaken: a) between the hours of 8:00 am to 5:00 pm Monday to Friday; b) between the hours of 8:00 am to 1:00 pm Saturday; and c) 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. For the purposes of this condition, 'continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition.	Section 6.1 / NV7
E21	Notwithstanding conditions E19 and E20, works may be undertaken outside the hours specified under those conditions in the following circumstances: a) construction works that cause LAeq (15 minute) noise levels that are: i. No more than 5 dB above rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009); and ii. No more than the noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses; or b) for the delivery of materials required by the police or other authorities for safety reasons; or c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or d) construction works approved through an Out-Of-Hours Work Protocol prepared as part of the Construction Noise and Vibration Management Plan required by condition E34(b), provided the relevant Council, local residents and other affected stakeholders	Appendix B

CoC	Requirement	Document Reference
	and sensitive Receptors are informed of the timing and duration at least 48 hours prior to the commencement of the works; or e) identified works approved by the Secretary.	
E22	<p>The Applicant shall implement all feasible and reasonable noise mitigation measures with the aim of achieving the following construction noise management levels and vibration criteria:</p> <ul style="list-style-type: none"> a) construction noise management levels established using the Interim Construction Noise Guideline (DECC 2009); b) vibration criteria established using the Assessing Vibration: a Technical Guide (DECC 2006) (for human exposure); and c) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage). <p>Any construction activities identified as exceeding the construction noise management levels and/or vibration criteria shall be managed in accordance with the Construction Noise and Vibration Management Plan required by condition E34(b).</p> <p>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.</p>	Section 4 / Section 7 / NV4 / NV5
E23	<p>The Applicant is to ensure that construction vehicles operate so as to minimise any construction noise impacts from the construction site. Measures that could be used include toolbox talks, contracts that include provisions to deal with unsatisfactory noise performance for the vehicle and/or the operator, and specifying non-tonal movement alarms in place of reversing beepers or alternatives such as reversing cameras and proximity alarms, or a combination of these, where tonal alarms are not mandated by legislation.</p>	Section 7, NV8 – NV12
E24	No use of compression brakes shall be permitted for construction vehicles associated with construction in the vicinity of the subject site.	NV14
E34(b)	As part of the CEMP for the SSD, the Applicant shall prepare and implement a Construction Noise and Vibration Management Plan to detail how construction noise and vibration impacts will be minimised and managed. The Plan shall be consistent with the guidelines contained in the Interim Construction Noise Guidelines (Department of Environment and Climate Change 2009). The plan shall be developed in consultation with the EPA and shall include, but not be limited to:	This CNVMP / Section 4.1 / Section 6.2 / Section 7
E34(b)	i. identification of the work areas, site compounds and access points	Figure 1 / Figure 4
E34(b)	ii. identification of sensitive receptors and relevant construction noise and vibration goals applicable to the SSD and stipulated in the conditions above;	Section 3.1 / Section 3.2 / Section 4
E34(b)	iii. details of construction activities and an indicative schedule for works, including the identification of key noise and/or vibration generating construction activities (based on representative construction scenarios, including at ancillary facilities) that have the potential to generate noise and/or vibration impacts on surrounding sensitive receptors, particularly residential areas	Section 5
E34(b)	iv. an Out-of-Hours Work Protocol for the assessment, management and approval of works outside of standard construction hours as defined in condition E19 of this approval, for the Secretary's approval. The Out-of- Hours Work Protocol must detail:	Appendix B

CoC	Requirement	Document Reference
	<ul style="list-style-type: none"> a) assessment of out-of-hours works against the relevant noise and vibration criteria; b) detailed mitigation measures for any residual impacts (that is, additional to general mitigation measures), including extent of at-receiver treatments; and c) proposed notification arrangements. 	
E34(b)	v. identification of feasible and reasonable measures proposed to be implemented to minimise and manage noise impacts (including construction traffic noise impacts), including, but not limited to, acoustic enclosures, erection of noise walls (hoardings) and respite periods.	Section 7 NV14 – NV16
E34(b)	vi. identification of feasible and reasonable procedures and mitigation measures to ensure relevant vibration criteria are achieved, including applicable buffer distances for vibration intensive works, use of low-vibration generating equipment/ vibration dampeners or alternative construction methodology, and pre- and post- construction dilapidation surveys of sensitive structures where blasting and/ or vibration is likely to result in damage to buildings and structures (including surveys being undertaken immediately following a monitored exceedance of the criteria).	Section 7 / Section 7.1.2 / Section 8.2.3 / NV5 / NV8 / NV11 / NV12
E34(b)	vii. a description of how the effectiveness of mitigation and management measures would be monitored during construction, clearly indicating how often this monitoring would be conducted, the locations where monitoring would take place, how the results of this monitoring would be recorded and reported, and, if any exceedance is detected, how any noncompliance would be rectified.	Section 6 / Section 7.1.1 / Section 7.2 / Section 8.2 / Section 8.3 / Section 8.4 / NV4 / NV5
E34(b)	viii. mechanisms for the monitoring, review and amendment of this plan.	Section 8.6
E34(c)	E34(c)(ii) in relation to non-Aboriginal Heritage: <ul style="list-style-type: none"> a) identification of heritage items directly and indirectly affected by construction; b) consideration of methods to prevent damage to any retained heritage items, including: <ul style="list-style-type: none"> I. procedures for identifying minimum working distances to retained heritage items (including, at minimum, vibration testing and monitoring), II. detailed options for alteration of construction methodology should preferred values for vibration be exceeded, and III. commitment to implementing those options if preferred values for vibration are likely to be exceeded. 	Section 8.2.3

Table 2 Final Compilation of Mitigation Measures (FCMM)

FCMM	Requirement	Document Reference
3A	A Construction Noise and Vibration Management Plan (CNVMP) (or equivalent) will be developed for the Proposal in accordance with the EPA's Interim Construction Noise Guidelines (ICNG).	This CNVMP

FCMM	Requirement	Document Reference
3A	<p>The following issues will be addressed within the plan:</p> <ul style="list-style-type: none"> Construction activities will have regard to the standard hours of 07:00 am to 18:00 pm Monday to Friday, and 08:00am to 13:00 pm Saturday. Any works undertaken outside of these hours will be undertaken in consultation with relevant authorities. Works outside these hours that may be permitted will include: <ul style="list-style-type: none"> Any works which do not cause noise emissions to be audible at any nearby sensitive receptors or comply with the 'Outside Standard Construction Hours' prescribed in Section 9. The delivery of materials which is required outside of these hours as requested by Police or other authorities for safety reasons. Emergency work to avoid the loss of lives, property and/or to prevent environmental harm. Works required to be undertaken during track possessions or road closures. Any other work as approved through the CNVMP Process. 	Section 6.1 / NV6 / Appendix B
3A	<ul style="list-style-type: none"> Selection of quiet plant and processes wherever feasible and retrofitting reversing alarms that are quieter and display less annoying characteristics. Such alarms could include "smart alarms" and "quacker alarms". 	NV8
3A	<ul style="list-style-type: none"> Provision of training and awareness of administrative measures to reduce noise impacts, which will include the following: <ul style="list-style-type: none"> Site awareness training/environmental inductions to provide instruction on noise mitigation techniques/measures to be implemented during construction of the Proposal Working within approved hours Working with noisy equipment away from sensitive Receptors Maintaining plant and equipment Turning off machinery when not in use Limiting the "clustering" of noisy plant / processes. 	NV2 / NV3

Table 3 Commonwealth Conditions of Approval (CCoA)

CCoA	Requirement	Document Reference
CCoA – 7(b)	Identification and quantification of all potential impacts associated with noise, vibration, air quality, traffic, light spill, hydrological changes, contamination, and indigenous heritage (including cumulative impacts associated with the DoF's proposed intermodal) upon Commonwealth land. Consideration must be given to people and communities at SME, DNSDC, Defence housing, and the environment more generally in neighbouring bushland areas.	This CNVMP
CCoA – 7(f)	Identification of the trigger values and criteria for all matters mentioned in condition 7(b) (excluding light spill, land contamination and indigenous heritage) that will be adopted for monitoring and managing potential impacts to Commonwealth Land.	Section 4

Table 4 Commonwealth Mitigation Measures (CMM)

CMM	Requirement	Document Reference
CMM	<ul style="list-style-type: none"> A Construction Noise and Vibration Management Plan would be developed to implement best practice mitigation and management measures to minimise noise impacts on surrounding land uses and sensitive receivers, including Commonwealth Land during construction. The Construction Noise and Vibration Management Plan would address following noise issues: 	This CNVMP
CMM	<ul style="list-style-type: none"> Construction activities would have regard to the standard hours of 07:00 am to 18:00 pm Monday to Friday, and 08:00am to 13:00 pm Saturday (with approval from relevant authorities). Works outside of these hours that may be permitted would include Wilkinson Murray 2013): <ul style="list-style-type: none"> Any works which do not cause noise emissions to be audible at any nearby sensitive receptors. The delivery of materials which is required outside of these hours as requested by Police or other authorities for safety reasons. Local residents would be informed of the timing and duration of approved works in accordance with the SIMTA's notification provisions. Emergency work to avoid the loss of lives, property and/or to prevent environmental harm. Works required to be undertaken during track possessions. Any other work as approved through the Construction Noise and Vibration Management Plan Process. 	Section 6.1 / NV6 / Appendix B
CMM	<ul style="list-style-type: none"> Training and awareness which would include the following: <ul style="list-style-type: none"> Site awareness training/environmental inductions to provide instruction on noise mitigation techniques/measures to be implemented during construction of the SIMTA proposal. Working within approved hours. Working with noisy equipment away from sensitive receivers. Maintaining plant and equipment. Turning off machinery when not in use. Limiting the "clustering" of noisy plant / processes. Communication, including a notification process to inform residents of respite times. Incident and emergency response. Non-conformance, preventative and corrective action procedures. 	NV2 / NV3
CMM	<ul style="list-style-type: none"> Selection of quiet plant and processes wherever feasible and retrofitting reversing alarms that are quieter and display less annoying characteristics. Such alarms could include "smart alarms" and "quacker alarms". 	NV8
CMM	<ul style="list-style-type: none"> Where appropriate specific mitigation measures that may be considered would include: <ul style="list-style-type: none"> Portable temporary screens to mitigate specific noise sources. Respite periods (e.g. for extended periods of driven piling and use of rock breakers). Consideration of offset distances, orientation and position of noisy plant away from sensitive receptors, including SME and DNSDC operations. 	Section 7.2

CMM	Requirement	Document Reference
	<ul style="list-style-type: none"> – Completion of loading and unloading activities away from sensitive receivers. – Use of spotters, closed circuit television monitors, “smart” reversing alarms or “squawker” type reversing alarms in place of traditional reversing alarms. – The anticipated effectiveness of some noise mitigation techniques in reducing construction noise impacts are presented in Table 84. 	
CMM	<ul style="list-style-type: none"> • Ground borne vibration levels would be measured and monitored to establish the minimum working separation between the equipment and nearby vibration sensitive receivers and buildings that have the potential to be impacted when vibration-generating equipment is used during construction of the SIMTA proposal. 	Section 8.2.3

Table 5 Revised Statement of Commitments (RSoC)

RSoC	Requirement	Document Reference
Item 1.3	RSoC – Noise and Vibration <ul style="list-style-type: none"> • Prior to undertaking demolition and construction on site, a Construction Noise and Vibration Management Plan should be prepared based on details of the proposed construction methodology, activities and equipment This should identify potential noise and vibration impacts and reasonable and feasible noise mitigation measures (such as those identified in this report) that may be implemented to minimise any potential impacts, including engineering and management controls. 	This CNVMP
Item 1.3	RSoC – Noise and Vibration <ul style="list-style-type: none"> • All construction activities will have regard to the standard hours During construction of 7:00am to 6:00pm Monday to Friday and 8:00am to 1:00pm Saturday (with approval from relevant authorities). Any works undertaken outside of these hours will be undertaken in consultation with relevant authorities. • Works outside these hours that may be permitted will include: <ul style="list-style-type: none"> – Any works which do not cause noise emissions to be audible at any nearby sensitive receptors. – The delivery of materials which is required outside of these hours as requested by Police or other authorities for safety reasons. Local residents, commercial and industrial premises will be informed of the timing and duration of approved works in accordance with the notification provisions outlined in the CNMP. – Emergency work to avoid the loss of lives, property and/or to prevent environmental harm. – Any other work as approved through the CNMP Process. 	Section 6.1 / NV6 / Appendix B

Table 6 Concept Plan Conditions of Approval (CPCoA)

Concept Approval	Requirement	Document Reference
S3(2.1)	Noise and Vibration <ol style="list-style-type: none"> a) The assessment shall: <ol style="list-style-type: none"> i. assess construction noise and vibration impacts associated with construction of the intermodal facility including rail link, including impacts from construction traffic and ancillary 	This CNVMP (prepared with due regard to the NVIA)

Concept Approval	Requirement	Document Reference
	facilities. The assessment shall identify sensitive receivers and assess construction noise/vibration generated by representative construction scenarios focusing on high noise generating works. Where work hours outside of standard construction hours are proposed, clear justification and detailed assessment of these work hours must be provided, including alternatives considered, mitigation measures	
S3(2.1)	Noise and Vibration a) The assessment shall: <ul style="list-style-type: none"> iii. be prepared in accordance with: NSW Industrial Noise Policy (EPA 2000), Interim Construction Noise Guideline (DECC 2009), Assessing Vibration: a technical guide NSW Government Department of Planning and Environment 9 (DEC 2006), the Rail Infrastructure Noise Guideline (EPA 2013), Development Near Rail Corridors and the NSW Road Noise Policy 2011 	This CNVMP

CONTENTS

REVISIONS.....	II
ACRONYMS AND DEFINITIONS.....	3
COMPLIANCE MATRICES	6
1 INTRODUCTION.....	1
1.1 Background and Scope	1
1.1.1 Environmental Planning Approval	2
1.2 Purpose and Application.....	4
1.3 Objectives and Targets.....	4
1.4 Consultation	5
2 ENVIRONMENTAL OBLIGATIONS	6
2.1 Legislation	6
2.1.1 Environmental Protection Licence.....	6
2.2 Policy and Guidelines	6
3 EXISTING ENVIRONMENT	8
3.1 Sensitive Receivers	8
3.2 Background Noise Levels	8
4 NOISE AND VIBRATION CRITERIA.....	11
4.1 Noise Criteria.....	11
4.1.1 Interim Construction Noise Guidelines	11
4.1.2 Sleep Disturbance.....	12
4.2 Vibration Criteria	12
4.2.1 Human Comfort.....	13
4.2.2 Building Damage (Structural/Cosmetic Damage).....	15
5 ASPECTS, IMPACTS AND RISKS	18
5.1 Environmental Aspects	18
5.2 Predicted Construction Impacts	19
5.2.1 Potential Noise Impacts	19
5.2.2 Potential Vibration Impacts.....	21
5.2.3 Impacts to Heritage Structures.....	22
5.2.4 High Energy Impact Compaction Works	26
6 NOISE AND VIBRATION ASSESSMENT	28
6.1 Hours of Work	28
6.2 Noise Management Levels	28
6.2.1 Sleep Disturbance Criteria	29
6.2.2 Construction Road Traffic Noise	30
6.3 Vibration Management Levels.....	31

7 MITIGATION AND MANAGEMENT MEASURES	32
7.1 Standard Mitigation Measures	32
7.1.1 Exceedance of Management Levels	38
7.1.2 Vibration Safe Working Distances	38
7.2 Additional Mitigation Measures	39
8 COMPLIANCE MANAGEMENT	42
8.1 Training.....	42
8.2 Monitoring and Reporting Requirements.....	42
8.2.1 Maximum Noise Levels for Plant and Equipment.....	43
8.2.2 Community Noise Monitoring	44
8.2.3 Vibration Monitoring	44
8.2.4 Monitoring Reports.....	45
8.3 Enquiries, Complaints and Incident Management	45
8.4 Roles and Responsibilities.....	47
8.5 Non-compliances, Non-conformance and Actions	48
8.6 Review and Improvement	48
9 REFERENCES.....	49
APPENDIX A	50
Acoustics: Glossary of Terms and Definitions.....	50
APPENDIX B	55
Out of Hours Works (OOHW) Protocol	55
APPENDIX C	61
Evidence of Consultation	61
APPENDIX D	62
Information document – Impact Roller Vibration Measurements for vibration site law validation (SLR Consulting, 2015)	62

LIST OF TABLES

Table 1 Ministers Conditions of Consent (CoC) as amended (amended CoC are in red).	6
Table 2 Final Compilation of Mitigation Measures (FCMM).....	8
Table 3 Commonwealth Conditions of Approval (CCoA).....	9
Table 4 Commonwealth Mitigation Measures (CMM).....	10
Table 5 Revised Statement of Commitments (RSoC)	11
Table 6 Concept Plan Conditions of Approval (CPCoA).....	11
Table 7 Objectives and Targets	4
Table 8 Consultation Summary.....	5
Table 9 Sensitive Receptors / Noise Catchment Areas	8
Table 10 Rating Background (Noise) Levels	9
Table 11 Construction Noise Management Levels – Residential	11
Table 12 Noise Levels for non-residential sensitive land use.....	12
Table 13 Impulsive Vibration Management Levels	14
Table 14 Continuous Vibration Management Levels	14

Table 15 Intermittent Vibration Management Levels	15
Table 16 Building Damage Vibration Management Levels (DIN4150:3)	16
Table 17 Building Damage Vibration Management Levels (BS 7385)	17
Table 18 Construction Works and Associated Activities.....	18
Table 19 Indicative Sound Power Levels – Construction Equipment	19
Table 20 Predicted LAeq, 15minute Construction Noise Levels.....	21
Table 21: Recommended safe working distances to receivers/features surrounding the MPE Stage 1 site for HIEDYC Activity	26
Table 22 Construction Noise Management Levels	29
Table 23 Sleep Disturbance Screening Levels	30
Table 24 Road Traffic Noise Management Levels.....	30
Table 25 Standard Noise and Vibration Mitigation Measures.....	33
Table 26 Safe Working Distances.....	38
Table 27 Additional Mitigation Measures	40
Table 28 Additional Mitigation Measures Matrix (AMMM)	41
Table 29 Noise and Vibration Incident / Complaint Response Management	45
Table 30 Roles and responsibilities	47
Table 31 OOHW Protocol	55

LIST OF FIGURES

Figure 1 Stage 1, Package 2 Site Overview	3
Figure 2 Noise catchment areas and noise monitoring locations	10
Figure 3 Building Damage Vibration Management Levels (DIN4150:3).....	16
Figure 4 Project Access Point, Compound, and Stockpile Locations	23
Figure 5 Project Construction Phases	24
Figure 6 Location of Heritage Structures	25

1 INTRODUCTION

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stage 1 of the Moorebank Precinct East (MPE) Project, including the rail link (Package 1) and Intermodal Terminal Facility (Package 2) on 12 December 2016 (SSD 6766). The construction and operation of the MPE Stage 1 Project was subject to an appeal in September 2017 (Appeal Number 2017/00081889). The approval was upheld and the revised Conditions of Consent (CoC) were released on 13 March 2018.

This Construction Noise and Vibration Management Plan (CNVMP) has been developed to manage impacts to the existing acoustical environment during the construction of Package 2 of the MPE Stage 1 Project (hereafter referred to as the Project).

Within this plan, a strategy has been established to demonstrate the contractor's approach to the management of the noise and vibration. The CNVMP also accounts for requirements of the MPE Stage 1 Project Environmental Impact Statement (EIS) [*Appendix N - SIMTA Intermodal Terminal Facility- Stage 1 - Noise and Vibration Impact Assessment and Appendix H - SIMTA Intermodal Terminal Facility- Stage 1 – Response to Submissions – Noise and Vibration Addendum*].

This CNVMP addresses the relevant requirements of the Project Approvals, including the EIS, Submissions Report and Minister's Conditions of Consent (CoC), and all applicable guidelines and standards specific to the management of noise and vibration during construction of the Project.

1.1 Background and Scope

The MPE Project site is located approximately 27 kilometres (km) south-west of the Sydney Central Business District (CBD) and approximately 26 km west of Port Botany and includes the former Defence National Storage and Distribution Centre (DNSDC) site.

The MPE Project involves the development of an intermodal facility, including warehouse and distribution facilities, freight village (ancillary site and operational services), stormwater, landscaping, servicing and associated works on the eastern side of Moorebank Avenue, Moorebank. It is to be developed in three key stages:

- Stage 1 - Construction of the Intermodal Terminal Facility (IMT) and Rail link
- Stage 2 - Construction of warehouse and Distribution Facilities
- Stage 3 - Extension of the IMT and completion of Warehouse and Distribution Facilities.

Stage 1 of the MPE Project comprises, and would be constructed across, two packages:

- Package 1: The Rail Link (not included within this CNVMP) includes a connection to the IMT facility, and traverses across Moorebank Avenue, Anzac Creek and Georges River prior to connecting to the Southern Sydney Freight Line (SSFL).
- Package 2 (Figure 1): The IMT Facility (subject of this CNVMP) includes the following key components:
 - Truck processing, holding and loading areas - entrance and exit from Moorebank Avenue
 - Rail loading and container storage areas – installation of four rail sidings with adjacent container storage area serviced by manual handling equipment initially and overhead gantry cranes progressively
 - Administration facility and associated car parking- light vehicle access from Moorebank Avenue

The layout of the IMT facility generally comprises operational areas, an administration area, rail sidings, utilities and drainage infrastructure, landscaping and signage. The operational areas of the IMT facility consist of the primary and secondary container loading / unloading areas and container storage areas, and the truck holding area. Within these areas containers would be stacked up to five high.

1.1.1 Environmental Planning Approval

The MPE Stage 1 Project has been assessed by the Department of Planning and Environment (DP&E) under Division 4.7 (Division 4.1 prior to March 2018) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as State Significant Development (SSD). The Planning Assessment Commission (PAC) granted Approval for the MPE Stage 1 Project on 12 December 2016 and is subject to the Minister's Conditions of Consent (CoC, 18 December 2016 (ref SSD-6766)). The MPE Stage 1 Project, its impacts, consultation and mitigation were documented in the following documents relevant to construction noise and vibration:

- State Significant Development Application SSD 6766 (as amended in the Land and Environment Court 13 March 2018);
- SIMTA Intermodal Terminal Facility- Stage 1 – Environmental Impact Statement, prepared by Hyder Consulting Pty Ltd, dated May 2014 (EIS).
- SIMTA Intermodal Terminal Facility- Stage 1 - Noise and Vibration Impact Assessment, prepared by Wilkinson Murray on behalf of Hyder Consulting Pty Ltd, dated May 2015 (NVIA).
- SIMTA Intermodal Terminal Facility- Stage 1 – Response to Submissions – Noise and Vibration Addendum, prepared by Wilkinson Murray on behalf of Hyder Consulting Pty Ltd, dated September 2015.

Table 1 to Table 6 to demonstrate how the CNVMP complies against the requirements of the relevant Project Approval for the works.

MPE Stage 1 CNVMP



LEGEND

- | | |
|-----------------------------------|----------------------|
| Project site | Creek/River crossing |
| Construction footprint | Road crossing |
| MPE site | Rail link |
| Rail Corridor | Existing railway |
| MPE Stage 1 Package 1 (Rail Link) | Watercourse |
| Construction access | |

ARCADIS AUSTRALIA PACIFIC PTY LTD
 ABN 76 104 485 289
 Level 16, 500 George St | Sydney NSW 2000
 P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001
 Coordinate System: GDA 1994 MGA Zone 56
 Aerial imagery supplied by nearmap (March, 2019)

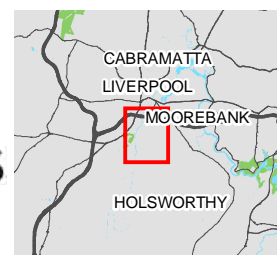


Figure 1: Stage 1, Package 2 Site Overview

1.2 Purpose and Application

Within the submission of planning approval for MPE Stage 1, Wilkinson Murray on behalf of Arcadis (then Hyder Consulting) undertook a Noise and Vibration Impact Assessment (NVIA). SIMTA have developed this CNVMP based on the initial noise and vibration impact assessment, and to address the Conditions of Approval. This plan aims to demonstrate how noise and vibration will be managed during construction of the Project and provides methods to measure and reduce the impacts of noise and vibration by the contractor during the construction of the Project, including all subcontractor and consultant partners.

Specifically, the purpose of this CNVMP is to:

Manage construction noise and vibration in accordance with the Project approval documents (as outlined in Section 1.1.1).

- Review and consider the Noise and Vibration Impact Assessment (Appendix N of EIS) during the construction phase of the Project
- Review and consider the Noise and Vibration Addendum (Appendix H of EIS) during the construction phase of the Project
- Ensure that through the use of best practice, impacts of noise and vibration are minimised.

1.3 Objectives and Targets

The high-level objectives and targets of the Project for the management of construction noise and vibration are identified in Table 7.

Table 7 Objectives and Targets

Objectives	Performance Indicators / Targets
<ul style="list-style-type: none"> • Ensure construction noise and vibration impacts on community, commercial stakeholders and structures are minimised • Ensure compliance and conformance with relevant CoC, applicable legislative and other requirements • Ensure that reasonable and feasible mitigation measures are implemented to manage impacts on surrounding residents and commercial stakeholders • Ensure that affected residents and other stakeholders are kept informed of upcoming works, out of hours works (if required) and mitigation measures to ensure “no surprises” 	<ul style="list-style-type: none"> • 100% compliance and conformance with approved hours of work and out of hours work protocol (Appendix B) • No exceedances of noise or vibration criteria • No structural or cosmetic damage to nearby buildings or structures due to vibration relating to works. • No validated complaints from the community regarding noise or vibration

1.4 Consultation

The CoC for the Project requires that the CNVMP be prepared in consultation with the EPA. A summary of consultation is provided in Table 8, with supporting evidence in Appendix C.

Table 8 Consultation Summary

Agency	Date Contacted	Comment	Status
EPA	Unknown, contacted by DPE	The EPA was consulted and has advised that it does not wish to provide comments on the plan.	Complete.
DPE	21/02/17	Comments provided throughout report for amendment.	Complete.

2 ENVIRONMENTAL OBLIGATIONS

2.1 Legislation

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

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

Under the POEO Act, the 'POEO (Noise Control) Regulation 2008' addresses common noisy activities that occur in residential situations; it limits the time of day that noisy articles (such as lawn mowers, stereos and leaf blowers) are permitted to be heard in neighbouring residences, however it does not specify noise limits and an applicable approach for the assessment of construction noise.

Various construction noise and vibration assessment guidelines (and policy) are endorsed by NSW regulators and provide a framework and methodology for deriving acceptable levels and standard methods for assessing, managing and measuring construction noise and vibration impacts with due regard to the POEO Act. For the CNVMP the applicable policy and guidelines are presented in Section 2.2 below.

2.1.1 Environmental Protection Licence

An EPL (No. 21054) was issued by the EPA for the Moorebank Precinct on 4 June 2018. A variation to the license was issued on 18 April 2019 to capture cut and fill earthworks occurring on the MPE Stage 2 Project Site and additional considerations observed during a site inspection on the 23 November 2018.

The licence applies to the Moorebank Precinct (excluding the MPE Stage 1 Rail Access Land Package (RALP) which has a separate EPL licence (No. 20966) and authorises > 100,000 – 500,000 tonnes crushing, grinding or separating processing capacity per annum and > 500,000 – 2,000,000 tonnes extraction, processing or storage capacity per annum. The licence applies to all other activities carried on at the premises, including road construction, bulk earthworks 'cut and fill' and importing fill.

Specific requirements for EPL 21054 are addressed in Table 5 and Section 4.2 of the CEMP.

2.2 Policy and Guidelines

The CNVMP has been prepared with due regard to and in accordance with the NSW Department of Environment and Climate Change – *NSW Interim Construction Noise Guideline* (ICNG), July 2009. The ICNG is the key guideline relating to construction noise and vibration in NSW.

The CNVMP has also considered and applied the following additional policy, guidelines and standards as relevant:

- NSW Environment Protection Authority – NSW Environmental Noise Management – Industrial Noise Policy (INP), January 2000 and relevant application notes;
- NSW Department of Environment, Climate Change and Water – NSW Road Noise Policy (RNP), March 2011;
- NSW Government – Transport for NSW (TfNSW) Construction Noise Strategy (CNS), April 2013;
- Standards Australia AS 2436–2010™ (AS2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites;
- Standards Australia AS1055–1997™ (AS1055) – Description and Measurement of Environmental Noise;
- Standards Australia AS IEC 61672.1–2004™ (AS61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ (AS1259) – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device;

- Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard™ – Electroacoustic – Sound Calibrators;
- German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150:3) – Structural Vibration - Effects of Vibration on Structures;
- British Standard BS7385: Part 2-1993 (BS 7385) - Evaluation and Measurement for Vibration in Buildings — Part 2 – Guide to Damage Levels from Ground-borne Vibration, dated 1993; and
- NSW Department of Environment and Conservation – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW Vibration Guideline), February 2006.

3 EXISTING ENVIRONMENT

The existing noise environment in the vicinity of the Project is best described as ‘urban’, being an area with an acoustical environment that:

- is dominated by ‘urban hum’ or industrial source noise
- has through traffic with characteristically heavy and continuous traffic flows during peak periods
- is near commercial districts or industrial districts
- has any combination of the above, where ‘urban hum’ means the aggregate sound of many unidentifiable, mostly traffic-related sound sources

‘Urban’ broadly represents and describes the surrounding areas. For certain receptors, the effect of traffic, urban hum or existing commercial/industrial noise may be reduced such that those areas are better described as ‘suburban’, being an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. Suburban areas often have decreasing noise levels in the evening and night and/or ambient noise levels defined by the natural environment and infrequent human activity.

3.1 Sensitive Receivers

The Noise and Vibration Impact Assessment (NVIA) identified four residential areas and several non-residential sensitive receivers surrounding the project. These are:

- Wattle Grove, south of Anzac Road
- Wattle Grove, north of Anzac Road
- Casula
- Glenfield
- All Saints Senior College
- Casula Powerhouse
- DNSDC

3.2 Background Noise Levels

To facilitate the assessment of noise impacts from the Project, the NVIA surrounding precincts were divided into Noise Catchment Areas (NCAs). These NCAs are shown in Figure 2 and described in Table 9 below.

Rating Background Levels (RBL) at sensitive receiver locations considered representative of each of the four NCA were established in accordance with the INP. The RBLs are presented in Table 10 below for the day, evening and night-time periods.

Table 9 Sensitive Receptors / Noise Catchment Areas

NCA	Sensitive Receiver	Distance from the Project Construction Area (m)
NCA1	Wattle Grove, south of Anzac Road	600
NCA2	Wattle Grove, north of Anzac Road	900
NCA3	Casula	1100*
NCA4	Glenfield	1700*
S1	All Saints Senior College	1300*
S2	Casula Powerhouse	950*
I1	DNSDC	80

*Distances have been revised from those presented in the MPE Stage 1 NVIA to reflect accurate distances from receptor to the nearest boundary of the MPE Stage 1 (package 2) IMEX construction footprint. Distances presented are for descriptive purposes only and do not affect the modelling results presented in this CNVMP adopted from the MPE Stage 1 NVIA.

Table 10 Rating Background (Noise) Levels

NCA	Rating Background Levels (RBL) in dB(A)		
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
NCA1	42	37	37
NCA2	36	36	36
NCA3	41	37	34
NCA4	44	44	37
<i>Source: Inferred (Operational (Intrusiveness) Noise Criteria– 5 dB) from Table 2-1, NVIA</i>			

The measured overall RBL values summarised in Table 10 are typical of urban or suburban areas already experiencing natural, traffic, urban hum or existing commercial/industrial noise within the overall noise environments. Decreasing noise levels in the evening and night are evident in the data at NCA 1 and NCA 3, consistent with that anticipated for suburban environments.

MPE Stage 1 CNVMP

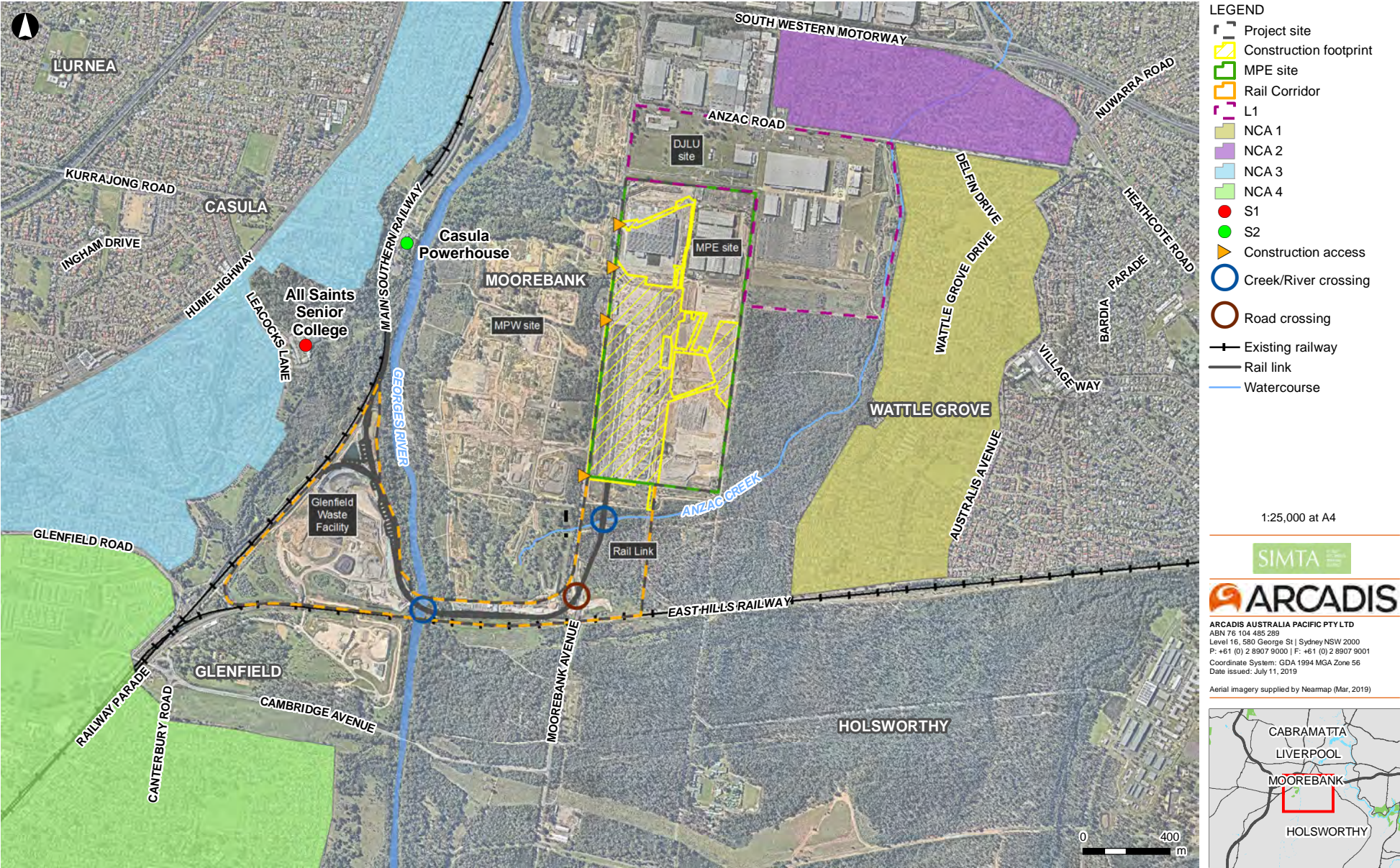


Figure 2 : Noise catchment areas and noise monitoring locations

4 NOISE AND VIBRATION CRITERIA

The ICNG and CNS are relevant to the Project works and provide guidance to establishing noise (and vibration) management levels (criteria) for assessing and managing noise impacts.

For residential receptors, the noise management levels are established based on existing background noise levels i.e. thresholds above which the background noise level may be exceeded. For other sensitive receptors the management levels are fixed values.

For residential and other sensitive receptors (human) and potentially sensitive structures (buildings) vibration management levels are fixed values established for either human comfort or structural/cosmetic damage. The levels vary depending on the potential sensitivity of the receptor and do not rely on existing conditions.

A summary of each in the context of the ICNG and CNS is provided below.

4.1 Noise Criteria

4.1.1 Interim Construction Noise Guidelines

The method for establishing ICNG Noise Management Levels for residential receptors is summarised in Table 11 and for non-residential receptors in Table 12. Separate criterion is provided for works during and outside the ICNG standard construction hours. The ICNG recommends more stringent noise criterion for works outside these standard hours. These hours of work are consistent with the approved hours described in CoC - E19.

Table 11 Construction Noise Management Levels – Residential

Time of Day	Noise Management Level (LAeq, 15minute)	Application
Recommended Standard Hours: Monday to Friday, 7am to 6pm Saturday, 8am to 1pm	Noise affected RBL + 10 dB(A)	<ul style="list-style-type: none"> The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq,15minute is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
No work on Sundays or Public Holidays	Highly noise affected 75 dB(A)	<ul style="list-style-type: none"> The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences; if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of Day	Noise Management Level (LAeq, 15minute)	Application
Outside the Recommended Standard Hours	Noise affected RBL + 5 dB(A)	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the Guideline.
<i>Source: INCG, CNS</i>		

Table 12 Noise Levels for non-residential sensitive land use

Land Use	Noise Management Level: LAeq, 15minute
Classrooms at schools and other educational Institutions	Internal Noise Level 45dB
Hospital wards and operating theatres	Internal Noise Level 45dB
Places of worship	Internal Noise Level 45dB
Active recreation	External noise level 65dB
Passive recreation	External noise level 60dB
Community centre	Depends on intended use – see AS2107
Industrial premises	External Noise Level 75 dB
Offices, retail outlets	External Noise Level 70 dB.
<i>Source: ICNG, CNS</i> External goal of 55dB(A) applies. The ICNG recommends that construction noise levels do not exceed 45 dB (LAeq, 15minute) internally within school classrooms when in use. For the purpose of the NVIA (and as adopted here to verify criteria for use in the CNVMP) the internal noise level has been translated to an external level of 55dB (LAeq, 15minute) based on the accepted level of attenuation (10dB) that is readily achieved through windows, partially opened for ventilation.	

4.1.2 Sleep Disturbance

For residential receptors, it is also important to consider potential sleep disturbance impacts associated with OOHW conducted during the night time (10pm to 6am) period.

The ICNG and CNS do not however provide specific guidance for establishing sleep disturbance criteria. In the absence of construction specific guidance, the INP provides indicative sleep disturbance thresholds and was utilised as the basis for establishing 'sleep disturbance screening levels' in the NVIA.

This method (RBL + 15 dB) is widely accepted as the appropriate method for assessing and managing sleep disturbance impacts (using the LA1, 1minute or LAmx parameters) and is adopted here to establish criteria for use in the CNVMP.

4.2 Vibration Criteria

Vibration refers to the oscillating movement of any object. The effects of vibration from construction works can be separated into two categories:

4. Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed
5. Building structure – vibration in which the integrity of the building or structure itself may be affected

Each of these effects can be assessed as follows:

- Human comfort – utilising the NSW Vibration Guidelines *Assessing Vibration: A Technical Guide* (DECC 2006)
- Structural Damage – application of the German Standard DIN4150:3

To meet the requirements of the CNS, BS7385 is also considered in this CNVMP to provide guidance for potential cosmetic damage issues. Each of the three relevant guidelines and standards are technical in nature but ultimately present fixed values that may apply to either human or building receptors.

The NSW Vibration Guidelines, DIN4150:3 and BS7385 criteria vary depending on the receptor type, the time of day and the potential sensitivity of the receptor being considered. They are each considered and adopted in the CNVMP to establish the applicable management levels for vibration that will apply to the Project works and activity.

4.2.1 Human Comfort

The NSW Vibration Guideline provides guidance for assessing human exposure to vibration. The publication is based on British Standard BS 6472:1992.

It presents criteria for three types of vibration:

- Impulsive- up to three instances of sudden impact per monitoring period (Table 13)
- Continuous - from uninterrupted sources (Table 14)
- Intermittent - such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (Table 15)

Construction work is generally considered as an intermittent source of vibration however all potentially relevant criteria are presented in this CNVMP to ensure that emissions are assessed and managed accordingly.

Table 13 sets out PPV (mm/s) values for impulsive vibration and Table 14 sets out PPV values for continuous vibration. Table 15 sets out VDV (m/s^{1.75}) values for intermittent vibration.

In each case daytime means between 7:00am and 10:00pm and night time means 10:00pm to 7:00am, Monday to Sunday inclusive.

Table 13 Impulsive Vibration Management Levels

Location	Time	Peak Particle Velocity (PPV in mm/s)	
		Preferred	Maximum
Critical working areas	Day or Night Time	0.14	0.28
Residences	Day	8.6	17.0
	Night	2.8	5.6
Offices, Places of Worship	Day or Night Time	18.0	36.0
Workshops	Day or Night Time	18.0	36.0
Source: <i>The NSW Vibration Guideline, CNS</i>			

Table 14 Continuous Vibration Management Levels

Location	Time	Peak Particle Velocity (PPV in mm/s)	
		Preferred	Maximum
Critical working areas (e.g. operating theatres, laboratories)	Day or Night Time	0.14	0.28
Residences	Day	0.28	0.56
	Night	0.20	0.4
Offices	Day or Night Time	0.56	1.1
Workshops	Day or Night Time	1.1	2.2
Source: <i>Table 2-7, NVIA</i>			

Table 15 Intermittent Vibration Management Levels

Location	Vibration Dose Value (VDV in $\text{m/s}^{1.75}$)			
	Daytime		Night Time	
	Preferred	Maximum	Preferred	Maximum
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.8
Workshops	0.80	1.60	0.80	1.6
Source: Table 2-8, NVIA				

Human comfort is subjective to the individual. As such, vibration is likely to be perceptible to occupants at lower or higher levels than the set limit.

4.2.2 Building Damage (Structural/Cosmetic Damage)

There are currently no Australian Standards or guidelines to provide guidance on assessing the potential for building damage from vibration and it is common practice to derive goal levels from international standards.

German Standard DIN 4150:3 is adopted as the primary structural damage guideline for the CNVMP as per CoC – E22 and the applicable management levels are tabulated in Table 16 with each “Line” shown in Figure 3 Building Damage Vibration Management Levels (DIN4150:3). To achieve the requirements of the CNS, British Standard BS 7385:1993 is also presented (refer Table 16) in the CNVMP and will be considered during works where applicable. Both standards provide safe limit guideline values, below which vibration is considered insufficient to cause structural or cosmetic damage to buildings. Of these, DIN 4150 is the more stringent.

Table 16 Building Damage Vibration Management Levels (DIN4150:3)

Line	Type of Structure	Guideline Values for Velocity (PPV in mm/s)		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz ¹
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under either of the other classifications, and of have intrinsic value (e.g. buildings under a preservation order).	3	3 to 8	8 to 10

Source: Table 2-9, NVIA

At frequencies above 100 Hz, the values given in this column may be used as minimum values; and the 50 Hz values may be applied to assess vibration at the horizontal plane of the highest building floor at all frequencies.

Consideration is also given to vibration impacts upon rail infrastructure located to the south of the site. If required, an assessment of vibration at the rail line (or as close as possible to the rail line), shall adopt values given for Commercial purposes, however, German Standard DIN 4150-3:1999 also states that; 'For civil engineering structures...the values in Line 1 of Table 11...may be increased by as much as a factor of two...' Therefore, values given for Commercial purposes above may be doubled when assessing vibration affecting the rail corridor.

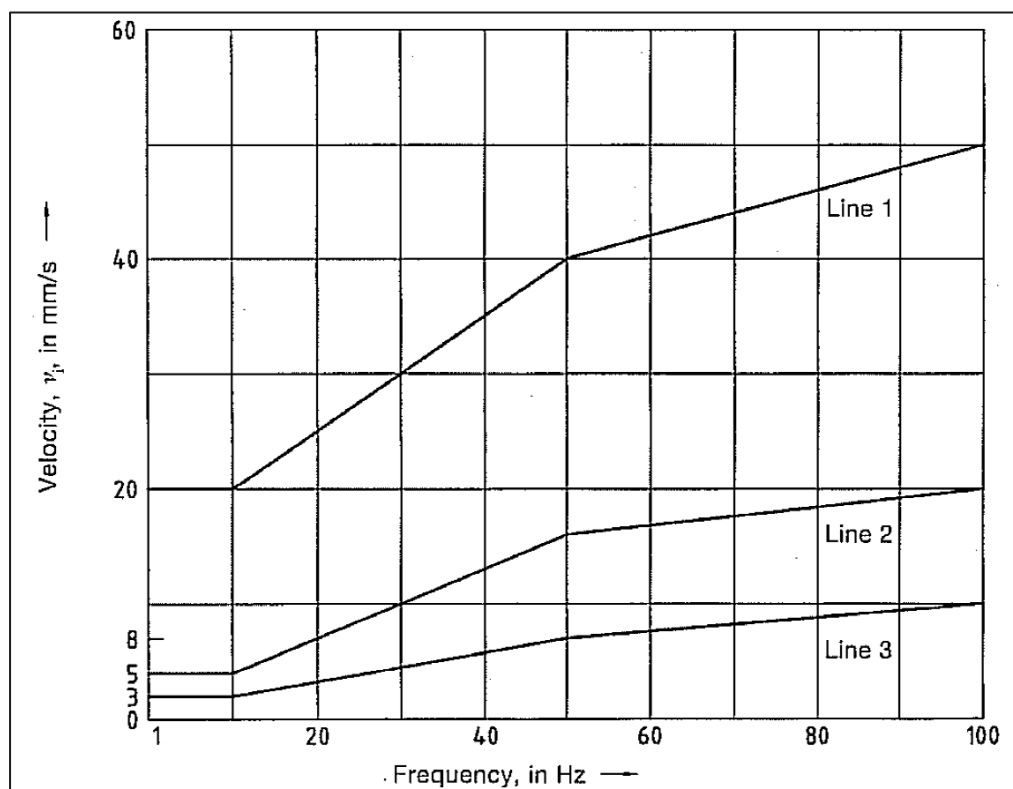


Figure 3 Building Damage Vibration Management Levels (DIN4150:3)

Guidance Note: with regard to these levels DIN 4150:3 states, “experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding [these] values does not necessarily lead to damage; should they be significantly exceeded, however, further investigations are necessary.”

The recommended limits (guide value, refer CNS) from BS7385 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented in Table 17.

Table 17 Building Damage Vibration Management Levels (BS 7385)

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

5 ASPECTS, IMPACTS AND RISKS

This section outlines relevant aspects of the construction methodology and the predicted construction noise and vibration impacts. The predicted noise and vibration impacts are discussed as relative to the surrounding community or nearby by structures.

5.1 Environmental Aspects

A number of key construction periods have been identified as follows:

- Works period 1 – Site preparation
- Works period 2 – Earthworks, drainage and utilities installations
- Works period 3 – Engineering Fill
- Works period 4 – Concrete construction and rail alignment construction
- Works period 5 – Miscellaneous structural construction, utilities, crane installation, commissioning and finishing.

Details of these construction works and periods (reproduced from the NVIA and updated to align with the CEMP) are presented in Table 18. There will be some overlap between these periods.

Table 18 Construction Works and Associated Activities

Works	Period	Activity
Site Preparation	6 months	<ul style="list-style-type: none"> • Establishment of a compound with portable offices and amenities and connection to utilities; • Vegetation clearing; • Demolition; • Separating and stockpiling material for disposal or reuse; • Treatment of materials for reuse (concrete crushing); and • Removal of decommissioned underground services.
Earthworks, Drainage & Utilities	8 months	<ul style="list-style-type: none"> • Excavation and filling of land on-site to create bulk earthworks platforms; • Excavation of trenches and consequent filling (if needed) e.g. for construction of open stormwater channels, pipes and structures; • Laying of stormwater pipes; • Construction of stormwater drainage structures; • Backfilling of trenches and behind structures; • Excavation of trenches for the construction of utility services pipes, conduits and structures; • Laying of pipes and conduits and construction of utility services structures; and • Backfilling of trenches and behind structures.
Engineering Fill	11 months	<ul style="list-style-type: none"> • Establish detailed construction platform and place under-slab base course; • Drainage construction; • Place capping layer; • Ethane gas line and 750 rising main protection slabs and Anzac creek culverts; • Ballast construction; • Driving piles; • In ground and waterways concrete placement and substructure formwork; and • In situ concrete deck and pre cast beam installation.
Concrete construction and	11 months	<ul style="list-style-type: none"> • Construct sub-base slab, kerbs, gutters and base slab; • Laying sleepers; and

Works	Period	Activity
rail alignment construction		<ul style="list-style-type: none"> Laying track.
Finishing Works	12 months	<ul style="list-style-type: none"> Removal of disused rail spur at the southern end of the site Misc. structural construction, utilities and finishing works.

5.2 Predicted Construction Impacts

In general, noise (and vibration) impacts may occur due to Project emissions. Additional mitigation or management measures may be required as outlined in Section 7. For vibration impacting building structures, the potential impacts relate to structural or cosmetic damage. High Energy Impact Compaction (HEIC) works are outlined in Section 5.2.4.

5.2.1 Potential Noise Impacts

The NVIA provided a detailed breakdown of the key construction periods and associated equipment, and their source noise emission (Sound Power Levels, LW or SWL). These values and the predicted LAeq, 15minute noise levels from the NVIA (determined via modelling for each scenario) are reproduced in Table 19 and Table 20. Locations of compounds and stockpiles sites and construction phases are presented in Figure 4 and Figure 5 respectively.

In each case, it was assumed in the NVIA that all plant would operate simultaneously and continuously, which is considered to be conservatively representative of the potential worst case conditions. Ultimately the NVIA results (reproduced in this CNVMP) indicated that construction noise emissions would be expected to comply with the ICNG NMLs during all works periods at all receptors.

The NVIA also presented a cumulative assessment of potentially overlapping works at other sites nearby however these results do not form part of the CNVMP. Regardless, the NVIA concluded that cumulative LAeq period construction noise levels complied with the daytime criteria at all receptors.

Table 19 Indicative Sound Power Levels – Construction Equipment

Period	Equipment	Sound Power Level / Item (LW in LAeq, 15 minute)	Sound Power Level / Activity (LW in LAeq, 15minute)
Site Preparation	Backhoe	105	
	Excavator	110	
	Static roller	114	
	Water truck	105	119
	Air compressor	100	
	Grader	116	
	Crane (40t)	100	

Period	Equipment	Sound Power Level / Item (LW in LAeq, 15 minute)	Sound Power Level / Activity (LW in LAeq, 15minute)
Earthworks, Drainage & Utilities	Articulated hauler	108	121
	Bulldozer	115	
	Scraper	110	
	Grader	110	
	Compact wheel loader	108	
	Water truck	105	
	Air compressor	100	
	Wheel loader	111	
Engineering Fill	Wheel loader	111	124
	Vibratory roller	114	
	Water truck	105	
	Grader	110	
	Excavator	110	
	Backhoe	105	
	Air compressor	100	
	Concrete agitator	105	
	Concrete pump	103	
	Piling rig	121	
	Bulldozer	115	
	Scraper	110	
	Crane (90t)	111	
	River work boat	111	
Concrete construction and rail alignment construction	Backhoe	103	124
	Excavator	110	
	Concrete batching plant	113	
	Concrete pump	103	
	Concrete saw	112	
	Piling rig	121	
	Crane (20t)	100	
	Air compressor	100	
	Concrete agitator	105	
	Forklift	106	
	Rail tamping machine	118	
	Crane (40t)	105	
	Welder	90	

Period	Equipment	Sound Power Level / Item (LW in LAeq, 15 minute)	Sound Power Level / Activity (LW in LAeq, 15minute)
Finishing Works	Excavator	110	117
	Wheel loader	111	
	Forklift	106	
	Crane (40t)	105	
	Air compressor	100	
	Oxy Cutter	105	

Source: Table 3-12, NVIA

Table 20 Predicted LAeq, 15minute Construction Noise Levels

Receptor	Works Period / Activity					NML
	Works Period 1	Works Period 2	Works Period 3	Works Period 4	Works Period 5	
NCA1	36	37	40	44	34	52
NCA2	22	24	27	27	20	46
NCA3	35	37	40	44	33	51
NCA4	27	29	32	39	25	54
I1	33	35	38	35	31	75
S1	34	36	39	39	32	55
S2	32	34	37	39	30	55

Source: Table 3-13, NVIA

5.2.2 Potential Vibration Impacts

Activities undertaken on the site during construction may generate ground vibration. With respect to the construction plant identified in Table 19, the highest levels of vibration would be expected to occur due to the use of a vibratory roller.

The NVIA presented results from vibration monitoring trials of vibratory rollers operating on high speed and high amplitude settings, previously undertaken by Wilkinson Murray. These values provided a guide to the levels that may occur due to similar activities undertaken during construction.

The NVIA noted that other construction activities were considered and deemed to produce vibration levels that are below that considered for vibratory rollers and are not significant in terms of human comfort and building damage issues.

Given the substantial setback distances to nearby receivers, including existing buildings within the SIMTA site not to be removed during Stage 1, the NVIA concluded that any ground vibrations arising due to construction activities would be unnoticeable at these locations and significantly below the relevant guideline criteria for human comfort and structural damage.

Criteria Selection based on Potential Impacts

During the works, impacts from vibration will be considered both in terms of the effects on building occupants (human comfort) and the effects on the building structures (structural/cosmetic damage).

The applicable criteria will be evaluated, selected and applied based on the receptor type and potential impacts:

- **Human comfort criteria** will be applied on a case by case basis, where necessary (i.e. if impacts have the potential to occur) and where appropriate to the vibration type being generated by the activity under assessment. The vibration type (impulsive, continuous or intermittent) and application of the relevant criteria will be evaluated and selected by a suitably experienced person or in consultation with a qualified technical specialist; and
- **Structural damage criteria** will be applied on a case by case basis, where necessary (i.e. if impacts have the potential to occur) and where appropriate to the structure under assessment. The structure type and application of the relevant criteria will be evaluated and selected by a suitably experienced person or in consultation with a qualified technical specialist. In general the DIN4150:3 “Line 1” criteria will apply to commercial buildings, the “Line 2” criteria will apply to residential buildings and the “Line 3” criteria will apply to heritage structures, or other structures that, because of their particular sensitivity to vibration, cannot be classified under either “Line 1” or “Line 2” classifications.

5.2.3 Impacts to Heritage Structures

Retained heritage structures exist on the MPE Stage 2 site; these will not be impacted on by the Project (refer to Section 5.2.2, figure 6 and the NVIA). Impacts to heritage structures are not expected, such that detailed options for any alteration of construction methodology will be evaluated and implemented on a case-by-case basis and if specific circumstances arise that deem it necessary. If vibratory activities are deemed to occur in the vicinity of a heritage structure, works will be planned accordingly, with regard to the safe work distances presented in Table 25 and vibratory monitoring will be undertaken to ensure levels are within those specified in Table 16 and Figure 6.

The sensitivity of a heritage structure can vary and the applicable DIN 4150-3 limits (refer commercial, residential or sensitive structures in Table 16 and Figure 6) will be established when planning the works and evaluating potential impacts. The sensitive structures criteria may not apply to all heritage structures.

The monitoring is designed to prevent damage to any heritage items and includes procedures for identifying minimum working distances. Monitoring procedures are described Section 8.1.5 of this CNVMP.

MPE Stage 1 CNVMP



- LEGEND
- Project site
 - Construction footprint
 - MPE site
 - Compound and stockpile area
 - Construction access
 - Watercourse

ARCADIS AUSTRALIA PACIFIC PTY LTD
ABN 76 104 485 289
Level 16, 500 George St | Sydney NSW 2000
P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001
Coordinate System: GDA 1994 MGA Zone 56
Aerial imagery supplied by nearmap (Sep, 2019)



Figure 4: Project Access Point, Compound, and Stockpile Locations

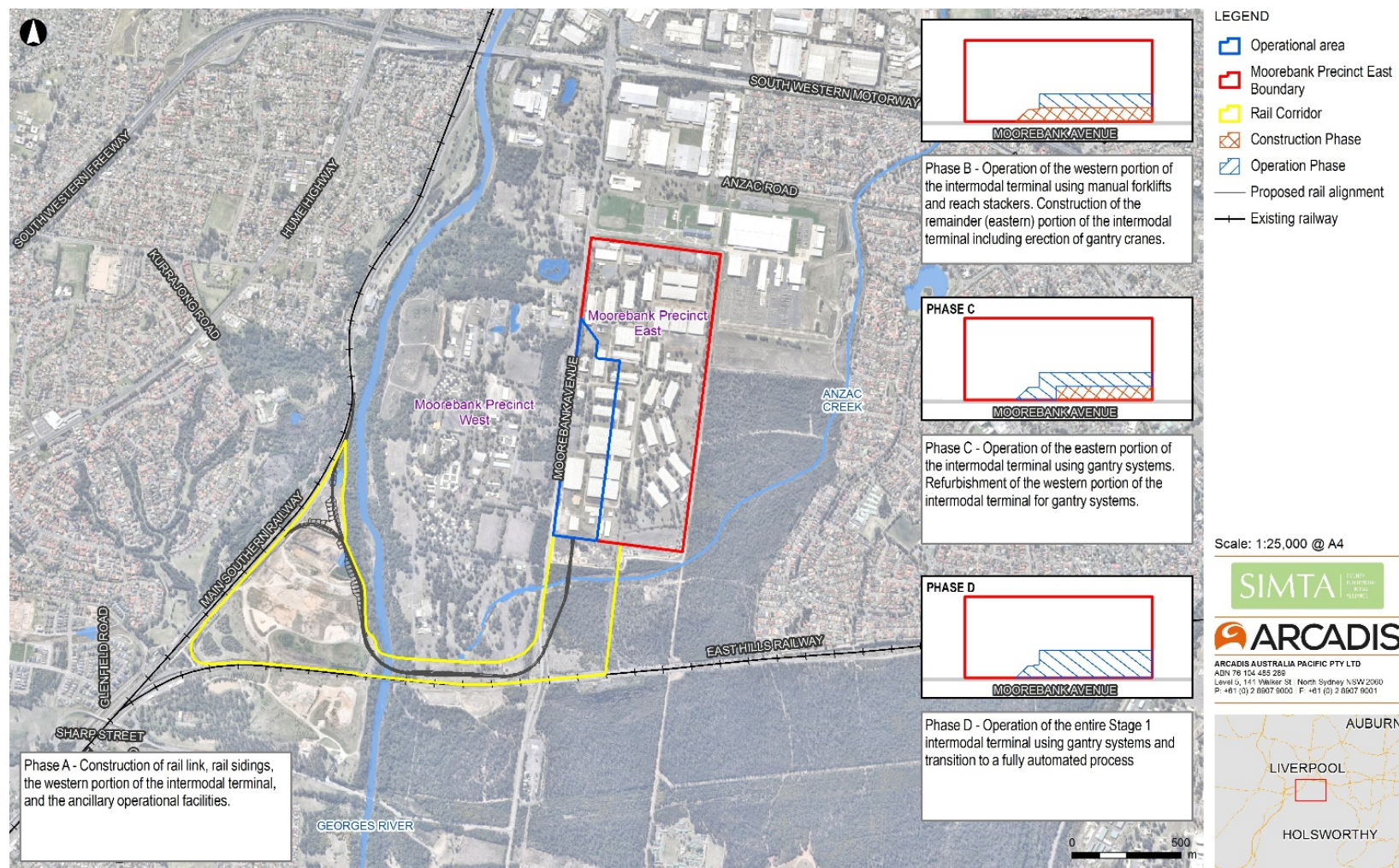


Figure 5 Project Construction Phases

Date: 30/01/2017 Path: F:\AA008017\GIS\Current\B_Maps\MPEST_CON\AA008017_MPEST_CON_004_MPEPhases_Air_Rt1.mxd
Created by: CA
QA by: KP

MPE Stage 1 CNVMP



LEGEND

- | | |
|---------------------------|--|
| Project site | Pre-1958, type unknown |
| Construction footprint | WWII QM (Quarter Master's) store |
| MPE site | WWII carpentry workshop |
| Site access point | WWII composite timber and steel store building |
| Isolated Aboriginal finds | WWII timber post and beam store building |
| Approximate PAD location | Modern building, c. 1990s |

ARCADIS AUSTRALIA PACIFIC PTY LTD
 ABN 76 104 485 289
 Level 16, 580 George St | Sydney NSW 2000
 P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001
 Coordinate System: GDA 1994 MGA Zone 56
 Aerial imagery supplied by nearmap (March, 2019)

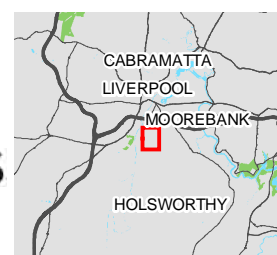


Figure 6: Location of Heritage Structures

5.2.4 High Energy Impact Compaction Works

High Energy Impact Compaction (HEIC) trial works were undertaken within a 100 m x 60 m plot located at the southern end of the MPE Stage 1 site construction boundary (close to the Package 1/Package 2 interface), approximately 650 metres from the nearest noise receiver (Wattle Grove south of Anzac Road), during the site preparation Works Period (Table 18). The testing works were undertaken in accordance with a Construction Method Statement (CMS ref: HIEDYC-T-CMS). It was anticipated that relevant noise criteria would not be exceeded, given the similarities regarding the environmental conditions and distances to sensitive receivers for similar works to be undertaken on the MPW site, and respective modelling results (refer to Day Design Report (July, 2016 ref: 6033-7.1L Rev C).

The purpose of these works was to assess whether intended site-wide HEIC works throughout the MPE site would generate noise and/or vibration impacts above relevant criteria, and what mitigation (if any) may be required, to conduct site-wide HEIC activities. A Noise and Vibration Assessment Report for HEIC Trial works was undertaken and is included in Appendix D of this CNVMP, and summarised below.

Noise and vibration monitoring was undertaken at four residential receivers during HEIC trial works to determine compliance and conformity with relevant noise and vibration criteria.

Vibration measurements were undertaken on the trial pad to determine a vibration site law. Minimum safe working distances from HEIC activity was determined, and is summarised in the table below.

Table 21: Recommended safe working distances to receivers/features surrounding the MPE Stage 1 site for HIEDYC Activity

Receptor type	Guideline Maximum PPV Level – mm/sec	Minimum Safe Distances for HIEDYC Activities (m)
Sensitive	3	15
Residential	5	10
Commercial	20	3
Civil Engineering and Rail infrastructure	40	3
Buried Pipework – Masonry	50	2
Buried Pipework – Concrete/ metal	80	2
Buried Steel	100	2

Noise levels recorded from HEIC equipment were inaudible at all times at each of the nearest residential receptors during the trial works, and noise levels measured at each residential receptor from HEIC activities comply with the established NMLs for the Project. Sound power levels for HEIC works were determined to be 106 dBA, which is below the established sound power levels established for the key construction Works periods associated with fill importation (Works period 3).

It is therefore concluded that compaction of fill using the HEIC method is compliant and acceptable for implementation across all areas of the MPE construction site boundary (as defined within this CNVMP). Future HEIC works are may occur throughout all areas of the MPE Stage 1 site to ensure subgrade compaction density is suitable for development for an IMT, internal roads and warehouse buildings. Key features located within vicinity of the site to be considered during future HEIC works include surrounding local roads, including Moorebank Avenue which runs in a north-south direction

directly adjacent (to the west) of the MPE Stage 1 site. Other key features include services and buried pipework located running parallel to Moorebank Avenue (along the eastern boundary of the MPE Stage 1 site and the East Hills Railway Line, which is located approximately 600 m to the south of the MPE Stage 1 site.

Monitoring of future HEIC works will be undertaken in accordance with methodology outlined in Section 7.2.2.

Vibration levels measured at all surrounding residential receivers were indistinguishable from the existing ambient vibration level at each residential receptor measured, and compliant with relevant vibration criteria. It is therefore concluded that no additional mitigation measures associated with vibration impacts from site wide HEIC are required, however, monitoring will continue to be conducted as per section 7.2.3.

6 NOISE AND VIBRATION ASSESSMENT

6.1 Hours of Work

All general construction works and activity will be scheduled to occur between the approved standard hours:

- 7:00am to 6:00pm Mondays to Fridays, inclusive
- 8:00am to 1:00pm Saturdays
- At no time on Sundays or public holidays

'Construction works and activity with the potential to generate "high noise impact" will be restricted to the following hours:

- between the hours of 8:00 am to 5:00 pm Monday to Friday
- between the hours of 8:00 am to 1:00 pm Saturday
- 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

'Continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition. High-noise impact activities and work means "*jack hammering, rock breaking or hammering, pile driving, vibratory rolling, cutting of pavement, concrete or steel or other work occurring on the surface that generates noise with impulsive, intermittent, tonal or low frequency characteristics*".

Out of Hours Works (OOHW) are works outside the approved Project standard hours. Where OOHW are required, the OOHW Protocol developed in accordance with CoC – E21 and CoC – E34(b)(iv) be implemented, as presented in Appendix B.

Works may be undertaken outside of the standard construction hours as follows:

- Where construction works will not generate LAeq, 15minute noise levels more than 5 dB above the rating background level at any residence and/or more than the noise management levels specified in Table 3 of the ICNG, as applicable to other sensitive land uses, as assessed in accordance with the ICNG and the additional requirements of this CNVMP; or
- For the delivery of materials required by the police or other authorities for safety reasons; or
- Where OOHW is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm;
- Construction works approved via the OOHW Protocol, provided the relevant Council, local residents and other affected stakeholders and sensitive Receptors are informed of the timing and duration at least 48 hours prior to the commencement of the works; or
- identified works are approved by the Secretary.

6.2 Noise Management Levels

Based on the ICNG and CNS methodology summarised in Section 4 the following construction Noise Management Levels (NMLs) will apply to the Project as presented below in Table 22.

Table 22 Construction Noise Management Levels

Noise Catchment Area (NCA)	Acceptable LAeq, 15 minute Noise Level			
	Standard Construction Hours RBL + 10 in dB(A) ¹	Out of Hours Works RBL + 5 in dB(A)		
		Daytime ²	Evening ³	Night ⁴
NCA1	52	47	42	42
NCA2	46	41	41	41
NCA3	51	46	42	39
NCA4	54	49	49	42
S1, S2	55	55	55	55
I1	75	75	75	75

Source: Table 2-6, NVIA

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

The NML will apply externally and will be assessed at the most-affected point on or within the receptor property boundary or, if that is more than 30 metres (m) from the receptor, at the most-affected point within 30 m of the receptor.

For other sensitive receptors (classrooms at schools and other educational institution,; hospital wards and operating theatres, and places of worship) the external criteria value translated from the ICNG internal goal may be adopted as relevant and if other receptors are identified.

The NML apply at a height of 1.5 m. It is noted that noise levels may be higher at upper floors of a noise affected residence. The NML presented in this CNVMP will apply only at an assessment height of 1.5 m above ground level. Where multi-storey buildings/receptors are identified their features will be noted (i.e. double storey brick house etc) however no additional assessment will be undertaken at any height above 1.5 m.

Exceedances against NML for OOHWs have not been identified within this CNVMP as the types and durations of OOHW have not yet been identified. A CNVIS will be developed as detailed within the OOHW Noise Protocol in Appendix B.

6.2.1 Sleep Disturbance Criteria

'Sleep disturbance screening thresholds' have been developed as per the guidance summarised in Section 4.1.2 and will be assessed externally, at a boundary location consistent with other NML and at a height of 1.5 m above ground level. These screening levels (refer Table 23) will only apply during the night time period and generally apply at residential (dwelling) receptors with other sensitive receptors considered where applicable e.g. at other receptors where habitable sleeping spaces are identified.

Highly Noise Affected Management Level: in accordance with the ICNG, the Highly Noise Affected Management Level of 75 dB(A) will apply to residential (dwelling) receptors during standard construction hours and during the daytime period only. The Highly Noise Affected Management Level does not apply outside the recommended standard hours and does not apply to other sensitive receptors.

Table 23 Sleep Disturbance Screening Levels

Receiver	Sleep Disturbance Screening Level (LA1,1minute / LAmax) ¹
NCA1	52
NCA2	51
NCA3	49
NCA4	52

Source: Table 2-3, NVIA
 These sleep disturbance screening levels only apply during the night time defined by the INP as the period from 10:00pm to 7:00am (Monday to Saturday) and 10:00pm to 8:00am (Sundays and Public Holidays).

6.2.2 Construction Road Traffic Noise

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

Whilst these criteria do not specifically apply to construction/demolition traffic movements, they have been conservatively adopted here in the CNVMP and are summarised in Table 24 below.

Table 24 Road Traffic Noise Management Levels

Road	Category	Management Level, dB(A)	
		Daytime ¹	Night time ²
M5 Motorway	Freeway	LAeq,1 hour ≤ 60 (external)	LAeq,1 hour ≤ 55 (external)
Moorebank Avenue	Arterial Road	LAeq,1 hour ≤ 60 (external)	LAeq,1 hour ≤ 55 (external)

Source: Table 2-4, NVIA
 Daytime means between 7:00am and 10:00pm, Monday to Sunday inclusive; and
 Night time means between 10:00pm to 7:00am, Monday to Sunday inclusive.

The Table 24 criteria do not apply to vehicle movements within the Project Site. For the purpose of this CNVMP any noise generated by on-site vehicle movements is considered as construction noise and managed holistically with on-site mobile plant in accordance with the ICNG.

Additionally, it is typically recognised that for existing residences and other sensitive land uses affected by additional traffic on existing roads, any increase in the total traffic noise level should preferably be limited to 2dB above the existing road traffic noise levels as an increase of 2dB is typically considered not noticeable.

The road traffic noise management levels differ from general construction NML and apply 1 m from the property façade. Road traffic impacts are not anticipated such that direct assessment of The Project road traffic noise will not be undertaken unless it becomes necessary (i.e. impacts are identified or complaints are received) during the works. Where impacts are identified or complaints are received the extent of assessment will be determined on a case by case basis.

6.3 Vibration Management Levels

Impacts from vibration will be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (structural/cosmetic damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

Refer Section 4.2 which describes how the human comfort structural/cosmetic damage criteria will be evaluated, selected and applied as appropriate to the receptor and potential impacts.

7 MITIGATION AND MANAGEMENT MEASURES

This section describes the overall approach to managing and mitigating noise and vibration impacts as a result of the Project works based on the predicted impacts as summarised in this CNVMP.

The management measures discussed in this section are based on the applicable EIS, NVIA, CoC, the ICNG as well as the requirements and standards of SIMTA and its contractors, including application of the CNS as relevant to the works.

The CNS was developed to address the assessment requirements documented in the ICNG. It also identifies the thresholds by which impacts can be qualified and the level of mitigation and management that is required for each stage of works.

The mitigation and management measures are consistent with the intent and recommendations of the INCG for own best-practice techniques to be developed for managing construction noise and vibration, and implementing feasible and reasonable mitigation measures.

The CNS assessment and mitigation approach has been adopted, in conjunction with the requirements of the ICNG, for the measured described in this CNVMP.

7.1 Standard Mitigation Measures

The standard mitigation measures that will be adopted during the Project are described in Table 25 and will be implemented for the works to manage and potentially reduce construction noise and vibration impacts.

Table 25 Standard Noise and Vibration Mitigation Measures

Item	Measure	Action Required	Action	Timing	Responsibility	Reference
NV1	Management	Implement community consultation measures	<p>As per CoC – E2 c) the approved hours of work, the name of the site/project manager, the responsible managing company, its address and 24 hour contact phone number for any inquiries, including construction/noise complaints will be displayed at the site, typically near site entrance points.</p> <p>Notification will be conducted in accordance with the processes established within the Community Communication Strategy. Notification will occur detailing all upcoming construction activities at least 14 days prior to commencement of relevant works.</p> <p>The Project website, information and response lines, email distribution list and any applicable community based forums will also be utilised for this purpose.</p> <p>Consultation in response to complaints (if received) will be undertaken, refer to Section 9 of this Plan for further detail.</p>	Pre-construction and during construction	Community Communication Manager	CoC – E2 C)
NV2	Management	Site Inductions	<p>A site-specific induction will be provided to all site personnel, contractors and sub-contractors with an emphasis on understanding and managing noise impacts from the work activities being undertaken.</p> <p>This will include the location of receptors, specific mitigation measures, site hours of operation, noise complaints procedure, etc. as well as the consequences of not complying with these mitigation measures.</p>	Pre-construction	Environment Manager	EIS - Table 22-1 NVIA CMM FCMM – 3A
NV3	Management	Behavioural Practices	Refer to Section 7 of this Plan for further detail.	During construction	Environment Manager	EIS - Table 22-1 NVIA CMM FCMM – 3A
NV4	Management	Monitoring	Refer to Section 8 of this Plan for further detail.	During construction	Environment Manager	CoC – E22 CoC – E34(b)

Item	Measure	Action Required	Action	Timing	Responsibility	Reference
NV5	Management	Attended Vibration Measurements	In accordance with CoC – E22, the ICNG penalties identified for ‘particularly annoying’ activities (that require the addition of 5dB(A) to the predicted level before comparing to the construction NML) will be applied.	During construction	Environment Manager	CoC – E22 CoC – E34(b)
NV6	Source Control	Construction Hours and Scheduling	<p>The approved CoC – E19 The Project standard construction hours are as follows:</p> <p>All general construction works and activity will be scheduled to occur between these hours, unless OOHW becomes necessary:</p> <ul style="list-style-type: none"> 7:00am to 6:00pm Mondays to Fridays, inclusive; 8:00am to 1:00pm Saturdays; and at no time on Sundays or public holidays. <p>As noise impacts are not anticipated during the approved hours, no shielding is warranted or provided for in this CNVMP.</p> <p>If additional mitigation during OOHW is recommended following a specific OOHW CNVIS, the CNVIS will provide further recommendations.</p> <p>Refer Section 4 of this plan for further detail.</p>	During construction	Environment Manager Site Supervisor	CoC - E19 EIS - Table 22-1 NVIA CMM RSoC – Item 1.3 FCMM – 3A
NV7	Source Control	Construction Respite Period	<p>CoC – E20 places further restriction on the hours that ‘high noise impact’ generating activities may occur.</p> <p>Construction works and activity with the potential to generate high noise impact will be scheduled to occur between these hours:</p> <ul style="list-style-type: none"> between the hours of 8:00 am to 5:00 pm Monday to Friday; between the hours of 8:00 am to 1:00 pm Saturday; 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. <p>Refer Section 4 of this plan for further detail.</p>	During construction	Environment Manager Site Supervisor	CoC – E20
NV8	Source Control	Equipment Selection	Quieter and less vibration emitting construction methods will be used where feasible and reasonable. The following will occur:	During construction	Environment Manager	CoC E34b)(vi) NVIA

Item	Measure	Action Required	Action	Timing	Responsibility	Reference
			<ul style="list-style-type: none"> Selection plant and equipment based on least noise and vibration emission levels where reasonable Use of low-vibration generating equipment/vibration dampeners or alternative construction methodology will be considered if necessary Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including excavators and trucks Plant and equipment will be regularly maintained and repaired or replaced if it becomes noisy The least noisy available construction equipment will be used Silenced generators and compressors will be used where possible Quiet plant and processes will be selected wherever feasible, specifically, reversing alarms will be procured or retrofitted that are quieter and display less annoying characteristics. Such alarms will include “smart alarms” and “quacker alarms” will occur where possible 		Site Supervisor	CMM FCMM – 3A
NV9	Source Control	Maximum Noise Levels	The noise levels of plant and equipment will be selected to have operating Sound Power Levels compliant with the values presented in Table 19 of this Plan.	Pre-construction	Environment Manager	Table 19 of CNVMP
NV10	Source Control	Rental Plant and Equipment	Table 2 of the CNS (or AS2436) will be utilised where necessary e.g. new equipment are introduced to the works.	Pre-construction	Environment Manager	Table 19 of CNVMP
NV11	Source Control	Use and siting of plant.	<p>The following will occur:</p> <ul style="list-style-type: none"> Where feasible, simultaneous operation of noisy plant would be avoided. The offset distance between noisy plant and adjacent sensitive receptors will be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive Receptors. “Clustering” of noisy plant or processes will be limited. Select and use lower vibrating generating equipment Adhere to the safe working distances identified in Section 6.1.2 	During construction	Environment Manager Site Supervisor	Section 6.1.2 of CNVMP

Item	Measure	Action Required	Action	Timing	Responsibility	Reference
			<ul style="list-style-type: none"> Select materials which require lower vibration generating activities to occur e.g. less compaction etc. 			
NV12	Source Control	Plan worksites and activities to minimise noise and vibration.	As noise impacts are not anticipated during the approved hours, no specific worksite and activity planning measures (to those already presented this table) are warranted or provided for in this CNVMP.	Pre-construction	Environment Manager	This Plan
NV13	Source Control	Non-tonal reversing alarms.	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site (and for any out of hours work) where appropriate.	Pre-construction	Site Supervisor	This Plan
NV14	Source Control	Minimise disturbance arising from delivery of goods to construction sites.	<p>In accordance with CoC – E23 construction vehicles will be operated so as to minimise any construction noise impacts from the construction site. To achieve this the following will occur:</p> <ul style="list-style-type: none"> Loading and unloading of materials/deliveries will occur as far as possible from receptors. Site access points and roads will be selected as far as possible away from receptors. Dedicated loading/unloading areas to be shielded if close to receptors. Delivery vehicles will be fitted with straps rather than chains for unloading, wherever reasonable and feasible. Delivery personnel and truck drivers to be made aware of approved haulage routes and access in and out of the construction site. Prevention of vehicles and plant queuing and idling outside the site prior to the morning start time. Pre-determined delivery times will be issued to suppliers and radio communication will be used to confirm status of the delivery. Any unsatisfactory noise performance for specific vehicles and/or the operators will be dealt with on a case by case basis. <p>In accordance with CoC – E24 no use of compression brakes will be permitted for construction vehicles associated with construction in the vicinity of the subject site.</p>	During construction	Environment Manager Site Supervisor	CoC – E23

Item	Measure	Action Required	Action	Timing	Responsibility	Reference
NV15	Emission Path (source to receptor)	Shield stationary noise sources such as pumps, compressors, fans etc.	<p>As noise impacts are not anticipated during the approved hours, no shielding is warranted or provided for in this CNVMP.</p> <p>Where shielding becomes necessary, stationary noise sources will be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.</p> <p>Guidance for noise reducing shielding will be taken from AS2436 or other relevant standards where necessary.</p>	During construction	Environment Manager	This Plan
NV16	Emission Path (source to receptor)	Shield sensitive receivers from noisy activities.	<p>As noise impacts are not anticipated during the approved hours, no shielding is warranted or provided for in this CNVMP.</p> <p>Where shielding becomes necessary, structures will be used to shield residential receptors from noise.</p> <p>This may include site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.</p> <p>Guidance for noise reducing shielding / hoarding / acoustic enclosures will be taken from AS2436 or other relevant standards where necessary.</p>	Pre-construction and during construction	Environment Manager	CoC – C3c This Plan
NV17	Emission Path (source to receptor)	Safe Working Distances	Safe working distance for vibratory intensive activities will be adhered to as outlined in Section 7.1.2	During construction	Environmental Manager	CoC E34b)vi) This Plan

7.1.1 Exceedance of Management Levels

Where construction is observed to exceed management levels the following will occur:

- Alternate work methodologies and plant will be investigated and considered to lower noise and vibration levels of construction works at the relevant receptors;
- Excessively noisy or vibration generating activities would cease or reduced under direction of the Environment Manager or Site Supervisor. Remedial measures would be implemented prior to recommencing work, and monitoring undertaken to verify noise or vibration levels if necessary;
- Plant and machinery will be checked and verified for noise levels and appropriate exhaust/fittings/noise attenuators.
- In the event of appreciable vibration levels arising, measures would be put in place to reduce vibration to within acceptable levels. Such measures may include reducing equipment size, changing operational settings, using other plant in lieu of that which is generating the vibration or a combination of these.

These actions are the responsibility of the Environment Manager and Site Supervisor. The noise and vibration incident and complaint response management process is summarised in Table 28 of Section 8.3.

7.1.2 Vibration Safe Working Distances

The CNS defines safe working distances for vibration intensive activities. These are reproduced in Table 26 and will be adopted during the Project works. These safe working distances are defined for both cosmetic damage (BS 7385) and human comfort (the NSW Vibration Guideline). The safe working distances for cosmetic damage will be complied with at all times.

Table 26 Safe Working Distances

Plant Item	Rating/Description	Safe Working Distance (m)	
		Cosmetic Damage (BS 7385)	Human Comfort (the NSW Vibration Guideline)
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m

Plant Item	Rating/Description	Safe Working Distance (m)	
		Cosmetic Damage (BS 7385)	Human Comfort (the NSW Vibration Guideline)
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	n/a
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure
Source: CNS			

These safe working distances are indicative only and will vary depending on the particular item of plant, local geotechnical conditions and receptor type. They apply to cosmetic damage of typical buildings under typical geotechnical conditions.

For significant equipment not listed above or for any highly sensitive receptors identified during works (none have been identified in the NVIA) specific assessment may be undertaken during works to ensure satisfactory operation of the equipment and to determine if any other mitigation or management measures are required to minimise the potential impacts.

If vibratory activities are deemed to occur in the vicinity of a heritage structure the safe work distances will be used as a preliminary guide but evaluated and refined to ensure compliance with the DIN4150-3 limits specified in Table 16 and Figure 6. In addition, vibratory monitoring will be undertaken to ensure levels are measured during the actual activity and compliance achieved. It is reiterated that the sensitivity of a heritage structure can vary and the applicable DIN 4150-3 limits (refer commercial, residential or sensitive structures in Table 16 and Figure 6) will be established when planning the works and evaluating potential impacts. The sensitive structures criteria may not apply to all heritage structures.

In relation to human comfort, the safe working distances above relate to continuous vibration. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods may be allowed. A targeted assessment may be undertaken during works to evaluate any decrease in human comfort safe work distance offsets and to determine if any other mitigation or management measures are required to minimise the potential impacts.

7.2 Additional Mitigation Measures

The implementation of the standard mitigation measures, together with community consultation should significantly reduce the noise and vibration impacts on nearby sensitive receptors. Nevertheless, due to the highly variable nature of activities associated with the Project, noise and vibration exceedances could occur under exceptional circumstances. As this potential exists, a number of additional measures to mitigate such exceedances (primarily aimed at pro-active engagement with affected sensitive receivers) have been identified below (Table 27). A full description of each measure is provided in Appendix C of the CNS.

Table 27 Additional Mitigation Measures

Measure	Abbreviation
Alternative Accommodation	AA
Monitoring	M
Individual Briefings	IB
Letter Box Drops	LB
Project-specific Respite Offer	RO
Phone Calls	PC
Specific Notifications	SN
<i>Source: CNS</i>	

In circumstances where, after the application of the standard mitigation measures, the construction noise and vibration levels are still predicted to exceed the noise or vibration objectives, the relevant Additional Mitigation Measures Matrix (AMMM) from the CNS are to be used to determine the additional measures to be implemented.

Using the relevant AMMM, the following steps will be carried out to determine the additional mitigation measures to be implemented:

- Determine the time period when the work is to be undertaken;
- Determine the level of exceedance; and
- Identify the relevant additional mitigation measures from Table 27 and Table 28.

The relevant AMMM for the Project (air-borne noise) is reproduced in Table 28 below. Those applicable to ground-borne noise and vibration are excluded from this CNVMP as any impacts are unlikely to occur.

Table 28 Additional Mitigation Measures Matrix (AMMM)

Time Period		Mitigation Measures			
		LAeq, 15minute Noise Level above Background (RBL) in dB(A)			
		0 to 10	11 to 20	21 to 30	>30
		Noticeable	Clearly Audible	Moderately Intrusive	Highly Intrusive
Standard	Mon-Fri (7am-6pm)				
	Sat (8am-1pm)	-	-	LB, M	LB, M
	Sun/Pub Hol (Nil)				
OOHW Period 1	Mon-Fri (6pm-10pm)				
	Sat (7am-8am & 1pm-10pm)	-	LB	M, LB	M, IB, LB, RO, PC, SN
	Sun/Pub Hol (8am-6pm)				
OOHW Period 2	Mon-Fri (10pm-7am)				
	Sat (10pm-8am)	LB	M, LB	M, IB, LB, PC, SN	AA, M, IB, LB, PC, SN
	Sun/Pub Hol (6pm-7am)				

Source: CNS

Guidance Note: as stated in the CNS (and as applicable to any additional mitigation considered) for some types of construction activities, a qualitative assessment of the potential noise impacts can be undertaken in lieu of detailed noise modelling. For these activities, noise mitigation measures should be evaluated on the basis of the noise levels being noticeable, clearly audible, moderately intrusive or highly intrusive.

The qualitative assessment should consider the type of equipment being used, the character of the noise emissions, times of day, the location of the nearest receptors and the noise sensitivity of the nearest receptors.

For the Project works, potential noise and vibration impacts for activities undertaken during the standard hours of construction have been comprehensively assessed in the NVIA via modelling. Such that any qualitative assessment will be limited to new or ad-hoc works not considered in the NVIA.

A qualitative assessment component has been incorporated into the OOHWS Protocol provided in Appendix B for works that are not anticipated to generate significant or audible noise levels. Where a qualitative assessment is being undertaken (for works during or outside the approved standard hours for construction) it will be reviewed and approved by the Environmental Manager.

8 COMPLIANCE MANAGEMENT

8.1 Training

All site personnel, contractors and sub-contractors shall undergo site specific induction training, which will include noise and vibration management training developed with an emphasis on understanding and managing noise impacts from the work activities being undertaken.

This site-specific induction training will include:

- The location of potentially sensitive receptors
- All relevant noise and vibration mitigation measures
- Site hours of operation i.e. the permissible hours of work, including deliveries
- A summary of relevant licence and approval conditions
- Any limitations on high noise generating activities
- Construction employee parking areas
- Designated loading/unloading areas and procedures
- Emphasis that there should be no swearing, shouting or loud stereos/radios on site
- Details of the complaints handling procedure
- Details of the environmental incident procedures
- Outline the consequences of not complying with these measures.

Toolbox meetings will be undertaken as required covering specific environmental issues and will include noise and vibration control measures where required, including but not limited to:

- Ensuring work occurs within approved hours
- Locating noisy equipment away from sensitive receptors
- Ensuring plant and equipment is well maintained and not making excessive noise
- Turning off machinery when not in use

Toolbox training on noise and vibration management requirements and measures will be completed by the Environmental Manager (or nominated authority) during the Project.

Personnel directly involved in implementing noise and vibration control measures on site will be given specific training in the various measures to be implemented. Records of all training will be filed in the Project filing system.

8.2 Monitoring and Reporting Requirements

Attended measurements will be the focus of all noise and vibration monitoring. Unattended noise and vibration monitoring will not be undertaken unless specific circumstances warrant. Real-time or internet accessible noise and vibration monitoring systems are not warranted and will not be implemented for the Project works unless specific circumstances warrant.

All attended measurements will be conducted by appropriately trained personnel in the measurement and assessment of construction noise and vibration. They will be familiar with the requirements of the relevant standards and procedures.

Attended noise measurements will be undertaken by an operator using a hand held Type 1 or Type 2 'integrating-averaging' sound level meter. The device will be calibrated prior to and after all measurement rounds, with any change in calibration levels noted. Measurements will be completed with the sound level meter mounted to a tripod at a height of 1.2-1.5m and with a windscreen fitted.

Noise monitoring will not be completed within 3 m of any reflective structure or wall, if possible. Where it is not possible to measure more than 3 m from any reflective structure or wall, a reduction of up to 2.5 dB will be applied to the measured site noise contribution (LAeq, 15 minute) to account for the likely increase in noise associated with reflective surfaces. No noise monitoring will be completed during periods where wind speeds exceed 5 m/s or during any rain events.

Instantaneous noise levels for all noted noise emission sources (extraneous or otherwise) and meteorological conditions (average and maximum wind speeds, temperature, precipitation and cloud cover etc.) shall be recorded during all measurements.

Monitoring will be conducted as per the requirements of this CNVMP and with due regard to AS1055, AS61672, AS1259 (or similar), IEC60942, or the NSW Vibration Guideline as relevant to the monitoring being conducted.

All noise samples shall be recorded using the “fast” time response of the sound level meter. Site activity records will be maintained during any noise or vibration monitoring events.

8.2.1 Maximum Noise Levels for Plant and Equipment

Attended noise measurements will be undertaken within a period of 28 days of significant equipment arriving on site to establish the Sound Power Level (LW or SWL) and to confirm that the operating noise levels comply with the values presented in Table 19 of this Plan. Table 2 of the CNS (or AS2436) will be utilised where necessary e.g. new equipment are introduced to the works.

Plant and equipment noise monitoring will ensure the LAeq, and LA90 parameters are recorded as a minimum, with LAeq, 15minute values inferred by extrapolation or calculation as necessary. The LMax parameter should be recorded for each measurement with the LA1, 1minute parameter measured directly or calculated where possible and if applicable. The time and location of the monitoring will also be noted.

The plant and equipment measurement sample height will be 1.5 m above ground level, unless an alternate height is identified by the operator that more accurately captures emissions data for the item being considered. All measurements will be completed with the sound level meter mounted to a tripod (if possible, hand held measurements are acceptable if the assessment height or position cannot be achieved using a tripod) and with a windscreen fitted.

The duration of each plant and equipment measurement sample will be selected by the operator to ensure the noise emission from the item being considered is adequately recorded. To avoid misunderstanding, a shorter duration less than 15 minutes may be adopted for plant and equipment noise level tests.

8.2.2 Community Noise Monitoring

Attended noise measurements will be undertaken within a period of 14 days from the commencement of construction activities to confirm that the noise levels in the adjacent community are consistent with the predictions the NVIA as reproduced in this CNVMP.

The attended measurements will be conducted at the potentially most affected receptors.

Attended noise measurements will be undertaken:

- On a three-monthly basis as part of the audit cycle to ensure that noise levels in the adjacent community remain consistent with the predicted NML
- In response to a complaint
- At the start of a new noisy activity
- During OOHW

Community noise monitoring will ensure the LAeq, 15minute and LA90, 15minute parameters are recorded as a minimum. The site noise level contribution (LAeq, 15minute) shall be determined in the absence of any influential source not associated with the Project works for direct comparison to the relevant criteria. The LAmax, LAmin, LA1 and LA10 parameters should be recorded for each measurement with the LA1, 1minute parameter measured directly or calculated where possible and if applicable.

The community noise measurement sample height will be 1.5 m above ground level. The duration of each community noise measurement sample will be 15 minutes. All measurements will be completed with the sound level meter mounted to a tripod (if possible) and with a windscreen fitted. The devices microphone will be focused on the noise emission centre of the equipment being tested.

If community noise monitoring identified that predicted noise levels are being exceeded, the contractor will revisit construction practices/sequencing etc. to reduce noise levels, minimise impacts and to enable provision of information on noise levels to surrounding and potentially affected residents should this be required (i.e. on request or following a complaint).

Where OOHW is approved and monitoring is determined to be required, attended noise measurements will be conducted at the most affected receptors following the general and community monitoring requirements specified above. Further guidance is provided in the OOHW Protocol included in this CNVMP as Appendix B.

Noise monitoring will be undertaken at the following receivers:

- NCA1: 15 Lara Court, Wattle Grove
- NCA2: 6 Namoi Court, Wattle grove
- NCA3: 2 Rushton Place, Casula
- NCA4: 14 Goodenough Street, Glenfield

8.2.3 Vibration Monitoring

Vibration monitoring of plant or equipment or in the community may be required. Circumstances where this may be required include:

- In response to vibration complaint
- Works occurring near or adjacent to retained heritage structures

The implementation of all noise and vibration mitigation measures will be monitored regularly throughout the works and audited on a three monthly basis. The location of vibration monitoring has not yet been nominated as there are currently no predicted vibration impacts.

Specific monitoring requirements and measures for heritage and other sensitive structures are described below:

- Should activities with the potential to generate significant vibration events in close proximity to heritage structures be identified, vibration testing will be undertaken for the activity at a location away from sensitive buildings or structures.

- The safe working distances for human comfort specified in Table 26 will be used to trigger this testing requirement, where the human comfort safe working distance values are adhered to there is negligible risk of vibration events exceeding the DIN4150:3 “Line 3” structural damage criteria.
- The vibration test location will be established so that impacts to heritage structures will not occur.
- The vibration testing will determine the actual safe working distance based on compliance with the DIN4150:3 “Line 3” structural damage criteria for heritage structures or other structures that, because of their particular sensitivity to vibration, cannot be classified under either “Line 1” or “Line 2” classifications.
- The vibration testing methodology will be established by a suitably experienced person and/or in consultation with a qualified technical specialist.
- The outcomes of the vibration testing may require continuous unattended vibration monitoring to occur for select activities. The methodology for any ongoing vibration monitoring will be established by a suitably experienced person and/or in consultation with a qualified technical specialist.
- Pre- and post- construction dilapidation surveys of sensitive structures where blasting and/ or vibration is likely to result in damage to buildings and structures (including surveys being undertaken immediately following a monitored exceedance of the criteria).
- Impacts to heritage structures are not expected, such that detailed options for any alteration of construction methodology will be evaluated and implemented on a case-by-case basis and if specific circumstances arise that deem it necessary.

8.2.4 Monitoring Reports

A report for the construction noise and vibration compliance monitoring will be compiled every 3 months detailing the community noise monitoring results as well as any other noise and vibration monitoring that was conducted during the reporting period. The report will include information about any exceedances detected and how non-compliances were addressed. This report will be sent to SIMTA until the completion of construction for inclusion into the 6-monthly compliance report.

All reports will include a map clearly showing the location of each monitoring station.

8.3 Enquiries, Complaints and Incident Management

Enquiries, complaints and incident management will be undertaken as per the Project CEMP section 9.2.1 and Communications Strategy, including that related to noise and vibration.

Complaints arising from Project works will be treated sensitively and in a manner that recognises the potential for noise and vibration to cause environmental impacts. The management of compliance and non-conformance is addressed in section 8.5 of this document. Special consideration will be given to complaints related to noise and vibration during highly intrusive works (particularly those activities when increased impacts are predicted) in order that additional mitigation can be implemented in a timely manner.

Various lines of communication will be made available for enquiries and complaints during construction of the Project. This will include a 24 hour telephone number for enquiries and complaints. Any complaints received during the works will be dealt with in accordance with the Construction Complaints Management System for the Project. Complaints management protocols are outlined in the Community Liaison Plan.

The noise and vibration incident and complaint response management process is summarised in Table 29 below.

Table 29 Noise and Vibration Incident / Complaint Response Management

Incident Type	Response	Responsibility
Noise levels from construction activities exceed noise goals and criteria	Noisy activities would cease or reduce under direction of the Environment Manager or Site Supervisor. Remedial measures would be implemented prior to	Environment Manager Site Supervisor

Incident Type	Response	Responsibility
	<p>recommencing work, and monitoring undertaken to verify noise levels.</p> <p>All plant and machinery will be checked and verified for noise levels and appropriate exhaust/fittings/noise attenuators.</p> <p>Works methodologies will be reviewed and amended if required.</p>	
Community complaint relating to noise or vibration	<p>Any noise or vibration complaints received from the community or adjacent stakeholders would be recorded and responded to within two hours in accordance with the complaints management system for the Project. Attended noise or vibration monitoring would be offered if the complaint is not immediately resolved.</p> <p>Noise or vibration intensive activities would cease or reduce under direction of the Environment Manager or Site Supervisor. Remedial measures would be implemented prior to recommencing work, and monitoring undertaken to verify noise levels.</p> <p>All plant and machinery will be checked and verified for noise levels and appropriate exhaust/fittings/noise attenuators.</p> <p>Works methodologies will be reviewed and amended if required.</p>	<p>Environment Manager</p> <p>Community Liaison Manager</p>
Negotiations with specific Receptors	<p>Additional noise and vibration mitigation measures may be negotiated with sensitive receptors if requested or as required to address complaints (if received).</p>	<p>Community Liaison Manager</p>
Vibration causing structural damage	<p>Activities causing significant vibration at off site buildings (however unlikely) would cease under direction of the Environment Manager or Site Supervisor. Any occupants of buildings may be evacuated with due consideration to safety, and the area secured to prevent unauthorised access.</p> <p>A structural assessment would be undertaken and the results compared with any previous condition survey; and if any damage is associated with construction, rectification work would be implemented or compensation agreed.</p>	<p>Environment Manager</p> <p>Site Supervisor</p>

8.4 Roles and Responsibilities

Relevant roles and responsibilities associated with this CNVMP are presented in Table 30.

Table 30 Roles and responsibilities

Roles	Responsibilities
Environment Manager / Site Supervisor	<ul style="list-style-type: none"> Oversee the overall implementation of this CNVMP Ensure that sufficient resources are allocated for the implementation of this CNVMP Ensure that the CEMP covers the management and mitigation measures presented in this CNVMP Consider and advise senior management on compliance obligations Ensure that the outcomes of compliance monitoring / incident reporting are systematically evaluated as part of ongoing management of construction activities Ensure all noise and vibration mitigation measures are implemented Where standard mitigation measures are deemed insufficient, undertake reasonable steps to manage adverse impacts and implement all additional measures Authorise cessation of construction activities on-site if exceedances are identified Ensure construction activity records / monitoring records/ incident reports are kept and maintained on-site Ensure audits of construction site activity records / monitoring records/ incident reports are undertaken as needed, findings are shared with relevant site personnel and corrective actions are implemented Ensure all relevant personnel have and understand the most up-to-date copy of this CNVMP Ensure that all requirements of this CNVMP are effectively implemented Ensure that any required actions arising from incident investigation processes during compliance construction monitoring are reported to the relevant personnel for further action and ensure that the actions are effectively implemented Coordinate the implementation of monitoring requirements and corrective actions Ensure that experienced, trained or qualified personnel conduct the noise (or vibration) monitoring Ensure all monitoring reporting requirements are met and maintained on site Acts as a primary site contact for any valid complaints received via the Community Communication Manager Authorise all monitoring reports and any revisions to this CNVMP
Construction contractors / sub-contractors / site personnel	<ul style="list-style-type: none"> Understand and implement mitigation as required in the CNVMP and any additional required measures identified during construction Participate (or conduct if authorised) relevant training to implement the requirements of this CNVMP
Noise and Vibration Monitoring Personnel (contractors)	<ul style="list-style-type: none"> Undertake relevant training to implement the requirements of this CNVMP Undertake all monitoring activities in accordance with this CNVMP Ensure regular maintenance of monitoring equipment Ensure all relevant monitoring quality control / assurance procedures are effectively implemented

8.5 Non-compliances, Non-conformance and Actions

It is the responsibility of all site personnel to report non-compliances and non-conformances to the Site Supervisor and/or the Contractor's EM.

Non-compliances, non-conformances and corrective and preventative actions will be managed in accordance with Section 9.2.1 of the CEMP.

8.6 Review and Improvement

The CNVMP will be reviewed on a case by case basis and where circumstances arise during the works that require amends to the plan. The type of circumstances that may trigger a CNVMP review could include, but are not limited to, significant changes in construction procedures, management protocols or environmental requirements; trends in validated noise or vibration complaints are identified; and/or an increase in noise and vibration impacts is identified.

Where noise (or vibration) levels are repeatedly identified (e.g. via monitoring) to be above management levels or the predicted values in the NVIA, a review of this CNVMP will be undertaken. The following steps will be completed:

- review and identify the cause of any noise (or vibration) exceedances. This should focus on the plant, equipment or machinery in use at the time, or activities undertaken so that any trends can be identified;
- confirm the type and extent of any mitigation or corrective actions implemented during the non-compliant events;
- identify, develop and implement any opportunities for improvement or additional mitigation or management measures that will assist to minimise impacts associated with any trends; and
- revise this management plan document, or supplement this plan (e.g. with separate work instructions) to reflect the outcomes of the review.

The revised management plan (or supplementary documentation) will be developed to the satisfaction of the Environmental Manager, so that the management strategy and management measures continue to assist to minimise impacts at receptors and to ensure that the plan remains an effective instrument for noise management and mitigation.

The CNVMP review will reflect these considerations and upon final approval of the revised CNVMP, the document will be circulated to relevant personnel.

9 REFERENCES

Australian Government – Department of Environment: **SIMTA Intermodal Terminal Facility – Commonwealth Conditions of Approval (CCoA)**, dated 6 March 2014

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

Commonwealth Mitigation Measures (CMM)

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

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

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

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

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

NSW Government – Department of Planning and Environment: **Concept Plan Conditions of Approval (CPCoA)** (MP10_0193), dated 29 September 2014

NSW Government – Transport for NSW (TfNSW) **Construction Noise Strategy (CNS)**, April 2013

Revised Statement of Commitments (RSoc), prepared by Urbis

SIMTA Intermodal Terminal Facility - Stage 1 – Environmental Impact Statement, prepared by Hyder Consulting Pty Ltd, dated May 2014 (EIS)

SIMTA Intermodal Terminal Facility - Stage 1 - Noise and Vibration Impact Assessment, prepared by Wilkinson Murray on behalf of Hyder Consulting Pty Ltd, dated May 2015 (NVIA)

SIMTA Intermodal Terminal Facility - Stage 1 – Response to Submissions – Noise and Vibration Addendum, prepared by Wilkinson Murray on behalf of Hyder Consulting Pty Ltd, dated September 2015

SIMTA Intermodal Terminal Facility Stage 1 - Response to Submissions – **Final Compilation of Mitigation Measures (FCMM)**, prepared by Hyder Consulting Pty Ltd

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

Standards Australia AS IEC 61672.1–2004™ (AS61672) – **Electro Acoustics - Sound Level Meters Specifications Monitoring** or Standards Australia AS1259.2-1990™ (AS1259) – **Acoustics – Sound Level Meters – Integrating/Averaging** as appropriate to the device

Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard™ – **Electroacoustic – Sound Calibrators**

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

The Minister for Planning Approval for The Project– Minister's Conditions of Consent (CoC, 18 December 2016 (**SSD 6766**))

APPENDIX A

Acoustics: Glossary of Terms and Definitions

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

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

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

What Factors Contribute To Environmental Noise?

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

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

How To Measure And Describe Noise?

Noise is measured using a specially designed 'sound level' meter which must meet internationally recognised performance standards. Audible sound pressure levels vary across a range of 107 Pascals (Pa), from the threshold of hearing at 20 μ Pa to the threshold of pain at 200 Pa. Scientists have defined a statistically described logarithmic scale called Decibels (dB) to more manageably describe noise.

To demonstrate how this scale works, the following points give an indication of how the noise levels and differences are perceived by an average person:

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

Human Response to Changes in Noise Levels

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

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

- A doubling of the distance between a noise source and a receiver results approximately in a 3 dB decrease for a line source (for example, vehicles travelling on a road); and a 6 dB decrease for a point source (for example, the idling car discussed above). A doubling of traffic volume for a line source results approximately in a 3 dB increase in noise, halving the traffic volume for a line source results approximately in a 3 dB decrease in noise.

Terms to Describe the Perception of Noise

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

- **Inaudible / Not Audible:** the noise source and/or event could not be heard by the operator, masked by extraneous noise sources not associated with the source. If a noise source is 'inaudible' its noise level may be quantified as being less than the measured LA90 background noise level, potentially by 10 dB or greater;
- **Barely Audible:** the noise source and/or event are difficult to define by the operator, typically masked by extraneous noise sources not associated with the source. If a source is 'barely audible' its noise level may be quantified as being 5 - 7 dB below the measured LA90 or LAeq noise level, depending on the nature of the source e.g. constant or intermittent;
- **Just Audible:** the noise source and/or event may be defined by the operator. However there are a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator;
- **Audible:** the noise source and/or event may be easily defined by the operator. There may be a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator; and
- **Dominant:** the noise source and/or event are noted by the operator to be significantly 'louder' than all other noise sources. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.

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

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

How to Calculate or Model Noise Levels?

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

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

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

Acoustics Terminology and Statistical Noise Descriptors

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

- **Decibel (dB is the adopted abbreviation for the decibel):** the unit used to describe sound levels and noise exposure. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure;
- **dB(A):** the unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear;
- **dB(C):** the unit used to measure 'A-weighted' sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans;
- **dB(Z) or dB(L):** the unit used to measure 'Z-weighted' sound pressure levels with no weighting applied, linear;
- **Hertz (Hz):** the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz;
- **Octave:** a division of the frequency range into bands, the upper frequency limit;
- **1/3 Octave:** single octave bands divided into three parts;
- **Leq:** this level represents the equivalent or average noise energy during a measurement period. The Leq, 15minute noise descriptor simply refers to the Leq noise level calculated over a 15 minute period. Indeed, any of the below noise descriptors may be defined in this way, with an accompanying time period (e.g. L10, 15 minute) as required;
- **Lmax:** the absolute maximum noise level in a noise sample;
- **LN:** the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis;
- **L10:** the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels;
- **L90:** the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L90 level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes;
- **Sound Power Level (LW):** this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment;
- **Sound Pressure Level (LP):** the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs from LW in that this is the received sound as opposed to the sound 'intensity' at the source;
- **Background noise:** the underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor;
- **Ambient noise:** the all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far;
- **Cognitive noise:** the noise in which the source is recognised as being annoying;
- **Masking:** the phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
- **Assessment Background Level (ABL):** is defined in the INP as a single figure background level representing each assessment period (day, evening and night). Its determination is by the tenth percentile method (of the measured LA90 statistical noise levels) described in Appendix B on the INP;
- **Rating Background Level (RBL):** is defined in the INP as the overall single figure background level representing each assessment period (day, evening and night) over the whole monitoring period (as opposed to over each 24hr period used for the ABL). This is the level used for assessment purposes. It is defined as the median value of:
 - all the day assessment background levels over the monitoring period for the day;
 - all the evening assessment background levels over the monitoring period for the evening; and

- all the night assessment background levels over the monitoring period for the night.
- **Extraneous noise:** the noise resulting from activities that are not typical of the area. Atypical INP activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous;
- **Most affected location(s):** locations that experience (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver;
- **Feasible and Reasonable measures:** feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:
 - noise mitigation benefits (amount of noise reduction provided, number of people protected);
 - cost of mitigation (cost of mitigation versus benefit provided);
 - community views (aesthetic impacts and community wishes); and
 - noise levels for affected land uses (existing and future levels, and changes in noise levels).

How to Measure and Control Vibration

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

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

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

Vibration is typically measured using specific devices that record the velocity or acceleration at a designated receiver location – usually being the closest premises to works. Modern vibration monitoring devices will typically capture amplitude data for the three (3) orthogonal axes being, the transverse, longitudinal and vertical and also the frequency at which the measured vibration event occurs. Monitoring of this level of detail enables analysis of significant vibration events to determine compliance with relevant guidelines.

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

Vibration Descriptors

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

- **Parameter:** an attribute with a value - for example, weighting;
- **Particle Velocity:** the instantaneous value of the distance travelled by a particle per unit time in a medium that is displaced from its equilibrium state by the passage of a sound or vibration wave;
- **Peak Particle Velocity (PPV):** is the highest (maximum or peak) particle velocity which is recorded during a particular vibration event over the three (3) axes. PPV is measured in the unit, mm/s;
- **Phase:** the relative position of a sound wave to some reference point, the phase of a wave is given in radians, degrees, or fractions of a wavelength;
- **Acceleration:** the change in velocity over time. Acceleration is dependent on the velocity and the frequency of the vibration event (velocity is a vector), as such acceleration changes in two ways - magnitude and/or direction. Acceleration is measured in the unit; m/s²;
- **Perceptible:** vibration levels that a receiver of building occupant may 'feel'. 0.2 mm/s is typically considered to be the human threshold for perception of vibration;
- **Geophone or accelerometer:** the transducer/device typically used to measure vibration;
- **Damage:** is defined in DIN 4150-3 (1999-02) Structural vibration - Effects of vibration on structures to include minor non-structural effects such as cosmetic damage or superficial cracking in paint or

cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls; and

- **Vibration Dose Value (VDV):** a concept outlined in the NSW Vibration Guideline which is a calculative approach to assessing the impact of intermittent vibration or extended periods of impulsive vibration. VDV require the measurement of the overall weighted RMS (Root Mean Square) acceleration levels over the frequency range 1Hz to 80Hz.

To calculate VDV the following formula (refer section 2.4.1 of “the guideline”) is used:

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

Where VDV is the vibration dose value in m/s^{1.75}, a (t) is the frequency-weighted RMS of acceleration in m/s² and T is the total period of the day (in seconds) during which vibration may occur.

APPENDIX B

Out of Hours Works (OOHW) Protocol

This Out of Hours Work (OOHW) protocol has been developed for the Project to comply with the requirements of CoC – E34(b)(iv) and other relevant conditions.

The protocol presents the assessment, management and approval process for works required outside of standard construction hours i.e. OOHW, including a quantitative assessment under which the Environmental Manager may approve (in consultation with ER) the out-of-hours (OOH) construction activities.

Relevant Condition of Consent

CoC – E34(b)(iv) requires the development of the OOHW Protocol however a number of other conditions directly relate to the features described herein. These CoC are CoC - E19, CoC – E20 and CoC – E21.

OOHW Protocol

Table 30 describes the OOHW protocol. It is noted that exceedances against the NML have not been included as the types and duration of OOHW are not yet known. Management of exceedances against NML are discussed in Table 30 rows 4-6.

Exclusions to this Protocol: with due regard to CoC – E21 OOHW will be undertaken without further assessment, management or approval in the following circumstances:

- Construction works will not generate LAeq, 15minute noise levels more than 5 dB above the rating background level at any residence and/or more than the noise management levels specified in Table 3 of the ICNG, as applicable to other sensitive land uses, as assessed in accordance with the ICNG and the additional requirements of this CNVMP; or
- For the delivery of materials required by the police or other authorities for safety reasons; or
- Where OOHW is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm;
- Construction works approved via this OOHW Protocol, provided the relevant Council, local residents and other affected stakeholders and sensitive Receptors are informed of the timing and duration at least 48 hours prior to the commencement of the works; or
- Identified works are approved by the Secretary.

A key feature of this Protocol is considering the need and justification for any OOHW. This is the first step of the OOHW Protocol and will occur prior to any impacts being assessed. Where possible, OOHW will be avoided and scheduled to occur during the approved hours for construction. Where OOHW are needed for the safe and efficient implementation of the Project, or due to exceptional circumstances the level of impacts of OOHW will be considered.

A Construction Noise and Vibration Impact Statement (CNVIS) will be utilised to identify risk of the proposed OOH activity and whether the application is required to be approved by the Environmental Manager and ER, or referred to the Secretary.

In compliance with Commonwealth approval mitigation measures for biodiversity, directional lighting will be used where lighting is required in construction areas.

Table 31 OOHW Protocol

No.	Step	Detail
1.	Work Identification	<ul style="list-style-type: none"> • Identify work activities required OOHW. • Identify the reason why OOHW are needed; does the work proposed need to be completed outside the approved hours of construction or can it be rescheduled for standard working hours.

No.	Step	Detail
		<ul style="list-style-type: none"> If the OOHW are essential to the Project, or are required due to exceptional circumstances, prepare and document a justification for the works.
2.	Assess Alternatives	<p>Assess alternate options that may allow construction to be undertaken within approved hours such as:</p> <ul style="list-style-type: none"> Using alternate equipment; Different construction methods; or Postponing scheduled works. <p>If no other options are considered practical, consult the Project Environment Manager and document a description of the works, the expected duration, a list of all noise generating plant, equipment and machinery in use, or activities to be undertaken, a list of all potential mitigation and management measures.</p>
3.	Undertake CNVIS	<p>If no alternate options are available / viable, the activity is to be assessed for noise and vibration impacts on the surrounding receptors via a Construction Noise and Vibration Impact Statement (CNVIS) prepared by suitably qualified personnel, taking into account all proposed noise and vibration mitigation measures. The CNVIS will:</p> <ul style="list-style-type: none"> Identify the closest and/or potentially most affected receptors situated within the potential area of influence of the works; Predict noise levels based on the NVIA scenarios or via modelling (or spreadsheet calculation) for new scenarios; Compare the predicted values to the noise management levels, and where relevant to the AMMM defined by the CNS; Provide a list of necessary mitigation and management measures that will be required to be implemented. <p>Predictions will account for potentially annoying (tonal, low frequency content or impulsive) work activities by applying a 5 dB(A) penalty to the values for annoying works.</p> <p>Predictions will account for all potential noise mitigation and management measures by applying a deduction to the values assessed above for the noise reducing measures that will be implemented.</p> <p>Predictions will be provided to assess potential sleep disturbance impacts, if anticipated.</p> <p>General activities which are inaudible at receptors, including (but not limited to), security operations, monitoring, survey and general site maintenance will not require a CNVIS.</p> <p>Refer Section 3 for existing conditions and Section 4 for applicable management levels.</p>
4.	Low Impact Works	<p>If the CNVIS shows that construction works <u>will not</u> generate $L_{Aeq, 15\text{minute}}$ noise levels more than 5 dB above the rating background level at any residence and/or more than the noise management levels specified in Table 3 of the ICNG, as applicable to other sensitive land uses, as assessed in accordance with the ICNG and the additional requirements of this CNVMP the activity will be considered low environmental risk and referred to the Environmental Manager for review and approval.</p> <p>Refer Section 3 for existing conditions and Section 4 for applicable management levels.</p>
5.	Medium Impact Works	<p>If the CNVIS shows that construction works <u>will</u> generate $L_{Aeq, 15\text{minute}}$ noise levels more than 5 dB above the rating background level at any residence and/or more than the noise management levels specified in</p>

No.	Step	Detail
		<p>Table 3 of the ICNG, as applicable to other sensitive land uses, as assessed in accordance with the ICNG and the additional requirements of this CNVMP, the activity will be considered a medium environmental risk and referred to ER for review and approval.</p> <p>In referring the approval to ER, the contractor will:</p> <ul style="list-style-type: none"> • Demonstrate the requirement for activities to be conducted outside the approved standard construction hours • Summarise the findings of the CNVIS assessment; • Detail the mitigation measures to be implemented for the specific OOHW, including specific consideration of the AMMM process; and • Detail the actions and notifications to be issued for the specific works. <p>Where the activity, likely impacts and management measures are considered acceptable by ER works will proceed following ER and Environmental Manager approval.</p> <p>Refer Section 3 for existing conditions and Section 4 for applicable management levels.</p>
6.	High Impact Works	<p>Where the CNVIS and consultation with ER identifies that that construction works will generate significant noise levels exceeding the AMMM thresholds defined in the CNS, these applications will be considered a high environmental risk and referred to the Secretary for endorsement and DPE approval. Further mitigation measures will be investigated and discussed with the ER and the Secretary. In seeking approval from the Secretary, the contractor will:</p> <ul style="list-style-type: none"> • Demonstrate the requirement for activities to be conducted outside the approved standard construction hours • Summarise the findings of the CNVIS assessment; • Detail the mitigation measures to be implemented for the specific works, including specific consideration of the AMMM process; • Investigate further mitigation measures that may be implemented to further reduce impact; and • Detail the actions and notifications to be issued for the specific works. <p>Up to 4 weeks (20 business days) will be allowed for DP&E to review the OOHW application.</p> <p>Refer Section 3 for existing conditions and Section 4 for applicable management levels.</p>
7.	OOHW Approval	<p>OOHW will not commence until approval is granted by the relevant authority.</p>
8.	Community Notification	<p>All OOHW (both medium and high impact) will require the AMMM to be implemented and notification to be distributed to receptors potentially affected by the works. A notification boundary will be established on a case by case basis.</p> <p>Notification will be conducted in accordance with the processes established for the Project.</p> <p>In accordance with CoC – E21 and advice from DPE the relevant Council, local residents and other affected stakeholders and sensitive receptors will be informed of the timing and duration of the OOHW at least 7 days prior to the commencement of the works.</p> <p>Refer Section 7.3 for the enquiries, complaints and incident management overview.</p>

No.	Step	Detail
9.	Mitigation and Monitoring	<p>All reasonable and feasible mitigation measures will be implemented in both standard approved hours and OOHW for the duration of The Project works.</p> <p>Attended noise monitoring will be undertaken where deemed necessary under the requirements of the AMMM.</p> <p>Monitoring will provide comparison the applicable CNVIS to ensure noise levels comply with those predicted in the CNVIS. Where noise (or vibration) levels are observed to continually exceed those outlined in the activity specific CNVIS, works shall stop and alternate methods and mitigation measures investigated and implemented.</p> <p>Noise monitoring will be undertaken by suitably qualified personnel, including professionally trained and experienced environmental staff and noise consultants where deemed necessary.</p> <p>Refer Section 6 for all (standard and additional) mitigation measures.</p> <p>Refer Section 7.2 for the noise and vibration monitoring plan. An OOHW monitoring will be undertaken as per the requirements of this CNVMP.</p>

EXAMPLE CNVIS

SYDNEY INTERMODAL TERMINAL ALLIANCE Construction Noise and Vibration Impact Statement (CNVIS)



SIMTA – Technical Report – CNVIS - XXX OOHW

SIMTA Reference:		Date:	Monday, 3 April 2017
Project Name:		Subject:	
Project Location:		Project Address:	
Client:		Reference:	
Prepared by:		Approved By:	
Sent to:		Copied to:	
Status:		Version:	

ID	Item	Description
1	Overview	<p>AN OVERVIEW OF THE PROJECT AND NECESSARY OOHW.</p> <p>---</p>
2	Methodology	<p>AN OVERVIEW OF THE ASSESSMENT METHODOLOGY.</p> <p>---</p> <p>To assess potential noise impacts associated with the proposed XXX Out-Of-Hours Work (OOHW) at the XXX, the following has been completed:</p> <ul style="list-style-type: none"> Determined the source noise emission (Sound Power Level, L_w) of the following equipment required for the out-of-hours work: XXX (L_w: XX dB); and XXX (L_w: XX dB). Predicted L_{Aeq, 15 minute} "mitigated" noise levels via a simplified project-specific construction noise model to calculate (ISO9613) noise levels at the closest and/or potentially most affected sensitive receptors situated in the vicinity of the XXX OOHW. These receptors are situated within the XXX area surrounding the site. The closest and/or potentially most affected sensitive receptor is located approximately XXX of the XXX construction site. To determine compliance, compared the predicted noise levels to project-specific noise management levels (NML) and existing ambient noise levels as identified in the XXX. Refer Table X in Section X of this technical report for this comparison. Qualitatively assessed potential impacts associated with construction road traffic noise based on the information that approximated XXX trucks per hour will visit the site during the XXX OOHW. Based on the outcomes of this assessment provided recommendations for noise mitigation and management measures for XXX to consider and implement during the XXX OOHW. <p>This noise assessment has been conducted to support the XXX OOHW, with due regard to and in accordance with the NSW Department of Environment and Climate Change – <i>NSW Interim Construction Noise Guideline</i> (ICNG), July 2009.</p> <p>All sound pressure levels (predicted noise levels) presented in this technical report are expressed in decibels (dB, re: 2 x 10⁻⁵ Pascals, Pa) with the "A-weighting" curve applied (represents human hearing). All sound power levels (L_w, source noise levels) are expressed in decibels (dB, re: 10⁻¹² Watts, W) with the "A-weighting" curve applied. Both sound pressure and power levels adopt the relevant L_{Aeq, 15 minute} statistical noise level parameter.</p>
3	Receptors	<p>A DESCRIPTION OF POTENTIALLY AFFECTED RECEPTORS.</p> <p>---</p> <p>The existing noise environment in the vicinity of the XXX OOHW for existing residential receptors is best described as 'urban'. Urban being an area with an acoustical environment that is dominated by 'urban hum', has through traffic with characteristically heavy and continuous traffic flows during peak periods; is near commercial districts or industrial districts; and has any combination of the above, where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.</p> <p>For certain receptors, the effect of traffic, urban hum or existing commercial/industrial noise may be reduced such that those areas are better described as 'suburban', being an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. Suburban areas often have decreasing noise levels in the evening and night and/or ambient noise levels defined by the natural environment and infrequent human activity.</p> <p>The following sensitive receptors were identified to be the closest and/or potentially most affected locations situated within the potential area of influence of the XXX OOHW, as presented in Table 1.</p>

SYDNEY INTERMODAL TERMINAL ALLIANCE
Construction Noise and Vibration Impact Statement (CNVIS)

ID	Item	Description																														
		<p>Table 1 – Receptor Locations (EXAMPLE ONLY)</p> <table border="1"> <thead> <tr> <th>Receptor ID</th><th>Residential Address</th><th>Approximate Distance from Site, metres</th><th>Direction from Site, compass point</th></tr> </thead> <tbody> <tr> <td>NCA1</td><td>15 Lara Court, Wattle Grove</td><td>600</td><td>E</td></tr> <tr> <td>NCA2</td><td>6 Namoi Court, Wattle Grove</td><td>900</td><td>NE</td></tr> <tr> <td>NCA3</td><td>2 Rushton Place, Casula</td><td>220</td><td>W</td></tr> <tr> <td>NCA4</td><td>14 Goodenough Street, Glenfield</td><td>750</td><td>SW</td></tr> </tbody> </table> <p>INCLUDED AS AN EXAMPLE – RECEPTORS MAY CHANGE DEPENDING ON LOCATION OF WORKS.</p> <p>These locations were established based on review of the SIMTA Stage 1 - Noise and Vibration Impact Assessment (NVIA), a review of aerial photography and the results of preliminary noise modelling, where receptor positions were optimised to ensure representative worst-case levels were being predicted. These locations do not represent all receptors located in the vicinity of the XXX OOHV but have been selected for the purposes of this noise impact assessment; they are considered to be representative of locations that will potentially experience the highest impacts associated with the XXX OOHV.</p>	Receptor ID	Residential Address	Approximate Distance from Site, metres	Direction from Site, compass point	NCA1	15 Lara Court, Wattle Grove	600	E	NCA2	6 Namoi Court, Wattle Grove	900	NE	NCA3	2 Rushton Place, Casula	220	W	NCA4	14 Goodenough Street, Glenfield	750	SW										
Receptor ID	Residential Address	Approximate Distance from Site, metres	Direction from Site, compass point																													
NCA1	15 Lara Court, Wattle Grove	600	E																													
NCA2	6 Namoi Court, Wattle Grove	900	NE																													
NCA3	2 Rushton Place, Casula	220	W																													
NCA4	14 Goodenough Street, Glenfield	750	SW																													
4	Results and Findings	<p>PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS.</p> <p>---</p> <p>The predicted LAeq,15 minute “mitigated” noise levels are compared to the project-specific noise management levels and existing ambient noise levels in Table 2.</p> <p>Table 2 – Predicted Noise Levels and Comparison to Criteria</p> <table border="1"> <thead> <tr> <th>Receptor ID</th><th>Predicted Noise Level Leq, 15 minute</th><th>Noise Management Level (NML) Leq, 15 minute</th><th>Existing Ambient Noise Level Leq, period</th><th>Comparison to NML Leq, 15 minute</th><th>Comparison to Leq, period</th></tr> </thead> <tbody> <tr> <td>NCA1</td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>NCA2</td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>NCA3</td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>NCA4</td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table> <p>General Discussion: XXX</p> <p>Assessment Outcomes: Some noise from construction sites is inevitable, such that the ICNG focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels. These results identify that best-practice construction noise mitigation and management measures will be required to reduce noise levels as far as practicable. These will need to be implemented in conjunction with community and stakeholder consultation and notification processes. Suitable recommendations are Provided in Section 5 of this report.</p>	Receptor ID	Predicted Noise Level Leq, 15 minute	Noise Management Level (NML) Leq, 15 minute	Existing Ambient Noise Level Leq, period	Comparison to NML Leq, 15 minute	Comparison to Leq, period	NCA1						NCA2						NCA3						NCA4					
Receptor ID	Predicted Noise Level Leq, 15 minute	Noise Management Level (NML) Leq, 15 minute	Existing Ambient Noise Level Leq, period	Comparison to NML Leq, 15 minute	Comparison to Leq, period																											
NCA1																																
NCA2																																
NCA3																																
NCA4																																
5	Recommendations	<p>RECOMMENDATIONS BASED ON SECTION 4 RESULTS AND THE REQUIREMENTS OF CNVMP, INCLUDING THE OOHV PROTOCOL.</p> <p>---</p>																														
6	Conclusion and Contact	<p>CONCLUSIONS AND CONTACT INFORMATION.</p> <p>---</p>																														
AUTHORISATION																																
Signature:																																
Name:																																
Title:																																
Date:																																

APPENDIX C

Evidence of Consultation

From:

Sent:

Thursday, 22 December 2016 11:40 AM

To:

Cc:

Subject:

CEMP and Sub-plan Consultation - Moorebank Precinct East Stage 1 -
IMEX

Hi,

Thank you for your time on the phone today. As discussed, we would like to submit the CEMP and sub-plans for MPE Stage 1 – IMEX to you in January for consultation. Please let me know if you have any queries. I will be in touch at the beginning of January to confirm dates for submission.

Many thanks and have a great Christmas.

From:
Sent: Monday, 20 February 2017 11:41 AM
To:
Subject: FW: Moorebank Precinct East Stage 1 (IMEX): Construction documentation for your review

From:
Sent: Friday, 27 January 2017 8:33 AM
To:
Subject: RE: Moorebank Precinct East Stage 1 (IMEX): Construction documentation for your review

Dear,

Thanks for your consultation dated 25 January 2017 as per the email below to the NSW Environment Protection Authority (EPA) to review and provide comments on the project's management plans developed for the Moorebank Precinct East Stage 1 Approved Project as follows:

- Construction Environmental Management Plan;
- Construction Noise and Vibration Management Plan;
- Construction Air Quality Management Plan; and
- Construction Soil and Water Management Plan.

I understand that a condition of planning approval requires you to consult with the EPA concerning the above management plans.

While the EPA encourages the use of environmental management plans and the like as an effective project management tool, it does not review or endorse them for reasons of maintaining regulatory 'arms length', and therefor EPA will not review or provide comments on any of the above management plans.

Please do not hesitate to contact me should you have any further questions.

Regards



From:
Sent: Wednesday, 25 January 2017 4:56 PM
To:
Subject: FW: Moorebank Precinct East Stage 1 (IMEX): Construction documentation for your review

Dear,

I tried calling your office phone this afternoon but unfortunately could not get hold of you. I am writing to provide you with information regarding your opportunity to provide input for upcoming Construction Environmental Management Plans (and associated sub-plans) for the Moorebank Precinct East Stage 1 Approved Project (IMEX terminal construction), being prepared by SIMTA.

As a condition of approval, we are required to consult with the EPA to consider comments you may have for the preparation of the following construction documentation:

- CEMP
- Construction Noise and Vibration Management Plan
- Construction Air Quality Management Plan
- Construction Soil and Water Management Plan

This email is to initiate this consultation process, and to inform you that we will be providing you with draft copies of the above documents for your comment during next week. You will have two (2) weeks from the date sent to make comment on the documents provided.

Further information on this Project, including the project location and description, can be found in the Environmental Impact Statement (EIS) through the Department of Planning's Major Projects website http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6766.

Please do not hesitate to contact me (either in the office or on my mobile) should you have any questions regarding the above.

Kind regards,

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

APPENDIX D

Information document – Impact Roller Vibration Measurements for vibration site law validation (SLR Consulting, 2015)

25 March 2015

610.14971 Site Law 20150325

Attention:

Dear

**Vibration Site Law
Captain Cook Drive, Kurnell
17 March 2015**

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) was engaged by LandPac Technologies Pty Ltd (LandPac) to undertake impact roller vibration measurements at Captain Cook Drive, Kurnell on 17 March 2015.

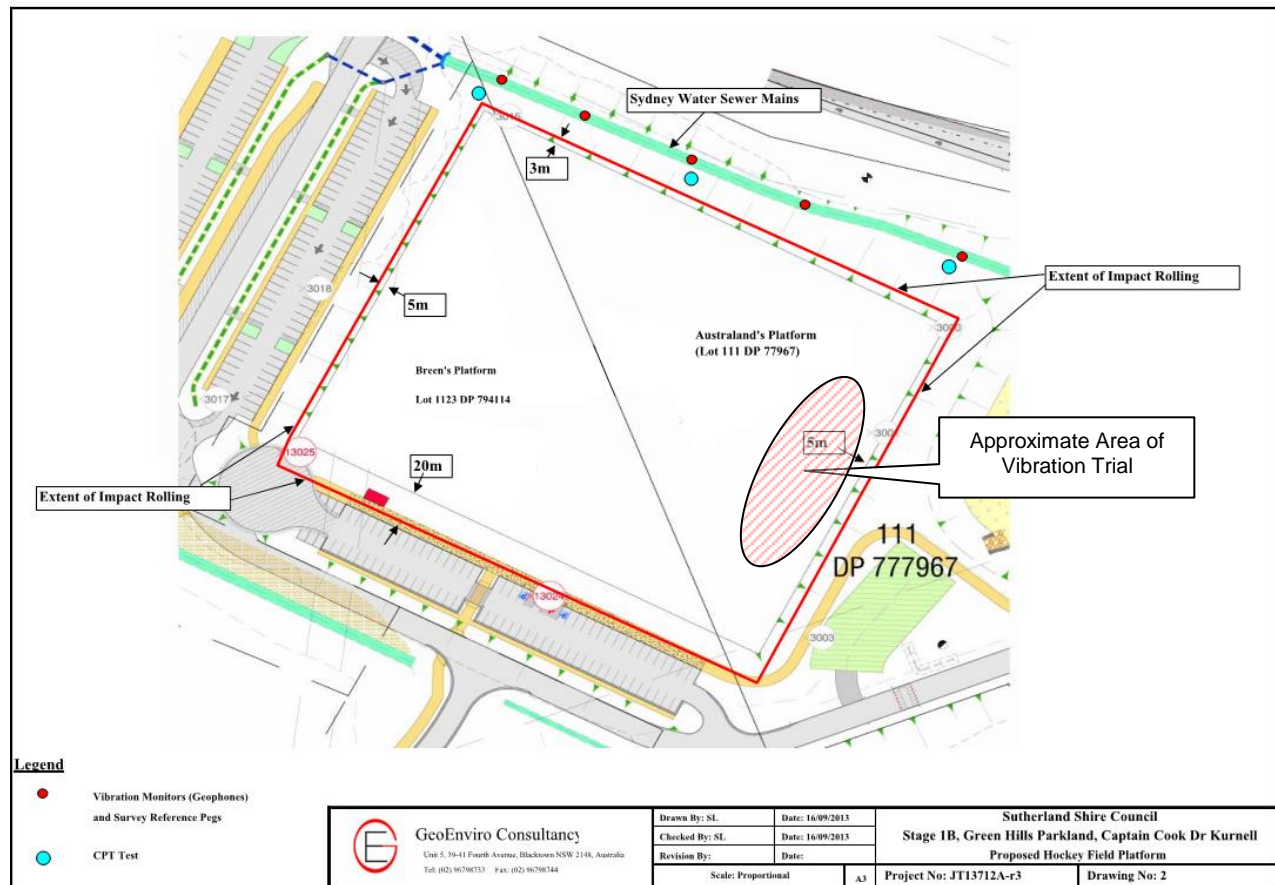
The purpose of this assessment was to establish a site specific vibration site law in order to determine the allowable impact roller distance in relation to the potential to cause vibration induced damage to nearby Sydney Water sewer mains.

2 Site Description and Work Operations

Soil compaction works were conducted in the trial area using a three-sided impact roller. Vibration measurements were carried out in the ground at various offset distances from the impact rolling works.

The area of impact rolling and Sydney Water sewer mains are shown in **Figure 1**.

Figure 1 Site Area



3 Vibration Damage Criteria

In terms of the most recent relevant vibration damage criteria for evaluating the effects of transient vibration on buried pipework, German Standard DIN 4150 Part 3 -1999 “*Structural Vibration - Part 5.3: Effects on Buried Pipework*” provides the guideline values reproduced in **Table 1**.

Table 1 Vibration Guideline Values for Buried Pipework

Pipe Material	Guideline Values for Velocity Measured on the Pipe
Steel (including welded pipes)	100 mm/s
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80 mm/s
Masonry, plastic	50 mm/s

It should be noted that the guideline values above refer to velocity measured on the pipe. Appendix D.1 of the Standard states that where it is difficult to measure vibration on the pipe itself, such as in this case, measurements can be made on the ground surface. Furthermore that “*vibration measured on the ground surface is usually greater than that measured directly on pipes.*”

Additionally, the guideline values relate to transient vibration, which does not give rise to resonant responses in structures and/or is not likely to induce fatigue failure of the structure. Subclause 6.3 of the Standard states that where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, then the guide values may need to be reduced by up to 50%. It should be noted that impact rolling works are not generally considered to have the potential to cause dynamic loading in buried pipework.

For “clay, concrete, reinforced concrete, pre-stressed concrete and metal” pipelines, the guideline value of 80 mm/s is recommended.

Where vibration measurements cannot be undertaken directly on the pipe, the vibration measurements can be undertaken in the ground immediately adjacent to the pipeline or on the ground surface above the pipeline. The criterion nominated above would still apply to the measured level. It is noted that this approach is likely to be conservative since it does not take into account the likely lower (attenuated) vibration levels to be expected on the pipe structure.

Notwithstanding the above, it is noted that the site “*Earth Management Plan*” (prepared by GeoEnviro Consultancy Pty Ltd, September 2013) have nominated a vibration control criterion of 10 mm/s.

4 Vibration Measurements

Soil compaction works were conducted in the trial area using a three-sided impact roller. Operator-attended vibration measurements were undertaken in the ground at a number of offset distances from the impact roller operations. During each passby of the impact roller, the highest vibration level was recorded as the impact roller was at the nearest point to the vibration monitor.

5 Vibration Monitoring Results

Figure 2 presents the maximum orthogonal vibration levels measured at all measurement locations at various offset distances from the three-sided impact roller. The maximum vibration trendline versus distance (site law) for the measured data is also shown.

Figure 3 presents the same data on a log-log plot for easier interpretation. The percentage probability exceedance levels are also shown.

Figure 2 Site Law for Impact Roller Trials – Linear Scale

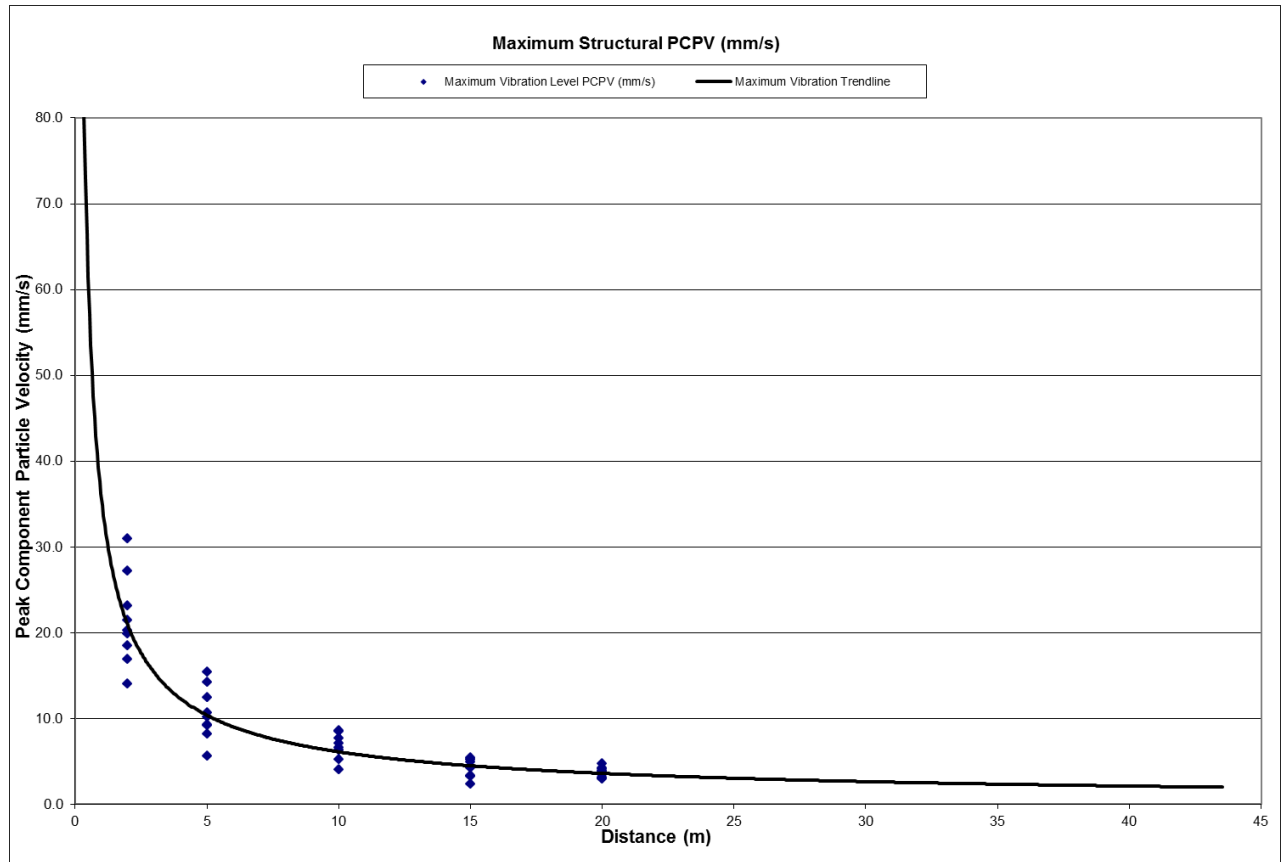
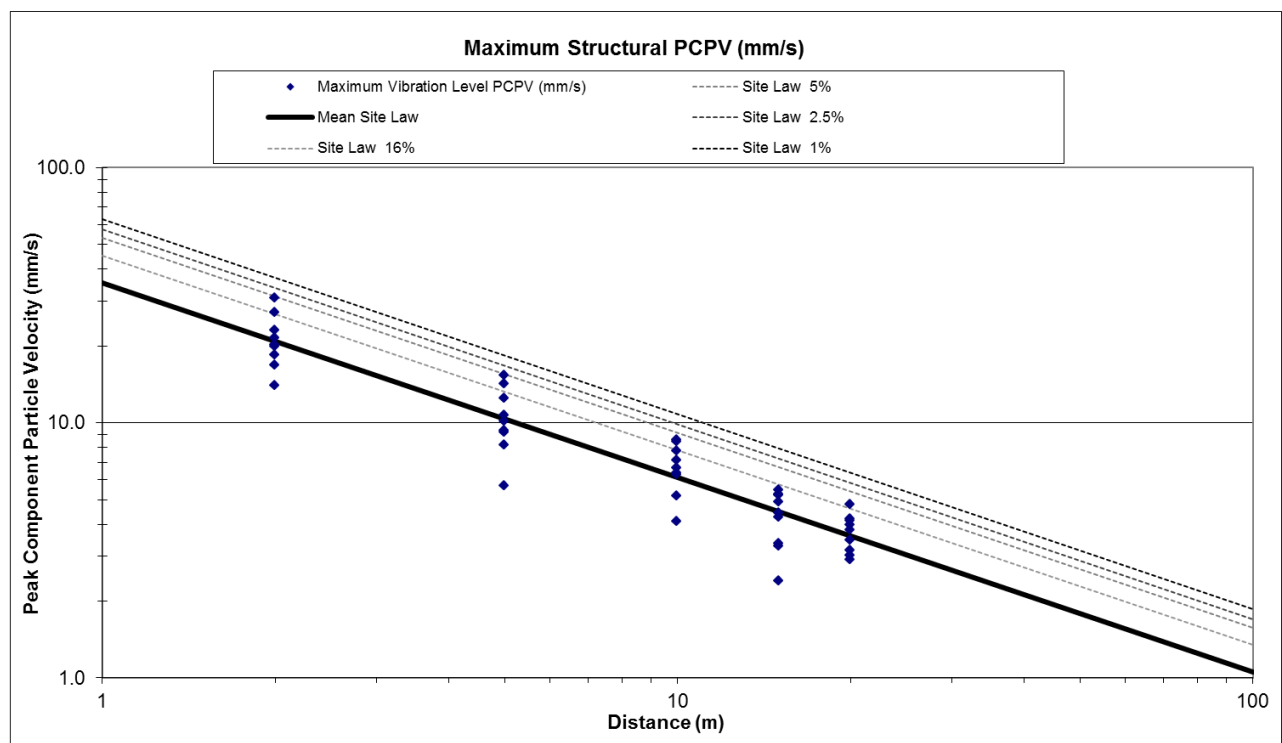


Figure 3 Site Law for Impact Roller Trials – Logarithmic Scale



6 Vibration Impact Assessment

It is noted that the vibration trial was conducted in ground which was denser than the loose sand in which the Sydney Water sewer mains are located. As such, it is expected that an amplification factor of up to 2 may be applied to the site law presented above.

Based on the above information and the 1% vibration level exceedance site law developed for the subject works and the criteria presented in **Section 3**, the three-sided impact roller can safely be operated at distances greater than 24 m from the Sydney Water sewer mains.

7 Conclusion

Vibration measurements were undertaken at Captain Cook Drive, Kurnell during impact rolling works conducted on 17 March 2015.

Based on the vibration site law the three-sided impact roller can safely operate at distances greater than 24 m away from the Sydney Water sewer mains.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 9427 8100.

Yours sincerely