

CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

Document and Revision History

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Revisions

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6	24/06/2022	Response to AA comments	Rachael Labruyere	Mira Segaran	James Renwick
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9	30/09/2022	Response to comments/update of appendices	Mira Segaran	Rachael Labruyere	James Renwick

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Terms and definitions

Terms	Explanation
AA	Acoustic Advisor
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
ARTC	Australian Rail Track Corporation
Attenuation	The reduction in the level of sound or vibration.
BRD	Botany Rail Duplication
CCS	Community Communications Strategy
CEMP	Construction Environmental Management Plan
CNVIS	Construction Noise and Vibration Impact Statement
CNVMP	Noise and Vibration CEMP Sub-plan (this document)
CoA	The Minister's Conditions of Approval for the CSSI
Construction Ancillary facility	A temporary facility for construction of the CSSI including an office and amenities compound, construction compound, material crushing and screening plant, materials storage compound, maintenance workshop, testing laboratory and material stockpile area
CSSI	Critical State Significant Infrastructure
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence under the POEO Act
ER	Environmental Representative for CSSI
Feasible and reasonable	Consideration of best practice accounting for the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, considering mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.
Highly noise intensive works	Works which are defined as annoying under the ICNG being: use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work; grinding metal, concrete or masonry; rock drilling; line drilling; vibratory rolling; bitumen milling or profiling; jackhammering, rock hammering or rock breaking; and impact piling.
HSEMS	Health Safety Environmental Management System
ICNG	Interim Construction Noise Guideline, NSW Department of Environment and Climate Change, July 2009
John Holland	John Holland Pty Limited
$L_{Aeq(15min)}$	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community.
$L_{A(max)}$	the A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter.
LGA	LGA Local Government Area
Minister, the	Minister, the NSW Minister for Planning

Terms	Explanation
NCA	NCA Noise Catchment Area
NML	NML Noise Management Level
NPfI	NSW Environment Protection Authority Noise Policy for Industry 2017
OOHW	OOHW Out of Hours Works
OSR	Other sensitive receivers
PEM	PEM Project Environment Manager
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
Rail Possession	A period of time during which a rail line is blocked to trains to permit work to be carried out on or near the line.
RBL	The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period (day, evening and night)
Relevant Council(s)	Bayside Council
RMMs	Revised Mitigation Measures
RNP	RNP NSW Department of Environment, Climate Change and Water – NSW Road Noise Policy 2011
Sensitive land uses	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, and retail spaces), and others as identified by the Planning Secretary.
Seven day rolling period	Seven day rolling period Refers to the period of time that includes the previous six days and the ending date of the period.
SWP	Sound Power Level
SPL	Sound Pressure Level
SSI	SSI State Significant Infrastructure
TfNSW	Transport for New South Wales
the Project	the Project Botany Rail Duplication

Compliance matrix

Minister's Conditions of Approval

CoA	Condition Requirement	Location in document
A5	<p>Where the terms of this approval require a document or monitoring program to be prepared or a review to be undertaken in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Planning Secretary with the document. The evidence must include:</p> <p>(a) documentation of the engagement with the party identified in the condition of approval that has occurred before submitting the document for approval;</p> <p>(b) a log of the dates of engagement or attempted engagement with the identified party and a summary of the issues raised by them;</p> <p>(c) documentation of the follow-up with the identified party where engagement has not occurred to confirm that they do not wish to engage or have not attempted to engage after repeated invitations;</p> <p>(d) outline of the issues raised by the identified party and how they have been addressed; and</p> <p>(e) a description of the outstanding issues raised by the identified party and the reasons why they have not been addressed..</p>	Section 3.4.1
A16	<p>Before establishment of a major construction ancillary facility(ies) (excluding minor construction ancillary facilities established under Condition A18), the Proponent must prepare a Site Establishment Management Plan which outlines the environmental management practices and procedures to be implemented for the establishment of the construction ancillary facility(s). The Site Establishment Management Plan must be prepared in consultation with the relevant council and government authorities. The Plan must be submitted to the ER for approval one (1) month before the establishment of any major construction ancillary facility(ies). The Site Establishment Management Plan must detail the management of the establishment of ancillary facilities and include:</p> <p>(a) a description of activities to be undertaken during establishment of the facility (including scheduling and duration of works to be undertaken at the site);</p> <p>(b) figures illustrating the proposed operational site layout;</p> <p>(c) a program for ongoing analysis of the key environmental risks arising from the site establishment activities described in subsection (a) of this condition, including an initial risk assessment undertaken prior to the commencement of site establishment works;</p> <p>(d) details of how the site establishment activities described in subsection (a) of this condition will be carried out to: (i) meet the performance outcomes stated in the documents listed in Condition A1, and (ii) manage the risks identified in the risk analysis undertaken in subsection (c) of this condition; and</p> <p>(e) a program for monitoring the performance outcomes, including a program for construction noise monitoring consistent with the requirements of Condition C9. Nothing in this condition prevents the Proponent from preparing individual Site Establishment Management Plans for each major construction ancillary facility.</p>	<p>Section 6.2</p> <p>Section 2.2 and Section 2.4 of CEMP</p>
A17	<p>The use of a major construction ancillary facility for construction must not commence until the CEMP required by Condition C1, relevant CEMP Sub-plans required by Condition C4 and relevant Construction Monitoring Programs required by Condition C9 have been approved by the ER.</p>	Section 2.4 of the CEMP
A18	<p>Lunch sheds, office sheds, portable toilet facilities, material storage, parking and the like, can be established and used where they satisfy the following criteria: (a) are located within the Construction Boundary; and (b) have been assessed by the ER to have - (i) minor amenity impacts to surrounding residences and businesses, after consideration of matters such as compliance with the Interim Construction Noise Guideline (DECC, 2009), traffic and access impacts, dust and odour impacts, and visual (including light spill) impacts, and (ii) minor environmental impact with respect to waste management and flooding, and (iii) no impacts on biodiversity, soil and water, and heritage items beyond those already approved under other terms of this approval.</p>	Section 5.2, Section 6.2.1
A19	<p>Boundary screening must be erected around major construction ancillary facilities that are adjacent to sensitive receivers for the duration of construction unless otherwise agreed with the relevant council, and adjacent residents, business operators or landowners.</p>	Section 6.2.2 and CNVIS
A20	<p>Boundary screening required under Condition A19 of this approval must minimise visual, noise and air quality impacts on adjacent sensitive receivers</p>	Section 7 CEMP Section 2.4

CoA	Condition Requirement	Location in document						
C4	CEMP Sub-plans must be prepared in consultation with the relevant government agency(ies) and council(s) as identified for each CEMP Sub-plan in Table 3.	Section 3.4.1 CEMP Section 3.1						
C5	The CEMP Sub-plans must state how: (a) the environmental performance outcomes identified in the documents listed in Condition A1 as modified by these conditions will be achieved; (b) the mitigation measures identified in the documents listed in Condition A1 as modified by these conditions will be implemented; (c) the relevant terms of this approval will be complied with; and (d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.	Section 2.3 and Section 5 Section 7.1, Section 7.4 and Section 7.5 This matrix and Section 8 Section 3.4.3, Section 6 and Section 7						
C7	Details of all information requested by an agency to be included in a CEMP Sub-plan as a result of consultation, including copies of all correspondence from those agencies, must be provided with the relevant CEMP Sub-Plan.	CEMP Section 3.3						
C8	Construction must not commence until the CEMP and all CEMP Sub-plans have been approved by the ER and must be implemented for the duration of construction. Where construction of the CSSI is staged, construction of a stage must not commence until the CEMP and sub-plans for that stage have been approved by the ER.	CEMP Section 3						
C9	The Construction Monitoring Programs set out in Table 5 must be prepared and implemented to enable comparison of the actual construction performance against the predicted performance. The Construction Monitoring Programs must be prepared in consultation with the relevant government agencies and councils as identified for each Construction Monitoring Program.	APPENDIX A						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 35%;">Required Construction Monitoring Programs</th> <th style="width: 60%;">Relevant government agencies to be consulted for each Construction Monitoring Program</th> </tr> </thead> <tbody> <tr> <td>(c)</td> <td>Noise and Vibration</td> <td>Pipeline operator</td> </tr> </tbody> </table>		Required Construction Monitoring Programs	Relevant government agencies to be consulted for each Construction Monitoring Program	(c)	Noise and Vibration	Pipeline operator	
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(c)	Noise and Vibration	Pipeline operator						
C10	Each Construction Monitoring Program must provide: (a) details of baseline data available; (b) details of baseline data to be obtained and when; (c) details of all monitoring of the project to be undertaken; (d) the parameters of the project to be monitored; (e) the frequency of monitoring to be undertaken; (f) the location of monitoring; (g) procedure for the timing and frequency reporting of monitoring and analysis against relevant criteria, including details of the timing and frequency for reporting results to the ER, the Planning Secretary and relevant government agencies; (h) details of the methods that will be used to analyse the monitoring data; (i) procedures to identify and implement additional mitigation measures where results of monitoring identify unexpected impact; and (j) any consultation to be undertaken in relation to the monitoring programs.	APPENDIX A Section 4 and A.4 Section 4 and A.4 Section 8.3 Section A.5 and A.6 Section A.5 and A.6 Section A.5 and A.6 Section A.5, A.6 and A.7 Section A.7 Section A.7						
C11	The Construction Monitoring Programs must be submitted to the ER for approval at least one (1) month before the commencement of construction.	Section A.1						
C12	Construction, which is required to be monitored under the Construction Monitoring Programs, must not commence until the Construction Monitoring Programs have been approved by the ER, and all relevant baseline data for the specific construction activity has been collected.	Section A.1 CEMP Section 3						
C13	The Construction Monitoring Programs, as approved by the ER must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.	Section A.1 CEMP Section 3 and Table 3-3						
C14	The results of the Construction Monitoring Programs must be made publicly available in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.	Section A.7.6						

CoA	Condition Requirement	Location in document
C15	<p>The Noise and Vibration Monitoring Program must include:</p> <p>(a) noise and vibration monitoring at agreed representative locations in consultation with the AA adjacent to the construction to confirm construction noise and vibration levels; and</p> <p>(b) for the purposes of (a), noise monitoring during the day, evening and night-time periods must be undertaken within the first month of construction and must cover the range of activities being undertaken at the sites.</p>	Section 8.3, Section A.5.6 and A.6
E14	<p>Construction Hours</p> <p>Work must only be undertaken during the following standard construction hours:</p> <p>(a) 7:00am to 6:00pm Mondays to Fridays, inclusive;</p> <p>(b) 8:00am to 1:00pm Saturdays; and</p> <p>(c) at no time on Sundays or public holidays.</p>	Section 5.1
E15	<p>Notwithstanding Condition E14, work may be undertaken between 1:00 pm to 6:00 pm on Saturday.</p>	Section 5.1
E16	<p>Variation to work hours</p> <p>Notwithstanding Conditions E14, E15 and E19 work may be undertaken outside the hours specified in the following circumstances:</p> <p>(a) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or</p> <p>(b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or</p> <p>(c) an approval has been obtained for a controlled activity under the Airports Act 1996; or</p> <p>(d) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or</p> <p>(e) work approved under an Out-of-Hours Work Protocol for work not subject to an EPL as required by Condition E29; or</p> <p>(f) construction that causes LAeq(15 minute) noise levels:</p> <p style="margin-left: 20px;">(i) no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009), and</p> <p style="margin-left: 20px;">(ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, and</p> <p style="margin-left: 20px;">(iii) continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), and</p> <p style="margin-left: 20px;">(iv) intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006); or</p> <p>(g) negotiated agreements with directly affected residents.</p> <p><small>Note: Section 5.24(1)(e) of the EP&A Act requires that an EPL be substantially consistent with this approval.</small></p>	Section 5.1
E17	<p>On becoming aware of the need for emergency works in accordance with Condition E16, the Proponent must notify the AA, ER and the EPA (if an EPL applies) of the need for that work. The</p> <p>Proponent must use best endeavours to notify all noise and/or vibration affected occupants of sensitive land uses of the likely impact and duration of those works.</p>	Section 7.4.1

CoA	Condition Requirement	Location in document
E18	<p>Except as permitted by an EPL, out-of-hours work that may be regulated through the Out of Hours Work Protocol as per Condition E28 includes, but is not limited to:</p> <ul style="list-style-type: none"> (a) carrying out work that, during standard hours, would result in a high risk to construction personnel or public safety, based on a risk assessment carried out in accordance with AS/NZS ISO 31000:2009 "Risk Management"; or (b) where the relevant road authority has advised the Proponent in writing that carrying out the work during standard hours would result in a high risk to road network performance and a road occupancy licence will not be issued; or (c) where the relevant utility service operator has advised the Proponent in writing that carrying out the work during standard hours would result in a high risk to the operation and integrity of the utility network; or (d) where an approval is required for a controlled activity in accordance with the Airports Act 1996; or (e) work undertaken in a rail possession for operational or safety reasons. <p>Note: Other out-of-hours works can be undertaken with the approval of an EPL, or through the project's Out-of-Hours Work Protocol for works not subject to an EPL.</p>	Section 7.4.2
E19	<p>Highly Noise Intensive Work</p> <p>Except as permitted by an EPL or approved through the Out of Hours Work Protocol in Condition E29, highly noise intensive work must only be undertaken:</p> <ul style="list-style-type: none"> (a) between the hours of 8:00 am to 6:00 pm Monday to Friday; (b) between the hours of 8:00 am to 1:00 pm Saturday; and (c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour between each block where the work is likely to impact the same noise sensitive receivers. <p>For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.</p> <p>Note: This condition does not prevent a negotiated agreement being reached with affected sensitive receivers as per Condition E16.</p>	Section 5.1
E20	<p>Construction Noise – Coordination</p> <p>The Proponent must consult with proponents or applicants of other State Significant development and infrastructure within 200 metres of the CSSI and take reasonable steps to coordinate work, including utility work, to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers.</p>	Section 3.4 and 7.4.3
E21	<p>All work undertaken for the delivery of the CSSI, including those undertaken by third parties (such as utility relocations), must be coordinated to ensure respite is provided. The Proponent must:</p> <ul style="list-style-type: none"> (a) reschedule any work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with Condition E26; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the AA and ER in support of any decision made by the Proponent in relation to respite or mitigation. 	Section 3.4 and 7.4.3
E22	<p>Noise generating work in the vicinity of potentially affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the relevant NML must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.</p>	Section 3.4 and 7.4.3

CoA	Condition Requirement	Location in document
E23	<p>Noise and Vibration Mitigation</p> <p>Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <ul style="list-style-type: none"> (a) construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009); (b) vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure); (c) Australian Standard AS 2187.2 - 2006 "Explosives - Storage and Use - Use of Explosives"; (d) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and (e) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration-effects of vibration on structures (for structural damage). <p>Any work identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan.</p> <p><small>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. Mitigation measures must provide ongoing mitigation for construction noise</small></p>	Section 5, 6, 7 and 8
E24	<p>Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before works that generate vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owners and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Sub-plan.</p>	Section 1
E25	<p>The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to be retained and protected, to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.</p>	Section 8.3.2
E26	<p>Construction Noise Mitigation - Respite</p> <p>The Proponent must provide respite* for sensitive land uses where work is undertaken outside hours specified in Condition E14 and E15 and exceeds the NML by 25 dB(A) or are greater than 75 dB(A) ($L_{Aeq}(15 \text{ min})$), whichever is the lesser at the façade of the building of a residential receiver.</p> <p>(The noise level must be reduced by 5dB where the noise contains annoying characteristics and increased by 10dB if the property has been treated or offered at-property noise treatment)</p> <p><small>Note * respite can be any combination of days or hours where out of hours work would not be more than 5dB(A) above the rating background level at any residence.</small></p>	Section 3.4 and 7.4.3
E27	<p>Out of Hours Work – Community Consultation on Respite</p> <p>In order to undertake work outside hours specified in Condition E14 and E15, the Proponent must identify appropriate respite* required by Condition E26, and/or additional mitigation measures required by Condition E28, for out-of-hours work in consultation with the community at each affected location on at least a 3 monthly basis. This consultation must include (but not be limited to) providing the community with a three-monthly forward schedule of likely out of hours works.</p> <p>The schedule must include:</p> <ul style="list-style-type: none"> (a) an indicative schedule of likely out-of-hours work for a period no less than three (3) months; (b) a description of the potential work, location and duration; (c) the noise characteristics and likely noise levels of the work; and (d) likely mitigation and management measures to be implemented and/or offered. <p>The outcomes of the community consultation (including any agreed alternative arrangements), the identified respite periods and the scheduling of the likely out-of-hour works must be provided to the AA, ER and EPA.</p> <p><small>Note * respite periods can be any combination of days or hours where out of hours works would not be more than 5dB(A) above the rating background level at any residence.</small></p>	Section 3.4 and 7.4.3

CoA	Condition Requirement	Location in document
E28	<p>Out of Hours Work –Mitigation</p> <p>Additional mitigation measures such as temporary alternative accommodation or other agreed mitigation measure, must be offered/ made available to residents affected by out-of-hours work (including where utility work is being undertaken for the project) where the construction noise levels, between:</p> <p>(a) 10:00 pm and 7:00 am, Monday to Friday;</p> <p>(b) 10:00 pm Saturday to 8:00 am Sunday; and</p> <p>(c) 6:00 pm Sunday and public holidays to 7:00 am the following day unless that day is Saturday then to 8:00am,</p> <p>are predicted to exceed the NML by 25 dB(A) or are greater than 75 dBA ($L_{Aeq(15\ min)}$), whichever is the lesser and the impact is planned to occur for more than two (2) nights over a seven (7) day rolling period.</p> <p>The NML must be reduced by 5 dB where the noise contains annoying characteristics and increased by 10 dB if the property has been treated or offered at-property noise treatment. The noise levels and duration requirements identified in this condition may be changed through an EPL applying to the CSSI.</p>	Section 7.4.4 and 7.5
E29	<p>Out-of-Hours Work Protocol – Work not subject to an EPL</p> <p>An Out-of-Hours Work Protocol must be prepared to describe the process for the consideration, management and approval of work which is outside the hours defined in Conditions E14 and E15 and E19 and that is not subject to an EPL. The Protocol must be approved by the Planning Secretary before commencement of out of hours work. The Protocol must be prepared in consultation with the AA. The Protocol must:</p> <p>(a) provide a process for the consideration of out-of-hours work against the relevant noise management level and vibration criteria (including ground-borne noise), including the determination of low and high-risk activities;</p> <p>(b) provide a process for the identification of mitigation measures for residual impacts, including respite periods in consultation with the community at each affected location, consistent with the requirements of Condition E26 and E27, and additional mitigation measures in accordance with Condition E28;</p> <p>(c) identify procedures to facilitate the coordination of out-of-hours works approved by an EPL to ensure appropriate respite is provided;</p> <p>(d) identify an approval process that considers the risk of activities, proposed mitigation, management and coordination, including where:</p> <p style="margin-left: 20px;">(i) low risk activities can be approved by the ER in consultation with the AA, and</p> <p style="margin-left: 20px;">(ii) high risk activities can be approved by the ER in consultation with the AA, and the approval provided to the Planning Secretary for information before work commences; and</p> <p>(e) identify arrangements to notify EPA and community for approved out of hours works, which may be detailed in the Communication Strategy.</p>	Refer to OOHW Protocol
E35	<p>The Proponent must identify the utilities and services (hereafter “services”) potentially affected by Construction to determine requirements for diversion, protection and/or support. The Proponent, in consultation with service providers, must ensure that disruption to services resulting from the Construction is avoided where possible. Where unavoidable, customers must be advised in accordance with the Communication Strategy required under Condition B1.</p>	Section 4.1, Appendix B
E36	<p>Before commencement of any construction, a structural engineer must undertake condition surveys of buildings, structures, utilities and the like that are identified in the Noise and Vibration CEMP Sub-Plan as being at risk of damage due to construction vibration unless as otherwise instructed or agreed to by the pipeline or utility operator. The results of the surveys or agreement with the pipeline or utility operator must be documented in a Condition Survey Report for each item at risk of damage. Copies of Condition Survey Reports must be provided to the owners of the items surveyed, and no later than one month before the commencement of construction.</p>	Section 7.3.2.1 and Section 7.3.2.2
E37	<p>After completion of construction, condition surveys must be undertaken by a structural engineer of all items for which condition surveys were undertaken in accordance with Condition E36. The results of the surveys must be documented in a Condition Survey Report for each item surveyed. Copies of Condition Survey Reports must be provided to the landowners of the items surveyed no later than three (3) months following the completion of construction.</p>	Section 7.3.2
E38	<p>The Proponent, where liable, must rectify any property damage caused directly or indirectly (for example from vibration or groundwater change) by the construction or operation of the CSSI at no cost to the owner unless otherwise agreed with owner.</p>	Section 7.3.2

Revised mitigation measures

REF	Revised mitigation measures	Location in document
CNV1	<p>Site EMPs will be prepared before any enabling works begin. Specific to the activities proposed, these plans will include:</p> <ul style="list-style-type: none"> • identification of nearby sensitive receivers • description of works, construction equipment and hours of work • mitigation measures that apply to the works proposed • criteria for the project and relevant licence and approval conditions • requirements for noise and vibration monitoring • details of how community consultation will be completed in accordance with the community and stakeholder engagement plan • details of how respite will be applied where ongoing high impacts are seen at certain receivers. <p>The requirement for enabling works out of hours will be described in the site EMPs to be approved by the independent Environmental Representative (ER). The Site EMPs will detail:</p> <ul style="list-style-type: none"> • the proposed activities and predict the potential noise impact against the relevant noise and vibration criteria • the relevant mitigation measures, including consideration of sleep disturbance and respite periods • the required community notification specific to the activities proposed. 	Site EMP (as required)
CNV2	<p>A CNVMP will be prepared as a sub plan to the CEMP before any main construction works begin. This will include:</p> <ul style="list-style-type: none"> • identification of nearby sensitive receivers • description of works, construction equipment and hours of work • criteria for the project and relevant licence and approval conditions • requirements for noise and vibration monitoring • details of how community consultation and notification will be completed • procedures for handling complaints • details on how respite will be applied where ongoing high impacts are seen at certain receivers. <p>The CNVMP will also consider cumulative construction impacts and the likelihood for 'construction fatigue' from consecutive projects in the area and ongoing operation and maintenance activities in the rail corridor, and define a suitable management approach. Quantitative road traffic noise impacts from temporary detours during construction would also be evaluated, especially for local roads with low existing volumes. Ongoing operation and maintenance activities of the existing rail corridor during the period of construction will be managed through ARTC's existing environmental management system</p>	<p>This Plan</p> <p>Section 4.1 CNVIS/Section 7.2/Section 5.1 Section 3.2 Section 8.3.1 Section 3.4.2 Section 8.4 Section 3.4.2 Section 3.4.3 Section 5.4</p>
CNV3	<p>Community consultation measures will be included in the CNVMP and community and stakeholder engagement plan, including periodic notification (monthly letterbox drop or equivalent) detailing all upcoming construction activities delivered to impacted sensitive receivers at least 14 days prior to commencement of relevant works.</p>	Section 3.4, Section 7.4.3 and Section 7.5.1
CNV4	<p>Unless subject to an Environment Protection License, an Out-of-Hours Work Protocol will be prepared and included as part of the CNVMP for main construction works. It will identify a process for the consideration, management and approval of works which are outside standard hours. The protocol will be prepared in consultation with the EPA and approved by the independent ER before the commencement of main construction works. The protocol will include processes for:</p> <ul style="list-style-type: none"> • the consideration of out of hours work against the relevant noise and vibration criteria • the identification of mitigation measures for residual impacts, including respite periods in consultation with the community at affected locations • consideration of the risk of activities, proposed mitigation, management and coordination for works outside of standard hours to be approved by the independent ER 	OOHW Protocol and Section 7.4.2

REF	Revised mitigation measures	Location in document
CNV5	Where feasible and reasonable, construction will be carried out during Standard Construction Hours. If it is not possible to restrict the works to daytime, then they will be scheduled so noise intensive equipment is not used after 11:00 pm, where possible, noting that there is a requirement for many of the works to be completed during possessions, and restrictions on working hours during these periods are generally not feasible.	Section 5.1
CNV6	Where noise intensive equipment is to be used near sensitive receivers, the works will be scheduled for Standard Construction Hours, where possible. If it is not possible to restrict the works to daytime then they will be scheduled so noise intensive equipment is not used after 11:00 pm, where feasible	Section 5.1
CNV7	Monitoring will be carried out at the start of noise and vibration intensive activities which are near to receivers to confirm that actual levels are consistent with the predictions. Where mitigation measures have been specified, the monitoring results should confirm their effectiveness.	Section 8.3.1 and Section A.5 and A.7.3
CNV8	Hoardings, or other shielding structures, will be used where receivers are near compounds or worksites with long-term works. To provide effective noise mitigation, the hoarding will break the line of sight from the nearest receivers to the works, where possible, and be of solid construction with minimal gaps. Hoarding for construction sites is typically around three metres in height.	Section 6.2.2/CNVIS
CNV9	Noise generating activities in compounds will be positioned away from receivers where possible. Items such as sheds can also be used to shield receivers from noise generated in other parts of the compound	Section 6.2.2/CNVIS
CNV10	Noise impacts are predicted for the compound between Banksia Street and Stephen Road due to the proximity of the nearest receivers. The use of this compound site during out of hours works associated with the road closures at Robey Street and O'Riordan Street will be avoided as far as practicable.	Section 6.2.2/CNVIS and Site Establishment Management Plan
CNV11	Where works are required within the minimum working distances and considered likely to exceed the cosmetic damage criteria: <ul style="list-style-type: none"> • different construction methods with lower source vibration levels will be investigated and implemented, where feasible • attended vibration measurements will be undertaken at the start of the works to determine actual vibration levels at the item. Works will be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria 	Section 7.3.2
CNV12	Building condition surveys will be completed before and after the works where buildings or structures, including heritage items, are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment. Appropriate criteria will be confirmed for each item before the works begin, based on the surveys	Section 7.3.2 and 7.3.2.1
CNV13	The potential human comfort impacts and requirement for vibration intensive works will be reviewed as the project progresses. Where receivers are within the human comfort minimum working distances, the impacts will be managed with the procedures defined in the CNVMP	Section 7.3.1 and A6
CNV14	The requirement for vibration intensive works near heritage items will be reviewed during detailed construction planning. Where heritage items are considered potentially sensitive to vibration impacts, the more stringent DIN 4150 Group 3 guideline values will be applied and monitoring will be completed when vibration intensive works are in close proximity. Condition surveys will be completed before and after the works where heritage items are within the minimum working distances and considered likely to exceed the cosmetic damage criteria.	Section 5.5.4 and Section 8.3.2.1
CNV15	The likelihood of cumulative or consecutive construction noise impacts will be reviewed during detailed design when detailed construction schedules are available. Coordination will occur between the various projects to minimise concurrent works (particularly concurrent out of hours work) in the same areas, where possible. Specific additional management and mitigation measures designed to address potential consecutive impacts will be developed and used to minimise the impacts as far as practicable, in consultation with the affected community	Section 3.4.3

REF	Revised mitigation measures	Location in document
CNV16	<p>All employees, contractors and subcontractors will receive an environmental induction. The induction must at least include:</p> <ul style="list-style-type: none"> • all relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on noise generating activities with special audible characteristics • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures 	Section 8.2
CNV17	<p>No swearing or unnecessary shouting or loud stereos/radios/phone calls on speaker and on site. No dropping of materials from height, throwing of metal items and slamming of doors. No unnecessary idling of vehicles near to receivers.</p>	Section 8.2 and CNVIS
CNV18	<p>Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored pile rather than impact-driven piles will minimise noise and vibration impacts</p>	Section 7.1 and CNVIS
CNV19	<p>Simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided. The offset distance between noisy plant and adjacent sensitive receivers will be maximised. Plant used intermittently will be throttled down or shut down. Noise-emitting plant will be directed away from sensitive receivers, where possible.</p>	Section 7.1 and CNVIS
CNV20	<p>Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site</p>	Section 7.1 and CNVIS
CNV21	<p>Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site as well as any out of hours work.</p>	Section 7.1 and CNVIS
CNV22	<p>Loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers. Site access points and roads will be selected as far as possible away from sensitive receivers. Dedicated loading/unloading areas will be shielded if close to sensitive receivers</p>	Section 7.1 and CNVIS
CNV23	<p>Where possible, noise from mobile plant will be reduced through additional:</p> <ul style="list-style-type: none"> • residential grade mufflers • damped hammers such as 'City' Model Rammer Hammers • Air Parking brake engagement is silenced. 	Section 7.1 and CNVIS
CNV24	<p>Stationary noise sources will be enclosed or shielded while ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding</p>	Section 7.1 and CNVIS
CNV25	<p>A CTTAMP will be prepared for the project to manage the haul routes and vehicle movements. Where construction routes are along local roads there is potential for impacts at the adjacent residential receivers, depending on the volume of construction traffic. The potential impacts will be managed using the following approaches:</p> <ul style="list-style-type: none"> • vehicle movements will be away from sensitive receivers and during less sensitive times, where possible • the speed of vehicles will be limited and will avoid the use of engine compression brakes • on-site storage capacity will be maximised to reduce the need for truck movements during sensitive times • heavy vehicles will be restricted from idling near residential receivers 	CTTAMP
CNV26	<p>Structures, such as site sheds, will be used to shield residential receivers from noise (where practicable), noting that upper floors of multi-storey buildings will be unlikely to benefit</p>	Section 7.1 and CNVIS

REF	Revised mitigation measures	Location in document
CNV27	<p>The assessment indicates there is potential for noticeable increases in road traffic noise for some receivers along the detours routes, such as Robey Street. Detours using this road are planned for up to 10 weekends (for closures to either Robey Street or O’Riordan Street) during construction of the project. The potential impacts would be reviewed as the project progresses using detailed traffic volume data. Where residential receivers are expected to be subject to a >2.0 dB nighttime increase during detours, the project would:</p> <ul style="list-style-type: none"> • consider the use of different detour routes that do not put traffic during the nighttime on roads with low existing volumes. Where this is not possible, the project would: • apply appropriate mitigation measures to the affected residential receivers, as agreed with the independent Environmental Representative (ER), based on the expected magnitude of the exceedance and the total duration of night-time impacts from all detours during construction of the project 	Section 5.4 and CNVIS
DNV1	<p>Sleep disturbance from consecutive night-time works</p> <p>The need for consecutive night-time works and likelihood for sleep disturbance impacts will be reviewed during detailed design. Where impacts are considered likely, appropriate noise mitigation will be developed which takes into consideration factors such as the existing facade performance of affected residential receivers.</p> <p>Appropriate respite will be provided to affected receivers to limit impacts from night-time works in the same location.</p>	Section 5.2.1.1 and Section 7.1/CNVIS
DNV2	<p>Potential noise impacts on hotels</p> <p>Further investigation will be completed during detailed design to determine appropriate criteria which take into account the existing facade performance of the affected hotels, noting that most of the hotels are of recent construction and are likely to have high performance facades.</p> <p>Prior to construction, all hotels within 50 metres of the project site will be consulted and assessed to determine their sensitivity to airborne and ground-borne noise impacts, existing facade performance, areas of permanent residence (if any) and to allow appropriate criteria and mitigation to be determined.</p>	Section 7.5/CNVIS
DNV3	<p>Potential vibration impacts on pipeline assets</p> <p>The project has the potential to impact a number of pipeline assets during construction. An assessment will be completed in detailed design which will:</p> <ul style="list-style-type: none"> • calculate the actual distance of the works from the structure • assess ground conditions and the effect this will have on vibration. <p>Where impacts are considered likely, the susceptibility of the various assets to vibration levels and appropriate monitoring and management protocols will be developed in consultation with the relevant owners. Condition surveys will be completed before and after the works where appropriate.</p>	Section 3.4
DNV4	<p>Noise impacts on the community</p> <p>In locations where ‘moderate’ or ‘high’ noise impacts are predicted, engagement with the affected communities will be outlined in the community and stakeholder engagement plan and undertaken during detailed design to determine their preference for mitigation and management measures.</p>	Section 7.4.3

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1 Introduction

1.1 Context

This Construction Noise and Vibration CEMP Sub-plan (CNVMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the construction of the Botany Rail Duplication Project (the Project).

This CNVMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA) and the environmental management measures listed in the Project's Environmental Impact Statement (EIS), the Response to Submissions on EIS and all applicable legislation and Australian Rail Track Corporation (ARTC) requirements.

1.2 Background and project description

The Project comprises a new second track typically within the existing Botany Line rail corridor between Mascot and Botany over a distance of three kilometres. Works will include construction of a new track, track realignment (slewing) and upgrading, construction of new rail crossovers, bridgeworks at Mill Stream, Southern Cross Drive, O'Riordan Street and Robey Street and construction of new embankment and retaining structures. The EIS assessed noise and vibration impacts on sensitive receivers and structures during construction and operation of the Project, within Chapter 9 and the Technical Report 2 – Noise and Vibration Impact Assessment, which formed part of the EIS).

The EIS identified the potential for noise and vibration impacts during construction which are dependent on the types of construction activity in progress and the proximity of works to sensitive receivers. However, it concluded any potential impacts could be managed by tailored mitigation and management measures, including construction noise and vibration monitoring.

Please refer to Section 2.2 of the CEMP for construction activities and the activities anticipated during the construction stage.

John Holland Pty Ltd (JH) was appointed by TfNSW as the construction contractor for the Project.

1.3 Scope of the Sub-Plan

The scope of this CNVMP is to describe how JH proposes to manage potential noise and vibration impacts during the construction of the Project. This CNVMP:

- Describes how the Project will achieve the environmental performance outcomes identified in the EIS, the Response to Submissions and the CoAs;
- Identifies noise and vibration mitigation and management measures that can be applied on-site to avoid or minimise noise and vibration impacts and how these would be implemented;
- Describes how JH will comply with the relevant terms of the Project Approval; and
- Outlines how issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.

This CNVMP applies to the construction of the Project, which includes:

- Track duplication – constructing a new track predominantly within the rail corridor for a distance of about three kilometres
 - Track realignment (slewing) and upgrading
 - Construction of four new rail crossovers to maintain and improve access at two locations
 - Construction of new bridge structures at Mill Stream, Southern Cross Drive, O’Riordan Street and Robey Street (adjacent to the existing bridges)
 - Re-construction of the existing bridge structures at Robey Street and O’Riordan Street
 - Construction of a new embankment and retaining structures adjacent to Qantas Drive between Robey and O’Riordan streets and a new embankment between the Mill Stream and Botany Road bridges
 - Other works as required to fulfil project objectives (for example, bi-directional signalling upgrades, drainage work and protecting/relocating utilities).
- Construction is anticipated to commence in January 2022. A detailed list of construction activities is provided in Section 2.2 and Figure 2-1 of the CEMP. An indicative schedule for works including location / access requirements and applicable works is provided in Section 2 of the CEMP.

Operational noise and vibration impacts and operational mitigation measures do not fall within the scope of this CNVMP and therefore are not included within the processes contained within this CNVMP.

1.4 Environmental management systems overview

The environmental management system is based on the John Holland Environmental Management System. The environmental management system overview is described in Section 4 of the CEMP.

2 Purpose of this document

2.1 Purpose

The purpose of this Plan is to describe how the JH proposes to manage potential noise and vibration impacts during the construction of the Project.

2.2 Objectives

The key objective of the CNVMP is to ensure all CoA, environmental management measures and licence/permit requirements relevant to noise and vibration are described, scheduled and assigned responsibility as outlined in the:

- Environmental Impact Statement (EIS) and Response to Submissions on EIS prepared for Botany Rail Duplication;
- Conditions of Approval for SSI 9714 granted to the project on 28 July 2020;
- Revised Mitigation Measures (RMM's), as detailed in the Response to Submissions report;
- The project specific environment protection licence (EPL21678) will be implemented on the project; and
- All relevant legislation and other requirements described in the Section 3 of this CNVMP.

2.3 Targets and environmental performance outcomes

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

- Ensure compliance with the relevant legislative requirements, CoA and RMMs;
- Meet EPL21678 requirements;
- Effective management of noise and vibration impacts during construction in accordance with the guideline documents summarised in Table 3.1;
- Ensure training is provided in the form of inductions to relevant Project personnel relating to noise and vibration issues before they begin work on site;
- Notify affected sensitive receivers of upcoming works and any out-of-hours works;
- Implement reasonably practicable measures to minimise noise and vibration impacts on surrounding residents, commercial and other sensitive receivers during construction;
- No exceedance of predicted noise and vibration impacts during construction of the Project because of Project works; and
- Address complaints in a timely and efficient manner.

The following performance outcomes relevant to noise and vibration (as identified in Chapter 24.4 Compilation of performance outcomes of the EIS) are detailed in Table 2.1 below.

Table 2.1: Noise and vibration performance outcomes (Construction)

Desired performance outcome	Target	How addressed
<p>Noise and Vibration – Amenity Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity.</p>	<p>Full compliance with predicted noise levels</p> <p>Noise management at source</p> <p>Noise management at the source-receiver transmission path</p> <p>Implement all reasonable and feasible noise and vibration mitigation measures with the aim of achieving the objectives in Section 5.</p>	<p>Construction noise and vibration impact statements (CNVIS) (see Section 6.2.2)</p> <p>Management reviews (see Section 12.4 CEMP)</p>
<p>Noise and Vibration – Structural Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage.</p>	<p>No damage from vibration generated by the Project works to buildings and items including Aboriginal places and environmental heritage</p> <p>Vibration management at source</p> <p>Vibration management at the source to receiver transmission path</p>	<p>Construction noise and vibration impact statements (CNVIS) (see Section 6.2.2)</p> <p>Management reviews (see Section 12.4 CEMP)</p>

3 Legal and other requirements

3.1 Relevant legislation

3.1.1 Legislation

All legislation relevant to this CNVMP is summarised in Section 6.3 and further detailed in Appendix J of the CEMP.

3.1.2 Guidelines

The main guidelines, standards and policy documents relevant to this Plan are summarised in Table 3.1.

Table 3.1: Construction Noise and Vibration Guidelines

Guideline/ Policy name
NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
NSW Road Noise Policy (RNP), Dept. of Environment, Climate Change and Water 2011
NSW Noise Policy for Industry (NPfI), Environment Protection Authority 2017
NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
Australian Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors
Australian Standard AS2834-1995 Computer Accommodation, Chapter 2.9 Vibration
Australian Standard AS2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites
British Standard BS6472-2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)
British Standard BS7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
German Standard DIN4150-2016 Structural vibration Part 3: Effects of vibration on Structures

3.2 Environmental Protection Licence

The Project EPL 21678 was approved on 6 May 2022, prior to issuing of the Project EPL, works were carried out under the the ARTC EPL 3142.

3.3 Roles and Responsibilities

Roles and responsibilities are included within Table 3.2.

Table 3.2: Project roles and responsibilities

Roles	Responsibilities
Project Director	<ul style="list-style-type: none"> Ensure that sufficient resources are allocated for the implementation of this CNVMP Ensure all appropriate noise and vibration mitigation measures are implemented Authorise cessation of construction activities on-site if exceedances are identified Authorise all monitoring reports and any revisions to this CNVMP

Roles	Responsibilities
Site Supervisor	<p>Oversee the overall implementation of this CNVMP</p> <p>Ensure all appropriate noise and vibration mitigation measures are implemented on site.</p> <p>Ensure works occur within standard construction hours unless the appropriate out of hours works approval is in place.</p> <p>Manage deliveries to mitigate noise impacts.</p>
Environment Manager (or delegate)	<p>Oversee the overall implementation of this CNVMP</p> <p>Consider and advise senior management on compliance obligations</p> <p>Ensure that the outcomes of compliance monitoring / incident reporting are systematically evaluated as part of ongoing management of construction activities</p> <p>Assesses and approves work outside of standard construction hours in adherence to conditions of the Project EPL 21678</p> <p>Ensure all appropriate noise and vibration mitigation measures are implemented</p> <p>Where standard mitigation measures are deemed insufficient, undertake reasonable steps to manage adverse impacts and implement all additional measures</p> <p>Authorise cessation of construction activities on-site if exceedances are identified</p> <p>Ensure construction activity records / monitoring records/ incident reports are kept and maintained on-site</p> <p>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</p> <p>Ensure all relevant personnel have and understand the most up-to-date copy of this CNVMP</p>
Community and Stakeholder Manager	<p>Develops and oversees the implementation of the CCS.</p> <p>Communicate general Project progress, performance and issues to stakeholders including the community.</p> <p>Responsible for a stakeholder and community relations induction and training program for all personnel involved in the performance of the project</p> <p>Ensures the Community Communications Strategy and key activities are integrated into the project schedule</p> <p>Manages media issues and acts as media spokesperson for JH (subject to media protocols)</p> <p>Responsible for the Communications for the project</p> <p>Maintain the 24-hour complaints/information hotline</p> <p>Liaise directly with the Independent Environment Representative as required and where appropriate to facilitate any environmental management requirements, including those identified within the Planning Approvals.</p>
Acoustic specialist consultant (Renzo Tonin & Associates)	<p>Undertake comprehensive noise and vibration modelling of the construction phase and prepare this Plan.</p> <p>Provide specialist advice and services in the development and implementation of this Plan and associated documents to ensure impacts can be avoided, minimised, or appropriately mitigated including:</p> <ul style="list-style-type: none"> • Preparing Construction Noise and Vibration Impact Statements • Develop the Project's construction noise and vibration management tool (Gatewave, www.gatewave.com.au) • Undertaking noise and vibration monitoring when required • Assisting in community consultation when required.

3.4 Consultation

3.4.1 Relevant government agencies and council(s)

A summary of consultation process undertaken as per Conditions of Approval A5, C4, C5, C7, for the preparation of this CNVMP is provided in Appendix E of the CEMP. Details of consultation feedback and comments are presented in Appendix E of this CNVMP, during the workshop notes were recorded regarding comments or actions which have been incorporated into Appendix E and this CNVMP alongside written consultation responses. The CNVMP has been updated following receipt of comments, as detailed in Appendix E. Full records of consultation will be contained in a separate document to this plan for information and provided to DPE on request.

A summary of consultation undertaken as per Conditions of Approval C9 and C10 for the preparation of the Noise and Vibration Monitoring Program (NVMP) (Appendix A) is provided in Appendix E. The NVMP will be updated further following receipt of comments, as required. Records of consultation will be contained in a separate document to this plan for information and provided to DPE with this NVMP. The Out of Hours Protocol (BRD-JHG-NV-0000-PRT-00001)(APPENDIX C) has been prepared in accordance with E29 and consultation was undertaken with the AA and EPA.

3.4.2 Community consultation

Consultation would be undertaken with the community affected by the works to coordinate appropriate respite periods, in accordance with CoA E22 and E27, as outlined in the Section 7.4.3. Ongoing consultation with the community may be carried out for issues pertaining to the Project's noise and vibration impacts, including the identification of appropriate respite periods for out-of-hours works (OOHW) and noise and vibration sensitive receivers.

Furthermore, for works near community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) consultation would be undertaken where noise and/or vibration generating works are predicted above the relevant NML criteria (detailed in Section 5), to satisfy CoA E22, E26 and E27. Noise generating works would not timetabled within sensitive periods, where reasonable and feasible and preferences for noise mitigation would be accommodated, where practicable.

Residential receivers affected by construction noise and/ or vibration from the Project will be determined through the assessment included in the CNVIS and any construction noise and vibration assessments completed using Gatewave (see Section 6.2.3). Community notification and consultation requirements for these works are identified and described in the CNVIS. Community consultation regarding construction noise and vibration will be undertaken in accordance with the Communication Strategy (Section 9.3 of the CEMP).

Community feedback and complaints relating to construction noise and vibration will be dealt with in accordance with the Communication Strategy.

3.4.3 Cumulative noise impact

Ongoing consultation will include regular coordination with State significant developments; infrastructure projects and other construction works being undertaken within 200m of the Project. This consultation will be undertaken with the aim of coordinating works to manage cumulative noise and vibration impacts, in accordance with CoA C5(d) and EPL 21678.

A Gateway-BRD centralised project coordination meeting has been established and held fortnightly to discuss Safety, Design, Program etc including cumulative impacts. Smaller working groups will be established on an as needed basis for specialised areas within the project such as environment/cumulative noise and to assess/manage potential construction fatigue on the surrounding community from both projects. The Gatewave model has been developed to enable inclusion of cumulative activities within the activity noise assessments, such as activities carried out by Sydney Gateway or works by JH for BRD under the REF scope.

4 Existing environment

4.1 Sensitive receivers

The Project is located within the Bayside local government area (LGA) and traverses the suburbs of Mascot, Botany and Pagewood. A land use survey in areas where works could impact on sensitive receivers is provided APPENDIX B of this Plan. The land use survey identified the existing land use and development within and around the Project, which contains a mix of residential, educational, commercial, industrial and open space uses.

The land use survey will continue to be updated throughout the delivery of the Project. Where sensitive receivers change, noise and vibration modelling will then account for the change and appropriate mitigation measures will be implemented.

4.1.1 Noise Catchment Areas

A noise assessment was conducted as part of the development of the EIS and forms Technical Report 2 – Noise and Vibration Impact Assessment. The EIS noted that noise environment surrounding the Project is generally dominated by transportation noise, with road, rail and aircraft noise affecting most locations during the daytime. The evening and night-time ambient noise levels typically decrease due to a reduction in road traffic volumes on the surrounding road network and the curfew on flights at Sydney Airport from 11 pm to 6 am.

To facilitate the assessment of noise impacts from the Project, receivers along the Project alignment have been divided into Noise Catchment Areas (NCAs). NCAs group individual sensitive receivers by common traits such as existing noise environment and location in relation to the Project.

The EIS assessment process identified a total of 8 NCAs along the Project alignment. These NCAs have been adopted the Project and are summarised in Table 4.1 with a description of the noise characteristics of each area. NCAs are also presented in the Land Use Survey (refer to APPENDIX B).

Table 4.1: Noise Catchment Areas and Surrounding Land Uses

NCA	Description of receivers	Minimum distance ¹
BRD01	Located to the north of the Botany Line and Sydney Airport. This catchment is mainly commercial with some distant residential receivers in the north, near to Coward Street. Several hotels are in this NCA, including the Stamford Plaza Hotel which is immediately north of the rail corridor. Robey Street Bridge and O’Riordan Street Bridge are in this NCA.	10 m
BRD02	This NCA is south of the rail corridor and covers Sydney Airport. The NCA has no residential receivers, with mainly commercial with the Qantas Flight Training Centre in the west, adjacent to Qantas Drive, and the Ibis Budget and Mantra Hotel near to the Joyce Drive and O’Riordan Street intersection.	40 m
BRD03	BRD03 is located north of the rail corridor in Mascot. Receivers are mainly residential, with the nearest receivers being opposite the rail corridor on Baxter Road. Two hotels, Quest Mascot and Felix Hotel, are located near to O’Riordan Street. Mascot Public School is north of the NCA on King Street.	20 m
BRD04	Located to the east of the rail corridor in Mascot and to the north of Southern Cross Drive. Receivers are mainly residential with the nearest receivers being on Botany Road and McBurney Avenue. An area of commercial use is located near to Wentworth Avenue and Botany Road. Southern Cross Drive Bridge is in the south extent of this NCA.	10 m
BRD05	BRD05 is north of the rail corridor and is the Eastlake golf course. There are no residential receivers in this NCA.	30 m

NCA	Description of receivers	Minimum distance ¹
BRD06 a	Located south of the rail corridor and south of Southern Cross Drive. Receivers are mostly commercial use with some residential around Botany Road. Mill Stream Bridge in the north of the NCA.	25 m
BRD07	Located east of the rail corridor in Pagewood. BRD07 is generally residential with the nearest receivers adjacent to the project on Myrtle Street, Banksia Street and Ocean Street.	15 m
BRD08	Located west of the rail corridor in Botany. Receivers are mainly residential with the nearest receivers adjacent the project on Ellis Street, Morgan Street and Victoria Street.	15 m
Notes:	<ol style="list-style-type: none"> 1. Approximate minimum horizontal distance in metres from track to nearest sensitive receiver. 2. Residents from Botany Road have been included in BRD06 in line with the monitored background noise monitoring detailed in Table 4.3 	

4.1.2 Heritage structures

Heritage structures identified in the EIS as being potentially impacted by construction induced vibration are summarised in Table 4.2.

Table 4.2: Heritage items identified in the EIS

NCA	Item	Location
BRD01	Mascot (Robey Street) Underbridge	Extends over Robey Street, Mascot
	Mascot (O’Riordan Street) Underbridge	Extends over O’Riordan Street, Mascot
BRD02	Sydney (Kingsford Smith) Airport Group	Part Lot 8, DP 1050923
	Commonwealth Water Pumping and Sewerage Pumping Station	General Holmes Drive (within the boundary of Sydney Airport)
BRD04	Railway Bridge over Botany Road	Extends over Botany Road, Botany
BRD05 & BRD06	Botany Water Reserves (also known as Botany Wetlands or Botany Swamps)	About 200ha between Mascot and Botany, including Eastlake golf course and Mill and Engine Ponds

4.2 Ambient noise

Ambient noise monitoring was completed at seven monitoring locations as part of the EIS in June, September and October 2018. The monitoring locations were representative of receivers that would likely be most affected by the construction and operation of the Project in each NCA. The attended measurements generally found that existing noise levels are typically dominated by transportation noise sources including road, rail and air, depending on location.

A summary of the unattended noise logging results is provided in Table 4.3 below, which is sourced from the EIS Technical Report 2 – Noise and Vibration Impact Assessment. This table provides a summary of the ambient noise monitoring results. The noise monitoring locations are shown on the Land Use Survey (refer to APPENDIX B).

Table 4.3: Summary of baseline noise monitoring data from EIS

Monitor ID (EIS)	Address	RBL ¹ DAY ²	EVE ²	NGT ²	LAeq ¹ DAY ²	EVE ²	NGT ²	Applicable NCA
L01	39 Kent Road, Botany	60	56	50	71	68	67	BRD01
L02 ³	289 King Street, Mascot	60	58	53	68	66	64	BRD01
L03	105 Baxter Road, Mascot	54	51	45	67	65	62	BRD03

Monitor ID (EIS)	Address	RBL ¹			LAeq ¹			Applicable NCA
		DAY ²	EVE ²	NGT ²	DAY ²	EVE ²	NGT ²	
L04	87 Hardie Street, Mascot	57	54	48	69	66	64	BRD04
L05	Eastlake Golf Club Pagewood	47	47 (49) ⁴	45	61	68	57	-
L06	13 Morgan Street, Botany	39	39 (41) ⁴	37	56	53	51	BRD08
L07	38 Ocean Street, Pagewood	46	46	43	58	54	54	BRD07
RTA01 ⁵	1-3 Lord Street, Botany	55	53	44	63	60	57	BRD06

- Notes:
1. RBL = Rating Background Level; LAeq = Existing Ambient Noise
 2. DAY is the period from 7am to 6pm (Monday to Saturday) and 8am to 6pm (Sundays and Public Holidays); EVE is the evening period from 6pm to 10pm; NGT is the night period from 10pm to 7am (Monday to Saturday) and 10pm to 8am (Sundays and Public Holidays)
 3. This location was influenced by noise from nearby construction works.
 4. The monitored evening level was found to be higher than the daytime, therefore the NPfl requires that the evening level be reduced to match the daytime level. Number in brackets () refers to measured RBL.
 5. Additional monitoring location has been included to establish suitable NMLs for NCA BRD06. The monitoring data is presented in APPENDIX F

5 Noise and vibration criteria for NSW

The documents outlined in Table 5.1 have been used to establish the Project management levels and goals for assessing construction noise and vibration.

Table 5.1 Policies and standards used to establish noise and vibration management levels/goals

Environment impact	Relevant documents used to establish noise and vibration management level
Construction hours	Conditions of Approval EPL 21678
Airborne noise	Conditions of Approval Interim Construction Noise Guideline (ICNG)
Sleep disturbance and maximum noise events	No specific guidelines. Guidance taken from the Interim Construction Noise Guideline (ICNG) and the Road Noise Policy (RNP)
Ground-borne noise	Conditions of Approval Interim Construction Noise Guideline (ICNG)
Construction-related road traffic noise	No specific guidelines. Guidance taken from the Interim Construction Noise Guideline (ICNG) and the Road Noise Policy (RNP).
Vibration (disturbance to building occupants)	Conditions of Approval NSW DECC's Assessing vibration; a technical guideline, published in February 2006, in line with CoA D16(b), which incorporates British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz)
Vibration (structural damage to buildings)	Conditions of Approval British Standard 7385:1993 Evaluation and measurement of vibration in buildings – Part 2 Guide to damage from ground-borne vibration DIN4150-2016 Structural vibration Part 3: Effects of vibration on Structures (for structurally unsound heritage structures)
Vibration (structural damage to buried services)	German Standard DIN 4150:1999 – Part 3 Structural vibration in buildings – Effects on structures
Vibration (sensitive scientific and medical equipment)	ASHRAE Applications Handbook (SI) 2003, Chapter 47 Sound and Vibration Control Gordon GC 28 September 1999 Generic Vibration Criteria for Vibration Sensitive Equipment Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration

5.1 Construction hours

Table 5.2 consolidates the information provided in the CoA regarding construction working hours for Project.

Table 5.2: Summary of construction working hours for the Project

CoA	Construction Activity	Monday to Friday	Saturday	Sunday/ public holiday
E14 & E15	Standard construction hours	7:00am to 6:00pm	8:00am to 6:00pm	No work ¹

CoA	Construction Activity	Monday to Friday	Saturday	Sunday/ public holiday
E16	<p>Work may be undertaken outside standard construction hours:</p> <ul style="list-style-type: none"> - for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or - where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm²; or - where different construction hours are permitted or required under an EPL in force in respect of the Project³; or - Works approved under an Out-of-Hours Work Protocol, where an EPL does not apply³ - Low impact work, for construction work that causes: <ul style="list-style-type: none"> - $L_{Aeq(15\text{ minute})}$ noise levels no more than 5 dB(A) above the RBL at any residence in accordance with the ICNG - $L_{Aeq(15\text{ minute})}$ noise levels no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG - continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of the AVTG - intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration specified in Table 2.4 of the AVTG negotiated agreements with directly affected residents. 	6:00pm to 7:00am	6:00pm to 8:00am	8:00am to 7:00am
E19	<p>Highly noise intensive works, except as permitted by an EPL, Out-of-Hours Work Protocol or negotiated agreement under CoA E16</p> <ul style="list-style-type: none"> - If continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour between each block where the work is likely to impact the same noise sensitive receivers. 	8:00am to 6:00pm (+ respite ⁴)	8:00am to 1:00pm (+ respite ⁴)	No work ¹

- Notes:
1. No work unless permitted and approved
 2. In accordance with CoA E17, on becoming aware of the need for emergency works to avoid the loss of life, damage of property or environmental harm, JH will notify the AA, the ER and the EPA (if an EPL applies) of the reasons for such work. In these circumstances, JH will use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of the works.
 3. Out-of-Hours works must be justified and include an assessment of the potential impacts and effectiveness of the proposed mitigation measures
 4. Minimum respite from highly noise intensive works of not less than one (1) hour between each continuous block of works not exceeding three (3)

The standard hours and OOHW periods are depicted in Figure 5.1. The OOHW periods are further defined as OOHW Period 1 and 2.

Figure 5.1: Construction hours

Day	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Monday																								
Tuesday																								
Wednesday																								
Thursday																								
Friday																								
Saturday																								
Sunday or Public Holiday																								

Construction would be undertaken during the approved standard construction hours wherever possible. Where construction cannot be undertaken during standard construction hours, works will be scheduled with the following hierarchy:

- 8:00 am to 6:00 pm Sunday (or public holidays) or 6:00 pm to 10:00pm weekdays (OOHW Period 1)
- 10:00 pm to 7:00 am weekday nights (OOHW Period 2)
- 10:00 pm to 8:00 am Saturday night or 6:00 pm to 7:00 am Sunday or public holiday nights (OOHW Period 2).

5.2 Airborne construction noise objectives

The ICNG provides guidelines for the assessment and management of airborne construction noise. The ICNG focuses on applying a range of work practices to minimise construction noise impacts rather than focusing on achieving numeric noise levels.

The main objectives of the ICNG are to:

- Identify and minimise noise from construction works;
- Focus on applying all ‘feasible’ and ‘reasonable’ work practices to minimise construction noise impacts;
- Encourage construction during the recommended standard hours only, unless approval is given for works that cannot be undertaken during these hours;
- Reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

5.2.1 Residential receivers

Table 5.3 was sourced from the ICNG and shows how NMLs at residential receivers are determined and how they are to be applied. The rating background level (RBL) is used when determining the noise management level (NML). The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term and methodology to obtain RBLs is described in detail within the Noise Policy for Industry (NPfI).

Table 5.3: Airborne Noise Management Levels (NMLs) at Residential Receivers

Time of Day	NML L_{Aeq} (15min)	How to Apply
Standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 6 pm	Noise affected RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L_{Aeq} (15 min) 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.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, JH would carefully consider other ways to reduce noise to below this level. If no quieter work method is feasible or reasonable and the works proceed, the proponent would provide respite periods and communicate with the impacted residents.

Time of Day	NML $L_{Aeq}(15min)$	How to Apply
Outside recommended standard hours	Noise affected RBL + 5 dB(A)	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 above the noise affected level, additional noise mitigation measures should be applied in accordance with RMS CNVG.

5.2.1.1 Sleep disturbance

Where construction works are planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts be completed. The ICNG refers to the Environmental criteria for road traffic noise (EPA 1999) for assessing the potential impacts, which notes that to limit the level of sleep disturbance the L_{Amax} should not exceed the existing L_{A90} noise level by more than 15 dB. In situations where this results in an external screening level of less than 55 dB(A), a minimum screening level of 55 dB(A) is set. Note that this is equivalent to a maximum internal noise level of 45 dB(A) with windows open.

Where there are noise events found to be above the initial screening level, further analysis is made to identify:

- The likely number of events that might occur during the night assessment period; and
- Whether events exceed an 'awakening reaction' level of 55 dB(A) L_{AFmax} (internal) that equates to NML of 65 dB(A) externally (assuming open windows).

Sleep disturbance screening and awakening criteria is provided in Table 5.4 below.

5.2.1.2 Adopted Project noise management levels for residential receivers

Table 5.4 below shows the NMLs for residential receivers for each of the NCAs described in Table 4.1 and shown in APPENDIX B. NMLs apply at the most noise-affected affected locations within the property boundary and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Table 5.4: Noise Management Levels (NMLs) for residential receivers (external), dB(A)

NCA	Monitor ID (EIS)	NML $L_{Aeq}(15min)$				Sleep L_{AFmax}	
		Standard hours (RBL + 10 dB) ¹		Out of hours (RBL + 5 dB) ²		Screening (RBL + 15 dB)	Awakening ⁵
		DAY	DAY	EVE	NGT	NGT	NGT
NCA BRD 01	L013	70	65	61	55	65	65
NCA BRD 02 ⁴	-	-	-	-	-	-	-
NCA BRD 03	L03	64	59	56	50	60	65
NCA BRD 04	L04	67	62	59	53	63	65
NCA BRD 05 ⁴	-	-	-	-	-	-	-
NCA BRD 06 ⁴	RTA01	65	60	58	49	59	65

NCA	Monitor ID (EIS)	NML $L_{Aeq(15min)}$				Sleep L_{AFmax}	
		Standard hours (RBL + 10 dB) ¹		Out of hours (RBL + 5 dB) ²		Screening (RBL + 15 dB)	Awakening ⁵
		DAY	DAY	EVE	NGT	NGT	NGT
NCA BRD 07	L07	56	51	51	48	58	65
NCA BRD 08	L06	49	44	44	42	52	65

- NOTES:
1. Standard construction hours are 7am to 6pm Monday to Friday and 8am to 6pm Saturdays.
 2. Daytime out-of-hours are 7am to 8am on Saturday, and 8am to 6pm on Sunday and public holidays; Evening out-of-hours are 6pm to 10pm Monday to Sunday; Night-time out-of-hours are 10pm to 7am Monday to Friday, to 8am on Saturday, Sunday and public holidays.
 3. NCA01 has two noise monitoring locations – L01 and L02. L01 has been used to set the NMLs for the catchment as it has lower background levels and results in more stringent criteria
 4. NCA includes residents in the vicinity of Botany Road (as detailed in Appendix B).
 5. External equivalent awakening reaction level of 65 dBA L_{Amax} assuming an open window.

5.2.2 Non-residential land uses

The ICNG provides noise management levels for commercial and industrial premises and ‘other sensitive’ land uses (ICNG, Table 3). The management levels for other noise sensitive receivers not listed in the ICNG that are applicable to the Project, such as hotels and libraries, are derived from AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors and the AAAC Guideline for Child Care Centre Acoustic Assessment. The management levels from AS2107 are the upper range levels to account for the variable and short-term nature of construction noise. Noise Management Levels for other sensitive receivers are featured in Table 5.5. Further details of hotel façade acoustic performance are presented in Appendix G.

Table 5.5: Noise Management Levels (NMLs) for non-residential receivers

Land Use	NML $L_{Aeq(15min)}$	Where NML applies	Referenced from:	Assumed facade loss (conservative)	External equivalent NML - $L_{Aeq(15min)}$
Studio building (music recording studio)	25 dB(A)	Internal noise level	AS2107 ‘maximum’	20 dB(A)	45 dB(A)
Studio building (film or television studio)	30 dB(A)	Internal noise level	AS2107 ‘maximum’	20 dB(A)	50 dB(A)
Cinema space, theatre, auditorium	35 dB(A)	Internal noise level	AS2107 ‘maximum’	20 dB(A)	55 dB(A)
Hotel (Sleeping areas: Hotels near major roads)	40 dB(A)	Internal noise level	AS2107 ‘maximum’	20 dB(A) ¹	60 dB(A)
Classrooms at schools and other educational institutions	45 dB(A)	Internal noise level	ICNG	10 dB(A)	55 dB(A)
Childcare centre (sleeping areas)	40 dB(A)	Internal noise level	AAAC - guideline for Child Care Centre Acoustic Assessment	10 dB(A)	50 dB(A)
Hospital wards and operating theatres	45 dB(A)	Internal noise level	ICNG	20 dB(A)	65 dB(A)
Places of worship	45 dB(A)	Internal noise level	ICNG	10 dB(A)	55 dB(A)
Library (reading areas)	45 dB(A)	Internal noise level	AS2107 ‘maximum’	20 dB(A)	65 dB(A)
Hotel (bars and lounges) ¹	50 dB(A)	Internal noise level	AS2107 ‘maximum’	20 dB(A)	70 dB(A)
Community centres – Municipal Buildings	50 dB(A)	Internal noise level	AS2107 ‘maximum’	10 dB(A)	60 dB(A)
Restaurant, bar (Bars and lounges/ Restaurant)	50 dB(A)	Internal noise level	AS2107 ‘maximum’	20 dB(A)	70 dB(A)

Land Use	NML $L_{Aeq(15min)}$	Where NML applies	Referenced from:	Assumed facade loss (conservative)	External equivalent NML - $L_{Aeq(15min)}$
Passive recreation (e.g. area used for reading, meditation)	60 dB(A)	External noise level	ICNG	-	60 dB(A)
Active recreation (e.g. sports fields)	65 dB(A)	External noise level	ICNG	-	65 dB(A)
Commercial premises (including offices and retail outlets)	70 dB(A)	External noise level	ICNG	-	70 dB(A)
Industrial premises	75 dB(A)	External noise level	ICNG	-	75 dB(A)

NOTE: 1. Most affected hotels are expected to have high performance façade (i.e., more than 20dB) to mitigate high existing noise levels near the airport. Appropriate criteria should be set which considers the existing facade performance of affected hotels.

In accordance with CoA E22, noise generating works in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with affected institutions are made at no cost to the affected institution.

Where works cannot be timetabled outside of sensitive periods, consultation with impacted sensitive receivers will be carried out, as per the Communication Strategy (Section 9.3 of the CEMP).

5.2.3 Annoying noise

The ICNG identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level. Annoying activities identified in the ICNG include:

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

In circumstances where monitoring indicates that activities not included above possess annoying characteristics. in accordance with the ICNG (i.e. tonality or impulsive etc), an addition of 5 dB(A) will be applied. Similarly should monitoring indicate activities listed above do not possess annoying characteristics, the 5 dBA will not be applied. Such monitoring will be provided to the AA for endorsement of such activities outside of EPL 21678, otherwise to the EPA as required by EPL 21678.

5.2.4 Facade performance

Some residential receivers may have been provided (either by the project, by past projects or independently designed-and-built) with at-property treatments which allow windows to be fixed or kept closed at night. In these cases, the noise benefit achieved by the property treatment can be considered in the assessment of airborne construction noise impacts at these individual receivers for the night period only and the external noise management levels can be conservatively increased by 10dB. JH will determine if specific receivers have benefitted from at-property treatments.

This approach is considered reasonable and consistent with CoA E28, which allows the NML to be increased by 10 dB if the property has been treated or offered at-property treatment (and declined the treatment) when eligibility for temporary alternative accommodation is assessed (see Section 7.4.4). This applies to the night period Monday to Sunday, and the evening period on Sundays and public holidays only.

Hotels likely to be affected by construction noise will be identified as part of the assessment process (Section 6). Consultation with identified hotels has been undertaken to confirm the location of sensitive spaces within the hotels. The hotel facades likely to be construction noise affected have been assessed to confirm the existing facade performance (external to internal noise transmission) in consultation with the hotel operators. The external equivalent noise management levels have been established and summarised in Table 5.6.

Table 5.6: External noise management level of hotels

Location	Facade	External Noise Management Level – dB(A) _{Leq(15min)} *
Mantra Hotel	North (Room 808)	78
Ibis Budget Hotel	West (Room 619)	81
	North (Room 618)	80
Citadin Hotel	Southeast corner (Room 702)	76
	Southern façade (Room 706)	76
Quest Mascot	Southwest corner (Room 506A - Bedroom)	76
	Southwest corner (Room 506A – Living Room)	75
Stamford Hotel	South (Room 620)	82
Travelodge Hotel	South (Room 620)	77
	West (Room 625)	77

This will allow further assessment of construction noise impact on the hotels and provision of detailed advice regarding likely impacts on hotel guests and form part of the Construction Noise and Vibration Impact Statements (CNVIS, see Section 6.2.2) for the Project.

The AA must approve any modifications to the external noise management levels.

5.3 Ground-borne noise objectives

Construction works can cause ground-borne noise impacts in nearby buildings when vibration generating equipment is in use. Ground-borne noise impacts should be considered where ground-borne

noise levels are higher than noise transmitted through the air, such as where buildings near to construction works have high performing facades which attenuate the airborne component.

Most of works would be undertaken at a sufficient distance from receivers for ground-borne noise impacts to be minimal. The EIS concluded that airborne noise levels would likely be dominant over the ground-borne component for construction works across the Project, which was confirmed through the land use survey provided APPENDIX B. The exception to this is potentially affected hotels, due to their high-performance facades and glazing performance. The EIS recommended that hotels within 50 metres of the project works should be consulted and assessed to determine their sensitivity to ground-borne noise impacts, existing facade performance and to allow appropriate criteria and mitigation to be determined.

Hotels likely to be impacted by works will be identified in the CNVIS (see Section 6.2.2). In accordance with the ICNG, mitigation measures will be applied when ground-borne noise levels exceed the ground-borne noise objectives detailed in Table 5.7 below.

Table 5.7: Ground-borne noise objectives

Receiver type	Period	Noise assessment location	Ground-borne noise objectives ($L_{Aeq(15\text{ minute})} - \text{dBA}$)
Residential	Evening ¹	Internal	40
	Night ²	Internal	35
Hotel - Sleeping areas (hotels near a major road)	When in use	Internal	40

Notes: 1. Evening period applies to 6:00pm to 10:00pm
 2. Night period applies to 10:00pm to 7:00am

5.4 Construction-related road traffic noise

When trucks and other vehicles are operating within the boundary of a construction site, road vehicle noise contributions are included in the overall predicted $L_{Aeq(15\text{ minute})}$ construction site noise emissions. When construction-related traffic moves onto the public road network a different noise assessment methodology is appropriate, as vehicle movements would be regarded as ‘additional road traffic’ rather than as part of the construction site. The community may associate heavy vehicle movements with the Project works, when vehicles are travelling on roads located immediately adjacent to construction sites. However, once the heavy vehicles move further from construction sites onto major collector or arterial roads, the noise may be perceived as being part of the general road traffic.

Construction detour routes can be required for a Project’s construction when certain roads are closed to allow construction works to be completed in a safe manner and to ease space constraints. In these circumstances redirected traffic may cause road traffic noise increases along the detour routes. No temporary detours are envisaged for the project. Should detours be identified, this will be assessed in the CNVIS.

The ICNG refers to the NSW Road Noise Policy (RNP) for the assessment of noise from construction traffic on public roads. In line with the RNP and the Construction Noise and Vibration Guideline (Roads and Maritime 2016), the Project will adopt the following approach for assessing and managing construction traffic noise impact:

- Complete an initial screening test to evaluate whether traffic noise levels increase by more than 2 dB(A) as a result of construction traffic within the vicinity of the Project sites;

- Where increases are 2 dB or less than the corresponding 'without construction traffic' scenario, no further assessment is required;
- Where the road traffic noise levels are predicted to increase by more than 2 dB as a result of construction traffic, consider the total road traffic noise levels (i.e. existing road traffic plus additional construction traffic);
- Review the total road traffic noise levels and whether these levels comply with the following road traffic noise criteria in the RNP:
 - 60 dB $L_{Aeq(15hour)}$ day and 55 dB $L_{Aeq(9hour)}$ night for existing freeway/arterial/sub-arterial roads, and
 - 55 dB $L_{Aeq(1hour)}$ day and 50 dB $L_{Aeq(1hour)}$ night for existing local roads.

Where total road traffic noise levels are less than or equal to RNP noise criteria, no further assessment is required. If total road traffic noise levels are above the RNP noise criteria, feasible and reasonable noise mitigation measures would be applied to reduce the potential noise impacts and preserve acoustic amenity. This may include consideration of alternative truck routes or potential reduction of truck movements.

In addition to the above, where Project trucks and other vehicles are using public roads during the night period, assessment of sleep disturbance is required.

5.5 Vibration criteria

5.5.1 Disturbance to building occupants

Vibration, with the potential to disturb human occupants of buildings, is managed referencing DECC's Assessing Vibration: a technical guideline (CoA E23(b)). This document provides criteria which are based on the British Standard BS 6472-2008 Evaluation of human exposure to vibration in buildings (1-80Hz).

Intermittent vibration criteria for human comfort, such as from drilling, compacting or other sources which operate intermittently, but which would produce continuous vibration if operated continuously, is presented in Table 5.8. This type of vibration is assessed based on vibration dose values (VDV) and is identified as the most likely source of vibration impacts on the Project.

Table 5.8: Vibration dose value criteria for intermittent vibration ($m/s^{1.75}$)

Building type	Assessment period ¹	Vibration dose values	
		Preferred	Maximum
Critical working areas (eg operating theatres or laboratories) ²	Daytime or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Daytime or night-time	0.40	0.80
Workshops	Daytime or night-time	0.80	1.60

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Source: BS 6472-2008

Continuous vibration from uninterrupted sources assessed based on weighted rms acceleration values presented in Table 5.9. Project activities are not likely to result in continuous vibration impacts.

Table 5.9: Preferred and Maximum Weighted Root Mean Square Values for Continuous Vibration

Receiver type	Assessment period ¹	Preferred values		Maximum values	
		Z-axis	X- and Y-axis	Z-axis	X- and Y-axis
Critical working areas (eg operating theatres or laboratories) ²	Daytime or night-time	0.0050	0.036	0.010	0.0072
Residential	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Daytime or night-time	0.020	0.014	0.040	0.028
Workshops	Daytime or night-time	0.04	0.029	0.080	0.058

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am
 2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above.
 Source: BS 6472-2008

Impulsive vibration can be defined as up to three instances of sudden impact per monitoring period, such as dropping heavy items. Impulsive vibration is assessed based on acceleration values presented in Table 5.10.

Table 5.10: Preferred and Maximum Weighted Root Mean Square Values for Impulsive Vibration
 Acceleration (m/s²) 1-80Hz

Receiver type	Assessment period ¹	Preferred values		Maximum values	
		Z-axis	X- and Y-axis	Z-axis	X- and Y-axis
Critical working areas (eg operating theatres or laboratories) ²	Daytime or night-time	0.0050	0.036	0.010	0.0072
Residential	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Daytime or night-time	0.020	0.014	0.040	0.028
Workshops	Daytime or night-time	0.04	0.029	0.080	0.058

Notes: 1. Daytime is 7.00 am to 10.00 pm and night-time is 10.00pm to 7.00 am
 2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specify above. Source: BS 6472-2008

5.5.2 Structural damage to buildings

Cosmetic damage vibration limits for buildings and associated minimum working distances are identified in the Construction Noise and Vibration Guideline, British Standard BS7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2 and German Standard DIN 4150: Part 3-2016 Structural vibration – Effects of vibration on structures.

The cosmetic damage levels set by BS7385 are considered ‘safe limits’ up to which no damage due to vibration effects has been observed for certain particular building types. This sets out the recommended vibration limits from BS7385 for transient vibration to ensure minimal risk of cosmetic damage to

residential, commercial and industrial buildings and is frequency dependent and specific to particular categories of structure.

Table 5.11: BS 7385 Transient vibration values for minimal risk of damage (mm/s)

Group	Type of building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial type buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

5.5.3 Vibration screening criteria

5.5.3.1 Disturbance to building occupants

To assess the potential for vibration impact on human comfort, an initial screening test will be done based on peak velocity units, as this metric is also used for the cosmetic damage vibration assessment. This screening test is a conservative approach since it is based on the continuous vibration velocity criteria (i.e. vibration that continues uninterrupted for a defined assessment period) whilst construction works are mostly intermittent. The screening test (Table 5.12) will be based on maximum peak values for surface construction works, which are intermittent in nature. This approach has been adopted so that the screening test is not unduly stringent.

If the predicted vibration exceeds the initial screening test, the total estimated Vibration Dose Value (eVDV) will be determined based on the level and duration of the vibration event causing exceedance and compared to the VDV maximum values in Table 5.8.

Table 5.12: Construction vibration human disturbance – initial screening test

Place and Time	Maximum peak velocity, mm/s (>8Hz)
Critical areas (day or night)	0.28
Residential buildings 16 hr day	0.56
Residential buildings 8 hr night	0.40
Offices, schools, educational institutions and places of worship (day or night)	1.10
Workshops (day or night)	2.20

5.5.3.2 Cosmetic damage

The limits presented in Table 5.11 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, then the guide values in Table 5.11 may need to be reduced by up to 50 percent. This is especially applicable at the lower frequencies where lower guide values apply.

On this basis, consistent a conservative vibration screening criteria per receiver type is given below:

- Reinforced or framed structures (Line 1): 25.0 mm/s
- Unreinforced or light framed structures (Line 2): 7.5 mm/s.

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would be required to determine the applicable safe vibration level. The analysis would take into consideration the transient vibration guide values for minimal risk of cosmetic damage set out in Table 5.11.

5.5.4 Heritage items and buried pipework

The German standard provides a conservative criterion for vibration limits for different buildings and buried pipework and has been used to identify the vibration criteria for the Project where the British Standard does not apply. The German standard values for peak particle velocity (PPV) (mm/s) measured at the foundation of the building are summarised in Table 5.13.

Table 5.13: DIN 4150-3 guideline values for short-term vibration on structures (mm/s)

Group	Type of structure	Foundations, all directions at a frequency of:			Topmost floor, horizontal	Floor slabs, vertical
		1-10Hz	10-50Hz	50-100Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 30	40 to 50	40	20
2	Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
3	Structures that because of their sensitivity to vibration, can't be classified into Line 1 or 2 and are of great intrinsic value e.g. heritage listed buildings	3	3 to 8	3 to 8	8	20

As noted in BS 7385, heritage buildings and structures should not be assumed to be more sensitive to vibration, unless structurally unsound. A conservative vibration damage screening level (peak component particle velocity) for heritage buildings/structures can be set to 2.5mm/s (the more stringent criterion in the German Standard DIN 4150-2016 Structural Vibration Part 3: Effects of Vibration on Structures). This screening level will allow potentially impacted heritage structures to be identified. If a heritage structure is predicted to be exposed to vibration levels above the conservative vibration screening level of 2.5mm/s, further investigation would be undertaken to determine whether the structure is structurally unsound. Where a heritage building is deemed to be sensitive to vibration impacts, the more stringent DIN 4150-2016 Group 3 guideline values can be applied. Otherwise, structural damage vibration limits based on BS 7385 (Section 5.5.2 and 5.5.3) can be applied.

Table 5.14 has been developed as a guide and provides details from both DIN and technical memorandum documents provided during consultation with the pipeline operators. Further consultation with utility owners and pipeline operators will be carried out during the works, specific to each pipeline in order to apply the most appropriate vibration criteria for each utility.

Where assets have a specific exclusion zone for vibration intensive works, this will also be considered and the more conservative vibration levels will be adopted as detailed in the monitoring programme detailed in Appendix A.

Table 5.14: Vibration values for short-term vibration on buried pipework (mm/s)

Technical Paper/ Requirement	Pipe material (where specified)	Limit values for vibration velocity measured on the pipe
DIN 4150-3	Steel (including welded pipes)	100
DIN 4150-3	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
DIN 4150-3	Masonry, plastic	50
APA Technical Requirement	All APA Pipelines	20
Ausgrid	All Transmission Cables	20
Ausgrid	Fluid filled and gas pressured cable joints, joint bays and surrounds	10
Ausgrid	Zone Substations (Outdoor transformer bays)	10
Ausgrid	Zone Substations (main substation building)	9
Ausgrid	Underground distribution cable joints and kiosk substations	12
Ausgrid	Aged underground distribution cables	20
Ausgrid	Aged overhead power lines	50

5.5.5 Sensitive scientific and medical equipment

Some scientific equipment, such as electron microscopes and microelectronics manufacturing equipment, can require stringent vibration goals than those applicable to human comfort or cosmetic building damage. Where vibration sensitive equipment is potentially affected by construction works, vibration limits for the operation of the equipment should be taken from manufacturer’s data or provided by the equipment owner.

Where this is not available the generic Vibration Criterion (VC) curves as published by the Society of Photo-Optical Instrumentation Engineers (Colin G. Gordon - 28 September 1999) may be adopted as vibration goals. These generic VC curves are provided below in Table 5.15.

Table 5.15: VC curves for Vibration Sensitive Equipment

Criterion curve	Max level (µm/sec, rms) ¹	Detail size (microns) ²	Description of Use
VC-A	50	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	12.5	1	A good standard for most lithography and inspection equipment to 1 micron detail size.
VC-D	6	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs and SEMs) and E-Beam systems, operating to the limits of their capability.
VC-E	3	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems requiring extraordinary dynamic stability.

Notes: 1. As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz
2. The detail size refers to the line widths for microelectronics fabrication, the particle (cell) size for medical and pharmaceutical research, etc. The values given consider the observation requirements of many items depend upon the detail size of the process.

6 Environmental aspects and impacts

6.1 Aspects and potential impacts

Table 6.1 includes the aspects, potential impacts for construction noise and vibration, as related to the Project works.

Noise and vibration risks are included in the Environmental Risk Assessment within Appendix B of the CEMP.

Table 6.1: Aspects and Potential Impacts

Aspects	Potential impacts/opportunities
Noisy works	Annoyance to residents
Out of hours works	Sleep disturbance
	Annoyance to residents
Vibratory works near residential properties	Annoyance to residents
	Structural damage
Vibratory works near industrial/commercial properties	Annoyance to workers
	Disruption to industrial or commercial processes that are sensitive to vibration
	Structural damage
Vibratory works near heritage items	Damage to heritage items
	Potential fines

The potential for noise and vibration impacts on sensitive receivers or structures will depend on several factors. Typically, these might include:

- The type of equipment in use;
- The number of equipment simultaneously in use;
- Ground condition;
- Topography and other physical barriers;
- Proximity to sensitive receivers;
- The physical condition of sensitive receiver structure;
- Hours/duration of construction works; and
- Existing background noise.

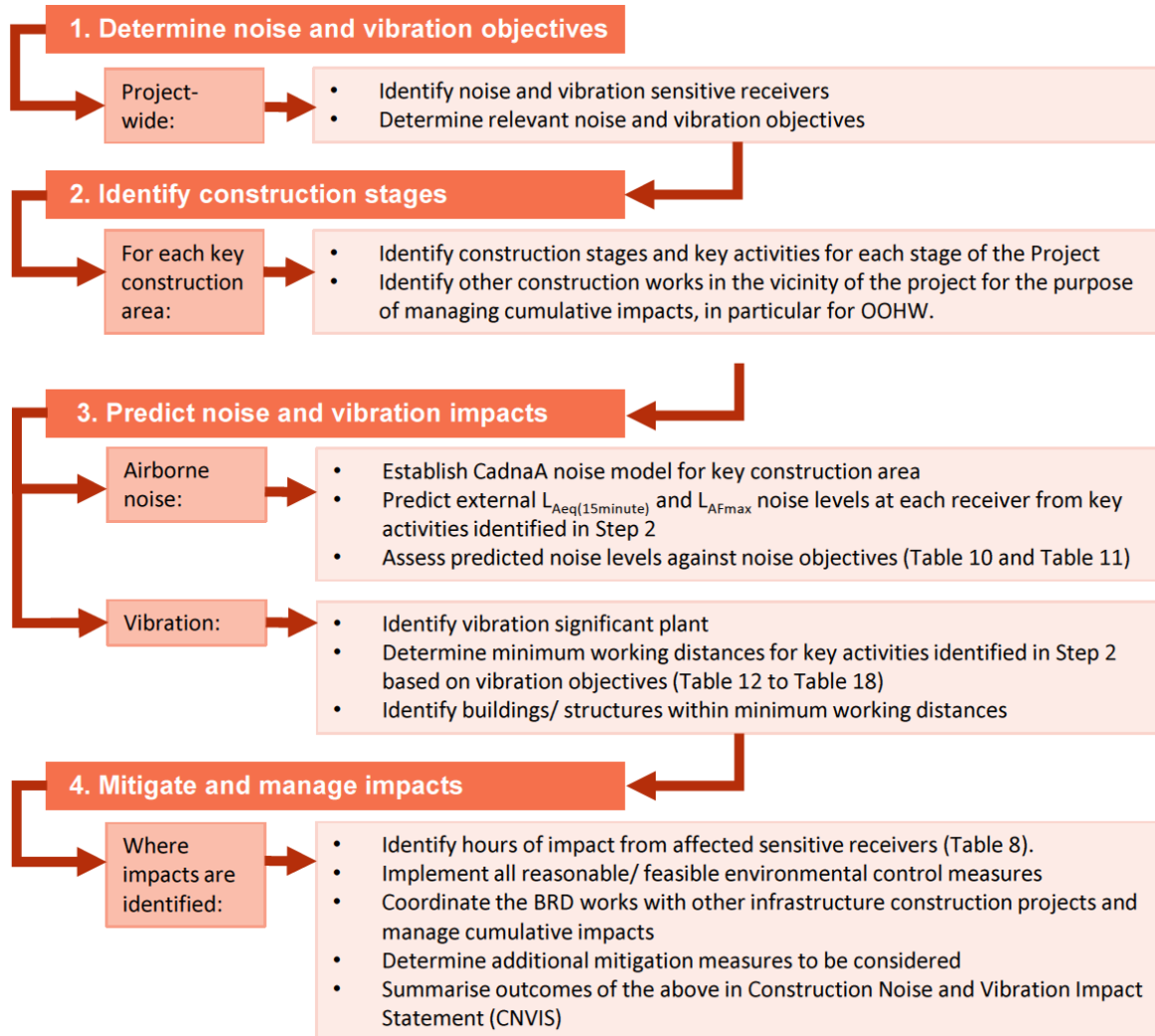
Noise and vibration impacts associated with the Project are anticipated and are detailed in the EIS Technical Report 2 – Noise and Vibration Impact Assessment, Chapter 9 of the EIS and the Response to Submissions Report. A suite of mitigation measures that will be implemented to avoid or minimise impacts on the receiving community and/or built environment is presented in the Section 7.

6.2 Construction noise and vibration assessment

6.2.1 Method for evaluation and assessment of impacts

The process of assessment of construction noise and vibration impacts is detailed in Figure 6.1. This process will form the basis of the assessments that will be prepared prior to construction works commencing. Where significant new/additional activities and/or significant changes to site layout or construction methodology are proposed, additional assessment as per this section will be undertaken. Site-specific or activity-specific noise assessments will be

prepared to assess all construction activities and ancillary facilities for the Project using the Gateway Model. Noise and vibration monitoring data will be collected throughout the delivery of the Project in accordance with the Construction Noise and Vibration Monitoring Program (refer to APPENDIX A). Figure 6.1: Process for assessing and managing construction noise and vibration



Note: Part 1 and 2 relates to the CNVMP (this plan) and parts 3 and 4 relates to the CNVIS.

6.2.2 Construction Noise and Vibration Impact Statements

The Construction Noise and Vibration Impact Statement (CNVIS) will be a key site management tool providing clear instructions for managing construction works. The CNVIS will be prepared before any works that result in noise and vibration impacts commence. The CNVIS will identify predicted noise and vibration impacts and applicable management measures (including boundary screening and other mitigations). Construction work identified in the CNVIS as exceeding the noise management levels and/ or vibration criteria will be managed in accordance with this CNVMP.

The CNVIS will be prepared by an appropriately qualified and experienced acoustic consultant with the information and insight from the Construction Team with regards to construction methodology, plant, equipment, etc. The Communication and Stakeholder team will provide information into the sensitivities of the surrounding community.

The CNVIS would set out the mitigation and management measures required for the construction stage, through consultation with affected sensitive receivers. They will address:

- Scope of work covered by CNVIS;
- Justification for OOHV (where required);
- Nearest noise and vibration sensitive receivers, based on the land use survey in APPENDIX B;
- Construction noise and vibration objectives;
- Construction noise and vibration impact assessment;
- Mitigation options, preferred management measures and ongoing risk management; and
- Noise and vibration monitoring requirements and auditing process.

Construction noise and vibration impacts associated with a construction worksite would be assessed by identifying the construction activities for each worksite, including likely plant and equipment.

Construction noise and vibration from the activities would be predicted and assessed against the noise and vibration criteria to identify the risk of impact. Where there is a risk of impact, all reasonable and feasible noise and vibration management measures would be recommended to reduce or manage the impacts as much as practicable.

Physical noise mitigation measures such as noise barriers and acoustic enclosures around fixed plant will be outlined in the CNVIS. Furthermore, specific management measures such as staging of works, respite periods (CoA E26, E27 and E28) and community notification (CoA B2(a), B2 (d)) will also be summarised, and implemented.

The CNVIS will identify the sensitive receivers that JH is required to notify regarding upcoming works to ensure ongoing noise and vibration risks are managed throughout the Project. This notification will include the likely noise and vibration impacts during the assessed works, the duration of impact and any additional mitigation (e.g. respite periods) that may be required to manage noise and vibration impacts.

Predicted noise and vibration levels in the relevant CNVIS will be verified against the monitored levels. This will allow for ongoing review and where necessary, update of the predictive model and a feedback mechanism to construction planning will ensure ongoing noise and vibration risks are identified and managed appropriately.

The key works included in the CNVIS (to be prepared under the CNVMP) are summarised in Table 6.2. Further to this, the Gatewave Model will be used to manage ongoing noise and vibration risks (including cumulative impacts) as works progress, as outlined in Section 6.2.3.

Table 6.2: Indicative CNVIS prepared under this CNVMP

Construction worksite/ stage	Construction activity
Botany Rail Duplication	Enabling works (including utility investigation) Ancillary facility establishment and operation Bridgeworks/ retaining walls Earthworks ULX installation and drainage Trackworks Signalling (including CSR) Testing, commissioning, and finishing

6.2.3 Gatewave noise and vibration management tool

A 3D construction noise and vibration management tool, Gatewave (www.gatewave.com.au), has been developed for the Project to allow defined work areas and activities to be planned, assessed and managed as construction works progress. It would also allow cumulative noise impact from other aspects of the Project or, where relevant, noise from other construction projects, to be assessed and managed in accordance with this CNVMP.

Gatewave incorporates ground elevation contours, building heights, the built environment and atmospheric conditions to predict construction noise in accordance with the International Standard ISO 9613-2:1996 implementing quality standard ISO 17534-1:2015. All sensitive receivers identified by the land use survey (see Section APPENDIX B) are integrated into the Gatewave tool.

The Project CNVIS would establish the overall impacts associated with worksites, ancillary facilities and rail duplication works. Gatewave incorporates the information from the CNVIS and enables the JH environment team to predict construction noise and vibration impacts by specifying specific work areas/activities in the noise model as construction progresses. The outputs from the Gatewave model include:

- Sensitive receivers where predicted noise levels are above the NMLs so that, where there are residual impacts even after all feasible and reasonable mitigation measures have been adopted, mitigation and management measures can be applied in accordance with this CNVMP; and
- Buildings/structures within minimum working distances established for cosmetic damage and human annoyance so that appropriate mitigation and management measures can be applied in accordance with this CNVMP.

Noise and vibration monitoring data would be collected throughout the delivery of the Project. This feedback loop would ensure the prediction tool is verified and adjusted as required to ensure accuracy across the Project.

7 Environmental control measures

7.1 Noise and vibration mitigation and management measures

In accordance with CoA E23, mitigation measures will be implemented with the aim of achieving the construction noise management levels and vibration criteria detailed in the Section 5 of this Plan. Specific measures and requirements to address contract specifications, CoA and REMM's in relation to impacts from noise and vibration are outlined in the following sections.

Table 7.1: Noise and vibration management and mitigation measures

ID	Measure / Requirement	To be implemented prior to	Responsibility	Evidence
Revised Environmental Mitigation Measures				
CNV01	<p>Construction Noise and Vibration Management</p> <p>Site EMPs will be prepared before any enabling works begin. Specific to the activities proposed, these plans will include:</p> <ul style="list-style-type: none"> - Identification of nearby sensitive receivers - Description of works, construction equipment and hours of work - Mitigation measures that apply to the works proposed - Criteria for the project and relevant licence and approval conditions - Requirements for noise and vibration monitoring - Details of how community consultation would be completed in accordance with the Stakeholder and Community Engagement Plan - Details on how respite would be applied where ongoing high impacts are seen at certain receivers. <p>The requirement for enabling works out of hours will be described in the site EMPs to be approved by the independent Environmental Representative (ER). The Site EMPs will detail:</p> <ul style="list-style-type: none"> - the proposed activities and predict the potential noise impact against the relevant noise and vibration criteria - the relevant mitigation measures, including consideration of sleep disturbance and respite periods - the required community notification specific to the activities proposed. 	Enabling works	Environment Manager Construction Manager Engineers Acoustic specialist consultant	Site EMPs
CNV02	<p>Construction Noise and Vibration Management Plan</p> <p>A CNVMP will be prepared as a sub plan to the CEMP to include:</p> <ul style="list-style-type: none"> - Identification of nearby sensitive receivers - Description of works, construction equipment and hours of work - Criteria for the project and relevant licence and approval conditions - Requirements for noise and vibration monitoring - Details of how community consultation and notification would be completed - Procedures for handling complaints - Details on how respite would be applied where ongoing high impacts are seen at certain receivers. <p>The CNVMP will also consider cumulative construction impacts and the likelihood for 'construction fatigue' from consecutive projects in the area and define a suitable management approach. Quantitative road traffic noise impacts from temporary detours during construction would also be evaluated, especially for local roads or roads with low existing volumes.</p> <p>Ongoing operation and maintenance activities of the existing rail corridor during the period of construction will be managed through ARTC's existing environmental management system.</p>	Main construction	Environment Manager Construction Manager Engineers Acoustic specialist consultant	This Plan

ID	Measure / Requirement	To be implemented prior to	Responsibility	Evidence
Revised Environmental Mitigation Measures				
CNV03	<p>Notification Community consultation measures will be included in the CNVMP and community and stakeholder engagement plan, including periodic notification (monthly letterbox drop or equivalent) detailing all upcoming construction activities delivered to impacted sensitive receivers at least 14 days prior to commencement of relevant works.</p>	Enabling works and main construction works	Environment Manager Community and Stakeholder Manager	This Plan
CNV04	<p>Noise impacts during out of hours work Unless subject to an Environment Protection Licence, an Out-of-Hours Work Protocol would be prepared and be included as part of the CNVMP for main construction works. It will identify a process for the consideration, management and approval of works which are outside standard hours. The protocol would be prepared in consultation with the EPA and approved by the independent ER before the commencement of main construction works. The protocol will include processes for:</p> <ul style="list-style-type: none"> - the consideration of out of hours work against the relevant noise and vibration criteria - the identification of mitigation measures for residual impacts, including respite periods in consultation with the community at affected locations - consideration of the risk of activities, proposed mitigation, management and coordination for works outside of standard hours to be approved by the independent ER. 	main construction works	Environment Manager Construction Manager Engineers Acoustic specialist consultant	OOHW Protocol (APPENDIX C this Plan)
CNV05	<p>Construction noise exceedances Where feasible and reasonable, construction will be carried out during Standard Construction Hours. If it is not possible to restrict the works to daytime, then they will be scheduled so noise intensive equipment is not used after 11:00 pm, where possible, noting that there is a requirement for many of the works to be completed during possessions, and restrictions on working hours during these periods are generally not feasible.</p>	Enabling works and main construction works	Environment Manager Construction Manager Engineers Acoustic specialist consultant	CNVIS
CNV06	<p>Construction noise exceedances Where noise intensive equipment is to be used near sensitive receivers, the works will be scheduled for Standard Construction Hours, where possible. If it is not possible to restrict the works to daytime then they will be scheduled so noise intensive equipment is not used after 11:00 pm, where feasible.</p>	Enabling works and main construction works	Environment Manager Construction Manager Engineers Acoustic specialist consultant	CNVIS
CNV07	<p>Monitoring Monitoring will be carried out at the start of noise and vibration intensive activities which are near to receivers to confirm that actual levels are consistent with the predictions. Where mitigation measures have been specified, the measurements should confirm their effectiveness.</p>	Enabling works and main construction works	Environment Manager	CNVIS and monitoring records
CVN08	<p>Compounds with long term works Hoarding, or other shielding structures, will be used where receivers are near to compounds or worksites with long term works. To provide effective noise mitigation, the hoarding should break line-of-sight from the nearest receivers to the works, noting that some affected receivers are multi-storey, and be of solid construction with minimal gaps. Hoarding for construction sites is typically around 3 m in height.</p>	main construction works	Environment Manager Construction Manager	CNVIS
CNV09	<p>Compound layout Noise generating items in compounds will be positioned away from receivers where possible. Items such as sheds can also be used to shield receivers from noise generated in other parts of the compound.</p>	main construction works	Environment Manager Construction Manager	CNVIS

ID	Measure / Requirement	To be implemented prior to	Responsibility	Evidence
Revised Environmental Mitigation Measures				
CNV10	Compound between Banksia Street and Stephen Road Noise impacts are predicted for this compound site due to the proximity of the nearest receivers. The use of this compound site during out of hours works associated with the road closures at Robey Street and O'Riordan Street will be avoided as far as practicable.	Enabling works and main construction works	Environment Manager Construction Manager	CNVIS
CVN11	Where works are required within the minimum working distances and considered likely to exceed the cosmetic damage criteria: - Different construction methods with lower source vibration levels will be investigated and implemented, where feasible - Attended vibration measurements will be undertaken at the start of the works to determine actual vibration levels at the item. Works will be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Enabling works and main construction works	Environment Manager	CNVIS and monitoring records
CNV12	Vibration works within minimum working distance Building condition surveys will be completed before and after the works where buildings or structures, including heritage items, are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment. Appropriate criteria would be confirmed for each item before the works begin, based on the surveys.	Enabling works and main construction works	Environment Manager	This Plan, CNVIS and monitoring records
CNV13	The potential human comfort impacts and requirement for vibration intensive works will be reviewed as the project progresses. Where receivers are within the human comfort minimum working distances, the impacts would be managed with the procedures defined in the CNVMP.	Enabling works and main construction works	Environment Manager	CNVIS and monitoring records
CNV14	Heritage items The requirement for vibration intensive works near to heritage items will be reviewed during detailed construction planning. Where heritage items are considered potentially sensitive to vibration impacts, the more stringent DIN 4150 Group 3 guideline values should be applied, and monitoring should be completed when vibration intensive works are in close proximity. Condition surveys will be completed before and after the works where heritage items are within the minimum working distances and considered likely to exceed the cosmetic damage criteria.	Enabling works and main construction works	Environment Manager Community and Stakeholder Manager	CNVIS, Condition Surveys and monitoring records
CNV15	Cumulative and consecutive construction impacts The likelihood of cumulative construction noise impacts will be reviewed during detailed design when detailed construction schedules are available. Coordination will occur between the various projects to minimise concurrent works (particularly concurrent out of hours work) in the same areas, where possible. Specific additional management and mitigation measures designed to address potential consecutive impacts will be developed and used to minimise the impacts as far as practicable, in consultation with the affected community.	Enabling works and main construction works	Environment Manager Construction Manager	Gateway
CNV16	Site inductions will be included in the site EMPs for Enabling Works and the CNVMP for main construction works All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: - All relevant project specific and standard noise and vibration mitigation measures - Relevant licence and approval conditions - Permissible hours of work - Any limitations on noise generating activities with special audible characteristics - Location of nearest sensitive receivers - Construction employee parking areas - Designated loading/unloading areas and procedures - Site opening/closing times (including deliveries) - Environmental incident procedures.	Enabling works and main construction works	Environment Manager Construction Manager	Site EMPs
CNV17	Behavioural practices No swearing or unnecessary shouting or loud stereos/ radios/ phone calls on speaker on site. No dropping of materials from height, throwing of metal items and slamming of doors. No unnecessary idling of vehicles near to receivers.	Enabling works and main construction works	Construction Manager	This Plan, CNVIS and toolbox talk records

ID	Measure / Requirement	To be implemented prior to	Responsibility	Evidence
Revised Environmental Mitigation Measures				
CNV18	<p>Equipment selection</p> <p>Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored pile rather than impact-driven piles will minimise noise and vibration impacts.</p>	Enabling works and main construction works	Construction Manager	CNVIS
CNV19	<p>Use and siting of plant</p> <p>Simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided. The offset distance between noisy plant and adjacent sensitive receivers will be maximised. Plant used intermittently will be throttled down or shut down. Plant used intermittently will be throttled down or shut down. Noise-emitting plant will be directed away from sensitive receivers, where possible.</p>	Enabling works and main construction works	Construction Manager	CNVIS
CNV20	<p>Plan worksites and activities to minimise noise and vibration</p> <p>Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.</p>	Enabling works and main construction works	Construction Manager	CNVIS
CNV21	<p>Non-tonal reversing alarms</p> <p>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.</p>	Enabling works and main construction works	Construction Manager	CNVIS and inspection records
CNV22	<p>Minimise disturbance arising from goods delivery to construction sites</p> <p>Loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers. Site access points and roads will be selected to as possible away from sensitive receivers. Dedicated loading/unloading areas will be shielded if close to sensitive receivers. Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.</p>	Enabling works and main construction works	Construction Manager	CNVIS
CNV23	<p>Silencers on Mobile Plant</p> <p>Where possible noise from mobile plant will be reduced through additional:</p> <ul style="list-style-type: none"> - Residential grade mufflers - Damped hammers such as 'City' Model Rammer Hammers <p>Air Parking brake engagement is silenced.</p>	Enabling works and main construction works	Construction Manager	
CNV24	<p>Shield stationary noise sources such as pumps, compressors, fans, etc</p> <p>Stationary noise sources will be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.</p>	Enabling works and main construction works	Construction Manager	CNVIS
CNV25	<p>Construction traffic</p> <p>A Construction Transport, Traffic and Access Management Plan will be prepared for the project to manage the haul routes and vehicle movements. Where construction routes are along local roads there is potential for impacts at the adjacent residential receivers, depending on the volume of construction traffic. The potential impacts will be managed using the following approaches:</p> <ul style="list-style-type: none"> - Vehicle movements will be away from sensitive receivers and during less sensitive times, where possible - The speed of vehicles will be limited and will avoid the use of engine compression brakes - On-site storage capacity will be maximised to reduce the need for truck movements during sensitive times - heavy vehicles will be restricted from idling near residential receivers. 	Main construction works	Environment Manager Construction Manager	CNVIS
CNV26	<p>Shield sensitive receivers from noisy activities</p> <p>Structures, such as site sheds, will be used to shield residential receivers from noise (where practicable), noting that upper floors of multi-storey buildings would be unlikely to benefit.</p>	Enabling works and main construction works	Construction Manager	CNVIS

ID	Measure / Requirement	To be implemented prior to	Responsibility	Evidence
Revised Environmental Mitigation Measures				
CNV27	<p>Detours during construction</p> <p>The assessment indicates there is potential for noticeable increases in road traffic noise for some receivers along the detours routes, such as Robey Street. Detours using this road are planned for up to 10 weekends (for closures to either Robey Street or O’Riordan Street) during construction of the project.</p> <p>The potential impacts would be reviewed as the project progresses using detailed traffic volume data. Where residential receivers are expected to be subject to a >2.0 dB night-time increase during detours, the project would:</p> <ul style="list-style-type: none"> - Consider the use of different detour routes that do not put traffic during the night-time on roads with low existing volumes. <p>Where this is not possible, the project would:</p> <ul style="list-style-type: none"> - Apply appropriate mitigation measures to the affected residential receivers, as agreed with the independent Environmental Representative (ER), based on the expected magnitude of the exceedance and the total duration of night-time impacts from all detours during construction of the project. 	Main construction works	Environment Manager Construction Manager	CNVIS and monitoring records

7.2 Maximum noise levels for plant and equipment

The Sound Power Level (SWL) represents the total noise output of operating plant and equipment. The SWL is used in computer noise models to predict Sound Pressure Levels (SPLs) at nearby receivers.

When undertaking site compliance measurements, it is normally the SPL that is measured at a specified distance (typically 7m) from the plant or equipment.

All plant and equipment used for the Project should have SWL and SPL which are no higher than the corresponding values shown in Table 7.2. Plant and equipment with SWLs or SPLs higher than those on the table would be deemed to be emitting an excessive level of noise and would not be permitted to operate on the Project. Plant and equipment will be subject to regular noise level checks to verify compliance (Section 9.3).

Table 7.2: Maximum Allowable Sound Power Levels for Construction Equipment

Equipment	Maximum Allowable Sound Power Level L _{Aeq} (dBA)	Maximum Allowable Sound Pressure Level L _{Aeq} at 7 m (dBA)	Not recommended Out of Hours (where practicable)
Air track drill	124	99	x
Asphalt truck & sprayer	103	78	
Backhoe	111	86	
Bulldozer D9	116	91	
Chainsaw 4-5hp	114	89	x
Compactor	106	81	
Compressor	109	84	
Concrete pump	109	84	
Concrete saw	118	93	x
Concrete truck	109	84	
Concrete vibrator	113	88	
Daymakers	98	73	
Dump truck	110	85	
Excavator ≤ 10 tonne	100	75	
Excavator ≤ 20 tonne	105	80	
Excavator ≤ 30 tonne	110	85	
Excavator ≤ 40 tonne	115	90	
Excavator ≤ 40 tonne with hydraulic hammer	122	97	x
Fixed crane	113	88	
Franna crane 20t	98	73	
Front end loader	112	87	
Grader 35t	113	88	
Grout plant	105	80	
Impact driving pile cases (associated with bored piling) ¹	131	106	x
Light vehicles	88	63	
Light vehicles (eg 4WD)	103	78	
Line marking truck	108	83	

Equipment	Maximum Allowable Sound Power Level L _{Aeq} (dBA)	Maximum Allowable Sound Pressure Level L _{Aeq} at 7 m (dBA)	Not recommended Out of Hours (where practicable)
Mobile crane	113	88	
Pavement laying machine	114	89	
Pavement profiler	117	92	x
Piling rig - bored	112	87	x
Piling rig – vibratory driven	116	91	x
Pneumatic hammer (jackhammer)	115	90	x
Power generator	103	78	
Road truck	108	83	
Rock crusher	118	93	x
Roller (large pad foot)	109	84	x
Scissor lift	98	73	
Scraper 651	110	85	
Smooth drum roller	107	82	
Tamping / Resurfacing (high noise impact)			
Truck (medium rigid)	103	78	
Truck compressor	75	50	
Tub grinder/ mulcher 40-50hp	116	91	x
Vacuum truck	109	84	
Vibratory roller	109	84	x
Water cart	107	82	
Welding equipment	105	80	

1. SWL measured by Renzo Tonin during pile driving at O’Riordan Street. Monitoring results have been presented in Appendix H

7.3 Minimising vibration impacts

The pattern of vibration radiation is very different to the pattern of airborne noise radiation and is very site specific. Final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

Recommended minimum working distances presented in the following sections provide a conservative screening method for indicating buildings and structures where there is a risk of vibration impact. Vibration monitoring would be carried out to confirm the minimum working distances at specific sites, where vibration significant plant is required to operate within or near the recommended minimum working distances.

7.3.1 Human exposure

Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures. At properties near the construction works, nearby receivers may be able to feel vibration when vibration-generating equipment is being utilised. For this reason it is appropriate identify properties where there is a probability of adverse comment so that impacts can be managed.

Recommended minimum working distances for typical vibration intensive construction equipment for human comfort (response) are shown in Table 7.3. These recommended distances relate to continuous vibration and are presented as a guide only. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels occurring over shorter time periods are allowed (see Section 5.5).

Table 7.3: Recommended minimum working distances (m) - human comfort (response)

Vibration significant plant item	Critical area	Residence (Day)	Residence (Night)	Office	Workshop
Concrete saw	15	10	10	5	5
Excavator (tracked) ≤ 5t + hydraulic hammer	25	20	20	15	10
Excavator (tracked) ≤ 15t + hydraulic hammer	30	20	25	15	10
Excavator (tracked) ≤ 35t + hydraulic hammer	40	25	30	20	15
Percussive drill (small)	20	10	15	5	5
Piling rig – bored (rock)	20	15	15	10	10
Piling rig – bored (soft ground)	10	10	10	5	5
Piling rig - vibratory driven pile casings	305	170	225	100	55
Piling rig – impact driven pile casings (high)	340	200	260	120	70
Piling rig – impact driven pile casings (typical)	175	105	135	65	40
Pneumatic hammer (jackhammer)	25	15	20	10	5
Terrain leveller	30	15	20	5	5
Vibratory roller (11t) padfoot - High vibration	120	70	90	40	25
Vibratory roller (11t) padfoot - Low vibration	110	60	80	35	20
Vibratory roller (13t) smooth drum - High vibration	105	55	75	30	15
Vibratory roller (13t) smooth drum - Low vibration	75	40	55	20	10
Wacker packer	20	10	15	5	5

- Notes:
1. Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method
 2. Minimum working distance based on vibration criteria set by AVTG
 3. Impact driving for pile casing installation MWDs have been determined from on-site monitoring results presented in Appendix H

7.3.2 Buildings and structures

Pre- and post-construction building condition surveys will be conducted on nearby buildings, structures and utilities. The inspections will document the existing condition of the property and typically note the location of all visible cracks and/or defects observed by the inspector. The post construction survey will record any changes to the property at construction completion.

Recommended minimum working distances to reduce the risk of cosmetic damage to buildings or structures from typical vibration intensive construction equipment are presented in Table 24 following. These are aimed at reducing the risk of cosmetic damage (as per BS 7385:1993 and DIN 4150-3:2016) and are based on the vibration screening criteria set in Section 5.

Unlike noise, vibration cannot be readily predicted. The minimum working distances below are indicative and will vary depending on the plant item, building types and foundations and local geotechnical conditions. Vibration monitoring would be carried out to confirm the site specific minimum working distances for this Project.

Table 7.4: Minimum working distances (m) - cosmetic damage¹

Vibration significant plant item	Reinforced or frame structures (BS7385) ²	Unreinforced or light framed structures (BS7385) ²	Structurally unsound heritage structures (DIN 4150-3) ³
Concrete/ road saw	5	5	5
Excavator (tracked) ≤ 15t + hydraulic hammer	5	5	10
Excavator (tracked) ≤ 35t + hydraulic hammer	5	10	10
Excavator (tracked) ≤ 50t + hydraulic hammer	5	10	20
Drill Rig	5	5	10
Pneumatic hammer (jackhammer)	5	5	5
Piling rig – bored (rock)	5	5	5
Piling rig – bored (soft ground)	5	5	5
Piling rig - impact driven pile casings (high)	15	30	65
Piling rig – impact driven pile casings (typical)	10	15	35
Piling rig - vibratory driven pile casings	10	20	50
Terrain leveller	5	5	5
Vibratory roller ≤ 25t padfoot	5	10	20
Vibratory roller ≤ 13t smooth drum - High vibration	5	5	15
Vibratory roller ≤ 13t smooth drum - Low vibration	5	5	10
Wacker packer	5	5	5

Notes: 1. Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method
 2. Minimum working distance based on vibration screening criterion which reduced the cosmetic damage levels set by BS7385 by 50% due to potential dynamic magnification.
 3. A building condition inspection should determine whether a heritage item is structurally unsound.
 4. Impact driving for pile casing installation vibration levels have been determined from on-site monitoring results presented in Appendix H

CoA E24 requires owners of properties at risk of exceeding the screening criteria for cosmetic damage to be notified before the commencement of vibration-generating works. Properties at risk of cosmetic damage will be identified through the vibration screening drawings, prepared based on proposed vibration intensive construction activities and presented in the CNVIS prepared for the Project. Structures within the minimum working distance screening limits and potentially at risk of damage from vibration are identified on the drawings.

Pre-construction surveys must be offered to the owners of surface and sub-surface structures and other relevant assets identified at risk of damage from vibration, in accordance with CoA E25. Specific properties will be identified in the CNVIS prepared for the Project.

Where properties are identified as within the recommended minimum working distances presented in Table 7.4, vibration monitoring is recommended to determine site specific minimum working distances that will prevent cosmetic and structural damage. If the monitoring above identifies that vibration is likely to exceed the screening criteria for cosmetic damage, further analysis would be undertaken, including consideration of a different construction method with lower source vibration levels and/or implement

additional mitigation measures to prevent damage. This notably applies to heritage items to satisfy CoA E25. Furthermore, if the potential exceedance is likely to occur more than once or extend over a period of 24 hours, owners and occupiers would be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier.

For highly sensitive receivers (e.g. high technology facilities, laboratories, recording studios and theatres), specific assessment is required to ensure satisfactory operation of the facility and determine if any mitigation or management measures are required to minimise the potential impacts. Highly sensitive receivers in the vicinity of the Botany Rail Duplication construction work areas are identified in the Land Use Survey in APPENDIX B and will be further investigated in the relevant CNVIS.

7.3.2.1 Pipelines or utilities

Utility investigations completed during enabling works will confirm the location of pipelines and utilities in the vicinity of the Project construction works. Buildings, structures, utilities and the like that may be impacted by construction generated vibration will be identified in the CNVIS. A structural engineer must undertake condition surveys of identified items prior to and following the identified construction activities unless as otherwise instructed or agreed to by the pipeline or utility operator.

A Condition Survey Report including details for each item at risk of damage will be produced following the Condition surveys. A copy of the report will be provided to the owners of the items surveyed, no later than one month prior to commencement of construction.

7.4 Mitigation and management of out-of-hours Work

7.4.1 Emergency works

Where out-of-hours works are required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm (CoA E16(b)), JH will notify the AA, the ER and the EPA of the reasons for emergency works. In addition, JH will use best endeavours to notify all potentially noise and/or vibration affected sensitive receivers of the likely impact and duration of those works at the earliest opportunity.

7.4.2 Out-of-Hours Works Protocol

An Out-of-Hours Work Protocol (OOHW Protocol) (BRD-JHG-NV-0000-PRT-00001) has been prepared in accordance with CoA E29. The OOHW Protocol provides a process for the consideration, management, and approval of work outside the approved construction hours detailed in Table 5.2, and that is not subject to an EPL.

The aim of the OOHW Protocol is to ensure that OOHW not subject to an EPL follow a rigorous process to identify the associated risk of adverse impacts on sensitive receivers with regards to the OOHW and include:

- Consideration of the OOHW against the relevant NMLs and vibration criteria, and providing a determination of low, medium and high-risk activities;
- Processes for selecting and implementing mitigation measures for residual impacts in consultation with the community;

- Procedures to facilitate the coordination of OOHW with those approved under an EPL or undertaken by a third party, to ensure appropriate respite is provided;
- An approval process for OOHW that considers risks, proposed mitigation, management and coordination, and includes review and approval the ER and AA for low risk activities and Planning Secretary approval for medium and high-risk activities; and
- Details of notification requirements for affected receivers and the EPA for all approved OOHW, including notification to the Planning Secretary for approved low risk OOHW.

The Out of Hours Works Protocol was produced in consultation with the Acoustics Advisor.

The Out of Hours Works Protocol will be provided to the EPA and comments incorporated.

Works carried out under an EPL will be managed in accordance with the requirements of the EPL and the OOHW Permit provided in Appendix D. Consultation with the AA will be carried out for all OOH works, including details of the date, location, modelling/noise assessment and community notification.

7.4.3 Community consultation on respite

To satisfy CoA E22 and E27, consultation with the community to determine appropriate respite periods for works would be undertaken where:

- Works are predicted above the relevant NML and in the vicinity of affected community, religious, educational institutions and noise and vibration sensitive businesses
- undertaken outside standard construction hours (see Table 5.2); and
- likely to exceed the noise and vibration objectives identified in CoA E26 and E28.

Prior to scheduling of works, under E22, the Land Use Survey (Appendix B) will be examined to determine if any community, religious or educational institutions as well as noise and vibration sensitive businesses are in the vicinity of the works. Should the aforementioned properties be identified and predicted noise levels be above the relevant NML consultation will be carried out with the affected property to determine sensitive periods and respite requirements.

The consultation carried out under CoA E27 would include, but not be limited to providing the community on at least 3 monthly intervals with:

- a schedule of likely OOHW;
- a description of the potential work, location and duration;
- the noise characteristics and likely noise levels of the Work; and
- likely mitigation and management measures to be implemented and/or offered.
- an opportunity to comment on respite and respite periods for OOHW under CoA E27

Note: Respite periods can be any combination of days or hours where OOHW would not be more than 5 dB(A) above the rating background level at any residence.

The outcomes of the community consultation, including the identified respite periods and the scheduling of works would be documented and provided to the AA and ER (and where required by CoA E27 the EPA) for information within two (2) weeks of completing the community consultation.

To satisfy CoA E21, all OOHW undertaken on the Project, including works undertaken by third parties (such as utility relocations), would be coordinated to ensure respite periods are provided in accordance

with CoA E26, E27 and E28. Where this is unable to be achieved, provision of temporary alternative accommodation or mitigation to impacted noise sensitive receivers would be considered. This would be documented as part of the relevant CNVIS/Gatewave Assessment.

7.4.4 Temporary alternative accommodation

Where out of-hours works are planned, noise modelling and assessment would be carried out to identify all residential receivers where the construction noise levels are predicted to exceed the NML by 25 dB(A) or are greater than 75 dBA ($L_{Aeq(15 \text{ min})}$), whichever is the lesser, between:

- 10:00 pm and 7:00 am, Monday to Friday;
- 10:00 pm Saturday to 8:00 am Sunday; and
- 6:00 pm Sunday and public holidays to 7:00 am the following day unless that day is Saturday then to 8:00 am.

Where the predicted impact is planned to occur for more than two (2) nights over a seven (7) day rolling period, temporary alternative accommodation would be offered to residents, consistent with CoA E28. There may be personal circumstances among the residential receivers where alternative accommodation is not best suited. The Community and Stakeholder Manager has the authority to amend the offer with due consideration of the personal circumstances that may apply and ensure no less than equivalent mitigation is provided.

The NML must be reduced by 5 dB where the noise contains annoying characteristics and can be increased by 10 dB if the property has been treated or offered (and declined) at-property noise treatment. Note the 10dBA increase does not apply to properties who have been offered (and accepted) at property treatment prior to installation of the treatment.

7.5 Additional noise and vibration management measures

Where OOHW are predicted to be above the noise or vibration management levels, reasonable and feasible measures will be implemented to reduce the noise and vibration levels at sensitive receivers. In instances where, after the application of all reasonable and feasible mitigation and management measures noise and vibration levels are still above management levels, additional management measures will be implemented. The additional management measures are outlined below.

7.5.1 Communication (COM1 and COM2)

Communication with receivers affected by OOHW should be undertaken as described, commensurate with the scale of the impact:

- Category 1 (COM1): Communication to provide information on the Project via letter box drop, email, newsletter, media advertisements and/or website a minimum of five days prior to the works commencing.
- Category 2 (COM2): Communication should be personalised (e.g. door knock, meeting, telephone call). Contact with these residents should commence early to enable feedback to be considered by the Project.

At minimum the information provided to stakeholders (COM1 or COM2) will include:

- the reason the work is required to be undertaken outside of the primary proposal construction
- a diagram that identifies the location of the proposed works in relation to nearby cross streets and local landmarks
- the nature, scope and duration of the works, including start and finish times
- the expected noise impacts on receivers
- information on how to obtain further information or make a complaint, including an afterhours number and Programme website.

7.5.2 Respite periods (RP)

During standard construction hours, respite periods must be provided works defined under the ICNG to be high noise impact works. These highly noise intensive works must only be undertaken:

(a) between the hours of 8:00 am to 6:00 pm Monday to Friday;

(b) between the hours of 8:00 am to 1:00 pm Saturday; and

(c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour between each block where the work is likely to impact the same noise sensitive receivers.

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

Should a receiver require specific hours of respite periods can be amended through a negotiated agreement in accordance with with CoA E16.

Noise generating works predicted/measured to generate noise levels above the relevant NML will be timetabled to provide respite during sensitive periods when working in the vicinity of community, religious, educational institutions and noise sensitive businesses in accordance with CoA E22.

7.5.3 Respite Offer (RO)

Residents subjected to lengthy periods of noise or vibration may be eligible for an alternative accommodation respite offer in line with CoA E28. The purpose of such an offer is to provide residents with respite from an impact across more than two evenings/nights over a seven day rolling period. Where noise and vibration levels are predicted for less than 2 nights, residents may be eligible for alternate respite offers such as pre-purchased movie tickets, meal vouchers, ear plugs or similar offer.

7.5.4 Alternate Accommodation (AA)

Temporary alternate accommodation options may be provided to residents when construction noise levels are predicted to exceed the night-time NML by 25dB(A) or are greater than 75 dB(A), whichever is the lesser and the impact is planned to occur for more than two nights over a seven day rolling period.

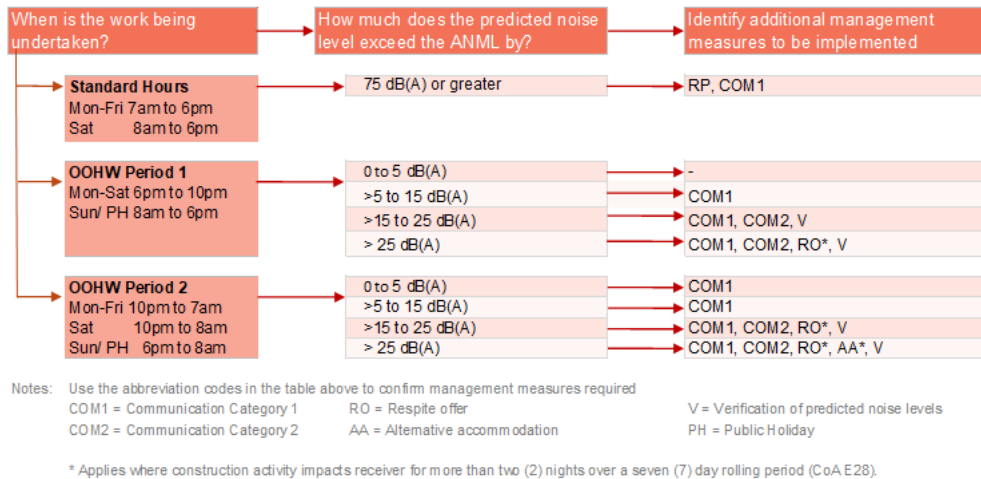
7.5.5 Verification monitoring

Verification, including measurement of the background noise level and construction noise and/ or vibration.

7.5.6 Implementation of additional management measures

Figure 7.1 details the additional mitigation measures for airborne noise, for standard hours and out-of-hours work (OOHW). Where feasible and reasonable, this approach will be implemented.

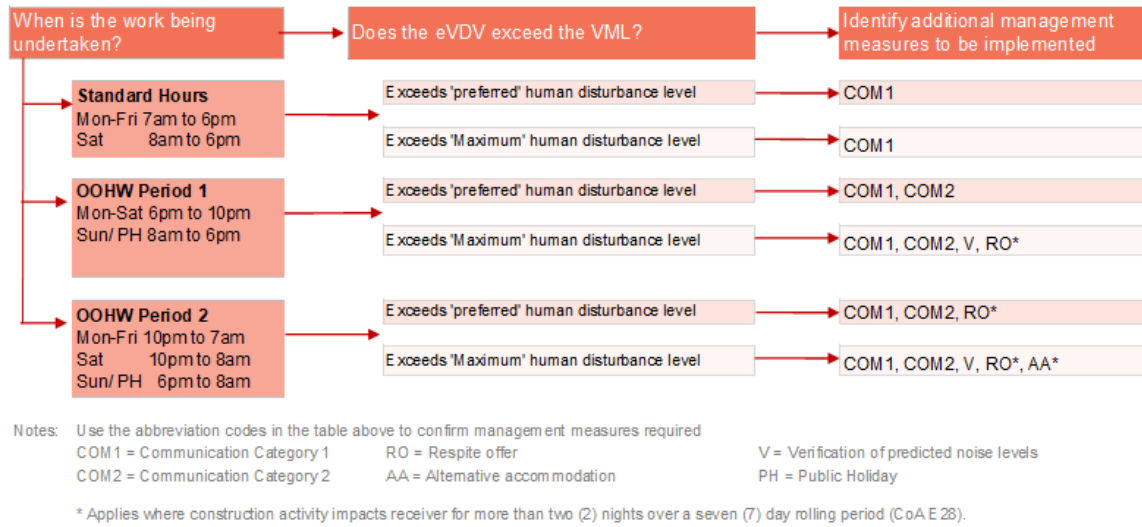
Figure 7.1: Triggers for Additional Mitigation Measures – Airborne Noise



As outlined in Section 5.2.4, some residential receivers may have been provided (either by the project, by past projects or independently designed-and-built) with at-property treatments which allow windows to be fixed or kept closed at night. In these cases, the noise benefit achieved by the property treatment can be considered in the assessment of airborne construction noise impacts at these individual receivers for the night period only and the external noise management levels can be conservatively increased by 10dB. This applies to the night period Monday to Sunday, and the evening period on Sundays and public holidays only.

Figure 7.2 details the additional mitigation measures for construction vibration, for standard hours and out-of-hours work (OOHW). Where feasible and reasonable, this approach will be implemented.

Figure 7.2: Triggers for Additional Mitigation Measures – Vibration



It should be noted that there may be personal circumstances among the sensitive receivers where the above approach to additional mitigation measures is not best suited. The Community and Stakeholder Manager has the authority to amend this approach considering the personal circumstances that may apply and ensuring no less than equivalent mitigation is provided.

8 Compliance management

8.1 Roles and responsibilities

The JH Project Team's organisational structure and overall roles and responsibilities are outlined in Section 7.1 and Figure 7-1 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Table 3.2 of this Plan.

8.2 Training

All employees, contractors, sub-contractors and utility staff working on site will undergo site induction training that includes construction noise and vibration management issues. The induction training will address elements related to noise and vibration management including:

- Existence and requirements of this sub-plan;
- Relevant legislation;
- Approved construction hours;
- The process for seeking approval for OOHW, including consultation;
- Location of noise sensitive areas;
- Complaints reporting;
- General noise and vibration management measures; and
- Specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works.

Further details regarding staff induction and training are outlined in Section 8.2 of the CEMP.

8.3 Inspection and monitoring

Weekly and other routine inspections by the JH Environment Team, ARTC, AA and ER will occur throughout construction. Detail on the nature and frequency of these inspections and activities are documented in Section 11 of the CEMP.

Noise and vibration monitoring will also occur routinely for the duration of the Project, in accordance with the Project's Noise and Vibration Monitoring Program, which is detailed in APPENDIX A of this Plan.

Monitored noise and vibration levels will be analysed against the predictions made in the relevant noise and vibration assessments. Where monitored noise levels are found to be above modelling predictions or vibration goals are exceeded, the following actions will be undertaken:

- Cease the noise and/or vibration generating source which causes the exceeded predictions;
- Confirm the monitored levels are not being impacted by other (non-Project related) noise or vibration sources;
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment;
- Identify if the equipment can be swapped out for another piece of equipment or alternative equipment or plant, or if additional mitigation can be included in the site design;
- Confirm that the modelling reflects the actual activity being undertaken;

- Implement other feasible and reasonable measures which may include reducing plant size, modifying time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilising alternative construction methodology or a combination of these;
- Review work practices to ensure compliance with the management levels set out in this CNVMP;
- Ensure that the learnings from the above are fed back into the noise modelling assessment process for fine-tuning;
- Continue work where impacts can be reduced; and
- Communicate lessons learnt to relevant personnel.

Where monitored noise levels are found to be significantly below modelling predictions, the Noise and Vibration Consultant will be notified and the Gatewave Model updated for accuracy to prevent unnecessary notification or respite offers being issued.

8.3.1 Noise monitoring

8.3.1.1 Baseline noise monitoring data

Baseline noise monitoring data was reported in the EIS as noted in the Section 4.

8.3.1.2 Plant and equipment

A plant induction process will be put in place for the Project. Part of the Plant Induction Process will be to complete a review of plant and equipment in use on the project. This will be supplemented with Spot Checks which would be carried out as required on a case-by-case basis, such as in response to a plant/equipment specific noise related complaint or during noise and vibration assessment validation monitoring when it is possible to isolate the noise from one piece of plant or equipment. Further details are provided in APPENDIX A.

8.3.1.3 Activities based noise monitoring

Attended noise monitoring will be carried out at representative locations adjacent to the construction works throughout the construction of the Project. The activities-based noise monitoring procedure is detailed in APPENDIX A.

Where monitoring indicates that the construction noise levels are above the predicted levels, work practices would be reviewed, and further mitigation measures applied where reasonable and feasible.

The attended measurements will be carried out by an appropriately trained person in the measurement and assessment of construction noise, who is familiar with the requirements of the relevant standards and procedures.

8.3.1.4 Ground-borne noise monitoring

Ground-borne noise monitoring locations would be determined on a case-by-case basis in a CNVIS, via the Project's noise and vibration management tool (Gatewave, see Section 6.2.3) or in response to complaints. The ground-borne noise monitoring procedure is detailed in APPENDIX A.

8.3.2 Vibration monitoring

8.3.2.1 Attended Vibration Monitoring in the Community

Attended vibration monitoring is to be undertaken as follows:

- At the commencement of construction for each plant or activity on site where the vibration screening criteria is likely to be exceeded, to refine the identified minimum working distances to suit site-specific conditions;
- Where vibration generating activities have the potential to impact on heritage items. If the vibration monitoring shows that the preferred values for vibration are likely to be exceeded, an alternative, lower impact construction methodology would be considered;
- Where it is not feasible to modify construction methodology to reduce vibration intensive construction activities within the minimum working distances for cosmetic damage;
- For short periods of potential risk for cosmetic damage to buildings and structures;
- Where deemed to be relevant to construction works in response to a vibration-related complaint; and
- As otherwise required by the CNVIS (or by an authorised officer of the EPA).

Where attended vibration monitoring is not feasible, due to extended periods of vibration intensive works, a permanent vibration monitoring system would be installed to warn plant operators (via flashing light, SMS alert, etc.) that there is potential cosmetic damage to buildings and structures.

Plant and equipment vibration measurement procedures are further detailed in the CNVIS.

Advice of a heritage specialist will be sought regarding methods and locations for installing equipment used for vibration monitoring on heritage-listed structures.

8.4 Complaints

Complaints will be recorded and managed as detailed in Section 9.3.1 of the CEMP and the Communications Strategy. Community enquiries and complaints related to the construction activities will be referred to the 24-hour community information line (1300 550 402) and /or the community email address (botanyduplication@jhjg.com.au). The telephone number and email address will be included in community notifications issued to the local area prior to the commencement of construction as well as included on the project website (www.botanyduplication.com.au).

All complaints will be responded to 24 hours a day, seven days a week. Complaints received via the ARTC Enviroline will be answered by an ARTC call centre that will record contact details and basic information about the nature and location of the complaint. The complainant will be advised that an on-call officer will contact them shortly to address the issue which ensures the caller is not placed on hold or referred to a recorded message. The Community and Stakeholder team will manage the ongoing communication with the complainant until they are satisfied with the action taken.

If the complainant remains unsatisfied, the complaint may be escalated in line with the ARTC Construction Complaints Management System.

John Holland will make use of translator services if a stakeholder or community member is unable to communicate their concerns in English.

John Holland will make suitably qualified and experienced team members available to monitor enquiries and complaints received by phone, post or email on a 24 hour a day, seven days a week basis.

Enquiries and complaints will be managed in line with the Ombudsman NSW Effective Complaint Handling Guide to ensure the highest standards of practice.

8.5 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 11.3 of the CEMP.

8.6 Compliance reporting

Reporting requirements and responsibilities are documented in Section 12.3 of the CEMP and are further detailed in the Project's Noise and Vibration Monitoring Program in APPENDIX A. Specific reports prepared in response to noise and vibration monitoring will include reporting required in accordance with the POEO Act and Regulations, and will capture the following information:

- The locations and descriptions of monitoring carried out;
- A tabulation of results (e.g. for noise including L_{Amax} , L_{A90} and L_{Aeq} noise levels) together with notes identifying the principle sources and operations;
- Summary of any measurements exceeding the nominated criteria, and descriptions of the plant or operations causing these exceedances; and
- Detail of any corrective actions and confirmation of their successful implementation.

9 Review and improvement

9.1 Continual improvement

Monitoring data will be reviewed throughout the construction for continual improvement.

Continual improvement of this Program will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets and Project performance outcomes of the EIS for the purpose of identifying opportunities for improvement.

The continual improvement process will be undertaken in accordance with Section 11.2 and Section 12.4 of the CEMP and the intention of this process is to:

- Identify areas of opportunity for improvement of environmental management and performance;
- Determine the cause or causes of non-conformances and deficiencies;
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies;
- Verify the effectiveness of the corrective and preventative actions;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.

9.2 Update and amendment

The processes described in Section 12.1 of the CEMP may result in the need to update or revise this Plan. This will occur as needed, in accordance with the process outlined in Section 12.4 of the CEMP.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 12.2 of the CEMP.

APPENDIX A Construction Noise and Vibration Monitoring Program

Table A.1: Compliance Matrix

Compliance Matrix: CoA C10	CNVMP Reference
(a) details of baseline data available;	Section 4.2
(b) details of baseline data to be obtained	A5.1
(c) details of all monitoring of the project to be undertaken	A5.1 and A5.2
(d) the parameters of the project to be monitored	A5.1, A5.2 and A5.6
(e) the frequency of monitoring to be undertaken	A5.4
(f) the location of monitoring	A5.6
(g) procedure for the timing and frequency reporting of monitoring and analysis against relevant criteria, including details of the timing and frequency for reporting results to the ER, the Planning Secretary and relevant government agencies	A7.6
(h) details of the methods that will be used to analyse the monitoring data	Section 8.3
(i) procedures to identify and implement additional mitigation measures where results of monitoring identify unexpected impact	CNVIS
(j) any consultation to be undertaken in relation to the monitoring programs.	Appendix E

A.1 Introduction

This appendix to the CNVMP outlines the Construction Noise and Vibration Monitoring Program (the Program) prepared for the construction of the Botany Rail Duplication Project (the Project). The Program has been prepared to address the requirements of the Minister’s Conditions of Approval (CoA) (specifically CoA C9 to C15), the Revised Mitigation Measures (RMMs) listed in the Botany Rail Duplication Project Environmental Impact Statement (EIS) and all applicable legislation.

The scope of this Program is to define how the John Holland Pty Ltd (JH) intends to monitor potential noise and vibration impacts during construction of the Project. Operational monitoring measures do not fall within the scope of the construction phase and therefore are not included in this Program.

This monitoring Program will apply for the duration of the Project’s construction works, unless a longer period is specified by the Secretary of the Department of Planning, Industry and Environment (DPE). It will be submitted to the ER for approval, at least one (1) month before the commencement of construction. The works must not commence until the Construction Management Programs have been approved by the ER, and all relevant baseline data for the specific construction activity has been collected.

A.2 Purpose and objectives

A.2.1 Purpose

The purpose of the Program is to describe how, where and when JH will monitor noise and vibration during construction of the Project and supplements the CNVMP, which itself is an Appendix of the Construction Environmental Management Plan (CEMP).

The Program will be implemented to monitor the effectiveness of mitigation measures applied during the construction phase of the Project (refer to Section 7 of the CNVMP). Monitoring will be undertaken for modelling verification at sensitive receivers, to assess compliance in response to complaints and for equipment spot checks. For further information refer to Sections A.4.2 (Baseline Noise Monitoring), A.6 (Construction Vibration Monitoring) and A.7 (Compliance Management) in this Appendices.

A.2.2 Objective

The key objective of this Program is to ensure all requirements relating to noise and vibration monitoring are described, scheduled, and assigned responsibility as outlined in:

- The Environmental Assessments prepared for the Project;
- Conditions of Approval granted to the project on 28 July 2020;
- Environment Protection Licence (EPL); and
- All relevant legislation and other requirements described in Section 3 of the CNVMP.

A.3 Relevant Standards and guidelines

The main guidelines, specifications and policy documents relevant to this noise and vibration monitoring Program are summarised in Table A.1.

Table A.1: Construction Noise and Vibration Guidelines

Guideline/ Policy name
NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
NSW Road Noise Policy (RNP), Dept. of Environment, Climate Change and Water 2011
NSW Noise Policy for Industry (NPfI), Environment Protection Authority 2017
NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
Australian Standard AS1055 Acoustics – Description and Measurement of Environmental Noise
Australian Standard AS2436:2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites
Australian Standard AS2659.1:1988 Guide to the use of sound measuring equipment – portable sound level meters
Australian Standard AS2775:2004 Mechanical Mounting of Accelerometers
British Standard BS 6472:2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)
British Standard 7385.2:1993 'Evaluation and measurement of vibration in buildings'
German Standard DIN4150:2016 Structural vibration Part 3: Effects of vibration on Structures
International Standard IEC 61672.1:2019 Electroacoustic – Sound Level Meters – Specifications;
International Standard IEC 60942:2017 'Electroacoustics - Sound calibrators
ISO 3744:2010 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
ISO 3746:2010 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane

Guideline/ Policy name

ISO 6393:2008 Earth-moving machinery - Determination of sound power level - Stationary test conditions

ISO 6395:2008 Earth-moving machinery - Determination of sound power level - Dynamic test conditions

NATA General Accreditation Guidance - General Equipment - Calibration and Checks, General Equipment Table 2019

A.4 Existing environment

A.4.1 Sensitive receptors

A land use survey in areas where works could impact on sensitive receivers is included in APPENDIX B of this CNVMP. The land use survey identified the existing land uses and development within and around the Project contains a mix of residential, educational, commercial, industrial and open space uses. Heritage structures have also been identified.

To facilitate the assessment of noise impacts from the Project, receivers along the Project alignment have been divided into Noise Catchment Areas (NCAs). NCAs group individual sensitive receivers by common traits such as existing noise environment and location in relation to the Project. The NCAs and Land Use Survey are described in more detail in Section 4.1 and featured in detailed maps in APPENDIX B of this CNVMP.

A.4.2 Baseline noise monitoring

Ambient noise monitoring was completed at seven monitoring locations as part of the EIS in June, September and October 2018. The monitoring locations were representative of receivers that would likely be most affected by the construction and operation of the Project in each NCA. The attended measurements generally found that existing noise levels are typically dominated by transportation noise sources including road, rail and air, depending on location.

For further information regarding baseline noise monitoring refer to Section 4.2 of the CNVMP and Section 3 of the EIS Appendix G Noise and Vibration Technical Report.

A.5 Construction noise monitoring

A.5.1 Activities based monitoring

Attended noise monitoring will be carried out at representative locations adjacent to the construction works throughout the construction of the Project. The monitoring locations will be agreed in consultation with the AA.

Attended noise monitoring locations may vary throughout the life of the Project. The locations would be determined on a case-by-case basis in a CNVIS, via the Project's noise and vibration management tool (Gatewave, see CNVMP Section 6.2.3) or in response to complaints. The identification of monitoring locations in the CNVIS or via Gatewave will consider the following:

- Most affected noise sensitive receiver location in proximity to the assessed activities,
- Location of previous monitoring sites,
- Proximity of the receiver to a Project worksite,
- Sensitivity of the receiver to noise,
- Background noise levels, and

- Safety of personnel undertaking the measurements,
- Expected duration of the impact.

Noise monitoring should, where practicable, be in positions with unobstructed views of general site activities, whilst shielded as much as possible from non-construction site noise (e.g. road traffic, rail noise and other surrounding noise). In accordance with Australian Standard AS1055, outdoor noise monitoring is to be undertaken at least 3.5m from any reflecting structure other than the ground. The preferred measurement height is 1.2-1.5m above the ground. Where the noise monitors are placed within 3.5 metres of building facades, walls or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Measurements inside buildings should be at least 1m from the walls or other major reflecting surfaces, 1.2 m to 1.5m above the floor, and about 1.5m from windows.

A.5.2 Plant and equipment noise audits

Plant/ equipment noise audits are required for noise intensive plant and equipment to ensure compliance with the noise levels for construction equipment assumed in the CNVIS. Spot checks would be carried out as required on a case-by-case basis, such as in response to a plant/equipment specific noise related complaint and during noise and vibration assessment validation monitoring when it is possible to isolate the noise from one piece of plant or equipment.

Ongoing spot checks for noise intensive plant and equipment should typically be carried out at 7 metres from the plant. The measurements should be undertaken at least 3.5m from any reflecting structure other than the ground. The preferred measurement height is 1.2-1.5m above the ground. Where the noise monitors are placed within 3.5 metres of building facades, walls, or cliffs, then a reflection correction of up to -2.5dB(A) shall be applied to remove the effect of increased noise due to sound reflections from such structures.

Further guidance for noise monitoring of specific plant items can be obtained from ISO 3744, ISO 3746, ISO 6393 and ISO 6395, referenced in Section A.3.

A.5.3 Ground-borne noise monitoring

Ground-borne noise monitoring locations would be determined on a case-by-case basis in a CNVIS, via the Project's noise and vibration management tool (Gatewave, see CNVMP Section 6.2.3) or in response to complaints. The monitoring will be undertaken in the most affected habitable room of the sensitive receiver building and will be conducted in conjunction with vibration measurements whenever practicable. The room selected for noise monitoring should be well shielded from airborne noise intrusions, such as road traffic noise to allow the ground-borne noise to dominate over non-construction generated airborne noise.

There may be instances where the sensitive receiver does not allow access to monitor in the most suitable habitable room. In these instances, JH will endeavour to monitor at the next most suitable available room or location, noting this in the monitoring form.

A.5.4 Monitoring frequency and method

All environmental noise monitoring equipment used must be at least Type 2 instruments as described in AS IEC 61672.1 'Electroacoustic - Sound Level Meters - Specifications'. Noise measurement will be taken with the following meter settings:

- Time Constant: Fast (i.e. 125 milliseconds)
- Frequency Weightings: A-weighting
- The minimum range of noise metrics to be recorded are: L_{90} , L_{eq} , and L_{max} .

Meteorological conditions such as wind velocity, wind direction and rainfall shall also be either monitored on site or recorded from the nearest weather station to the project site, during the noise monitoring period. Measurements of noise should be disregarded when rain or wind affects the measured noise levels as described in the AS 1055.

Monitoring frequency and methods are outlined in Table A.2.

Table A.2: Monitoring frequency and method

Type of noise monitoring	Timing/ Frequency	Duration
Activities based airborne noise monitoring	<ul style="list-style-type: none"> • At the first opportunity within the first month of starting construction activities as well as throughout the construction period to confirm: <ul style="list-style-type: none"> • the range of activities being undertaken at the site are measured (see CNVMP Section 8.3), • that actual noise levels are consistent with predicted noise impacts and • that the effectiveness of actions and mitigation measures implemented are satisfactory, • Where a change in methodology, plant or equipment is anticipated to result in a significant increase in construction noise impact than what has been assessed, • In response to a noise related complaint(s) (determined on a case-by-case basis) and in accordance with EPL Conditions, • As directed by an authorised officer of the EPA, • As otherwise required by the CNVIS (refer to CNVMP Section 6.2.2 for information regarding CNVIS). Specific monitoring requirements will be identified in the relevant CNVIS as they are location and task specific, • As required by the Out of Hours Works (OOHW) Protocol or EPL. • Following the implementation of mitigation measures or noise attenuation to reduce exceedance of predicted noise levels (refer to Section A.7.4) 	15-minute
Plant/ Equipment checks	<ul style="list-style-type: none"> • At the first opportunity within the first month of starting construction activities as well as throughout the construction period. • Spot checks would be carried out as required on a case-by-case basis, such as in response to a specific noise related complaint and during noise verification monitoring when it is possible to isolate the noise from one piece of plant or equipment. 	Static/ constant plant ¹ : 1 to 2-minute Dynamic plant ² : capture a representative activity, such as one truck-and-trailer load cycle
Ground-borne noise monitoring	<ul style="list-style-type: none"> • At the first opportunity following commencement of works if ground-borne noise impacts identified, • Where appropriate in response to ground-borne noise related complaint(s) (determined on a case-by- case basis) and in accordance with the EPL, and • As otherwise required by a CNVIS, OOHV Protocol or EPL. 	15-minute

Notes: 1. Constant noise source (e.g. generator, fan)
 2. Variable or inconstant noise source (e.g. front-end loader in spoil bin)

A.5.5 Noise management goals

The noise monitoring results will be assessed against the noise management levels (NMLs) outlined in Section 5 of the CNVMP. Where, after all reasonable and feasible mitigation measures have been implemented, measured noise levels are above the NMLs, they will be compared to the predicted noise levels in the relevant CNVIS.

If exceedance of the NML is identified, a review of site-specific mitigation measures will be undertaken to confirm that all reasonable and feasible mitigation and management measures have been implemented and confirm if there are any opportunities to further reduce noise levels on site.

If, after all reasonable and feasible mitigation measures have been implemented, an exceedance of the predicted noise levels is identified, a management response will be triggered. Details on this management response is detailed in Section A.7.4.

A.5.6 Noise Monitoring Locations

Attended noise monitoring is to be undertaken to verify that noise levels resulting from construction works are in accordance with the levels predicted in the overall CNVIS or in the Gateway noise and vibration assessment reports. Noise monitoring should be carried out on or near the property boundary at a location representative of the worst noise affected receiver (i.e. in publicly accessible areas on or near the nominated receivers, typically at ground level, if it is safe to do so and subject to obtaining the property owner/occupier's consent to access the property). Table A.4 identifies indicative monitoring locations.

Table A.4: Nominated verification monitoring locations

NCA	Nominated receiver address	Work areas
BRD08	125 BANKSIA STREET BOTANY	Banksia St compound, Zone 1
BRD06	28-30 LORD STREET, BOTANY, NSW (UTS Lab)	Mill Stream bridge, Zone 1
BRD04	63 MCBURNEY AVENUE, MASCOT, NSW	South Cross Drive, Zone1, Zone 2, Botany triage compound
BRD04	1283A BOTANY ROAD, MASCOT, NSW	General Holmes Drive compound, Zone 4
BRD01	Stamford Plaza Sydney Airport Hotel & Conference Centre	Robey St bridge, O'Riordan Bridge, O'Riordan St Bridge compound, Zone 4

A.6 Construction vibration monitoring

This Program describes monitoring of vibration impacts during construction of the Project. Where human comfort is a concern, vibration monitoring will meet the requirements of the EPA's Assessing Vibration – a technical guideline. Where property damage is a concern, vibration monitoring will meet the requirements of BS7385-2:1993 and DIN 4150-3:2016.

A.6.1 Building damage vibration monitoring

Attended or unattended vibration monitoring locations may vary throughout the life of the Project. Locations would be determined on a case-by-case basis in a CNVIS, via the Project's predictive noise

and vibration management tool (Gatewave, see CNVMP Section 6.2.3) or in response to complaints. The identification of a suitable vibration monitoring location will consider the following:

- vibration monitoring equipment shall be placed outside at the footings or foundations of the building or at the nearpoint to buried services/pipes of interest closest to the vibrating plant or as specified in an associated technical memorandum/in agreement with the asset owner;
- the surface should be solid and rigid to best represent the vibration entering the structure/utility of the building or buried pipeline under investigation;
- the vibration sensor or transducer shall not be mounted on loose tiles, loose gravel or other resilient surfaces;
- the vibration sensor or transducer shall be directly mounted to the vibrating surface using either adhesive, double sided tape or a magnetic mounting plate onto a steel washer, plate or bracket which shall be either fastened or glued to the surface of interest; and
- where a suitable mounting surface is unavailable, then a metal ground spike shall be driven into solid ground adjacent to the building of interest, and the vibration sensor or transducer shall be mounted on that.

A.6.2 Plant/ equipment vibration monitoring

Attended vibration monitoring to confirm the site specific minimum working distances for vibration intensive plant/ equipment would be determined on a case-by-case basis in a CNVIS, via the Project's noise and vibration management tool (Gatewave, see CNVMP Section 6.2.3). Items to consider in the identification of a suitable vibration monitoring location are noted above.

A.6.3 Human exposure vibration monitoring

Attended vibration monitoring to confirm human exposure to vibration would be determined on a case-by-case basis in a CNVIS, via the Project's noise and vibration management tool (Gatewave, see CNVMP Section 6.2.3) or in response to complaints. The monitoring will be undertaken in the most affected habitable room of the sensitive receiver building and will be conducted in conjunction with ground-borne noise measurements where applicable. The room selected for vibration monitoring should be well shielded from extraneous vibration intrusions, such as heavy vehicle road traffic, condenser units or pumps.

There may be instances where the resident does not allow access to monitor in the most suitable habitable room. In these instances, JH will endeavour to monitor at the next most suitable available room or location, noting this in the monitoring form.

A.6.4 Monitoring frequency and method

The minimum range of vibration metrics to be recorded is the following:

- Root-Mean-Square acceleration (RMS), or
- Peak Particle Velocity (PPV), or
- Vibration Dose Values (VDVs) (for human exposure to vibration).

Monitoring frequency and methods are outlined in Table A.3.

Table A.3: Monitoring frequency and method

Type of noise monitoring	Timing/ Frequency	Duration
Building damage vibration monitoring	At the commencement of vibration generating activities that have the potential to impact on heritage items, sensitive buried services/utilities and/ or the vibration sensitive locations are found to fall within the site specific or recommended minimum working distances established for vibration intensive plant	Representative sample of vibration being generated
Plant/ Equipment checks	At the commencement of vibration intensive activities on site that have been identified in a CNVIS (refer to CNVMP Section 6.2.2 for information regarding CNVIS) or in the noise and vibration management tool (Gateway, refer to CNVMP Section 6.2.3) as likely to exceed the vibration screening criteria	Representative sample of vibration being generated
Human exposure vibration monitoring	At the first opportunity following commencement of works, concurrent with ground-borne noise monitoring where applicable, Where appropriate in response to vibration related complaint(s) (determined on a case-by- case basis) and in accordance with the EPL, and As otherwise required by a CNVIS, OOHV Protocol or EPL.	15-minute or Representative sample of vibration being generated (as required)

A.6.5 Vibration management goals

The vibration monitoring results will be compared to the vibration goals outlined in Section 5.5 of the CNVMP, as required. If an exceedance is identified, a management response will be triggered. Details on this management response is detailed in Section A.7.4.

Vibration monitoring to manage vibration induced building damage would be undertaken as outlined in Figure A.1. Vibration monitoring results will be assessed and reported against the British Standard 7385 and German Standard DIN 4150, as presented in the CNVMP (Section 5.5.2).

Where human comfort is a concern, vibration monitoring would be undertaken as outlined in Figure A.2. Vibration monitoring results would be assessed and reported against the values set out in Tables 2.2 and 2.4 of the EPA's Assessing Vibration – a technical guideline, as presented in the CNVMP (Section 5.5.1).

Figure A.1: BRD Project vibration monitoring (cosmetic damage to structures) flow chart

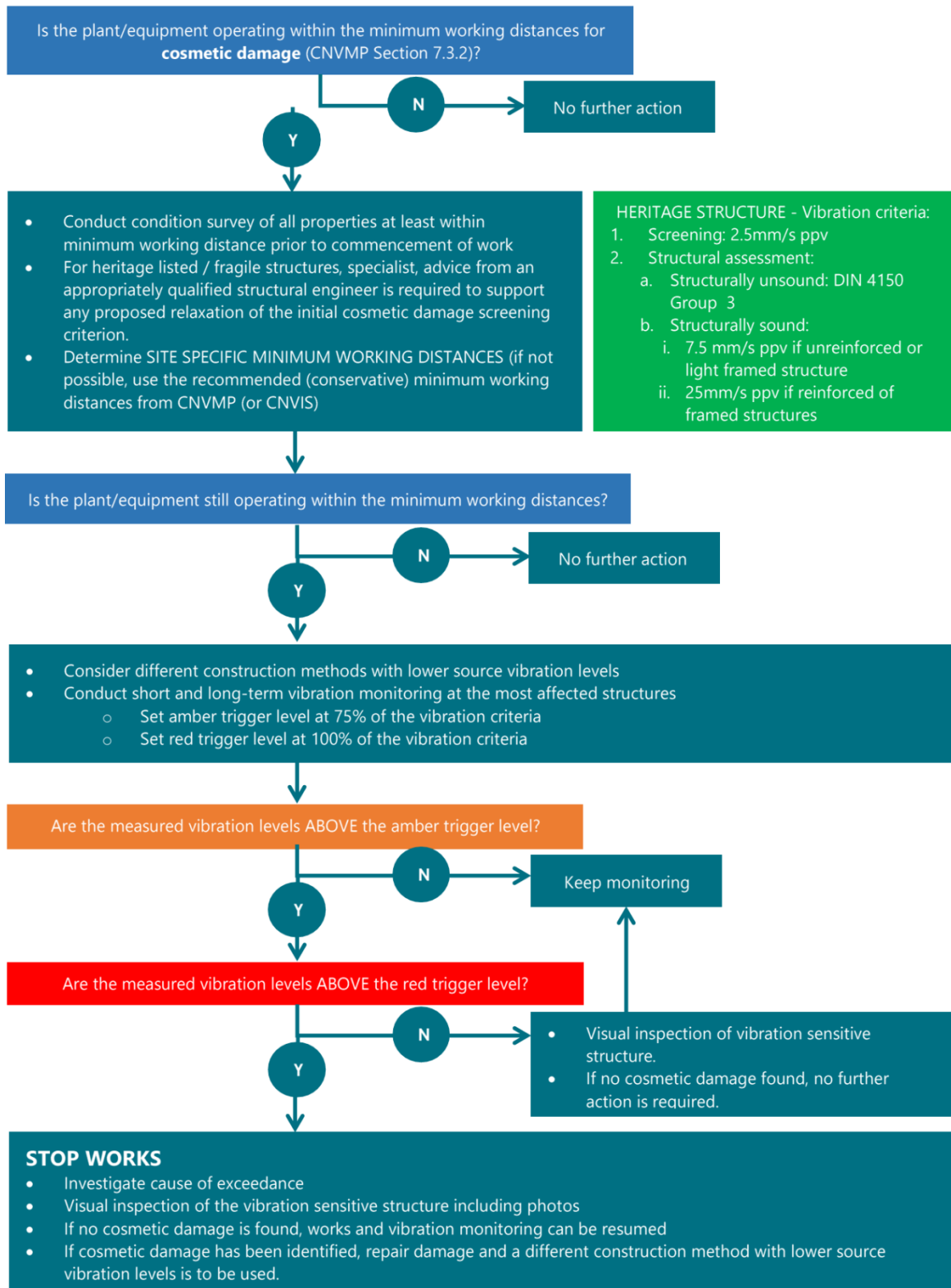
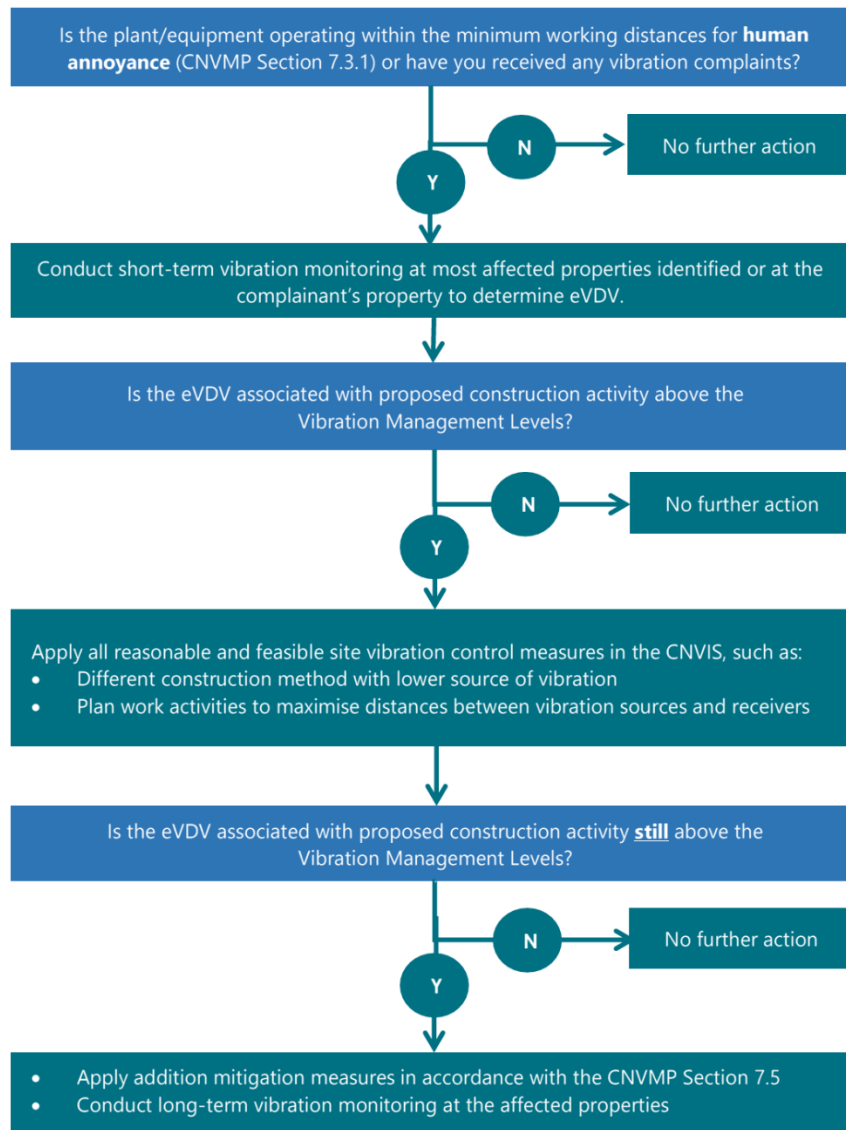


Figure A.2: BRD Project vibration monitoring (human exposure) flow chart



A.7 Compliance management

A.7.1 Roles, responsibility and training

The JH Project Team's organisational structure and overall roles and responsibilities are outlined in Section 7.1 and Figure 7-1 of the CEMP. Specific responsibilities for the implementation of environmental controls for construction noise and vibration are detailed in the CNVMP.

All noise and vibration monitoring will be carried out by an appropriately trained and competent person in the measurement and assessment of construction noise and vibration, who is familiar with the requirements of the relevant standards and procedures, detailed in the CNVMP. Training will be undertaken by the Project Noise and Vibration consultant.

A.7.2 Calibration, quality assurance and documentation

Attended noise monitoring equipment used will be at least Type 2 instruments and calibrated in accordance with manufacturer specifications or relevant Australian Standards. Records of equipment laboratory calibration will be maintained by JH throughout the delivery of the Project. The calibration of the monitoring equipment will be checked in the field before and after the noise measurement period.

All vibration instruments will be calibrated in accordance with manufacturers specifications or relevant Australian Standards. Records of monitoring equipment calibration will be maintained by JH throughout the delivery of the Project.

All monitoring records will be retained throughout JH's delivery of the Project. Monitoring records will record:

- Date and time of measurements;
- Name of person(s) undertaking the measurements;
- Qualifications and/or competency/suitability of the person carrying out the monitoring;
- Weather conditions during measurements;
- Type and model number of monitoring equipment;
- Calibration dates of monitoring equipment;
- Time of day, length of measurement and measurement time intervals;
- Monitoring location details including:
 - a sketched map showing the monitoring location, the location of noise/vibration generating items (construction activities and other environmental noise sources), the location and type of mitigation measures, the location of other acoustically relevant items (e.g. walls/barriers); and
 - photographs clearly identifying the monitoring location;
- Number of measurements at each location;
- Construction activities under investigation, including load conditions of plant; and
- Possible extraneous noise (e.g. road traffic, aircraft, insects) or vibration influences from other sources (e.g. domestic vibrations, other mechanical plant, traffic etc.)
- For noise, the following additional items should be recorded:
 - results of field calibration checks;
 - microphone height;
 - presence (or otherwise) of reflecting surfaces (such as walls), the distance from them in addition to any corrections made for the presence of reflecting surfaces;
 - Measured noise levels including the minimum descriptors required in Section A.5.4;
 - Estimated noise level from construction activities only;
 - Presence of identified annoying characteristics and if a correction has been made to the measured noise levels;
 - Estimated noise levels from environmental noise sources other than construction; and
 - Mitigation measures in place at the time of the measurement and observations on their potential effectiveness.

A.7.3 Monitoring and inspection

This Program details the monitoring requirements for noise and vibration. In accordance with Section 11.2 of the CEMP, JH Environmental and Sustainability Manager will be responsible for ensuring

monitoring activities are undertaken. Additional requirements and responsibilities in relation to inspections are documented in Section 12.3 of the CEMP.

A.7.4 Data analysis and management response

Results obtained as per the construction monitoring Program will be compared against the noise and vibration management goals listed in Section A.5.5 and Section A.6.5. If an exceedance is observed a review will be initiated to determine the significance of the exceedance(s) and possible causes. The review will assess:

- Activities occurring during the exceedance compared to CNVIS;
- Effectiveness of noise and vibration management and mitigation measures in place (Section 7 of the CNVMP);
- Effectiveness of specific mitigation and management measures identified in the relevant CNVIS; and
- Other aspects that may have influenced the measurement result (e.g. meteorological conditions, extraneous noise/ vibration source).

If the exceedance is determined to be attributable to Project works, the event will be treated as an environmental incident or non-conformance (which is applicable) and managed in accordance with the requirements of the CEMP (section 10.1) as well as the Project EPL no 21678. Corrective and preventative actions will be identified and implemented as part of that process.

A.7.5 Compliance and Auditing

Compliance monitoring and Auditing (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Program, CoA, and other relevant approvals, licenses, and guidelines. Compliance and auditing requirements are detailed in Section 11.3 and 11.4 of the CEMP.

A.7.6 Reporting

During construction, noise and vibration monitoring data will be collected, tabulated and assessed against the goals identified in in Section A.5.5 and Section A.6.5. A Noise and Vibration Monitoring Report will be produced every six months and be made publicly available. The format of the report will be agreed with the ER, AA and ARTC within the first 3 -4 months of construction and prior to the issuing of the first six monthly report.

Reporting requirements associated with the Program for the construction phase of the Project are presented in Table A.2.

Figure A.3: Construction Noise and Vibration Reporting Requirements

Report	Frequency	Content	When	Reporting Authority
Noise and Vibration Monitoring Report	Every 6 months	<ul style="list-style-type: none"> • Data summary tables from monitoring undertaken in reporting period • Exceedances • Management responses to any exceedances which may have occurred during reporting period 	Within 60 days of end of reporting period	EPA, ER, pipeline operator

A.8 Review and improvement

Monitoring data will be reviewed throughout the construction for continual improvement.

Continual improvement of this Program will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets and Project performance outcomes of the EIS for the purpose of identifying opportunities for improvement.

The continual improvement process will be undertaken in accordance with Section 12.1 and 12.4 of the CEMP and the intention of this process is to:

- Identify areas of opportunity for improvement of environmental management and performance;
- Determine the cause or causes of non-conformances and deficiencies;
- Develop and implement a Program of corrective and preventative action to address any non-conformances and deficiencies;
- Verify the effectiveness of the corrective and preventative actions;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.

APPENDIX B Land Use Survey/Noise Catchment Areas

APPENDIX C Out of Hours Work Protocol

APPENDIX D EPL OOHW Permit Template

APPENDIX E Consultation

Construction Noise and Vibration Management Plan/Monitoring Programme Consultation

Agency	Comment	JH Response
Bayside Council	The Mascot and Botany Areas are already severely impacted by noise from heavy vehicular traffic and planes from Sydney Airport. So Residents, Businesses and Property Owners are used to noise however they are more concerned about vibration from works from the BRD Project which could cause structural damage to their properties in a worst case scenario. It therefore recommended that before commencing works a dilapidation survey be undertaken on all Properties in close proximity to the works to be used as a record should any issues arise in the future.	All properties likely to be impacted by vibration (cosmetic damage) have been assessed by Renzo Tonin and the properties identified have been included in Appendix B of this CNVMP. Dilapidation surveys have been carried out for these properties and reports provided to the property owners
	Noise and Vibration Monitoring to be undertaken on a regular basis particularly near residential areas and if deemed excessive immediate action be taken to address the issues.	Noise and vibration monitoring to be carried out regularly as detailed in the Noise and Vibration Monitoring Program presented in Appendix A of this CEMP.
	Construction times of 7am – 6pm (Mon – Fri) and 8am – 1pm (Sat) be maintained at all times. Before undertaking any essential works outside these approved hours approval is to be sought from Council.	Out of Hours Works to be carried out as per the SSI CoA E16, E17 and E18.
	Prior to undertaking noisy works notify residents and stakeholders. Council can assist with this notification to Residents and Businesses.	Notification to be carried out as per the SSI CoA B1 and B2 and the relevant EPL requirements.
	For excessively noisy works manage the noise by enclosing the works with temporary sheds. Give residents noise relief in residential areas.	Enclosures and other mitigation measures will be applied to noisy works as detailed in Section 7.5 of this CNVMP.

	There is an aviation fuel line which runs through the area in close proximity to the BRD Project. It is essential the Project has no impact on this pipeline.	Consultation process includes consultation with pipeline owners and operators. Details of vibration monitoring included in Section 5.5.4 and Appendix A.
	There is a highly explosive ethane gas pipeline which runs through the area in close proximity to the BRD Project. It is essential the Project has no impact on this pipeline.	Consultation process includes consultation with pipeline owners and operators. Details of vibration monitoring included in Section 5.5.4 and Appendix A.
Ausgrid	Monitoring to be carried out in accordance with the Ausgrid technical memorandum	Reference to technical memorandum included in Monitoring Program in Appendix A of this CNVMP. Requirement to adopt most conservative vibration criteria included in Section 5.5.4.
Quenos	Pipeline locations to be surveyed and potholing to be carried out in areas where pipelines are located.	Survey requirements outside the scope of the CNVMP. Survey requirement included in the WMS and AMS.
APA	The APA line has a 20mm/s maximum vibration. Areas of concern during piling works at Mill Pond. How will monitoring be carried out to ensure vibration levels don't exceed the 20mm/s maximum vibration.	Vibration monitoring to be carried out as detailed in Appendix A of this CNVMP. Requirement to adopt most conservative vibration criteria included in Section 5.5.4.

APPENDIX F Additional noise monitoring location

Noise Monitoring Location 1: 1-3 Lord Street, Botany - front of site



1-3 Lord Street, Botany (front of site)

Background & Ambient Noise Monitoring Results - NSW 'Noise Policy for Industry', 2017						
Periods with insufficient results excluded	L_{A90} Background Noise Levels⁴			L_{Aeq} Ambient Noise Levels		
Date	Day¹	Evening²	Night³	Day¹	Evening²	Night³
Tuesday-18-May-2021	-	53	44	-	62	58
Wednesday-19-May-2021	55	54	44	64	61	56
Thursday-20-May-2021	55	54	45	64	61	58
Friday-21-May-2021	57	52	47	63	58	55
Saturday-22-May-2021	53	54	44	63	61	56
Sunday-23-May-2021	52	50	42	61	58	57
Monday-24-May-2021	55	49	43	64	61	57
Tuesday-25-May-2021	-	-	-	-	-	-
Representative Weekday⁵	55	53	44	64	61	57
Representative Weekend⁵	53	52	43	62	60	56
Representative Week⁵	55	53	44	63	60	57

Notes:

1. Day is 7:00am to 6:00pm on all days except Sundays and Public Holidays when it is 8:00am to 6:00pm
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Assessment Background Level (ABL) for individual days
5. Rating Background Level (RBL) for L_{A90} and logarithmic average for L_{Aeq}
6. Leq is calculated in the free field. 2.5dB is subtracted from results if logger is placed at façade
7. Number in brackets represents the measured (actual) RBL value, which is below the minimum policy value of 30 dB(A) during the evening or night period or 35 dB(A) during the day period.

APPENDIX G Hotel Façade Noise Reduction and External Noise Management Levels

APPENDIX H Impact Driving Pile Casing (Noise and Vibration Monitoring)