



Construction Noise and Vibration Management Plan

**Shared Path Bridge over Newcastle
Road, Jesmond**

1630

INTEGRATED MANAGEMENT SYSTEM

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1 INTRODUCTION

This Construction Noise and Vibration Management Plan (CNVMP) forms part of the Construction Environmental Management Process Plan (CEMPP) for the Shared Path Bridge (SPB) over Newcastle Road, Jesmond which is being delivered as early works for the Newcastle Inner City Bypass (NICB) between Rankin Park and Jesmond (RP2J).

1.1 PURPOSE

The CNVMP has been developed with specific information to allow for effective management and control of construction noise and vibration impacts. This plan has been developed taking into consideration the Integrated Project Management Plan (IPMP), Daracons Legal and Other Requirements including but not limited to relevant Acts, Regulations, Codes of Practice and Industry Standards / Guidelines.

In addition, the framework for this plan has been prepared to align with the Daracon Management System (DMS), AS/NZS & ISO Standards and Client requirements.

The purpose of the Construction Noise and Vibration Management Plan is to;

- Describe how noise and vibration impacts will be managed during construction of the SPB

1.2 SCOPE

The project involves the construction of a new shared path bridge over Newcastle Road and associated works at Jesmond, within the Newcastle City Council Local Government Area (LGA).

The scope of work required for the project involves the following specific activities:

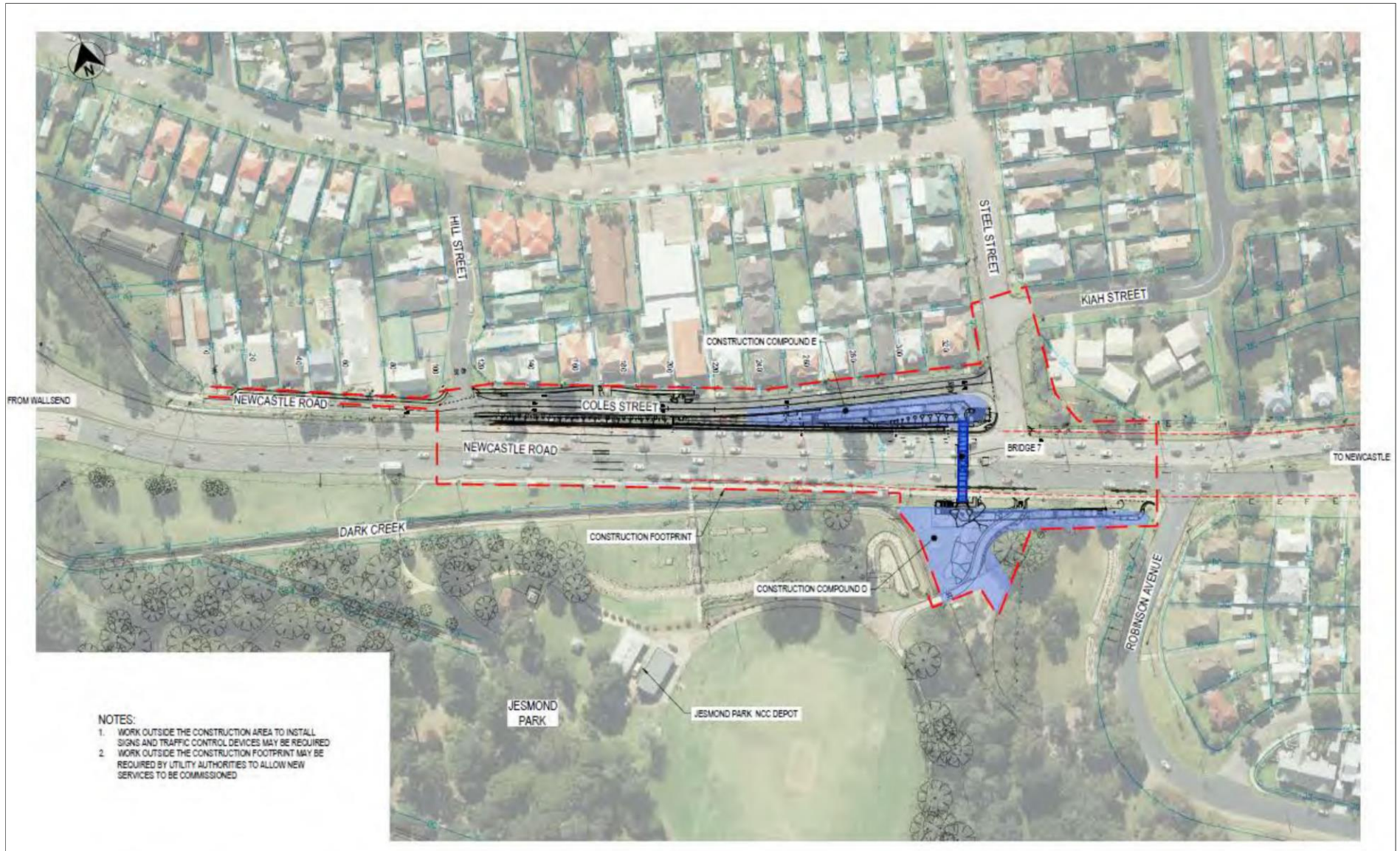
- Site Establishment
- Vegetation clearing, including riparian vegetation, and topsoil stripping
- Earthworks, including excavation or filling
- Transportation of cut or fill materials
- Site access
- Drainage works
- Stockpiling of topsoil, vegetation and other construction materials
- Movement of heavy vehicles across exposed ground
- Demolition works to remove a redundant retaining wall and ramps structures
- Piling works to facilitate the construction of the SPB
- Construction of a new shared path bridge over Newcastle Road west of Steel Street;
- Concrete Ramps, stairs and retaining structures providing access to the new shared path bridge;
- Relocation of existing utilities including overhead electricity and underground water mains;

- Roadworks in Coles Street and Jesmond park to connect the new bridge to existing facilities;
- Roadworks for minor widening on the northern side of Newcastle road west of Steel Street;
- Removal of the existing mid-block pedestrian crossing and removal of the existing bus shelter and
- Miscellaneous works including erosion and sedimentation control, utility adjustments, the construction of earthworks, drainage, kerbs and/or gutters, pavement, safety barriers, concrete paving for the shared path, footpaths and driveways, pavement markings and vegetation works.

Other operations will be undertaken by Daracon that are considered normal in delivery of the above activities. Additional activities may also be realised at the request of the Client throughout the duration of the project.

See [Figure 1](#) outlining the Shared Path Bridge (SPB) Project Location on the following page

FIGURE 1 – SHARED PATH BRIDGE PROJECT LOCATION



1.3 CONSULTATION

1.3.1 CONSULTATION FOR PREPARATION OF THE CNVMP

This CNVMP has been developed in consultation with Newcastle City Council (NCC) as required by CoA A9(a). In accordance with CoA A5, the evidence of the consultation undertaken for the preparation of this CNVMP, is documented in the following table.

1.3.2 CONSULTATION LOG

TABLE 1 – CONSULTATION LOG

Department	Contact	Date	Correspondence Type	Description
CoN	██████████ ██████	13 June 2019	Email	Nil comments
Environmental Representative	██████████ ██████████	16 August 2019	Email	Draft plan submitted 13/8/19 and found to satisfy requirements. Updated by Daracon and resubmitted 8/11/19.

1.3.3 ONGOING CONSULTATION DURING CONSTRUCTION

Ongoing consultation between Roads and Maritime and Daracon, stakeholders, the community and NCC regarding the management of noise and vibration impacts will be undertaken during the construction of the SPB as required. The process for consultation is documented in the Construction Community Liaison Management Plan (CCLMP), which includes the key principals contained within the RP2J Community Communication Strategy (CCS) developed by Roads and Maritime.

2 OBJECTIVES AND TARGETS

2.1 OBJECTIVES

The key objectives of the CNVMP are to;

- Minimise noise and vibration impacts to the local community and the built environment during construction
- Provide a clear framework for OOHV
- Provide a mechanism for community complaints

2.2 TARGETS

The key targets for the management of noise and vibration impacts during construction of the SPB are to:

- Provide suitable mitigation in accordance with the ICNG, as detailed in the SPIR, to meet the requirements of the CoA
- Establish an OOHV Protocol, consult with NCC and gain approval by the ER and the Planning Secretary
- Establish a community complaints system for the SPB works.

3 SUB-PLAN REFERENCE DOCUMENTS

Daracon will comply with all legislation, standards and guidelines, client documents and project approvals, as nominated within the [Section 3](#) of this CNVMP.

3.1 LEGISLATION

- Protection of the Environment Operations Act 1997 (POEO Act)
- Protection of the Environment Operations (Noise Control) Regulation 2008.

3.2 STANDARDS, CODES OR GUIDELINES

- Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime, 2016)
- Road Noise Policy (RNP) (DECCW 2011)
- Environmental Noise Management Manual (Roads and Maritime, 2001)
- NSW Industrial Noise Policy (EPA, 2000)
- Noise Policy for Industry (INP) (EPA, 2017)
- Interim Construction Noise Guideline (ICNG) (NSW Department of Environment and Climate Change, 2009)
- Assessing Vibration – a technical guideline (Department of Environment and Conservation (DEC), 2006)
- Australian Standard AS 2659.1 - 1998: Guide to the use of sound measuring equipment - Portable sound level meters
- British Standard 7385: Part 2-1993 Evaluation and measurement of vibration in buildings Part 2 (BSI, 1993)
- British Standard BS 6472 (1992) Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)
- German Standard DIN4150 Part 3-1999 Structural vibration - Effects of vibration on structures (Deutsches Institute fur Normung, 1999)

3.3 CLIENT DOCUMENTS

The following client documents have been identified as being important to ensure Daracon deliver the project safely, with minimal environmental impact and to specification.

TABLE 2 – CLIENT DOCUMENTS

Client Document Number and Name	
Document Number	Document Name
Newcastle Inner City Bypass – Rankin Park to Jesmond Environmental Impact Statement (GHD, November 2016)	
Submissions and Preferred Infrastructure Report – Newcastle Inner City Bypass, Rankin Park to Jesmond (GHD, March 2018)	
NSW Department of Planning & Environment Minister’s Conditions of Approval (Feb 2019)	
Department of the Environment and Energy (DoEE) - Commonwealth Controlled Action Approval (April 2019)	
QA Specification G1	Job Specific Requirements
QA Specification G36	Environmental Protection
QA Specification G38	Soil and Water Management
QA Specification G40	Clearing and Grubbing
QA Specification G10	Traffic Management
QA Specification G22	Work Health and Safety (Construction and Maintenance Works)
QA Specification Q6	Quality Management System (Type 6)

Where there are changes to the above document references, communication of changes that are applicable to this project will be communicated to all workers using a suitable means of communication as prescribed within this Sub-Plan.

3.4 PROJECT APPROVALS AND/OR LICENSING

The following approvals have been obtained by Roads and Maritime:

- EPBC Decision Notice dated October 2015 (confirming the RP2J project is a controlled action).
- Project Approval under Part 5.2 of the EP&A Act – SSI 6888 granted by the minister for planning on 15 February 2019.

All necessary licences, permits and approvals required for Daracon’s contracted works will be obtained and maintained as required throughout the life of the Project. Inspection and monitoring programs completed as part of this plan will ensure the control measures outlined in any of the above approvals, licenses or permits are complied with at all times.

3.5 HOLDPOINTS

Roads and Maritime specifications are a key source of environmental protection management processes relevant to this CNVMP. The specifications set out environmental protection requirements, including Hold Points, that will be complied with during construction of the SPB. A Hold Point is a point beyond which a work process must not proceed without express written authorisation from Roads and Maritime. Hold points applicable to noise and vibration management are provided in [Table 3](#).

TABLE 3 – HOLDPOINTS APPLICABLE TO NOISE AND VIBRATION MANAGEMENT

Clause no.	Description
Specification G1 – Job Specific Requirements	
5.2	Establishment of Site facilities (including environmental controls for noise)
Specification G36 – Environmental Protection	
3.2.4	Environmental Work Method Statement (including for works out of standard hours). 21 days prior to the commencement of OOHW activities an EWMS is to be submitted for Roads and Maritime to consider prior to authorising release of work covered by the EWMS.
4.7	Ground vibration
4.13	Working in environmentally sensitive areas adjacent to noise sensitive receivers (such as the Church in Coles Street)

4 CONDITIONS OF APPROVAL

The Rankin Park to Jesmond Project proposal was subject to assessment and approval under the EP&A Act. The EPBC Act conditions directly reflect the EP&A Act conditions of approval. Subsequently, the NSW infrastructure Conditions of Approval (CoA) listed below in Table 4, detail the Commonwealth and State CoA's relevant to the CNVMP;

TABLE 4 – COA RELEVANT TO THE CNVMP

CoA	Requirement	Reference
E26	<p>Construction Hours</p> <p>Work must only be undertaken during the following construction hours:</p> <ul style="list-style-type: none"> (a) 7:00 am to 6:00 pm Mondays to Fridays, inclusive; (b) 8:00 am to 5:00 pm Saturdays; and (c) at no time on Sundays or public holidays. 	Clause 8.1.1
E27	<p>Variation to Works Hours</p> <p>Notwithstanding Conditions E26 and E30, work may be undertaken outside the hours specified, in the following circumstances:</p> <ul style="list-style-type: none"> (a) for the delivery of materials where required by the NSW Police Force or other authority for safety reasons; or (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 (c) where different construction hours are permitted or required under an EPL in force in respect of the SSI; (N/A to SPB) or (d) work approved under an Out-of-Hours Work Protocol or an Out of Hours Work Management Process or equivalent (for work not subject to an EPL) under Condition E31; or (e) work that causes: <ul style="list-style-type: none"> (i) no more than 5 db(A) above the rating background level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009), and (ii) no more than the 'Noise affected' noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses, and (iii) continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical</i> 	Clause 8.1.3 OOHW Protocol

	<p><i>guideline</i> (DEC, 2006), and</p> <p>(iv) intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006).</p>	
E28	<p>On becoming aware of the need for emergency work in accordance with Condition E27(b), the Proponent must notify the ER and the EPA of the reasons for such work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive receivers of the likely impact and duration of those works</p>	<p>Clause 8.1.3 OOHW Protocol</p>
E29	<p>In order to undertake out-of-hours work, the Proponent must identify appropriate respite periods for the out-of-hours works in consultation with the community at each affected location on a monthly basis. This consultation must include (but not be limited to) providing the community with:</p> <ul style="list-style-type: none"> (a) a schedule of likely out-of-hours work for a period of no less than three (3) months in advance; (b) potential work, location and duration; (c) proposed respite periods; (d) noise characteristics and likely noise and vibration levels; and (e) likely mitigation and management measures. <p>The outcomes of the community consultation, the identified respite periods and the scheduling of likely out-of-hour work must be provided to the ER, EPA and the Planning Secretary.</p>	<p>Clause 8.1.4 OOHW Protocol</p>
E30	<p>Highly Noise Intensive Work</p> <p>Except as permitted by an EPL, highly noise intensive works exceeding 75 dB(A) $L_{Aeq}(15 \text{ minute})$ noise descriptor at a sensitive receiver must only be undertaken:</p> <ul style="list-style-type: none"> (a) between 8:00 am to 6:00 pm Monday to Friday; (b) between 8:00 am to 1:00 pm Saturday; and (c) if continuously, then not exceeding three (3) hours, with a minimum respite from those activities and works of not less than one (1) hour. <p>For the purposes of this condition, 'continuous' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.</p>	<p>Clause 8.1.2</p>
E31	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of work which are outside the hours defined in Condition E26, and that are not subject to an EPL. The Protocol must be approved by the Planning Secretary before the commencement of the work. The Protocol must be prepared in consultation with the EPA and the ER. The Protocol must:</p>	<p>Clause 8.1.4 OOHW Protocol</p>

	<p>(a) provide a process for the consideration of out-of-hours work against the relevant noise and vibration criteria, including the determination of low and high-risk activities;</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 E29;</p> <p>(c) identify procedures to facilitate the coordination of out-of-hours work permitted by an EPL to ensure appropriate respite is provided;</p> <p>(d) undertake a risk analysis that considers the risk of activities, proposed mitigation, management, and coordination, including where:</p> <ul style="list-style-type: none"> ° low risk activities can be approved by the ER, and ° any other activity approved by the Planning Secretary; and <p>(e) identify Department, EPA and community notification arrangements for approved out of hours work, which may be detailed in the Communication Strategy.</p> <p>The Out-of-Hours Work Protocol is not required if the Proponent has an existing Out of Hours Work Management Process or equivalent that addresses Condition E31 (a) to (e) and has been approved by the Planning Secretary prior to the commencement of work.</p>	
E32	<p>Utility Coordination and Respite</p> <p>All work undertaken for the delivery of the SSI, including that undertaken by third parties (such as utility relocation), must be coordinated to ensure respite periods are provided. The Proponent must:</p> <p>(a) schedule any work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with Condition E29; or</p> <p>(b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and</p> <p>(c) provide documentary evidence to the ER in support of any decision made by the Proponent in relation to respite or mitigation.</p>	Clause 8.3
E33	<p>Noise and Vibration Mitigation</p> <p>Noise generating work in the vicinity of sensitive receivers and land uses (including community, religious, educational institutions and noise and vibration-sensitive businesses, medical facilities, and the John Hunter Hospital) resulting in noise levels above the NMLs at critical working areas (such as operating theatres and precision laboratories) must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected receivers are made at no cost to the affected receivers.</p>	Clause 5.2 Clause 8.4
E34	<p>Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <p>(a) construction 'Noise affected' noise management levels established using the <i>Interim Construction Noise Guideline</i> (DECC, 2009);</p> <p>(b) vibration criteria established using the <i>Assessing vibration: a technical guideline</i> (DEC, 2006) (for human exposure);</p>	Clause 8 Clause 6

	<p>(c) Australian Standard AS 2187.2 - 2006 “Explosives - Storage and Use - Use of Explosives”;</p> <p>(d) BS 7385 Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2” as they are “applicable to Australian conditions”; and</p> <p>(e) The vibration limits set out in the <i>German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures</i> (for structural damage).</p> <p>Any work identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan, including in any Out- of-Hours Work Protocol or Out of Hours Work Management Process or equivalent, required by Condition E31, and in relation to Bridge 7 the documents required by Condition A9.</p> <p><i>Note: The Interim Construction Noise Guideline identifies ‘particularly annoying’ activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.</i></p>	<p>Clause 8.1.4 OOHW Protocol</p>
<p>E35</p>	<p>Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:</p> <ul style="list-style-type: none"> • evening (6:00 pm to 10:00 pm) — internal $L_{Aeq(15\text{ minute})}$: 40 dB(A); and • night (10:00 pm to 7:00 am) — internal $L_{Aeq(15\text{ minute})}$: 35 dB(A). <p>The mitigation measures must be outlined in the Noise and Vibration CEMP Sub-plan, including in any Out-of-Hours Work Protocol or Out of Hours Work Management Process or equivalent, required by Condition E31, and in relation to Bridge 7 the documents required by Condition A9.</p>	<p>Clause 8.1.4 OOHW Protocol</p>
<p>E36</p>	<p>Landowner(s) and occupier(s) of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before works that generate vibration commences near those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, landowner(s) and occupier(s) must be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the landowner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Subplan, including in any Out-of-Hours Work Protocol or Out of Hours Work Management Process or equivalent, required by Condition E31, and in relation to Bridge 7 the documents required by Condition A9.</p> <p><i>Note: Condition E54 requires Pre-construction Building and Structure Condition Surveys of buildings and structures of risk of damage to be undertaken prior to the commencement of work in the vicinity of the buildings or structures.</i></p>	<p>Clause 8.5 OOHW Protocol Clause 8.6</p>
<p>E37</p>	<p>The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.</p>	<p>Clause 8.5</p>
<p>E44</p>	<p>The SSI must be delivered with the aim of achieving the following vibration goals:</p> <p>(a) for structural damage to heritage structures, the vibration limits set out in the German Standard <i>DIN 4150-3: Structural Vibration – Part 3 Effects of vibration on structures</i>;</p>	<p>Clause 6.5</p>

	<p>(b) for damage to other buildings and/or structures, the vibration limits set out in the British Standard <i>BS 7385-1:1990 – Evaluation and measurement of vibration in buildings—Guide for measurement of vibration and evaluation of their effects on buildings</i> (and referenced in Australian Standard 2187.2 – 2006 <i>Explosives – Storage and use – Use of explosives</i>); and</p> <p>(c) for human exposure, the acceptable vibration values set out in <i>Assessing Vibration: A Technical Guideline</i> (Department of Environment and Conservation, 2006).</p>	
E54	<p>Building Condition Survey</p> <p>Pre-construction Building and Structure Condition Surveys must be undertaken of all buildings, structures, and utilities and the like, identified in the documents listed in Condition A1, as being at risk of damage from works associated with the SSI.</p> <p>The surveys must be undertaken by a suitably qualified structural engineer before the commencement of any work that could cause damage to buildings, structures and utilities. The results of the surveys must be documented in a Preconstruction Building and Structure Condition Survey Report for each building, structure and utility surveyed. Copies of the Preconstruction Building and Structure Condition Survey Reports must be provided to the owners of the buildings, structures and utilities surveyed no later than one (1) month before the commencement of work in the vicinity of the impacted buildings, structures and utilities.</p>	Clause 8.6
E55	<p>After completion of construction of the SSI, a follow-up condition survey of all items for which building and structure condition surveys were undertaken in accordance with Condition E54, must be undertaken by a suitably qualified structural engineer. The results of the surveys must be documented in a Post-construction Building and Structure Condition Survey Report for each building, structure and utility surveyed. Copies of the Post-construction Building and Structure Condition Survey Reports must be provided to the owners of the buildings, structures and utilities surveyed no later than three months following the completion of construction.</p>	Clause 8.6
E56	<p>The Proponent, where liable, must rectify any damage caused directly or indirectly (for example from vibration or from groundwater change) by the construction or operation of the SSI at no cost to the landowner. Alternatively, the Proponent may pay compensation for the property damage as agreed with the landowner.</p>	Clause 8.6

5 EXISTING ENVIRONMENT

The following section summarises the existing noise and vibration conditions within and adjacent to the SPB, based on information contained within the EIS.

5.1 NOISE CATCHMENT AREAS

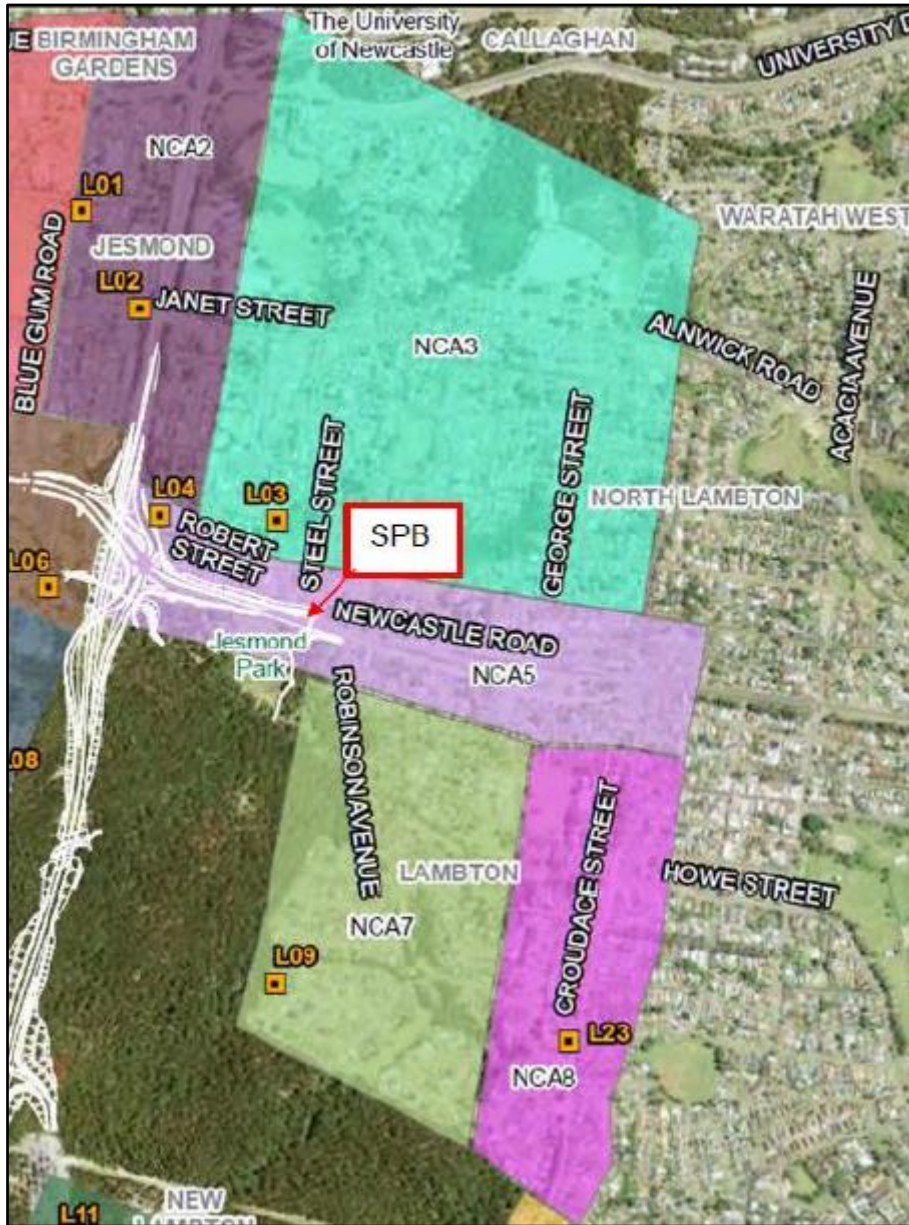
Noise catchment areas (NCA's) that reflect land uses and the nature and types of receivers within each NCA were established as part of the noise assessment. The SPB is located within NCA 5 and in proximity to NCAs 2, 3, 6, 7 and 8. [Figure 2](#) shows the locations and extents of the NCAs in the vicinity of the SPB. [Figure 2](#) also shows the locations of the noise loggers in each NCA. The 2019 GHD assessment found that the SPB works would not impact on NCAs 6 and 8 and hence they have not been included in this CNVMP.

The land use characteristics within the NCA's impacted by the SPB works are described in [Table 5](#) below;

TABLE 5 – NOISE CATCHMENT AREAS

Noise Catchment Area	Description
NCA 2	This area is bounded by Blue Gum Road to the west and Ralph Street to the east in the suburbs of Jesmond and New Lambton. The existing noise environment is dominated by traffic on the existing bypass and Newcastle Road.
NCA 3	This area is to the east of Ralph Street and north of Robert Street in the suburb of North Lambton. The nearest receivers are about 130 m to the north of Newcastle Road.
NCA 5	Receivers located along Newcastle Road to the east of the existing Jesmond roundabout. The existing noise environment is dominated by traffic on Newcastle Road.
NCA 7	This area includes receivers to the south of Newcastle Road to the east of the existing Jesmond roundabout. It includes receivers in Robinson Avenue, Drysdale Drive, Roberts Circuit and other local roads west of Pangari Place in the suburb of Lambton. The nearest receivers are about 120 m to the south of Newcastle Road.

FIGURE 2 – LOCATION OF NCA’S AND NOISE MONITORING LOCATIONS



5.2 SENSITIVE RECIEVERS

The SPB is situated in the residential suburb of Jesmond within the Newcastle City Council local government area (LGA). The SPB will be constructed over Newcastle Road with primarily low-density residential land use to the north, east and west and parkland to the south (Jesmond Park). Sensitive receivers which may be impacted by the SPB works include:

- Residential sensitive receivers
- Non-residential sensitive receivers – recreation areas and places of worship (churches).

The location of noise sensitive receivers within the vicinity of the SPB are shown in [Figure 3](#).

Non- residential noise sensitive receivers potentially impacted by the works are listed in the table below;

TABLE 6 – NON-RESIDENTIAL NOISE RECEVIERS IN THE VICINITY OF THE SPB

NCA	Item	Address	Receiver Type
NCA 5	Jesmond Park Uniting Church	Coles Street, Jesmond	Worship
NCA 5	Saint Margaret’s Anglican Church	Newcastle Road, Jesmond	Worship
N/A	Jesmond Park	Newcastle Road, Jesmond	Active Recreation

The Approximate distances to the nearest noise sensitive receivers in the vicinity of the SPB are displayed in the below table;

TABLE 7 – DISTANCES TO SENSITIVE RECEIVERS

Description	Distance to Receivers (m)	
	Nearest	Typical
Residences on Coles Street	12	12-15
Residences on Kiah Avenue	43	>70
Residences on Steel Street	57	>60
Jesmond Park Uniting Church	19	-
Saint Margaret’s Anglican Church	80	-
Jesmond Park	0	100

5.3 AMBIENT NOISE

The main contributor to ambient noise in the SPB project area is road traffic noise, including from heavy vehicles, along Newcastle Road. Long term unattended noise surveys in the RP2J area, including the SPB area, were conducted as part of the EIS in 2015. The unattended noise monitoring was undertaken to provide background noise levels and to establish appropriate construction noise assessment criteria. Monitoring sites were selected according to the noise sources affecting the site (e.g. traffic and/or other ambient sources) and included all receivers potentially affected by the RP2J project.

The GHD’s 2019 assessment included receivers within a radius of about 600 m of the SPB works (a total of 733 potential receivers), as shown below in [Figure 3](#);

FIGURE 3 – NOISE AND VIBRATION SENSITIVE RECEIVERS AND NOISE MONITORING LOCATIONS



The *Industrial Noise Policy* (INP) recommends that the level of background and ambient noise be assessed separately for the day, evening and night periods which are defined as follows:

Day:	7:00 am to 6:00 pm, Monday to Saturday 8:00 am to 6:00 pm Sundays and Public Holidays
Evening:	6:00 pm to 10:00 pm, Monday to Sunday
Night:	10:00 pm to 7:00 am, Monday to Saturday 10:00 pm to 8:00 am Sundays.

The rating background level (RBL) is used to determine the appropriate 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). A summary of the noise monitoring results and adopted RBLs in the vicinity of the SPB is provided in [Table 8](#);

TABLE 8 – SUMMARY OF BACKGROUND AND AMBIENT NOISE LEVELS (DBA)

NCA	Noise Logger ID and location	Rating background level (RBL) 90 th percentile L _{A90} (15 min)			Ambient noise levels, L _{Aeq} (period)		
		Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
2	L02 18 Janet Street	49	43	35	59	55	51
3	L03 16 Shereline Ave	37	37	30	56	43	43
5	L04 53 Robert Street	55	51	41	61	62	55
7	L09 40 Roberts Circuit	39	36	34	67	50	57

6 NOISE AND VIBRATION CRITERIA

The EPA recommends noise and vibration management levels and goals be adopted for assessing construction noise and vibration in accordance with:

- Interim Construction Noise Guideline (ICNG) (DECC, 2009)
- Assessing Vibration: A Technical Guideline (DEC, 2006).

Relevant elements of these documents are summarised and discussed in this section.

6.1 CONSTRUCTION NOISE ASSESSMENT OBJECTIVES

The ICNG provides guidelines for the assessment and management of 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
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

6.2 CONSTRUCTION NOISE CRITERIA

Construction noise assessment goals presented in the ICNG are referenced to noise management levels (NML) for residential, sensitive land uses and commercial/ industrial premises.

6.2.1 RESIDENTIAL LAND USE

[Table 9](#) sets out the residential NMLs and how they are to be applied during the construction of the SPB.

TABLE 9 – ICNG RESIDENTIAL NOISE MANAGEMENT LEVELS

Time	Management Level - L_{Aeq}	How to Apply
Standard Working hours	Rating Background Level +10 dB	<p>This noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where measurements are greater than the noise affected level, Daracon will investigate further changes to work methods to reduce noise.</p> <p>Community consultation will occur regarding likely impacts</p>
	Highly Noise Affected 75 dB(A)	<p>Levels at which there may be a strong affected level represents the point above which there is strong community reaction.</p> <p>Daracon will conduct community consultation on noise generating activities and provide respite periods as directed by the relevant authority.</p>
Outside Standard Working Hours	Rating Background Level +5 dB	<p>Community concerns imminent.</p> <p>Daracon will consult the community regarding night works and take steps to minimise the noise from the work activities.</p>

6.2.2 SLEEP DISTURBANCE

The ICNG (DECC 2009) states that where construction work is planned to extend over more than two consecutive nights, assessment of the maximum noise levels and the extent and number of times the maximum noise level exceeds the rating background levels should be carried out.

The INP Application Notes (EPA 2010) recommends that where the $L_{A1(1min)}$ or $L_{A(max)}$ exceeds the $L_{A90(15min)}$ by more than 15 dB(A) outside the bedroom window, a more detailed analysis is required.

The ICNG (DECC 2009) also refers to the Environmental Criteria for Road Traffic Noise (EPA, 1999) for more guidance on sleep disturbance from maximum noise level events. This guideline has since been superseded by the RNP (DECCW 2011). Both guidelines discuss research into the effects of maximum noise level events on sleep disturbance and conclude that the L_{Amax} or $L_{A1(1min)}$ should not exceed the ambient $L_{A90(15min)}$ noise level by more than 15 dB(A). This takes into account the emergence of noise events but does not directly limit the number of such events or their highest level, which are also found to affect sleep disturbance.

The RNP (DECCW 2011) provides the following further guidance:

- Maximum internal noise levels below 50 – 55 dB(A) are unlikely to cause awakening reactions

- One or two noise events per night with maximum internal noise levels of 65 to 70 dB(A) are not likely to significantly affect health and wellbeing.

Accordingly, the background level plus 15 dB(A) has been applied as the screening level trigger for sleep disturbance during the construction of the SPB.

6.2.3 OTHER SENSITIVE LAND USES

Other sensitive land uses, such as schools and offices, typically find noise from construction to be disruptive when the properties are being used, such as during work and school times. Table 10 presents NML’s for sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed.

TABLE 10 – NON-RESIDENTIAL AND COMMERCIAL/INDUSTRIAL LAND USES NML’S

Land Use	Noise Assessment Location	NML (L _{Aeq} , 15min)
Classrooms at schools and other educational institutions	Internal	45
Place of worship		
Passive Recreation Areas ¹	External	60
Active Recreation Areas ²	External	65
Industrial Premises	External	75
Commercial Premises	External	70

Notes:

¹ Passive recreation areas characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion.

² Active recreation areas are characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.

6.3 ADOPTED CONSTRUCTION NOISE MANAGEMENT LEVELS

The NMLs adopted for the construction of the SPB have been determined based on the measured noise levels for each NCA presented in Clause 5.1 and the criteria provided in Clause 6.2 The lowest RBL’s within each NCA have been used to determine the applicable NML.

The adopted NMLs and sleep disturbance screening criterion for residential receivers are provided in [Table 11](#). [Table 12](#) sets out the adopted construction NMLs for non-residential receivers.

TABLE 11 – CONSTRUCTION NML’S AND SLEEP DISTURBANCE SCREENING RESIDENTIAL CRITERIA (STANDARD HOURS)

NCA	Adopted background noise RBL L_{A90}			NML ($L_{Aeq(15min)}$) (dBA)					Sleep disturbance screening criterion ³ L_{Amax} (dBA)
				Standard working hours		Out of standard hours			
	Day	Evening	Night	Noise affected level	Highly affected noise level;	Day ¹	Evening ²	Night ³	
2	49	43	35	59	75	54	48	40	
3	37	37	30	47	75	42	42	35	40
5	55	51	41	65	75	60	56	46	61
7	39	36	34	49	75	44	41	39	54

1 OOHW Day = 7 am to 8 am and 5 pm to 6 pm Saturday, 8 am to 6 pm Sunday and public holidays

2 OOHW Evening = 6 pm to 10 pm, Monday to Sunday and public holidays

3 OOHW Night = 10 pm to 7 am, Monday to Saturday; 10 pm to 8 am Sunday and public holidays

For work outside standard hours, CoA E35 requires that mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:

- evening (6:00 pm to 10:00 pm) — internal $L_{Aeq(15\text{ minute})}$: 40 db(A)
- night (10:00 pm to 7:00 am) — internal $L_{Aeq(15\text{ minute})}$: 35 dB(A).

TABLE 12 – CONSTRUCTION NML’S FOR NON-RESIDENTIAL RECEIVERS

Non-residential receiver	No. of buildings	Land use	NCA	NML $L_{Aeq(15\text{ minute})}$ dB(A)
Jesmond Park Uniting Church	1	Place of Worship	5	45 (Internal)*
Saint Margaret’s Anglican Church	1	Place of Worship	5	45 (Internal)*
Jesmond Park	N/A	Active Recreation	5	65*

* When in use

6.4 CONSTRUCTION VIBRATION ASSESSMENT OBJECTIVES

The following construction vibration goals apply for the SPB as required by CoA E34 and E44:

- For structural damage to heritage structures, the vibration limits set out in the German Standard *DIN 4150-3: Structural Vibration - effects of vibration on structures*
- For damage to other buildings and/or structures, the vibration limits set out in the British Standard BS 7385-1:1990 - *Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings (and referenced in Australian Standard 2187.2 – 2006 Explosives – Storage and use – Use of explosives)* and

BS 7385 Part 2-1993 “*Evaluation and measurement for vibration in buildings Part 2*” as they are “applicable to Australian conditions”

- For human exposure, the acceptable vibration values set out in *Assessing Vibration: A Technical Guideline* (DEC, 2006).

Further detail is provided in the following sections.

6.5 VIBRATION CRITERIA

Effects of ground vibration on buildings resulting from construction can be classified as follows:

- Human exposure – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed
- Effects on building contents – vibration where the building contents may be affected
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

6.5.1 HUMAN COMFORT

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with *Assessing Vibration: A Technical Guideline* (DEC, 2006). The guideline provides criteria which are based on the British Standard *BS 6472-1992 Evaluation of human exposure to vibration in buildings (1-80Hz)*. Sources of vibration are defined as either 'continuous', 'impulsive' or 'intermittent':

- Continuous vibration – from uninterrupted sources, e.g. machinery, steady road traffic, continuous construction activity
- Impulsive vibration – up to three instances of sudden impact per monitoring period e.g. occasional dropping of heavy equipment, occasional loading and unloading
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously.

Maximum and preferred values for continuous and impulsive vibration are defined in [Table 13](#). Application of the continuous and impulsive vibration criteria considers the level, duration of exposure, time of day, and varies for land uses.

TABLE 13 – PREFERRED AND MAXIMUM WEIGHTED VALUES FOR CONTINUOUS AND IMPULSIVE VIBRATION (AVTG, DEC 2006)

Location	Assessment period ¹	Rms acceleration (m/s ²) ³		Peak velocity (mm/s) ⁴	
		Preferred	Maximum	Preferred	Maximum
Continuous vibration					
Critical areas ²	Day or night-time	0.0050	0.010	0.014	0.28
Residences	Daytime	0.010	0.020	0.28	0.56
	Night-time	0.007	0.014	0.20	0.40
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.040	0.056	1.1
Workshops	Day or night-time	0.040	0.080	1.1	2.2
Impulsive vibration					
Critical areas ²	Day or night-time	0.0050	0.0210	0.14	0.28
Residences	Daytime	0.30	0.60	8.6	17.0
	Night-time	0.10	0.20	2.8	5.6
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	1.28	18.0	36.0

Notes:

- 1 Daytime is 7.00am to 10.00pm and night-time is 10.00pm to 7.00am
- 2 Such as hospital operating theatres or precision laboratories
- 3 Values derived from z-axis critical frequency range 4–8 Hz. Where required, a more detailed analysis can be conducted as per BS 6472–1992.
- 4 Values given for the most critical frequency range >8 Hz assuming sinusoidal motion. Where required, a more detailed analysis can be conducted as per AS 2670.2–1990. Sufficient justification should accompany the use of a peak velocity approach if used in an assessment.

Intermittent vibration impact is assessed using vibration dose values (VDVs). The VDV method is more sensitive to peaks in the acceleration waveform and makes corrections to the criteria based on the duration of the source’s operation. The acceptable VDV’s for intermittent vibration are defined in [Table 14](#) below;

TABLE 14 – ACCEPTABLE INTERMITTENT VIBRATION DOSE VALUES (M/S.^{1.75})

Location	Daytime ¹		Night-time ¹	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical areas ²	0.10	0.20	0.10	0.02
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:

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

² Includes operating theatres, precision laboratories and other areas where vibration sensitive activities may occur.

Humans are capable of detecting vibration at levels well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in *BS 5228.2 – 2009, Code of Practice for noise and vibration on construction and open sites – Part 2: Vibration*, as shown below:

- 0.14 mm/s - vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction
- 0.3 mm/s – vibration might be just perceivable in residential environments
- 1.0 mm/s – It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents
- 10 mm/s – vibration is likely to be intolerable for any more than a very brief exposure.

6.5.2 STRUCTURAL DAMAGE

Currently, there is no Australian Standard that sets the criteria for the assessment of building damage caused by vibration. The standards by which building damage from construction-induced vibration is assessed are British Standard *BS 7385 Part 2 Evaluation and measurement of vibration in buildings* (BS 7385) and the German Standard *DIN 4150: Part 3 – 1999 Effects of Vibration on Structure* (DIN 4150-3) (DIN, 1999).

British Standard

BS 7385 is used as a guide to assess the likelihood of building damage from ground vibration. BS 7385 suggests levels at which ‘cosmetic’, ‘minor’ and ‘major’ categories of damage might occur, where the categories of structural damage are defined as:

- Cosmetic - the formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/ concrete block construction
- Minor - the formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks
- Major - damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.

The levels for structural damage outlined in the standard refer to non-continuous vibration sources and are considered ‘safe limits’ up to which no damage due to vibration effects are expected to occur for the various building types. Where vibration is continuous these levels may be reduced by up to 50% and additional assessment against the standard would be necessary.

BS 7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4 to 250 Hz, being the range usually encountered in buildings. [Table 15](#) sets out the BS 7385 criteria for cosmetic, minor and major damage.

TABLE 15 – BS 7385 STRUCTURAL DAMAGE CRITERIA

Group	Type of structure	Damage level	Peak component particle velocity ¹ (mm/s)		
			4 – 15 Hz	15 – 40Hz	≥40Hz
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50	50	50
		Minor ²	100	100	100
		Major ²	200	200	200
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 - 20	20 - 50	50
		Minor ²	30 - 40	40 - 100	100
		Major ²	60 - 80	80 - 200	200

Notes:

- 1 Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.
- 2 Minor and major damage criteria established based on BS 7385 Part 2 (1993) Section 7.4.2

German Standard

DIN 4150-3 provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be more stringent criteria. DIN 4150-3 presents the recommended maximum limits over a range of frequencies (Hz), measured in any direction, and at the foundation or in the plane of the uppermost floor of a building or structure.

Where heritage structures are impacted, DIN 4150-3 vibration criteria will be applied. The criteria applicable to heritage buildings are identified in [Table 16](#). Based on DIN 4150-3, a measured value exceeding those listed in [Table 16](#) will not necessarily lead to damage if it is significantly exceeded, however, further investigations may be necessary.

TABLE 16 – DIN 4150-3 VIBRATION GUIDELINES FOR HERITAGE BUILDINGS

Type of structure	Guideline values for vibration velocity (mm/s)			
	Vibration at the foundation at a frequency of			Vibration at the horizontal plane of the highest floor at all frequencies
	1 - 10 Hz	10 - 50 Hz	50 - 100 Hz ¹	
Heritage buildings	3	3 - 8	8 - 10	8

Notes: ¹ At frequencies above 100 Hz the values given in this column may be used as minimum values.

6.5.3 SAFE WORKING DISTANCES

Safe working buffer distances to comply with the human comfort, cosmetic damage, standard dwelling and heritage building structural damage criteria for typical intermittent vibration values are listed in [Table 17](#), based on advice given in BS7385: 1993 – *Evaluation and measurement of vibration in buildings*. As there are no anticipated sources of continuous or impulsive vibration, assessment for human comfort impacts has been carried out for intermittent vibration only.

Vibration may be amplified in multi-level buildings through the structure to the upper floors. A doubling of the buffer distances provided in [Table 17](#) will provide a conservative allowance for this possible effect in multi-level buildings.

TABLE 17 – VIBRATION ESTIMATED SAFE WORKING BUFFER DISTANCES (M)

Activity	Human comfort BS 5228-2 criteria ¹ (1.0 mm/s)	Structural damage	
		Heritage structure DIN 4150-3 criteria (3.0 mm/s)	Standard dwellings DIN 4150-3 criteria (5.0 mm/s)
Roller	90	24	13
15 tonne vibratory roller	140	35	18
Loader breaking kerbs	120	30	16
7 tonne compactor	90	24	13
Pavement Breaker	90	24	13
Dozer	60	15	8
Backhoe	10	3	2
Jackhammer	4	2	1
Excavator	25	7	4
Piling (bored/CFA)	120	35	17

The safe working distances presented in [Table 17](#) are indicative and will vary depending on the item of plant (particularly its power rating) and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions and vibration monitoring is recommended at specific sites.

7 ENVIRONMENTAL ASPECTS AND IMPACTS

7.1 ENVIRONMENTAL ASPECTS

Construction of the SPB will involve a range of activities incorporating various heavy machinery, plant and equipment that will operate at the SPB construction works site. In order to assess the level of potential impact on noise and vibration sensitive receivers, the broad categories of construction activity likely to interact with these receivers include:

- site establishment
- clearing and grubbing
- utility relocation
- earthworks and drainage
- materials haulage
- bridgeworks (piling)
- paving and concrete saw cutting
- ancillary facilities
- finishing works such as landscaping
- road furnishing.

7.2 ENVIRONMENTAL IMPACTS

The potential for noise and vibration impacts on sensitive receivers or structures will depend on a number of factors including:

- 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 condition of sensitive receivers
- hours/duration of construction works
- proximity of heavy traffic areas.

Relevant aspects and the potential for related impacts have been considered in the Global Risk Assessment (GRA) which is provided as part of the IPMP (IPMP Appendix 13).

Noise and vibration impacts attributable to construction of the SPB are anticipated. Clause 8 of this CNVMP provides a suite of mitigation measures that will be implemented to avoid or minimise noise and vibration impacts on the receiving community and/or built environment.

8 ENVIRONMENTAL MITIGATION AND MANAGEMENT MEASURES

A range of environmental requirements and management measures are identified in the EIS and SPIR, the conditions of approval and relevant Roads and Maritime documents.

Specific measures and requirements to address construction noise and vibration impacts relevant to the SPB are outlined in [Table 18](#). Construction working hours are addressed in Clause 8.1.

Activities that are predicted to exceed the NMLs in [Table 11](#) and [Table 12](#) and the requirements of CoA E27(e) will only occur in accordance with CoAs E30, E33 and E34. Generally, construction work will be undertaken in standard construction hours whenever practicable and in compliance with the daytime NMLs. Some activities, such as bridgeworks, paving and operation of ancillary facilities may occur during out of hours in accordance with the requirements of CoAs E27 and E31.

In accordance with CoA E33, noise generating work in the vicinity of sensitive receivers and land uses resulting in noise levels above the NMLs at critical working areas will not be timetabled within sensitive periods, unless other reasonable arrangements with the affected receivers are made at no cost to the affected receivers.

In accordance with CoA E34, any work identified as exceeding NMLs and/or vibration criteria will be managed in accordance with this CNVMP and the Out of Hours Work Protocol required by CoA E31.

TABLE 18 – NOISE AND VIBRATION ENVIRONMENTAL MANAGEMENT MEASURES

No.	Environmental Safeguard	Daracon Reference	Responsibility	Timing
NV07	<p>An out of hours work procedure (for work outside the proposed extended construction hours) will be developed and would include the following:</p> <ul style="list-style-type: none"> • Contact the local community potentially affected by the proposed work and inform them by letter of the proposed work, location, type of work, days and dates of work and hours involved. The contact will be made before the start of work • A suitable advertisement will be placed in local papers including a reference to night-time noise impacts • A 24-hour community liaison phone number and permanent site contact will be provided so that complaints can be received and addressed in a timely manner • Measures to investigate and respond to any valid noise complaints. 	Clause 8.1.4 OOHW Protocol	Daracon	Pre-construction / Construction
NV08	Building condition surveys will be conducted at receivers (as required) within 18 m of proposed vibration generating activities (buildings and other structures).	Clause 8.6	Daracon	Pre-construction / Post construction
NV09	Notification of the proposed construction activities by letterbox drop will be carried out for all occupied buildings within 18 m of vibration generating activities.	Clause 8.5	Daracon	Pre-construction / Construction
NV10	Where construction work will be located within 18 m of any building, vibration monitoring will be carried out at the beginning of the given construction activity. Where measurements indicate building damage criteria are exceeded, vibration generating activities are to immediately halt and alternative low-vibration work practices will be investigated and implemented.	Clause 8.5 Appendix 2	Daracon	Construction
NV11	<p>A documented review will be carried out to determine if alternative methods can be implemented, where construction activity involving vibration intensive plant occurs:</p> <ul style="list-style-type: none"> • Within 18 m of buildings • Within the sensitive equipment buffer distances <p>Or if any monitoring indicates levels are excessive.</p>	Clause 8.5	Daracon	Construction
NV13	Where practical, equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate silencers and be in good working order. Machines found to produce excessive noise compared to normal industry expectations will be removed from the site or stood down until repairs or modifications can be made.	Clause 8.2	Daracon	Construction

No.	Environmental Safeguard	Daracon Reference	Responsibility	Timing
NV14	<p>Where reasonable and feasible, measures will be taken to shield sensitive receivers from noise such as:</p> <ul style="list-style-type: none"> • The layout of the construction compound so that primary noise sources are at a maximum distance from residences, with solid structures (sheds, containers, etc.) placed between residences and noise sources (and as close to the noise sources as is practical). • Enclosures to shield fixed noise sources such as pumps, compressors, fans, screens (where practicable). • Taking advantage of site topography when situating plant. 	Clause 8.2	Daracon	Construction
NV15	<p>In the event of a valid noise complaint, monitoring will be carried out and reported as soon as possible. If exceedances are detected, the situation will be reviewed to attempt to identify reduce the impact to acceptable levels, where practicable.</p>	<p>Clause 9.3 Clause 9.5.1 Appendix 1</p>	Daracon	Construction

8.1 WORKING HOURS

8.1.1 HOURS OF WORK

In accordance with CoA E26, standard construction hours are:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 5 pm
- At no time on Sundays and public holidays.

8.1.2 HIGH NOISE

In accordance with CoA E30, highly noise intensive works exceeding 75 dB(A)_{L_{Aeq}(15 minute)} noise descriptor at a sensitive receiver will only be undertaken:

- Monday to Friday: between 8:00 am to 6:00 pm
- Saturday: between 8:00 am to 1:00 pm
- If continuously, then not exceeding three hours, with a minimum respite from those activities and works of not less than one hour.

'Continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing the work.

Any work that is performed outside of normal working hours is to minimise noise impacts in accordance with the OOHW Protocol.

8.1.3 VARIATION TO STANDARD HOURS OF WORK

In accordance with CoA E27, works outside of the standard construction hours identified in [Clause 8.1.1](#) may be undertaken in the following circumstances:

- 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 the loss of lives, property and/or to prevent environmental harm or
- work approved under the SPB Out-of-hours-work Protocol under CoA E31 (refer [Clause 8.1.4](#) and Appendix 2) or
- work that causes:
 - 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
 - no more than the 'Noise affected' noise management levels specified in Table 3 of the *Interim Construction Noise Guideline* (DECC, 2009) at other sensitive land uses, and
 - continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of *Assessing Vibration: a technical guideline* (DEC, 2006), and

- intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of *Assessing Vibration: a technical guideline* (DEC, 2006).

In accordance with CoA E28, the Daracon will notify the Roads and Maritime Project Manager, the ER and the EPA (if required) on becoming aware of the need for the emergency works. Daracon will use its best endeavours to notify all noise and /or vibration sensitive receivers of the likely impact and duration of the emergency works.

8.1.4 OUT OF HOURS WORK

For purposes of noise assessment (refer [Table 11](#)) and noise mitigation, out of hours for the SPB are divided into the following periods:

OOHW Day	7 am to 8 am and 5 pm to 6 pm Saturday, 8 am to 6 pm Sunday and public holidays
OOHW Evening	6 pm to 10 pm, Monday to Sunday and public holidays
OOHW Night	10 pm to 7 am, Monday to Saturday, 10 pm to 8 am Sundays and public holidays

The Out-of-Hours Work (OOHW) Protocol, prepared in accordance with CoA E31, identifies the process for the consideration, management and approval of any SPB works which are outside the hours defined in CoA E26 and that are not subject to an EPL. The Protocol has been prepared to address the requirements of CoA E27, E28, E29 and E31, the *Construction Noise and Vibration Guidelines* (Roads and Maritime, 2016) and Roads and Maritime specifications. The OOHW Protocol is provided as a sperate document to this CNVMP.

8.2 NOISE MITIGATION MEASURES

Noise impacts from construction activities for the SPB will be reduced by implementing measures to control noise at the source including:

- Selecting equipment to minimise noise emissions, where practicable
- Ensuring construction plant and equipment is fitted with properly maintained noise suppression devices in accordance with the manufacturer’s specifications
- Ensuring construction plant and equipment are maintained in an efficient condition and fitted with appropriate silencers
- Removing from the site machines found to produce excessive noise compared to typical industry expectations or standing down these machines until repairs or modifications can be made
- Training site personnel to operate construction plant and equipment in a proper and efficient manner

- Using alternatives to diesel and petrol engines and pneumatic units where feasible and reasonable
- Avoiding vehicle movements at night, where practicable
- Reducing plant throttle settings and turning off equipment when not in use
- Avoiding or using less irritating alternatives to audible reversing and movement alarms or configure the construction site/haulage routes to minimise the need for reversing of heavy vehicles and mobile plant
- Using dampening materials where relevant
- Erecting temporary noise barriers at site boundaries and ancillary facilities, and/or using mobile hoardings to reduce noise transmission to sensitive receivers
- Positioning stockpiles and temporary buildings within site layouts to act as acoustic barriers
- Locating compressors, generators, pumps and any other fixed plant as far from residences as possible and behind site structures
- Selecting equipment to minimise noise emissions where practical to do so
- Avoiding the positioning and use of vehicle parking areas and unloading/loading zones near residences and other sensitive land uses
- Avoiding positioning multiple plant near residences and other sensitive land uses
- Restrict areas where mobile plant can operate so that it is away from residences and other sensitive land uses at particular times
- Locating site access points away from residences and other sensitive land uses
- Ensuring drivers are aware of nominated vehicle routes and parking areas
- Locating electrical generators away from residences and other sensitive land uses
- Preventing construction vehicles arriving at the SPB site and construction compounds outside the standard construction hours described in [clause 8.1.1](#) from queuing with idling engines
- Avoiding the use of outdoor radios during night-time periods
- Avoiding shouting and slamming doors
- Avoiding unnecessary idling of machinery and plant
- Where practical, operating machines at low speed / power and switching them off when not in use rather than leaving them idling for prolonged periods
- Minimising the reversing of machines
- Avoiding dropping materials from height
- Limiting deliveries outside normal working hours as far as practicable
- Avoiding metal to metal contact on materials as far as practical.

Daracon will make all efforts to implement the measures outlined above during construction of the SPB. Daracon will prepare construction programs and construction site layouts to minimise noise

impacts from construction activities. Regular inspections, including spot inspections of plant and equipment, will be carried out by the site supervisor and/or the ESR to monitor the compliance with these requirements.

The layout of Ancillary Facilities D and E will be arranged so that primary noise sources are at a maximum practicable distance from residences, with solid (sheds and containers) placed between residences and noise sources (and as close to the noise source as is practical) where feasible. Enclosures will be provided to shield fixed noise sources such as pumps, compressors, fans with screens where practicable. The site topography will be considered when situating plant.

Boundary fencing will be erected around Ancillary Facilities D and E to reduce noise impacts, where they are adjacent to noise sensitive receivers, for the duration of construction of the SPB, unless otherwise agreed with affected residents, business operators and landowners (including NCC where it is the landowner).

The site layout plans for Ancillary Facilities D and E, including boundary fencing, are provided in the Ancillary Facility Management Plan (Appendix A4 of the CEMPP).

8.3 CO-ORDINATION AND RESPITE

In accordance with CoA E32, Daracon will coordinate all work for the delivery of the SPB, including that undertaken by third parties (such as utility relocations), to ensure respite periods are provided. Daracon will:

- Schedule any work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with CoA E29
- Consider the provision of alternative respite or mitigation to impacted noise sensitive receivers
- Provide documentary evidence to the ER in support of any decision made by the Roads and Maritime in relation to respite or mitigation.

Further details of the proposed respite periods and measures are provided in the OOHV Protocol.

8.4 SCHEDULING OF WORKS

Sensitive receivers in the vicinity of the SPB are identified in [Figure 3](#) and Appendix 15 of the CEMPP.

In accordance with CoA E33, Daracon will not timetable noise generating work in the vicinity of sensitive receivers and land uses (including community, religious, educational institutions) resulting in noise levels above the NMLs at critical working areas) within sensitive periods, unless other reasonable arrangements with the affected receivers are made at no cost to the affected receivers.

8.5 VIBRATION MITIGATION MEASURES

Daracon will implement measures to prevent damage to adjacent public utilities, structures and buildings resulting from construction vibration.

Daracon will undertake an environmental risk assessment to determine potential risks to buildings and occupants from discrete work activities and ensure that all reasonable and feasible vibration mitigation and management measures are implemented.

Properties at risk of exceeding the screening criteria for cosmetic damage (refer [Clause 6.5](#)), will be considered when undertaking works in close proximity to these locations, with the required plant and safe working distance to be assessed prior to commencing works.

In accordance with CoA E36, Daracon will notify the landowners and occupiers of the at-risk properties prior to works that generate vibration commencing near those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, Daracon will provide the landowners and occupiers a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the landowner and occupier.

Where construction work will be located within 18 m of any buildings, Daracon will carry out vibration monitoring at the beginning of the activity. Where measurements indicate building damage criteria are exceeded, Daracon will immediately halt vibration generating activities and investigate and implement alternative low-vibration work practices.

Daracon will carry out a documented review to determine if alternative methods can be implemented, where construction activity involving vibration intensive plant occurs within 18 m of buildings, , or if monitoring indicates levels are excessive. Works shall only recommence where effective controls are implemented.

8.6 BUILDING CONDITION SURVEYS

In accordance with CoA E54, Daracon will undertake Pre-construction Building and Structure Condition Surveys of all buildings, structures, and utilities and the like at risk of damage from works associated with the SPB or if these are located within the distance from the construction activity specified in [Table 17](#).

Daracon will arrange for the surveys to be undertaken by a suitably qualified structural engineer prior to the commencement of any work on the SPB that could cause damage to buildings, structures and utilities. The results of the surveys will be documented in a Pre-construction Building and Structure Condition Survey Report for each building, structure and utility surveyed. The Building Condition Inspection Reports will contain photographs of the inspected properties and include details of the inspectors' qualification and expertise, together with a list of any identified defects, where relevant.

Daracon will provide copies of the Survey Reports to Roads and Maritime and the owners of the buildings, structures and utilities surveyed no later than one month before the commencement of work in the vicinity of the impacted buildings, structures and utilities.

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

In accordance with CoA E56, Daracon, where liable, will rectify any damage caused directly or indirectly (for example from vibration or from groundwater change) by the construction of the SPB at no cost to the landowner. Alternatively, Daracon may pay compensation for the property damage as agreed with the landowner.

9 COMPLIANCE MANAGEMENT

9.1 ROLES AND RESPONSIBILITIES

The organisational structure and roles and responsibilities for Daracon personnel are provided within IPMP (refer IPMP – Appendix 2). The roles and responsibilities specific to the construction of the SPB are provided within IPMP, which displays the organisational chart for the project (refer IPMP – Appendix 1).

9.2 COMMUNICATION

Communication with stakeholders and the community is detailed within the Construction Community Liaison Management Plan (CCLMP), which includes the key aspects identified within the Community Communication Strategy (CCS) developed by RMS.

Construction noise and vibration management information will be communicated to the community and stakeholders in accordance with the principles and procedures outlined CCLMP.

9.3 COMPLAINTS MANAGEMENT

The management of complaints for the SPB will be in accordance with the Construction Community Liaison Management Plan (CCLMP), which includes the key aspects identified within the Complaints Management System (CMS) developed by RMS.

9.4 TRAINING

To ensure that this CNVMP is effectively implemented, all site personnel (including sub-contractors) will undergo site induction training that includes construction noise and vibration management issues prior to construction commencing. The induction training will address elements related to noise and vibration management, including:

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

- specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works.

9.5 MONITORING AND INSPECTIONS

9.5.1 MONITORING

Noise and vibration monitoring will include, but not be limited to:

- monthly noise monitoring at sensitive receivers
- spot checks of noise intensive plant
- attended vibration monitoring
- dilapidation surveys of buildings and structures.

In the event of a valid noise complaint, Daracon will undertake attended compliance noise and vibration monitoring and report the results to Roads and Maritime as soon as possible.

The noise and vibration monitoring program for the SPB construction is included in [Appendix 1](#) and [Appendix 2](#).

9.5.2 INSPCETIONS

Regular inspections of sensitive areas, activities and control measures will occur for the duration of the construction of the SPB. A weekly environmental inspection will be completed by the ESR and /or Project Engineer.

9.6 INCIDENTS

Incidents will be managed in accordance with Section 9 of the IPMP and Section 6.11 of the CEMPP.

9.7 AUDITING

Audits (both internal and external) will be undertaken to assess the effectiveness of noise and vibration management measures, compliance with this CNVMP, conditions of approval and other relevant approvals, licenses and guidelines. Audit requirements are detailed in Section 11.4 of the IPMP and Section 5.9 of the CEMPP.

9.8 NON- CONFORMANCES

A non-conformance is the failure or refusal to comply with the requirements of project system documentation, including this CNVMP. Non-conformances may be identified through auditing and review processes (Section 11.4 of the IPMP and section 5.9 of the CEMPP), monitoring and inspection processes (Section 11 of the IPMP) or incident management (Section 9 of the IPMP and Section 6.11 of the CEMPP).

9.9 REPORTING

Reporting requirements and responsibilities are documented in Section 5.11 of the IPMP and section 5.11 of the CEMPP.

Records of noise and vibration monitoring will be provided to RMS as requested or as part of Daracons monthly reporting. Reporting may include, but not limited to;

- Date and time of monitoring
- Location of monitoring
- Results assessed against allowable criteria
- Complaint received and response actions

10 REVIEW AND IMPROVEMENT

10.1 CONTINUOUS IMPROVEMENT

Continuous improvement of this CNVMP will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement. The continuous improvement process will be designed to:

- identify areas of opportunity for improvement of environmental management and performance
- identify environmental risks not already included in the risk register
- 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
- make comparisons with objectives and targets.

10.2 CNVMP UPDATE AND AMENDMENT

The processes described in Section 11 of the IPMP may result in the need to update or revise this CNVMP. This will occur as needed.

Any revisions and/or changes to the CNVMP will be distributed to all relevant stakeholders in accordance with the approved document control procedure detailed in Section 13 of the IPMP.

11 DEFINITIONS

All terms referenced within this plan are included within [REG.00001](#) *Definitions & Glossary of Terms Register*.

12 ASSOCIATED DOCUMENTS AND PROCEDURES

Approved Forms, Process Flowcharts, Registers and/or other documents referenced within the body of, or those that are associated with this plan, are accessible and made available for all Daracon personnel via the following link: <https://dms.daracon.com.au/documents>

APPENDIX 1 Noise Monitoring Procedure

The noise monitoring procedure to be implemented during the construction of the SPB is provide in the following – [Table 1](#). All noise monitoring will be undertaken in accordance with Australian Standard AS 2659.1 – 1998: "Guide to the use of sound measuring equipment – portable sound level meters", or any revisions of that standard which may be made by Standards Australia, and the compliance monitoring guidance provided in the "NSW Noise Policy for Industry" (EPA, 2017).

TABLE 1 - NOISE MONITORING PROCEDURE

Monitoring Details	Frequency	Test Procedure
Noise monitoring at sensitive receivers	Monthly	Test method to comply with AS 2659.1:1998 and includes; <ul style="list-style-type: none"> • Sound level meter configured for "Fast" time weighting and "A" frequency weighting • Test environment will be free from reflecting objects where possible. Where the noise monitoring is conducted within 3.5meters of large walls or a building façade, then a reflection correction of up to -2.5dBA will be applied to remove the effect of increased noise due to sound reflections from such structures • Tests will not be carried out during rain or when the wind speed at the test site exceeds 5m/s • Conditions such as wind velocity, wind direction, temperature, relative humidity and cloud cover will be recorded. • Monitoring period should be sufficient such that the measured noise levels are representative of the noise over a 15-minute period • At a minimum Leq, Lmax, L10 and L90 levels will be measured and reported • The observations of the person undertaking the measurements will be reported including audibility of construction noise, other noise in the environment and any discernible construction activities contributing to the noise at the receiver
OOHW noise monitoring at sensitive receivers	As required: during OOHW	
In response to a noise complaint; <ul style="list-style-type: none"> • If monitoring is considered an appropriate response to determine if noise levels exceed predicted 'worst case' construction noise levels – refer Table 11 (CNVMP) 	As required	
Spot checks of noise intensive plant	Monthly – for construction activities predicted to exceed NML's	The test procedure for construction plant will follow the stationary test procedures according to Australian Standard AS 2112.1 <ul style="list-style-type: none"> • Sound level meter configured for "Fast" time weighting and "A" frequency weighting • The test environment will be free from reflecting objects • Tests will not be carried out during rain or when the wind speed at the test site exceeds 5 m/s • in accordance with AS 2012.1, a minimum of 3 measurement points will be defined at locations on the hemispherical surface around the plant with the radius determined by the basic length (L) of the machine • The A-weighted Leq background noise at the measurement locations will be at least 6 dB and preferably 10dBA below the level with the plant operating. • Leq and L10 levels will be measured and reported
Where required; <ul style="list-style-type: none"> • Refining construction methods • To reduce noise levels 	As required	

APPENDIX 2 Vibration Monitoring Procedure

The vibration monitoring procedure to be adopted for the SPB is provided in [Table 2](#). All vibration monitoring will be undertaken in accordance with the technical guidance provided in the "*Environmental Noise Management - Assessing Vibration: a technical guideline*" (DEC, 2006). Vibration monitoring results will be assessed and reported against the acceptable values of human exposure to vibration set out in [Clause 6.5.1](#) and guidelines for structural damage described in [Clause 6.5.2](#) of this CNVMP.

TABLE 2 – VIBRATION MONITORING PROCEDURE

Monitoring Details	Frequency	Test Procedure
At the commencement of vibratory compaction work within 18 m of residential buildings	As required	Attended vibration monitoring will be undertaken when checking the safe working distances from construction plant or in response to a complaint. The testing method includes:
Where a valid complaint is received in relation to human exposure to vibration levels and monitoring is considered an appropriate response	As required	<ul style="list-style-type: none"> • Transducer to be affixed to ground or building in general accordance with AS 2775-2004 • Monitoring to be conducted for at least three distances from the plant, including a representative distance for the nearest sensitive structures and/or receivers • The testing will be conducted at each location to obtain a suitable representation of the range of vibration levels that would occur from the tested plant • Peak (PPV) vibration levels and the dominant frequency of the vibration will be recorded for assessment against the structural and cosmetic damage criteria. In situations in which human comfort is also of concern then the rms vibration level should also be recorded
Where a valid complaint is received in relation to suspected property damage due to vibration impacts and monitoring is considered an appropriate response	As required	
Where an activity may occur within safe working distances for cosmetic damage for no more than one day continuously	As required	
Where required for the purposes of refining construction methods to reduce vibration levels	As required	
Where an activity may occur within safe working distances for cosmetic damage for a period of more than one day continuously	As required	
		Continuous vibration monitoring will be undertaken in situations where there is a risk that vibration from a particular construction activity may exceed the cosmetic damage criteria at a sensitive structure. This will be where activities may occur within the safe working distances for cosmetic damage identified in Table 17 (CNVMP)
		<ul style="list-style-type: none"> • Transducer to be affixed to ground or building in general accordance with AS 2775-2004 • Vibration logger to continuously measure vibration level while the relevant works are occurring within the safe working distance for cosmetic damage • Measurement to be conducted as close as possible to the sensitive structure. • A warning system will be implemented with the monitoring system including one or both of the following: <ul style="list-style-type: none"> ○ audible and/or visual warning alarm ○ SMS and/or email alerts to site personnel
Dilapidation surveys of buildings and structures where construction works occurs within the safe working distance for cosmetic damage	Prior to construction works / Post construction	At a minimum, dilapidation surveys and reports will comprise: <ul style="list-style-type: none"> • A visual inspection of the structure, including all internal and external walls, ground level floors and external pavements, all connections of other structures above ground level and their connection at ground level and any exposed foundations • Full written building Condition Survey Report outlining the condition of the internal and external components of each property • A series of photographs of each identified defect/crack • A sketched floor plan showing the exact location of each defect and measurements of crack width/defect size • Identification of any condition changes relative to Pre-Construction and the likely cause of the change (Post-construction only)

APPENDIX 3 Out of Hours Works Program

Item #	Activities	Anticipated Date of Commencement	Expected Duration (Nights)	Resource Requirements	Traffic Scheme
A2890	Installation of EB F Type Barriers CH 180 to 340	Monday, 2 December 2019	1	1x excavator/franna, semis, 1x dogman, 1x labourer	EB Lane 1 Closure
A2450	Electrical - Install HV / LV pole JU-10551 (Newcastle Road / Steel Street) O1Prep	Monday, 16 December 2019	1	Crane-bored, 4 labour	EB Lane 1 Closure
A5450	DN375 Watermain Cutover Stage 1	Wednesday, 29 January 2020	3	1x Excavator, 1x Water Cart, 4 Labour	WB Shoulder Closure
A5510	DN375 Watermain Cutover Stage 2	Thursday, 13 February 2020	1	1x Excavator, 1x Water Cart, 4 Labour	WB Shoulder Closure
A2460	Electrical - Install HV / LV poles JU-13771, JU-12511 (Newcastle Road near T. Lights) O2Prep	Tuesday, 14 January 2020	1	Crane-bored, 4 labour	EB Lane 1 Closure
A2620	Electrical - Remove redundant HV along Newcastle Road O2	Tuesday, 4 February 2020	1	Crane-bored, 4 labour	EB Lane 1 Closure
A2610	Electrical - remove HV along Newcastle Road / Steel Street	Tuesday, 4 February 2020	1	2 x EWPs, crane-borer 6 x labour	EB Lane 1 Closure
A2470	Electrical - Install LV poles: JU-14076 and JU-13441 O3Prep [likely done behind barriers]	Wednesday, 5 February 2020	1	Crane-bored, 4 labour	EB Lane 1 Closure
A2490	Electrical - Install ADSS pole: JU-13067 O5	Tuesday, 10 March 2020	1	Crane-bored, 4 labour	WB Lane 1 Closure
A2760	Electrical - Install LV/ADSS Pole and string across road	Tuesday, 24 March 2020	1	2 x EWPs, 2 x labour	Full short term road closure (<5 mins) - Rolling closure if possible
A4410	Install Steel Arch	Saturday, 4 July 2020	1	250t Crane, Delivery Truck, 10 Labour	Full road closure & detour
A4720	Relocate EB F Type Barriers CH 80 to 220	Saturday, 25 July 2020	1	1x excavator/franna, semis, 1xdogman, 1x labourer	EB Lane 1 Closure
A4730	Decomission Traffic Signals	Saturday, 25 July 2020	1	1x crane truck	
A5000; A5070	Newcaslte Rd Type D Pavement - AC 20	Thursday, 17 September 2020	3	1x Paver, 2x Rollers, Delivery Trucks, 10 Labour	Alternate lane closures to suit works
A5010; A5080	Newcaslte Rd Type D Pavement - Mill and Fill - AC 14	Tuesday, 22 September 2020	1	1x Paver, 2x Rollers, Delivery Trucks, 10 Labour	Alternate lane closures to suit works
A5090	Removal of F Type Barriers	Wednesday, 23 September 2020	1	1x excavator/franna, semis, 1x dogman, 1x labourer	