Construction Noise & Vibration Management Plan (CNVMP)

TAP04 Redfern Station Upgrade - New Southern Concourse

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Appendix B, RtS (Sept 2020)	Construction Environmental Management Framework
TAP04-PLN-CC-0001 (V2)	Community Liaison Management Plan

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Revision Control			
Revision No	Change from previous	Date	Comment
00	Document creation	16/10/2020	Draft issue
01	Revised with comments	16/11/2020	Issue with comments
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03	Updated with TfNSW and ER comments	16/12/2020	Updated with TfNSW and ER comments
04	Updated Section 8.4	24/03/2021	Updated CNVMR frequency
05	OOHW Protocol Removed	20/04/2022	Revised OOHW Protocol
06	Revised timeframe and construction mitigation	16/05/2022	Revised CNVMR timeframe and construction mitigation

Reviewers / Approvers				
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Ministers Condition of Approval

The CoA relevant to this plan are listed in Table 1. A cross reference is also included to indicate where the condition is addressed in this plan or other Project management document.

Table 1: Minister's Conditions of Approval (CoAs)

<table>
<tr><th>CoA #</th><th>Condition Requirement</th><th>Document Reference</th><th>How Addressed</th></tr>
<tr><td colspan="4">CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN</td></tr>
<tr><td>C6</td><td>The following CEMP Sub-plans must be prepared in consultation with the relevant government agencies identified for each CEMP Sub-plan:
<table><tr><th></th><th>Required CEMP Sub-plan</th><th>Relevant government agencies to be consulted for each CEMP Sub-plan</th></tr><tr><td>(a)</td><td>Traffic and transport</td><td>City of Sydney Council</td></tr><tr><td>(b)</td><td>Noise and vibration</td><td>City of Sydney Council, Heritage NSW</td></tr><tr><td>(d)</td><td>Soil, contamination and water</td><td>Sydney Water and the City of Sydney Council (if it is proposed to discharge to or impact on their assets)</td></tr><tr><td>(e)</td><td>Heritage</td><td>Heritage Council of NSW, Heritage NSW and City of Sydney Council</td></tr></table></td><td>This CNVMP</td><td>This CNVMP addresses the conditions with regard to noise and vibration within the City of Sydney Council – Code of Practice 1992 and captures the requirements set out in the Technical report 5 – Non-Aboriginal Heritage. Consultation will be undertaken with City of Sydney Council and Heritage NSW in accordance with this condition.
Although the City of Sydney is a stakeholder with a consultation role, the City of Sydney Code of Practice 1992 does not apply to the Redfern Station works, which are carried out in accordance with the Conditions of Approval and associated documents including the TfNSW CNVS.</td></tr>
<tr><td colspan="4">CONSTRUCTION MONITORING PROGRAM</td></tr>
<tr><td>C8</td><td>The Proponent must engage a suitably qualified and experienced person to prepare a Construction Noise and Vibration Monitoring Program (CNVMP). The program must be prepared in consultation with the City of Sydney Council and include, but not be limited to:
(a) noise and vibration monitoring at representative locations adjacent to construction activities (including at the most / worst affected residences) to confirm construction noise and vibration levels;
(b) noise monitoring during the day, evening and night-time periods throughout the construction period, covering the range of activities (including worst-case construction noise levels) being undertaken;
(c) method and frequency for reporting of monitoring results;
(d) procedures to identify and implement additional mitigation measures where results of monitoring indicate noise levels in excess of predicted noise levels and / or vibration levels in excess of vibration criteria; and
(e) any consultation to be undertaken in relation to the monitoring program.</td><td>This CNVMP Section 8.4</td><td>This Construction Noise and Vibration Management Plan details the methodology for conduction noise monitoring (referred to as the CNVMP in the CoA) and the requirements associated with assessing compliance in Section 8.4.</td></tr>
</table>

CoA #	Condition Requirement	Document Reference	How Addressed
C9	The **CNVMP** must be submitted to the **ER** for approval and be approved before the commencement of construction.	This CNVMP	This CNVMP will be submitted to the ER for approval
C10	The approved **CNVMP** must be made publicly available before the commencement of construction.	This CNVMP	This CNVMP will be made publicly available once approved, prior to commencement of construction
C11	The **CNVMP** must be implemented for the duration of construction.	This CNVMP	This CNVMP covers all construction aspects for the full duration of the project and is implemented for the duration of the project.
C12	The results of the construction noise and vibration monitoring must be provided to the Planning Secretary, and relevant regulatory agencies, in the form of a **Construction Noise and Vibration Monitoring Report** at the frequency identified in the **CNVMP**. *Note: The **CNVMP** may be incorporated into the **CEMP Noise and Vibration Sub-plan.***	This CNVMP, Section 8.4	This CNVMP provides noise and vibration monitoring requirements. Monitoring results are to be reported quarterly to the Planning Secretary and relevant regulatory agencies.
KEY ISSUE CONDITIONS – NOISE AND VIBRATION			
D14	**Work Hours** Work must only be undertaken during the following standard construction hours: (a) 7:00 am to 6:00 pm Mondays to Fridays, inclusive; (b) 8:00 am to 6:00 pm Saturdays; and (c) at no time on Sundays or public holidays.	This CNVMP Refer to Sections 3.1 and 3.2	The assessment of noise and vibration impacts have been conducted based on the construction hours and are assessed accordingly.
D15	**Highly Noise Intensive Work** Except as permitted by an EPL or an Out-of-Hours Work Protocol (where an EPL does not apply), highly noise intensive Work that results in an exceedance of the applicable noise management level (NML) at the same receiver 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. 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.	This CNVMP Section 8.2 OOHW Protocol Appendix A	The out of hours definitions have been defined in this plan where highly noise intensive work are identified with the areas predicted to have exceeded the NMLs. This will be supplemented with the inclusion of noise prediction contours. Restrictions on hours of work and respite periods will be applied where practicable as described in D15, and the Out-of-Hours Works Protocol which will apply if the highly noise intensive work must be carried out outside the standard hours of work.
D16	**Variation to Work Hours**	This CNVMP	Section 3.2 describes requirements for planning

CoA #	Condition Requirement	Document Reference	How Addressed
	Notwithstanding **Condition D14,** Work may be undertaken outside the hours specified in the following circumstances: (a) for the delivery of materials required by the NSW Police Force or other appropriate 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 the relevant road authority has advised the Proponent in writing that a road occupancy licence will not be issued during the hours specified in **Condition D14,** and the Works are undertaken in accordance with **Condition D19**; or (d) where the rail authority has advised the Proponent in writing that a Rail Possession is required and approval has been given to complete Work during the rail possession, and the works are undertaken in accordance with **Condition D19**; or (e) where different construction hours are permitted or required under an EPL in force in respect of the SSI; or (f) where an EPL is not required or in force, Work approved under an **Out-of-Hours Work Protocol** developed in accordance with **Condition D19**; or (g) construction that causes: (i) $L_{Aeq(15\ minute)}$ noise levels 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 (ii) $L_{Aeq(15\ minute)}$ noise levels 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 (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 (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 (h) where negotiated agreements with directly affected residents and other sensitive land uses have been reached. *Note: Section 5.24(1)(e) of the EP&A Act requires.*	Section 3.2 OOHW Protocol	and conducting out-of-hours works. The Out of Hours Works Protocol describes the project requirements for planning, assessing and managing out-of-hours works.
D17	On becoming aware of the need for emergency work in accordance with **Condition D16(b)** the Proponent must notify the ER, Planning Secretary and the EPA of the reasons for such work as soon as possible after the works have commenced. 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 as soon as possible after the works have commenced.	This CNVMP Section 3.2	This CNVMP addresses the situation for emergency work and the approvals required to proceed with the emergency work. It also describes requirements for advising the ER, Planning Secretary, EPA and the affected sensitive receivers of the nature of

CoA #	Condition Requirement	Document Reference	How Addressed
			any emergency works as soon as possible.
D18	**Out-of-hours works – Community Consultation on Respite** In order to undertake Work outside the hours specified in **Condition D14** the Proponent must identify appropriate respite periods for the out-of-hours Work in consultation with the affected community on a regular basis. The consultation on respite periods must include (but not be limited to) providing the community with: (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. The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hours Work must be submitted to the Planning Secretary for information prior to Work scheduled for the subject period being undertaken. *Notes:* 1. *Respite periods can be any combination of days or hours where out-of-hours Work would not be more than 5 dB(A) above the rating background level at any residence.* 2. ***ConditionD18** applies to the Works specified in **Conditions D16 (c), (d), (f)***	This CNVMP CLMP OOHW Protocol, Section 4	This CNVMP provides the assessment for receivers affected by the project and assessed in accordance with the CNVS and the CNVS addendum (Nov 2019) In addition, Non-residential and residential sensitive receivers will be informed of upcoming out-of-hours works and consulted to determine appropriate respite periods which would apply for those works.
D19	**Out of hours work protocol – work not subject to an EPL** An **Out-of-Hours Work Protocol** must be prepared to identify a process for the consideration, management and approval of Work which is outside the hours defined in **Condition D14** and that is not subject to an EPL. The Protocol must be submitted to the Planning Secretary for approval at least five (5) business days before commencement of out-of-hours works. Out-of-hours work must not be undertaken until the Out-of-hours Work Protocol has been approved. The Protocol must identify Work activities in terms of their risk of adverse impacts on sensitive receivers and include: (a) a process for the consideration of out-of-hours Work against the relevant NML and vibration criteria, including the determination of low, medium and high-risk activities; (b) a process for the identification, selection and implementation of mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of **Conditions D18 and D20.** The measures must take into account the predicted noise and vibration levels and the likely frequency and duration that sensitive	This CNVMP CEMF OOHW Protocol	The out of hours protocol is addressed in this CNVMP outlining a procedure for undertaking an approval of work during out of hours. Note that the proposed works will not be subject to an EPL. The Out-of-Hours Work Protocol provides guidance and a process for meeting the conditions in D19.

CoA #	Condition Requirement	Document Reference	How Addressed
	receivers would be exposed to residual impacts, including the number of noise-awakening events; (c) procedures to facilitate the coordination of out-of-hours Work, including those approved by an EPL or undertaken by a third party, to ensure appropriate respite is provided; (d) an approval process that considers the risk of activities, proposed mitigation, management and coordination of work, including where - (i) low risk activities can be approved by the **ER**, and (ii) medium and high-risk activities can be approved by the ER and the approval submitted to the Planning Secretary for information before the Work commences; and (e) notification arrangements for affected sensitive receivers and the EPA for all approved out-of-hours Works.		
D20	**Out of hours - Mitigation** Additional mitigation measures such as temporary alternative accommodation, must be offered/ made available to residents affected by out-of-hours Work (including where utility works are being undertaken for the SSI or Work is being undertaken during a rail possession or under a road occupancy licence) where the construction noise levels, between: (a) 10:00 pm and 7:00 am, Monday to Friday; (b) 10:00 pm Saturday to 8:00 am Sunday; and (c) 6:00 pm Sunday and public holidays to 7:00 am the following day unless that day is Saturday then to 8:00 am, are predicted to exceed the NML by 25 dB(A) or are greater than 75 dBA ($L_{Aeq(15\ min)}$), whichever is the lesser. The NML must be reduced by 5 dB where the noise contains annoying characteristics and increased by 10 dB if the property has received at-property noise treatment. The noise levels and duration requirements identified in this condition may be changed through an EPL applying to the SSI.	This CNVMP Section 8.2	Mitigation has been addressed for the assessed Noise Catchment Areas of the project. Additional mitigation measures such as Alternative Accommodation are considered based on the ICNG, CNVS and the CNVS addendum (Nov 2019) which are specified according to the exceedance above the NMLs. The periods when Alternative Accommodation is considered are consistent with D20.
D21	**Construction noise – coordination and Respite** The Proponent must consult with proponents or applicants of other State significant development and infrastructure projects within 200 metres of the SSI and take reasonable steps to coordinate Work, including utility Work, to minimise cumulative noise and vibration impacts and maximise respite for affected sensitive receivers.	This CNVMP Section 4.4	The EIS lists construction sites which may be active at the time of the Redfern Station Works. The Contractor will make contact with construction managers of sites which may be active concurrently with Redfern Station works, in order to manage cumulative impacts if possible.
D22	Noise and vibration 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	This CNVMP Section 8.2	All non-residential receivers within the NCAs have been assessed with regard to potential

CoA #	Condition Requirement	Document Reference	How Addressed
	above the NMLs or vibration levels above the relevant criteria must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.	OOHW Protocol, Section 4	impacts and exceedances of the NMLs have been identified to determine appropriate mitigation in this CNVMP. Non-residential receivers will be consulted to understand their noise-sensitive times and efforts will be made to schedule works to avoid those periods or provide alternative arrangements where appropriate.
D23	All work undertaken for the delivery of the SSI, including those undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided**.** The Proponent must: (a) reschedule any Work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with **Condition D18** and **D20**; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the **ER** in support of any decision made by the Proponent in relation to respite or mitigation.	This CNVMP Section 8.2 Section 3.2.1 CNVS	All sensitive receivers within the NCAs have been assessed with regard to potential impacts and exceedances of the NMLs have been identified to determine appropriate mitigation. Section 3.2.1 outlines the coordination approach to OOHW. Reasonable efforts will be made to coordinate works with third parties to ensure provision of respite periods.
D24	**Noise and vibration Mitigation** Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria: (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). 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.** *Note: The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require*	This CNVMP Section 5 CNVS	Construction noise and vibration impact assessments have been conducted in accordance with the criteria set out in the relevant standards and legislation. The CNVS summarises the relevant noise and vibration management levels in accordance with the standards listed in D24. Note that D20 requires an adjustment of 5dB to the NML, rather than adding the 5dB penalty to the predicted level as per the D24 note. The project will reduce the NML in accordance with D20 and not "double-count" the penalty by adding it to the predicted or measured noise levels.

CoA #	Condition Requirement	Document Reference	How Addressed
	the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.		
D25	Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded: (a) evening (6:00 pm to 10:00 pm) — internal $L_{Aeq(15\ minute)}$: 40 dB(A); and (b) night (10:00 pm to 7:00 am) — internal $L_{Aeq(15\ minute)}$: 35 dB(A). The mitigation measures must be outlined in the **Noise and Vibration CEMP Sub-plan,** including in any **Out-of-Hours Work Protocol**, required by **Condition D19.**	This CNVMP Section 5.1.4 Section 7.1	This CNVMP has assessed the ground borne noise impacts to sensitive receivers. If any, mitigation measures would be defined for affected properties. Example mitigation measures are described in Section 8.3
D26	Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before Work that generates 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**.	This CNVMP Section 7.2 Section 4.3.4 Table 21	This CNVMP has assessed vibration impacts in relation to structural damage and identified potentially affected receivers. Where properties have been predicted to exceed the management levels, monitoring is triggered to identify appropriate mitigation where applicable.
D27	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 and structural 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, amend the methodology and/or implement additional mitigation measures to prevent damage.	This CNVMP Section 8	This CNVMP outlines the appropriate methodology for conduction vibration testing to understand vibration impacts from works.
D28	The Proponent must seek and implement the advice of a heritage specialist on impacts to heritage-listed structures from installing equipment used for vibration, movement and noise monitoring before its installation.	This CNVMP Section 8.3.3 HCMP	This CNVMP indicates the heritage sites within the project area which have been assessed against the heritage structure criteria to quantify vibration impacts. Where monitoring is proposed at heritage-listed structures, a heritage specialist will be consulted to ensure that the method of installing sensors and monitors do not risk damaging the heritage fabric of the building.

Revised mitigation measures

The revised mitigation measures relevant to this Plan are listed in Table 2. A cross reference is also included to indicate where the condition is addressed in this Plan or other Project management documentation.

Table 2: Revised mitigation measures relevant to this CNVMP

Reference	Management and mitigation measures	CNVMP Reference	How Addressed
Construction noise and vibration			
N1	A Construction Noise and Vibration Management Sub-Plan (CNVMP) would be prepared as part of the CEMP. The CNVMP would include all safeguards to manage noise emissions from the Project. The CNVMP would include, as a minimum, the following: • identification of nearby residences and other sensitive land uses • description of approved hours of work and an Out of Hours Protocol • description and identification of all construction activities, including • work areas, equipment and duration (and provision for re-assessment of noise and vibration impacts if required due to changes) • description of the work practices (generic and specific) that would be applied to minimise noise and vibration • works scheduling to minimise the noise impact on sensitive receivers, with consideration given to cumulative noise impacts (and provision for re-assessment of noise and vibration impacts if required due to changes to work stages or other surrounding projects) • a complaints handling process • noise and vibration monitoring procedures, including for heritage-listed items/structures. The CNVMP and CEMP must be updated as required to account for any changes in noise and vibration management issues and strategies, to ensure these documents remain adequate for their purposes.	Sections 3, 4, 5, 6, 8, 9	Identification of sensitive receivers are defined in Section 4 Description of work hours are defined in Section 3 Description of assessment of construction impacts in Section 5 Description of construction activities and details of staging are presented in Section 6 Description of general and specific work practices are detailed in Section 8 A complaints process is detailed in Section 9 Noise and vibration monitoring methodologies are outlined in Section 8
N2	All employees, contractors and subcontractors would receive an environmental induction. As a minimum the induction must 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 (noise with characteristics that can cause annoyance and disturbance, containing noticeable factors such as tonality, low frequency noise, impulsive or intermittent noise events) • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures and complaint handling procedures.	Section 9.3	A Project induction will be conducted for all personnel. 'Toolbox talks' will also form part of ongoing awareness of sensitive noise and vibration premises on a daily basis.
N3	All nearby residents and sensitive receivers impacted by noise levels from the Project which are expected to exceed the NML would be notified prior to the commencement of the particular activity, with the highest consideration given to those that are predicted to be most affected as a result of the works.	Sections 8.2 CLMP Appendix A	Based on the predicted levels, the affected receivers are defined to allow the appropriate information to be provided

Reference	Management and mitigation measures	CNVMP Reference	How Addressed
	The information provided to the receivers will include: • programmed times and locations of construction work • the hours of proposed works • construction noise and vibration impact predictions • construction noise and vibration mitigation measures being implemented on site. Community notification and management procedures regarding construction noise and vibration would be detailed in a Community Liaison Management Plan for the construction of the Project and would include a 24 hour hotline and complaints management process.		regarding noise and vibration impacts. This is to be carried out in conjunction with the CLMP.
N4	If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage described in this EIS (Technical report 4 – Noise and vibration), then attended vibration measurements would be undertaken when work commences, to determine "site specific minimum working distances" and confirm appropriate vibration limits for that structure. The Construction Contractor would be informed of the minimum working distances **(refer to mitigation measure N9 also which addresses working within site specific minimum working distances).**	Section 7.2	Predicted construction vibration impacts for construction scenarios are detailed. Minimum distances of construction plant have been assessed based on the proposed construction staging.
N5	For heritage items where the vibration screening criteria are predicted to be exceeded, the more detailed assessment would include condition assessment and specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.	Section 7.2	Predicted construction vibration impacts include those of heritage value and assessed accordingly with heritage criteria in accordance with the CNVS.
N6	The CNVMP would be implemented with the aim of meeting the construction noise management levels where feasible and reasonable. The following mitigation measures would be included in the CNVMP: • use of at-source noise attenuation around equipment where possible • where feasible and reasonable structures such as site sheds and fencing shall be used to shield residential receivers from noise (e.g. including along appropriate sections of the rail corridor fence line of Little Eveleigh Street and Marian Street, and through the use of 1.8 m high fencing around ancillary facility 3). Site topography shall be considered when situating plant • traffic flow (i.e. vehicle movements, including deliveries), parking and loading/unloading areas would be planned to minimise reversing movements within construction sites • loading and unloading of materials/deliveries would occur as far as possible from sensitive receivers • if site access points and roads are altered during detailed design, they would be selected to be as far as possible away from sensitive receivers within rail corridor access constraints • dedicated loading/unloading areas would be shielded if close to sensitive receivers wherever feasible and reasonable • delivery vehicles would be fitted with straps rather than chains for unloading, wherever possible. • non-tonal reversing beepers would be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work, including delivery vehicles	Section 8	Mitigation and management measures have been detailed which include specific measures for site operations to ensure noise and vibration impacts are minimised as reasonable and practicable. Mitigation measures include site fencing as described in N6.

Reference	Management and mitigation measures	CNVMP Reference	How Addressed
	• on-site storage capacity would be maximised to reduce the need for truck movements during sensitive times • the offset distance between noisy plant and adjacent sensitive receivers would be maximised • plant used intermittently would be throttled down or shut down • noise-emitting plant would be directed away from sensitive receivers where construction activities allow the noise levels of plant and equipment must have operating sound power or sound pressure levels as presented in this EIS (Technical report 4 – Noise and vibration) that would meet the predicted noise levels • quieter and less vibration emitting construction methods would be used where feasible and reasonable (e.g. rubber wheeled instead of steel tracked plant) • where practicable, materials would be pre-fabricated and/or prepared off-site to reduce noise. Materials can then be delivered to site for installation.		
N7	Work generating noise with special audible characteristics (such as jack hammers, rock breakers, piling rigs and diamond saws) and/or vibration levels would be scheduled during less sensitive time periods for receivers (for example, before 10:00 pm or as determined during community consultation) where feasible and reasonable, and also in accordance with the requirements of the CNVS and CEMF.	Section 6.1	Works including audible characteristics will be reviewed as part of a management measure to avoid intrusive works where feasible for the Project. These works are defined as Highly Noise Intensive Works under the Conditions of Approval and are managed in accordance with the CoA.
N8	Vehicle movements would be routed away from sensitive receivers and scheduled during less sensitive times where feasible and reasonable. The speed of vehicles would be limited, and the use of engine compression brakes avoided.	Section 8.1	Site vehicular movements have been addressed as a management measure to include defined paths and frequent maintenance of site grounds to minimise noise and vibration impacts.
N9	A noise and vibration monitoring program would be carried out for the duration of works in accordance with the CNVS, CNVMP and any approval and licence conditions. Monitoring of noise would be undertaken at appropriate intervals and in response to complaints during construction. In addition, vibration intensive work would not proceed within the site-specific minimum working distances unless a permanent vibration monitoring system is installed approximately one metre from the building footprint, to warn operators (e.g. via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective.	Sections 8	Noise and vibration monitoring methodologies and procedures are detailed within the plan. Section 8.3 refers to program requirements and methodologies for monitoring follows.
N10	In accordance with the CNVS, additional mitigation measures would be implemented according to Table 13-22 and Table 13-23 (and Appendix A of Technical report 4 – Noise and vibration) of this EIS for sensitive receivers where noise levels are predicted to exceed applicable criteria.	Section 8.2	Additional mitigation measures are defined based on levels that have exceeded the NML. The level of exceedance determines the additional mitigation measures based on the CNVS and

Reference	Management and mitigation measures	CNVMP Reference	How Addressed
			the CNVS addendum (Nov 2019)
CEMF	Construction hours will be in accordance with the working hours specified in Section 5.5 of the CEMF Hoarding and enclosures to minimise airborne noise impacts will be implemented where required, as outlined in the CNVMP The layout of site compounds and work areas will aim to minimise airborne noise impacts to surrounding receivers	Sections 3.1, 8.1	The CNVMP construction hours are implemented in accordance with the CEMF and the CoA. Site specific management measures have been detailed to include strategies associated with hoarding locations and suitable setup of site compounds.

Environmental Performance Outcomes

Relevant Environmental Performance Outcomes (EPOS) are listed in Table 3. This includes reference to required outcomes, the timing of when the commitment applies, relevant documents or sections of the environmental assessment influencing the outcome and implementation.

Table 3: Environmental Performance Outcomes (EPOS) relevant to this CVNMP

Environmental Performance Outcome	CNVMP Reference	How Addressed
Construction Noise and Vibration		
Construction airborne and ground-borne noise and vibration is effectively managed to minimise adverse impacts on acoustic amenity	Section 8.2	Noise and vibration impacts are managed through mitigation and management measures to minimise impacts.
Construction vibration is effectively managed to minimise adverse impacts on the structural integrity of buildings and items	Section 7.2	Vibration impacts are managed through mitigation and management measures which include monitoring.to minimise impacts.
Appropriate mitigation measures outlined in the TfNSW CNVS are identified and implemented to minimise noise and vibration impacts	Section 8	This is included as general and specific mitigation measures to minimise noise and vibration impacts
Specific notifications to the community are issued no later than seven days prior to construction works	Section 9	Specific information and details have been defined to be included in notifications to the community.

Table of Content

Abbreviations

Term	Meaning
AADT	Annual Average Daily Traffic
ABL	Assessment Background Level
AVATG	Assessing Vibration: A Technical Guideline
CNVMP	Construction Noise and Vibration Management Plan
CNVS	Construction Noise and Vibration Strategy
dB	Decibel
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DPIE	Department of Planning, Industry and Environment
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
Heritage Act	*Heritage Act 1977* (NSW)
ICNG	*Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009).
NATA	National Association of Testing Authorities
NSW	New South Wales
NCA	Noise Catchment Area
NML	Noise Management Level
NPfI	Noise Policy for Industry
OEH	NSW Office of the Environment and Heritage
OEMP	Operational Environmental Management Plan
OOHW	Out-of-Hours Works
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
RBL	Rating Background Level
RNP	Road Noise Policy
SEARS	Secretary's Environmental Assessment Requirements
TAP	Transport Access Program
TfNSW	Transport for NSW
VDV	Vibration Dose Value

Glossary

Term	Meaning
A-weighted decibels [dB(A)]	The A-weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Airborne noise	Airborne noise is sound transmitted through the air/atmosphere, e.g. conversation between people.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Ancillary facility area	Areas required for temporarily storing materials, plant and equipment and providing space for other ancillary facilities, such as site offices, during construction.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Community	A group of people living in a specific geographical area or with mutual interests that could be affected by the Project.
Concept design	Broadly refers to the process that the Construction Contractor undertakes (should the Project proceed) to refine the scoping design to a design suitable for construction (subject to Transport for New South Wales acceptance).
Construction	Includes all physical work required to construct the Project and also includes construction planning such as the development of construction management plans.
Day	The period from 7:00 am to 6:00 pm Monday to Saturday and 8:00 am to 6:00 pm Sundays and public holidays.
Decibel [dB]	The measurement unit of sound.
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume.
Detailed design	Detailed design broadly refers to the process that the Construction Contractor undertakes (should the Project proceed) to refine the concept design to a design suitable for construction (subject to Transport for New South Wales acceptance).
Down-side	Down-side refers to the direction of travel away from Central Station.
Equivalent continuous sound level [L_{eq}] and A-weighted equivalent continuous [$L_{Aeq(15min)}$]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy. The INCG defines $L_{Aeq(15min)}$ as '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 industry, road, rail and the community.
Evening	The period from 6:00 pm to 10:00 pm Monday to Sunday and public holidays.

Feasible and reasonable	Consideration of best practice taking into account 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, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements.
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Ground-borne noise	Ground-borne noise is noise generated by vibration transmitted through the ground into a structure, e.g. tunnelling works affected residential building above.
Heavy vehicle	A vehicle what has a gross vehicle mass (GVM) or aggregate trailer mass (ATM) of more than 4.5 tonnes.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
L_{10}	The sound pressure level exceeded for 10 per cent of the measurement period. For 10 per cent of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90 per cent of the measurement period. For 90 per cent of the measurement period it was louder than the L_{90}.
Light vehicle	A vehicle up to a B99 in size. A B99 vehicle is the 99th percentile vehicle size.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
Methodology	The method for analysis and evaluation of the relevant subject matter.
Night	The period from 10:00 pm to 7:00 am Monday to Saturday and 10:00 pm to 8:00 am Sundays and public holidays.
Noise intensive works	Works which include the use of power saws for the cutting of timber, masonry and steel; grinding of metal, concrete or masonry; rock/line drilling; bitumen milling and profiling; jack hammering, rock hammering and rock breaking; or impact piling.
Opal card	The integrated ticketing smartcard introduced by Transport for New South Wales.
Out-of-hours works	Defined as works outside standard construction hours (i.e. outside of 7:00 am to 6:00 pm Monday to Friday, 8:00 am to 1:00 pm Saturday and no work on Sundays/public holidays).
Project area	The Project area comprises the overall potential area of direct disturbance by the Project, which may be temporary (for construction) or permanent (for operational infrastructure) and extend below the ground surface.
Proponent	A person or body proposing to carry out an activity under Division 5.1 of the *Environmental Planning and Assessment Act 1979* - in this instance, Transport for New South Wales.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.
Secretary's Environmental Assessment Requirements (SEARs)	Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of Planning, Industry and Environment under section 5.16 of the EP&A Act.

Sensitive receiver/ receptor	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), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises).
Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Sydney Trains	The provider of metropolitan train services for Sydney.
The Project	The construction and operation of the Redfern Station Upgrade – New Southern Concourse.
Track possession	Track possession means the temporary closure of part of the railway network for a specified period of time for the purposes of carrying out repair, maintenance or upgrading work on or adjacent to the railway network, during which no trains operate.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Up-side	Up-side refers to the direction of travel towards Central Station.
Vibration intensive works	Works which use vibration intensive equipment such as jack hammers, piling rigs and rock breakers.

1. Purpose and Scope

This Construction Noise and Vibration Management Plan (CNVMP) describes the process to be adopted by Novo Rail, to manage noise and vibration impacts from the proposed construction activities associated with the Redfern Station Upgrade – New Southern Concourse (the Project). It includes:

- **Section 2:** An overview of the project requirements and conditions
  - Consisting of key project condition requirements and the relevant policies and guidelines that apply
- **Section 3:** Construction noise and vibration work hours
  - Consisting of the recommended construction hours and out of hours work conditions
- **Section 4:** Summary of the project environment and sensitive receivers
  - Consisting of the surrounding environment and its interaction with sensitive receivers
- **Section 5:** Construction noise and vibration criteria
  - Consisting of the construction noise and vibration criteria that sensitive receivers are assessed against in managing noise and vibration impacts
- **Section 6:** Construction noise and vibration assessment staging
  - Consisting of the proposed construction schedule and the nature of works to be undertaken for the project
- **Section 7:** Predicted construction noise and vibration impacts
  - Consisting of the predicted noise and vibration impacts when assessed against the relevant criteria
- **Section 8:** Details of the mitigation and management measures
  - Consisting of suggesting additional or site-specific mitigation measures as well as general mitigation to minimise noise and vibration activity
- **Section 9:** Details of community engagement strategies and consultation responses
  - Consisting of community engagement strategies and appropriate response methods to complaints and remediation actions where necessary.

The CNVMP outlines how the risk of noise and vibration impacting stakeholders, property and the environment will be managed through the application of environmental management and monitoring measures.

At this stage of the project, construction staging is in the planning phase which are used to assess potential construction noise and vibration impacts. This is subject to change as construction commences and throughout the timeline of the program. As noise predictions are refined, noise prediction spreadsheets will be issued to TfNSW, AA and the ER. CNVMP will be updated on a 6 monthly basis, to include any updated noise predictions.

This plan has been prepared to address the requirements of the Secretary of the Department of Planning, Industry and Environment (DPIE) (the Secretary's Environmental Assessment Requirements' or SEARs, 20 December 2020) and the Final Draft Conditions of Approval – Redfern Station Concourse (November 2020). Following determination this plan will be updated to ensure compliance with the final Conditions of Approval.

1.1 Project Description

The Redfern Railway Station Upgrade includes a new Southern Concourse as a component of the wider Transport Access Program (TAP). Redfern Railway Station is located approximately 1.3 km from the Central Station. Redfern Station is located within the suburbs of Redfern and Eveleigh in the City of Sydney Local Government Area (LGA). Redfern Railway Station contains 12 platforms in total, of which platforms 1 to 10 are above ground platforms, and platforms 11 and 12 are underground platforms which service the Eastern Suburbs Railway. A project overview is illustrated in

Figure 1.

The project area is surrounded by a mix of residential properties and commercial land uses. Surrounding land uses include:

- East – Redfern town centre
- South – south Eveleigh (formerly Australian Technology Park)
- West – residential areas, Carriageworks, The University of Sydney and Royal Prince Alfred Hospital
- North – residential areas and the Redfern Community Centre

Currently, there are four entrances to Redfern Railway Station:

- The Lawson Street overbridge located to the north of the station, which includes an entrance on Lawson Street

- The corner of Lawson Street and Little Eveleigh Street
- The Gibbons Street entrance, located to the southeast of the station, adjacent to the Gibbons Street/Redfern Street intersection
- The Marian Street entrance, located to the south of the station, which provides access directly to Platform 10

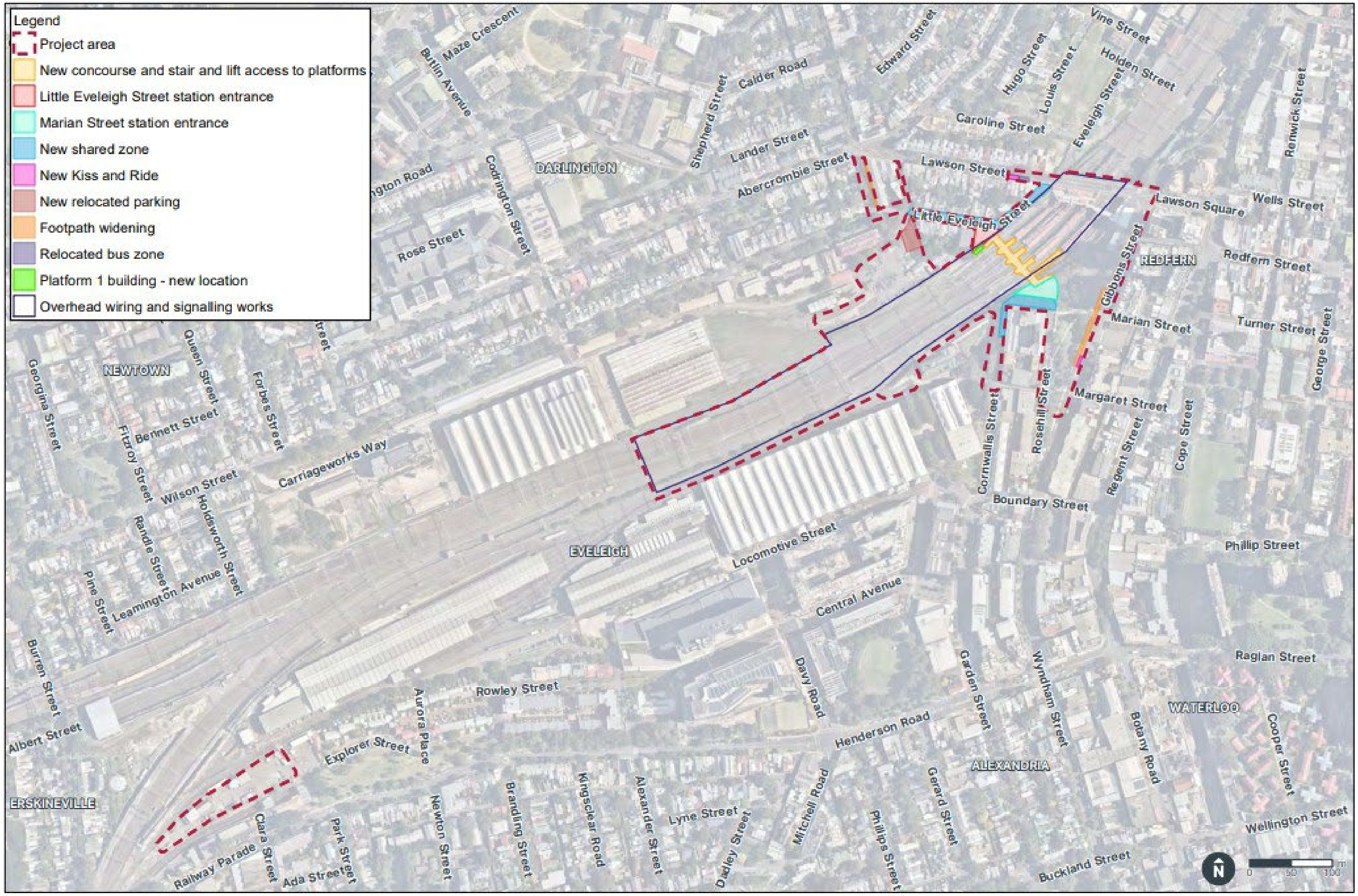
Legend
Project area
New concourse and stair and lift access to platforms
Little Eveleigh Street station entrance
Marian Street station entrance
New shared zone
New Kiss and Ride
New relocated parking
Footpath widening
Relocated bus zone
Platform 1 building - new location
Overhead wiring and signalling works
DARLINGTON
NEWTOWN
REDFERN
EVELEIGH
WATERLOO
ALEXANDRIA
ERSKINEVILLE
Maze Crescent
Butlin Avenue
Codrington Street
Shepherd Street
Calder Road
Lander Street
Abercrombie Street
Edward Street
Hugo Street
Louis Street
Vine Street
Holden Street
Caroline Street
Eveleigh Street
Lawson Street
Little Eveleigh Street
Lawson Square
Wells Street
Renwick Street
Rose Street
Gibbons Street
Redfern Street
Marian Street
Turner Street
George Street
Margaret Street
Regent Street
Cope Street
Cornwallis Street
Rosehill Street
Boundary Street
Phillip Street
Queen Street
Forbes Street
Georgina Street
Bennett Street
Fitzroy Street
Wilson Street
Carriageworks Way
Holdsworth Street
Randle Street
Leamington Avenue
Pine Street
Locomotive Street
Central Avenue
Raglan Street
Burren Street
Albert Street
Rowley Street
Aurora Place
Explorer Street
Davy Road
Henderson Road
Garden Street
Wyndham Street
Botany Road
Cooper Street
Wellington Street
Railway Parade
Clara Street
Ada Street
Park Street
Newton Street
Branding Street
Kingsclear Road
Alexander Street
Lyne Street
Dadley Street
Mitchell Road
Phillips Street
Gerard Street
Buckland Street

Figure 1: Redfern Railway Station Upgrade - New Southern Concourse layout

Works associated with construction of the New Southern Concourse includes:

- A six-metre-wide concourse between Little Eveleigh Street and Marian Street
- New stair and lift access from the new concourse to platforms 1 – 10
- An upgrade station entrance at Marian Street including station services and customer amenities
- A new station entrance at Little Eveleigh Street including station services and customer amenities
- Formalisation of a shared zone on Little Eveleigh Street, including:
  - Safety improvements to vehicle, cyclist and pedestrian interactions
  - Improvements to streetscape such as landscaping, lighting, drainage and pavements
  - Relocation of approximately 20 parking spaces (including 18 resident/restricted parking spaces, one accessible parking space and one car share scheme parking space) to a new car park at the western end of Little Eveleigh Street
  - Utility adjustments
- Upgrade of Marian Street / Cornwalls Street / Rosehill Street area
  - Extension of existing shared zone including part of Rosehill Street
  - Safety improvements to vehicle, cyclist and pedestrian interactions including footpath widening
  - Improvements to streetscape such as lighting, drainage, landscaping and pavements as well as utility adjustments
  - Changes to street parking arrangements including removal of approximately 16 parking spaces (including relocation of one car share scheme parking space).

Other upgrades associated with the Project include:

- Relocation of the shuttle bus zone from Little Eveleigh Street to Lawson Street
- Kiss and ride on Lawson Street, and footpath upgrade
- Kiss and ride on Gibbons Street, and footpath upgrade
- Footpath widening on Ivy Street
- Relocation of a building on Platform 1 to accommodate concourse
- Repurposing, relocations and alterations to platform building features and other platform features. Including privacy walls, doors, screens and roofing, platform seats and electrical equipment.
- Platform canopies
- Platform resurfacing on all platforms and associated drainage alterations
- Installation of station operational components and infrastructure including:
  - Wayfinding and signage
  - Tactile ground surface indicators (TGSI)
  - Rubbish bins
  - CCTV
  - Passenger information systems (e.g. passenger information display, public address and hearing loops)
  - Emergency equipment (e.g. for fire and life safety)
- Services relocations and upgrades including:
  - Relocation of overhead wiring structures
  - Installation of new rail signal between Platforms 1 and 2.

The proposed upgrades of the project will have construction noise and vibration impacts. The CNVMP shall be incorporated when reviewing construction procedures to evaluate if any construction scenario has been identified to be exceed the construction noise and/or vibration management levels.

2. Project Assessment Requirements

The SEARs relating to Noise and Vibration Impact Assessment (Table 4) for the Project have been addressed and are outlined in Table 4 with reference to the CoA.

Table 4 Secretary's environmental assessment requirements

Key issue and desired performance outcome	Secretary's environmental assessment requirements	Where addressed
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. Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.	1. Construction noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must consider cumulative impacts from nearby key infrastructure projects. The assessment must justify impacts to receivers including consideration of sleep disturbance (including the number of noise-awakening events), and, as relevant, the characteristics of noise and vibration (for example, low frequency noise).	Section 6, 7
	2. construction noise and vibration including:	
	a. the nature of construction activities (including transport, tonal or impulsive noise-generating works, as relevant)	Section 6.1
	b. the intensity and duration of noise (both air and ground borne) and vibration impacts	Section 6.1
	c. identification of receivers, existing and known future, during construction	Section 4.2, 4.3
	d. the sensitivity of receivers to the level of impact	Section 5
	e. the need to balance: i. timely conclusion of noise and vibration-generating works with periods of receiver respite; ii. the need to work at night and during planned rail possessions; and iii. other factors that may influence the timing and duration of construction activities	Section 8
	f. noise impacts of out-of-hours works (including utility works), the activities to be undertaken, their estimated duration and justification in terms of the *Interim Construction Noise Guideline* (DECCW, 2009)	Section 6, 7
	g. cumulative noise and vibration including project impacts and concurrent construction activities within the proposal and the construction of other relevant development in the vicinity	Section 6
	h. details and analysis of the predicted effectiveness of mitigation measures to adequately manage identified impacts, including impacts as identified in (g), and any potential residual noise and vibration impacts following application of mitigation measures	Section 6, 8
	i. a description of how feedback received during preparation of the Environmental Impact Statement	Section 8, 9

Key issue and desired performance outcome	Secretary's environmental assessment requirements	Where addressed
	has been taken into account (and would be taken into account following exhibition of the Environmental Impact Statement) in the design of mitigation measures, including any tailored mitigation, management and communication strategies for sensitive receivers.	
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. Increases in noise emissions and vibration affecting environmental heritage as defined in the *Heritage Act 1977* during operation of the project are effectively managed.	1. construction noise and vibration impacts to the structural integrity and heritage significance of items (including Aboriginal places and items of environmental heritage) in accordance with relevant guidelines.	Section 4.3.2, 7

Notes:

1. No blasting is proposed as part of the Project.

2.1 Key project condition requirements

The project is subject to conditions of approval from the Minister for Planning and Public Spaces under Section 5.19 of the *Environmental Planning & Assessment Act 1979.* Project requirements also include the noise and vibration aspects defined in the *Technical report 4 – Noise and Vibration*. Under the application for approval to carry out this State Significant Infrastructure (SSI) the following key conditions of approval for noise and vibration are outlined in Table 1. The revised mitigation measures outlined in the Response to Submissions relevant to this Plan are listed in Table 2. The performance outcomes outlined in the CEMF are listed in Table 3.

2.2 Policies and guidelines

The following policies and guidelines are relevant for this assessment:

- *Interim Construction Noise Guideline* (ICNG), NSW EPA, 2009
- *Assessing Vibration: A Technical Guideline* (AVATG), NSW EPA, 2006

- *NSW Road Noise Policy* (RNP), NSW EPA, 2011
- *Noise Policy for Industry*, Environment Protection Authority, 2017
- *Noise Guide for Local Government*, Environment Protection Authority, 2013
- *Rail Infrastructure Noise Guideline*, Environment Protection Authority, 2013
- *Development Near rail Corridors and Busy Roads*, Department of Planning, Industry, and Environment, 2008
- *Construction Noise and Vibration Strategy* (CNVS), Transport for NSW, 2019
- *Construction Noise and Vibration Strategy* (CNVS) Addendum (Nov 2019), Transport for NSW, 2019
- DIN Standard 4150: Part 3 2016 *Vibration in Buildings - Effects on Structures*, 1999
- British Standard 7385: Part 2 1993 *Evaluation and Measurement of Vibration in Buildings*, 1993
- British Standard 6472: *Evaluation of human exposure to vibration in buildings (1-80 Hz),* 1992
- Australian Standard AS 2436-2010, *Guide to noise and vibration control on construction, demolition and maintenance sites*, 2010
- Australian Standard AS 1055-2018 – *Acoustics—Description and measurement of environmental noise*, 2018
- CONCAWE – Environmental science for European refining: *The propagation of noise from petroleum and petrochemical complexes to neighbouring communities*
- International Standard ISO 9613-2:1996 - *Acoustics -- Attenuation of sound during propagation outdoors - Part 2: General method of calculation*
- Australia Standard AS IEC 61672.1-2019 - *Electroacoustics – Sound level meters Specifications*
- British Standard 5228: Part 1 2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise*, 2009 including Amendment 1, 2014

Definitions for acoustic terminology used within this report can be found in the glossary at the beginning of this report.

3. Construction noise and vibration strategy

The Redfern Railway Station Upgrade – New Southern Concourse Project qualifies for a detailed assessment, as the nature of the works are likely to exceed the noise and vibration objectives as identified in the *Redfern Railway Station Upgrade – New Southern Concourse – Technical Report – Noise and vibration*.

The TfNSW *Construction Noise and Vibration Strategy (CNVS), (DMS-ST-157)* document forms the basis for managing construction noise and vibration impacts.

3.1 Construction hours

In accordance with the ICNG and CNVS, construction activities which includes the delivery of plant and equipment should be limited to the Standard Hours described in Table 5 below wherever feasible and reasonable. This will help reduce noise impacts by limiting these activities to the daytime period, when background noise and local activity are higher. Respite from construction noise and vibration will be largely

be provided during the evening, night-time and on weekends although some standard-hours respite periods may apply for Highly Noise Intensive Works and following consultation with noise-sensitive receivers in accordance with D15 and D22. The following are the Project construction hours as defined in the CoA.

- Standard construction hours for this project are defined as: Monday to Friday 7:00am to 6:00pm and Saturdays from 8:00am to 6:00pm in accordance with D14
- Work outside of standard construction hours is defined as Out-of-Hours Work (OOHW) in accordance with the CNVS and the Out of Hours Works Protocol, which can be classified as:

  Period 1
  - Monday to Saturday 6:00pm to 10:00pm (evening)
  - Saturday 7:00am to 8:00am (day)
  - Saturday 6:00pm to 10:00pm (Day and evening)
  - Sunday and Public Holidays 8:00am to 6:00pm (day)

  Period 2
  - Monday to Saturday 10:00pm to 7:00am (night)
  - Sunday and Public Holidays 6:00pm to 8:00am (night)

Table 5: Construction Hours (Source: TfNSW CNVS)

Hour commencing	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Monday																								
Tuesday																								
Wednesday									Standard										OOHW					
Thursday			OOHW						Hours										Period 1					
Friday			Period 2																Evening					
Saturday																								
Sunday									OOHW Period 1											OOHW				
Public Holiday									Day											Period 2				

3.2 Out of Hours Work

Out of hours work is managed through the implementation of the Out of Hours Work Protocol (OOHW Protocol). This sets out the process for the preparation, consideration, assessment, management and approval of out of hours work on the Redfern Station Upgrade. This is for works that is proposed to be undertaken outside of standard construction hours as referred to in Section 3.1.

3.2.1 Coordination

In accordance with CoA D23, coordination of OOHW will occur to provide respite, minimise the duration and impact on sensitive receivers, and taking into account community consultation. Novo Rail are to coordinate OOHW in a manner that minimises the cumulative noise impacts, considers the outcomes of community and stakeholder consultation, ensures compliance with conditions of approval including mitigation measures and aligns with the best practice management principles of the CNVS. The ER and AA will be consulted on coordination of OOHW. The principles of coordination of OOHW will be:

- Providing respite to impacted sensitive receivers so that standard respite periods of the Conditions of Approval are achieved;
- Consult and advise the AA and ER of decisions relating to respite and mitigation, including any documentary evidence as necessary; and

- Where reasonable and feasible, works shall be coordinated with other construction projects to manage respite in noise catchments, as per Section 3.3.1.

3.2.2 Other State significant development and infrastructure projects

As per CoA D21, other state significant development and infrastructure projects within 200 metres of the Project will be consulted with, to ensure reasonable steps are taken to coordinate work, including utility work, to minimise cumulative noise and vibration impacts and maximise respite for affected sensitive receivers.

4. Environment description and sensitive receivers

4.1 Project site description

Redfern Railway Station is situated in a suburban environment approximately 3 km south of Sydney CBD which services many commuters daily. The project is surrounded by residential, commercial and industrial receivers. The closest residential receivers are located adjacent to the Redfern Railway Station 20 m northwest of the station on Little Eveleigh Street and 30 m southeast of the station on Marian Street. The overview of the site is presented in Figure 2.

4.2 Noise catchment areas

To assess construction noise at receivers the noise catchment areas have been retained as defined during the EIS stage. A total of five noise catchment areas (NCAs) have been defined which surround the immediate project boundary for the purposes of assessing noise impacts. Noise management levels are defined for each NCA where all residential receivers within the NCA are exposed to a similar noise environment. This is based on the separation distance of NCAs relative to the works location of the project. The NCAs are presented in Figure 2.

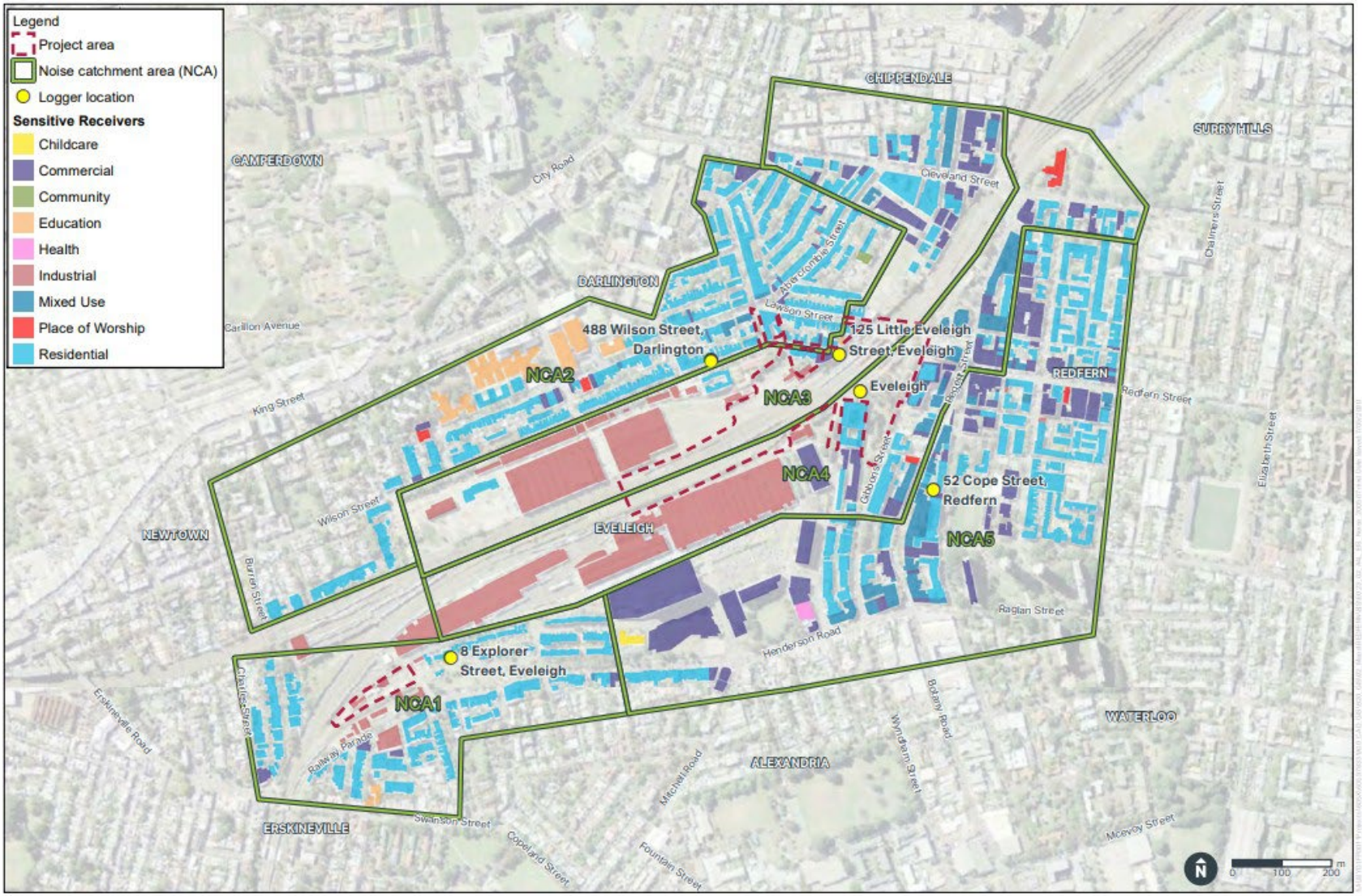

Figure 2: Site layout and Noise catchment areas (Extract from Redfern Station Upgrade - New Southern Concourse EIS Report, May 2020)

4.3 Sensitive receivers

4.3.1 Non – residential receivers

Noise sensitive receivers other than residential receivers that are located within the NCAs are listed in Table 6

Table 6: Non-residential receivers surrounding the project boundary

Noise Catchment area	Receiver	Receiver type
NCA 1	South Sydney Rotary Park	Passive Recreation
NCA 1	Solander Park	Passive Recreation
NCA 1	St Marys Catholic Primary School	Educational Facility
NCA 1	Ethel Street Playground	Passive Recreation
NCA 2	Hollis Park	Passive Recreation
NCA 2	Darlington Public School	Educational Facility
NCA 2	Saint Michael the Archangel Melkite Cathedral	Place of Worship
NCA 2	University of Sydney	Educational Facility
NCA 2	Church of the Assumption of Our Lady	Place of Worship
NCA 2	TAFE NSW – Eora	Educational Facility
NCA 2	Charles Kernan Reserve	Passive Recreation
NCA 2	Hugo Street Reserve	Passive Recreation
NCA 2	Redfern community centre / playground	Passive Recreation
NCA 3	Key College	Educational Facility
NCA 4	Cathedral of the Annuciation of Our Lady	Place of Worship
NCA 4	Prince Alfred Park	Passive Recreation
NCA 4	Gibbons Street Reserve	Passive Recreation
NCA 4	Carriageworks	Passive Recreation
NCA 5	Reconciliation Park	Passive Recreation
NCA 5	St Vincent de Paul's Catholic Church Redfern	Place of Worship
NCA 5	South Eveleigh Playground	Passive Recreation
NCA 5	Redfern Park	Passive Recreation
NCA 5	Alexandria Park	Passive Recreation
NCA 5	Alexandria Childcare Centre	Childcare Centre

4.3.2 Heritage listed items

Heritage listed items located adjacent to the project area and is part of the heritage register are summarised in Table 7.

Table 7: Summary of listed heritage items surrounding the project boundary

Noise Catchment area	Receiver	Level of significance
NCA 4	Eveleigh Railway Workshops	Registered, State
NCA 3	Darlington Heritage Conservation Area	Registered
NCA 3	Eveleigh Chief Mechanical Engineers Office (former)	Registered, State
NCA 4	Redfern Railway Station Group	State
NCA 4	Eveleigh Railway Workshops	State
-	Pressure tunnel and Shafts	State
NCA 3	RailCorp Moveable Heritage Collection (former paint shop)	Local
NCA 4	Eveleigh Railway Workshops	State
-	Telecommunications equipment centre	State
NCA 3	Administration Building former chief mechanical engineer's office	State
NCA 3	Booking office, Redfern Railway Station, Lawson Street	State
NCA 4	Eveleigh locomotive workshops precinct	State
NCA 3	the Carriageworks at Eveleigh	State
NCA 3	Darlington Heritage Conservation area	Local
NCA 2	Golden Grove Heritage Conservation area	Local

4.3.3 Residential receivers

Noise sensitive receivers are the remaining receivers that are residential in nature within the NCAs. These are summarised in Table 8

Table 8: Summary of receiver locations in NCAs

Noise Catchment area	Receivers
NCA 1	- Between Charles Street and Burren Street - Between Railway Parade and Swanston Street - Between Henderson Road and Renwick Street
NCA 2	- Leamington Lane - Holdsworth Street - Wilson Street Between Holdsworth Street and Lawson Street - Shephard Street to Abercrombie Street - Lawson Street to Wilson Street - Lawson Street to Caroline Street - Including receivers North of Little Eveleigh Street
NCA 3	- Vine Street to Cleveland Street - Cleveland Street to Meagher Street - Including receivers South of Little Eveleigh Street
NCA 4	- Gibbons Street from Boundary Street to Lawson Street - Regent Street from Redfern Street to James Street - Cleveland Street from George Street to Pitt Street - The Watertower (Marian Street, Rosehill Street, Cornwallis Street)
NCA 5	- Henderson Road to Regent Street - Phillip Street to Redfern Street - Redfern Street to James Street

4.3.4 Property condition survey

Dilapidation surveys have been conducted on selected receivers surrounding the Project. This is illustrated in Figure 3. A full list of properties that have undertaken dilapidation surveys are listed in Appendix B.

Figure 3: Property condition survey map

4.4 Cumulative construction impacts

During the EIS phase, existing surrounding projects that are state significant development and infrastructure projects has been reviewed. At the time of the review, the following projects have been identified which are:

- Sydney Metro City & Southwest – Waterloo Over Station Development
- Pemulwuy Student Accommodation
- 1 Lawson Square, Redfern
- Social Housing, 11 Gibbons Street, Redfern
- 90 – 102 Regent Street, Redfern
- The Regent Hotel, 56 – 58 Regent Street, Redfern
- Mixed use development at No. 48 Regent Street, Redfern

The list above is representative of the time when the EIS had been conducted. The current environment may include other state significant development and infrastructure projects.

In accordance with CoA D21, any other state significant development and infrastructure projects within 200m will have to be consulted to coordinate works in order to minimise cumulative construction impacts. The Contractor shall make contact with construction managers of other surrounding projects which may be active concurrently with Redfern Railway Station works to manage cumulative impacts where reasonable and practicable.

5. Construction noise and vibration management levels

In accordance with CoA D24 the applicable guidelines and standards are listed for reference for the derivation of noise and vibration management levels for the Project. These are consistent with the CNVS.

5.1 Construction noise management levels

As part of the revised mitigation measures, this CNVMP shall include a description and identification of all construction activities, including work areas, equipment and duration with the inclusion of assessment of noise and vibration impacts.

Noise level emissions from construction activities are predicted at the sensitive receivers using the environmental software package SoundPlan Version 8.1 and are compared to the noise management levels (NMLs) derived during the EIS stage in accordance with the *Interim Construction Noise Guideline (DECC, 2009)*.

5.1.1 Residential

Specific NMLs for residential receivers within the NCAs are presented in Table 9 which is extracted from the *Redfern Railway Station Upgrade – New Southern Concourse: Technical Report 4 – Noise and Vibration*.

Table 9: Construction NMLs at residential receivers within NCAs

Noise catchment area	Period	RBL, L_{A90} dB(A)	Standard hours noise management levels, $L_{Aeq,15min}$, dB(A)	Out-of-hours noise management levels, $L_{Aeq,15min}$, dB(A)
1	Day	42	52 (75 – highly noise affected level)	47
	Evening	37	-	42
	Night	32	-	37
2	Day	41	51 (75 – highly noise affected level)	46
	Evening	39	-	44
	Night	35	-	40
3	Day	53	63 (75 – highly noise affected level)	58
	Evening	51	-	56
	Night	39	-	44
4	Day	53	63 (75 – highly noise affected level)	58
	Evening	51	-	56
	Night	39	-	44
5	Day	44	54 (75 – highly noise affected level)	49
	Evening	44	-	49
	Night	37	-	42

5.1.2 Sensitive areas

Specific NMLs for non-residential receivers within the NCAs are presented in Table 10 which is adopted from the *Redfern Railway Station Upgrade – New Southern Concourse: Technical Report 4 – Noise and Vibration*.

Table 10: Construction NMLs at non-residential receivers within NCAs

Land use	Construction noise management level, $L_{Aeq\ (15\ min)}$ (applies when properties are in use)
Classrooms in schools and other educational institutions	45 dB(A) (Internal noise level) Equivalent to 55 dB(A) (external) with windows open[1]

Places of worship	Internal noise level 45 dB(A) Equivalent to 55 dB(A) (external) with windows open[1]
Active recreation areas characterised by sporting activities and activities which generate their own noise, making them less sensitive to external noise intrusion	External noise level 65 dB(A)
Passive recreation areas characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example reading, meditation	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended "maximum" internal levels in AS/NZS 2107:2016 for specific uses.
Industrial premises	External noise level 75 dB(A)
Offices, retail outlets	External noise level 70 dB(A)
Other noise sensitive land uses as identified in AS/NZS 2107:2016	Refer to the noise levels in AS/NS 2107:2016 for specific uses.

Notes:

1. *External noise management level is based upon an internal noise management level and a 10 dB reduction from outside to inside through an open window.*

5.1.3 Sleep disturbance

Where construction works are planned to occur over more than two consecutive nights a quantitative assessment is required in accordance with the ICNG where the maximum noise level and the expected number of exceedances of the RBL should be covered in the analysis.

The sleep disturbance criteria have been derived based on the *NSW Road Noise Policy (DECCW, 2011)* which concludes that *'Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions'*. Therefore, given that an open window provides approximately 10 dB in noise attenuation from outside to inside, external noise levels of 60-65 dB(A) are unlikely to result in awakening reactions.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers within NCAs are presented in Table 11. Where the screening level is exceeded it should be noted that there is a significant increase above the background levels. Where the awakening reaction criteria is exceeded, consideration should be given to reasonable and feasible mitigation measures.

Table 11 Sleep disturbance criteria

Noise catchment area	Background noise level	Sleep disturbance criteria (external) $L_{A1(1\ minute)}$, dB(A)	
	(L_{A90}), dB(A)	Screening level	Awakening reaction
1	32	47	65
2	35	50	65
3	39	54	65
4	39	54	65
5	37	52	65

5.1.4 Ground-borne noise

Ground-borne noise is generated by construction vibration that is transmitted through ground onto a structure. This is typical of underground works where vibrations can be more noticeable than airborne noise in some cases. Ground-borne noise can be assessed internally with the aim to protect the residential amenity of people within a building. The ground-borne noise management levels are presented in Table 12.

Table 12: Ground-borne noise criteria

Time of day	Internal noise level measured at the centre of the most affected habitable room
Evening (6pm to 10pm)	$L_{Aeq\ (15\ minute)}$ = 40 dB(A)
Night (10pm to 6am)	$L_{Aeq\ (15\ minute)}$ = 35 dB(A)
Notes: Levels are only applicable when ground borne noise levels are higher than airborne noise levels. Management actions include community consultation to determine acceptable level of disruption and provision of respite accommodation in some circumstances.	

5.2 Construction vibration management levels

The CNVS provides detailed guidance on the assessment of construction-related vibration which is consistent with D24. The relevant standards and guidelines for the assessment of construction vibration in relation to amenity and structures are referred in the CNVS which are:

- *Assessing Vibration: A Technical Guideline*
- *BS7385.2 – 1993: Evaluation and measurement for vibration in buildings. Guide to damage from ground-borne vibration*

5.2.1 Vibration amenity

The assessment of human comfort which is intermittent vibration in nature is outlined in the *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006) which is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods. The VDV criteria is based on the likelihood that a person would be annoyed by vibration over an assessment period. This is detailed in Table 13.

Table 13: Preferred and maximum vibration dose values for intermittent vibration (m/s$^{1.75}$)

Type of space occupancy	Vibration Dose Values (m/s$^{1.75}$)			
	Day (7am to 10pm)		Night (10pm to 7am)	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residential	0.2	0.4	0.1	0.2
Offices, schools, educational institutions, places of worship	0.4	0.8	0.4	0.8
Workshops	0.8	1.6	0.8	1.6
Notes: *1. Day is defined as 7:00 am to 10:00 pm. Night is defined as 10:00 pm to 7:00 am.* *2. The Guideline Targets are non-mandatory; they are goals that should be sought to be achieved through the application of practicable mitigation measures. If exceeded, then management actions would be required*				

5.2.2 Vibration of Structures

The assessment of vibration on structures is evaluated by the British Standards *BS7385.2 – 1993: Evaluation and measurement for vibration in buildings. Guide to damage from ground-borne vibration.* It is important to note that buildings exposed to higher levels of vibration than those recommended limits do not necessarily result in damage. Similarly, levels that are below the recommended limits does not mean damage would not occur. This guideline vibration management levels are presented in Table 14.

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

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

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

Heritage buildings and structures would be assessed as per the screening level state above as they should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound. If a heritage building or structure is found to be structurally unsound (following inspection) a more conservative cosmetic damage objectives of 2.5 mm/s peak component particle velocity (from DIN 4150) would be considered.

Table 14: Transient vibration guideline values - minimal risk of cosmetic damage (as referenced in TfNSW CNVS)

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 – 15 Hz	15 Hz and above
1	Reinforced or frame 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

When evaluating services or buried pipework, the DIN 4150-3 Guideline has been adopted and is presented in Table 15.

Table 15: DIN 4150-3 Guideline values for vibration velocity when evaluating the effects of short-term vibration on buried pipework (as referenced in TfNSW CNVS)

Line	Pipe material	Guideline values for vibration velocity measured on the pipe
1	Steel (including welded pipes)	100 mm/s
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80 mm/s
3	Masonry, plastic	50 mm/s

Specific vibration objectives should be determined on a case-by-case basis. A suitably qualified acoustic consultant should be engaged by the contractor to liaise with regarding structures or utility owners to determine acceptable vibration levels.

6. Construction noise and vibration assessment

6.1 Construction scenarios

Construction noise and vibration impacts have been assessed based on the construction staging developed during the planning stage. The works stages assessed are the worst-case construction scenarios based on the proximity of works location to sensitive receivers and where construction staging have plant with high noise and vibration emissions. The assessed work staging is presented in Table 16 along with the expected hours of operation and the duration of the works. Scenarios that are considered to have minimal level of impacts have been excluded from the assessment, as noise emission levels would be lower than those listed in Table 16. The hours of work are addressed in Section 3.

Construction emissions shall be reasonably and practicably managed to reduce the impacts on sensitive receivers relative to the level of exceedance above the NMLs. Rail infrastructure upgrade works typically have

the need to conduct OOHW, in order to sustain the operational requirement of the public rail infrastructure, that provides benefit to the community. In this case, a large portion of proposed works for the Project is covered by OOHW conditions given rail possession will be required to undertake the required works. The need to conduct OOHW should be adequately justified based on the incapability to undertake the works during standard hours.

The construction scenarios are subject to change during the construction period for various reasons. Predicted noise impacts will also likely change relative to changes occurring during construction. In such cases, the management and mitigation of construction impacts shall be in line with the current OOHWP for the Project.

Table 16: Construction scenarios for Redfern Railway Station Upgrade

Construction scenario	Specific construction activity	Major Plant Items	Typical hours of operation	Approximate scheduling
Scenario 1: Site establishment and enabling works	- installation of site offices and utilities within ancillary areas - installation of hoarding and site boundaries	Bobcat, crane, excavator, generator, lighting	Standard hours	December 2020
Scenario 2: Hoarding and Piling works – Platform 6 - 10	- hoarding installation on platform 6 – 10 - piling works on platform 6 – 10	crane, concrete truck, concrete pump, piling rigs, excavators, dump truck, vac truck	Standard hours, Period (all) 1, Period 2 (all)	December 2020
Scenario 3: Foundation and Piling works – Platform 6 – 10 & Marian St	- piling works on platform 6 – 10 - foundation FRP on platform 6 – 10 - Marian St piling works	Trucks (deliveries), concrete pump, concrete trucks, piling rigs, excavators, vac trucks	Standard hours	January 2021
Scenario 4: Foundation and Piling works – Platform 4 – 9 & Marian St	- Piling works on platform 4 & 5 - lift pit FRP on platform 6 – 9 - Marian St sheet piling works	Trucks (deliveries), concrete pump, concrete trucks, piling rigs, excavators, vac trucks	Standard hours	January - February 2021
Scenario 5: Sky bridge – Platform 8 – 9	- Sky Bridge Foundation on platform 8 & 9	Crane, concrete truck, concrete pump, piling rigs, excavators, vac truck	Period 1 weekend, period 2 weekend	February 2021
Scenario 6: Piling works – Platform 1 – 5 & Marian St	- hoarding installation on platform 1 – 3 - foundation FRP on platform 4 & 5	Concrete pump, concrete trucks, piling rigs, excavators, vac truck	Standard hours	March – April 2021

Construction scenario	Specific construction activity	Major Plant Items	Typical hours of operation	Approximate scheduling
	- Marian St sheet piling works			
Scenario 7: FRP works Platform 1 – 5 & Marian St ground works	- FRP works on platform 1 – 5 - Marian St Building	Concrete pump, concrete trucks, piling rigs, excavators, vac truck	Standard hours	June – July 2021
Scenario 8: Super T Beam installation – Platform 7 – 10	- Super T beam installation on Platform 7 & 8	Crane, trucks (deliveries) EWPs	Period 1 weekend, period 2 weekend	July 2021
Scenario 9: Super T Beam installation – Platform 1 – 4	- Super T beam installation on Platform 1 to Platform 2 & 3 - Super T beam installation on Platform 2 & 3 to Platform 4 & 5	Crane, trucks (deliveries) EWPs	Period 1 weekend, period 2 weekend	August 2021
Scenario 10: Bridge installation and connection slab – Platform 1 – 7	- installation of bridge overhead structures - connection slab between lift and bridge on platform 2 to 7	Cranes, concrete pump, concrete truck	Standard hours	August – November 2021
Scenario 11: Asphalting – Platform 10	- Asphalting on platform 10	Dump truck, excavators, compactor	Standard hours	March 2022
Scenario 12: Asphalting – Platform 1 – 5	- Asphalting on platform 1 to 5	Dump truck, excavators, compactor	Standard hours	April 2022
Scenario 13: Trenching and combined services route works	- Trenching platform 10 - combined services route works	Excavator, vac truck, compactor, saw cut	Standard hours	December 2020 – March 2021
Scenario 14: Little Eveleigh Street and Marian Street Roadworks	- Road works on Little Eveleigh Street - Road works on Marian Street	Excavators, jackhammers, concrete trucks, rollers, plate compactors	Standard hours	Feb 2021 – March 2022
Scenario 15: Tree Removal and pruning	- tree removal and trimming in local areas - Marian Street, Little Eveleigh Street and Platform 1 locality	Chain saws, chipper, trucks	Standard hours	December 2020

Rail possessions are utilised where commuting is generally lower such as the overnight, weekends and holiday periods. This will be implemented throughout the Project where it is feasible. However, scheduling of construction works is subject to change.

6.2 Propagation model

Construction environmental noise have been predicted externally at sensitive receivers within NCA locations collectively. Emissions are based on the specified plant/equipment to be used for the construction works. The predictions represent the worst-case impacts, with all plant operating simultaneously which is a situation unlikely to occur in practice.

6.2.1 Noise Model

Noise modelling of the construction activities has been undertaken using the *CONCAWE noise propagation model*[1] which is implemented through the environmental noise software package SoundPLAN v 8.1. The model developed includes the topography of the surrounding residential and non-residential areas and Redfern Railway Station. Modelling features includes geometrical divergence, atmospheric absorption and ground absorption between sources and receivers.

The noise model has all proposed indicative plant grouped within the allocated construction area closest to the receiver which is considered a worst-case situation as construction plant would be typically spread out or idling across the construction area.

6.2.2 Vibration prediction

Vibration predictions are calculated based on the propagation between the vibration source and the receivers. The propagation characteristic through the ground is represented by a material damping coefficient indicative of the ground material.

The material damping coefficient is derived from the geotechnical borehole investigation findings on site. With reference to *Appendix G – Geotech Contamination Investigation Reports* of the *Redfern Railway Station Upgrade – New Southern Concourse EIS report* the material damping coefficients are detailed in Table 17. Vibration predictions assumes a uniform propagation with distance.

Table 17: Material damping coefficients based on geotechnical investigations

Borehole	Location	Coordinates		Material description	Material damping coefficient
		Northing	Easting		
BH03	Entrance to Little Eveleigh Street	6248326	333329	Silty Clay with fine to coarse sand	1.3
BH02	Retaining wall above platform 10	6248278	333393	Sand, Clayey sand and sandy clay	1.3

Note: Material damping coefficient is based on prediction methodology set out in reference – *Construction noise and vibration impact on sensitive premises, Roberts C. proceedings of Acoustics 2009*

[1] *CONCAWE – Environmental science for European refining: The propagation of noise from petroleum and petrochemical complexes to neighbouring communities*

6.3 Construction noise sources

The source noise levels for construction plant use in construction stages are detailed in Table 18. Source noise levels data that are applicable to the Project has been obtained from the CNVS.

Table 18: Construction plant source noise levels

Equipment	Sound Power Level, dB(A)		Construction scenario
	L_{Aeq}	L_{Amax}	
Bobcat	104	112	1
Concrete pump	106	109	2,3,4,5,6,7,10
Concrete truck	106	114	2,3,4,5,6,7,10,14
Crane (450 tonne)	106	114	1,2,5,8,9,10
Crane trucks (semi-trailer and tipper)	108	116	3,4,8,9,14,15
Excavator (20 tonne)	98	106	1,2,3,4,5,6,7,11,12,13,14
Franna crane	93	101	1,2,5,8,9,10
Generator	101	104	1
Hand tools	94	102	1,2,3,4,5,6,7,8,9,10,11,12,13,14, 15
Hydrema/hirail	94	102	2,11,12
Lighting tower	95	98	1
Mobile crane	104	112	1,2,5,8,9,10
Bored piling rig	103	111	2,3,4,5,6,7
Plate compactor	108	116	11,12,13,14
Power tools	97	105	1
Scissor lift / EWP	100	108	8,9
Vac truck	109	112	2,3,4,5,6,7,13
Saw cutter	115	123	13
Jackhammer	113	121	14
Chain saw	114	117	15
Chipper/mulcher	111	114	15

6.4 Construction vibration sources

The source vibration levels for construction plant use in construction stages are detailed in Table 19. Source vibration levels data has been obtained from a combination of:

- British Standards *BS5228-2:2009 – Code of practice for noise and vibration control on construction and open sites – vibration*
- Federal Transit Administration (FTA) – Transit noise and vibration impact assessment, May 2006

Table 19: Construction plant source vibration levels

Equipment	Individual vibration reference level, mm/s		Construction stage
	PPV	Ref (m)	
Jackhammer	1	7.6	14
Excavator	4	10	1,2,3,4,5,6,7,11,12,13,14
Bored piling rig	3.5	10	2,3,4,5,6,7
Heavy vehicles (trucks)	1.9	7.6	3,4,8,9,14,15
Plate compactor	2.5	7.6	11,12,13,14

7. Predicted construction impacts

The predicted noise and vibration levels at sensitive receivers within the NCAs from the proposed construction activities, are detailed in the following sections. Predictions are based on the number of plant items designated for each construction scenario defined in Section 6.1.

7.1 Predicted construction noise

The predicted construction noise impacts at sensitive receivers within the NCAs for each scenario is presented in Table 20. The construction noise impact assessment and sleep disturbance criteria are both presented.

In accordance with the ICNG and the CNVS, the ground-borne noise criteria is not expected to be exceeded for this project. Based on the proposed construction activities, the predicted airborne noise levels are above those of the ground-borne noise criteria. Therefore ground-borne noise is not expected to be intrusive to the amenity of sensitive receivers.

7.2 Predicted construction vibration

The predicted construction vibration impacts at sensitive receivers within the applicable NCAs for each scenario is presented in Table 21. The construction vibration impact assessment and human comfort criteria are both presented.

Table 20: Summary of construction noise impact and sleep disturbance assessment on sensitive receivers

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
NCA 1	**52 dB(A)**	**47 dB(A)**	**42 dB(A)**	**37 dB(A)**	**75 dB(A)**	**Refer Table 10**	**47 dB(A)**	**65 dB(A)**
Scenario 1 (excavating)	Predicted exceedances of 10 – 15 dB above NML at: - Clara St - Henderson St - Railway Pde - Explorer St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 2 (piling, dump trucks)	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers
Scenario 3 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 4 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 5 (piling, excavating)	-	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers
Scenario 6 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 7 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 8 (Crane, trucks)	-	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 9 (Crane, trucks)	-	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted compliance at all residential receivers	Predicted compliance at all residential receivers
Scenario 10 (Crane, trucks)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 11 (Excavating, compacting)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 12 (Excavating, compacting)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 13 (Excavating, compacting, saw cutting)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 14 (Excavating, compacting, rolling, jackhammer)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 15 (trucks, chain saws)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
NCA 2	**51 dB(A)**	**46 dB(A)**	**44 dB(A)**	**40 dB(A)**	**75 dB(A)**	**Refer Table 10**	**50 dB(A)**	**65 dB(A)**
Scenario 1 (excavating)	Predicted exceedances of 1 – 5 dB above NML at: - Ivy Ln - Little Eveleigh St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 2 (piling, dump trucks)	Predicted exceedances of 10 – 15 dB above NML at: - Ivy Ln - Little Eveleigh St - Lawson St	Predicted exceedances of 15 – 20 dB above NML at: - Ivy Ln - Ivy St	Predicted exceedances of 15 – 20 dB above NML at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St	Predicted exceedances of 20 – 25 dB above NML at: - Ivy Ln - Ivy St - Little Eveleigh St	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted exceedances at: - Ivy Ln - Little Eveleigh St - Lawson St - Louis St	Predicted exceedances at: - Little Eveleigh St

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
	- Louis St	- Little Eveleigh St - Wilson St - Lawson St - Louis St	- Lawson St - Caroline Ln - Louis St	- Wilson St - Wilson Ln - Lawson St - Caroline Ln - Louis St - Hugo St - Abercrombie St				
Scenario 3 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Ivy Ln - Little Eveleigh St - Lawson St - Louis St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 4 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St - Wilson St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 5 (piling, excavating)	-	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St - Lawson St - Louis St - Hugo St - Caroline St - Caroline Ln	Predicted exceedances of 5 – 10 dB above NML at: - Ivy St - Little Eveleigh St - Wilson St - Lawson St - Louis St - Hugo St - Caroline St - Caroline Ln	Predicted exceedances of 10 – 15 dB above NML at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St - Wilson Ln - Lawson St - Caroline Ln - Caroline St - Louis St - Hugo St - Abercrombie St	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted exceedances at: - Little Eveleigh St - Lawson St - Louis St	Predicted compliance at all residential receivers
Scenario 6 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St - Lawson St - Louis St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 7 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St - Lawson St - Louis St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 8 (Crane, trucks)	-	Predicted exceedances of 15 – 20 dB above NML at: - Little Eveleigh St - Lawson St - Louis St - Hugo St - Caroline St - Caroline Ln	Predicted exceedances of 15 – 20 dB above NML at: - Ivy St - Little Eveleigh St - Wilson St - Lawson St - Louis St - Hugo St - Caroline St - Caroline Ln	Predicted exceedances of 20 – 25 dB above NML at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St - Wilson Ln - Lawson St - Caroline Ln - Caroline St - Louis St - Hugo St	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted exceedances at: - Ivy St - Little Eveleigh St - Wilson St - Lawson St - Louis St - Caroline St - Caroline Ln	Predicted exceedances at: - Little Eveleigh St
Scenario 9 (Crane, trucks)	-	Predicted exceedances of 20 – 25 dB	Predicted exceedances at of	Predicted exceedances	No highly affected	Predicted compliance at all non-	Predicted exceedances at:	Predicted exceedances at:

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
		above NML at: - Ivy St - Little Eveleigh St - Lawson St	20 – 25 dB above NML at: - Ivy St - Ivy Ln - Little Eveleigh St - Wilson St - Lawson St	of 25 – 30 dB above NML at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St - Wilson Ln - Lawson St	receivers predicted	residential receivers	- Ivy St - Little Eveleigh St	- Little Eveleigh St
Scenario 10 (Crane, trucks)	Predicted exceedances of 15 – 20 dB above NML at: - Little Eveleigh St - Lawson St - Louis St - Wilson St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 11 (Excavating, compacting)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St - Lawson St - Caroline Ln	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 12 (Excavating, compacting)	Predicted exceedances of 10 – 15 dB above NML at: - Little Eveleigh St - Lawson St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 13 (Excavating, compacting, saw cutting)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St - Lawson St - Louis St - Hugo St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 14 (Excavating, compacting, rolling, jackhammer)	Predicted exceedances of 25 – 30 dB above NML at: - Ivy St - Ivy Ln - Wilson St - Wilson Ln - Little Eveleigh St	-	-	-	Predicted exceedances at: - Little Eveleigh St - Lawson St - Ivy St - Abercrombie St - Wilson St	Predicted exceedances at: - Little Eveleigh St - Lawson St - Wilson St	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
	- Lawson St - Louis St - Hugo St - Abercrombie St							
Scenario 15 (trucks, chain saws)	Predicted exceedances of 25 – 30 dB above NML at: - Ivy St - Ivy Ln - Wilson St - Wilson Ln - Little Eveleigh St - Lawson St - Louis St - Hugo St	-	-	-	Predicted exceedances at: - Little Eveleigh St - Lawson St	Predicted exceedances at: - Little Eveleigh St - Lawson St	No works proposed during OOHW	No works proposed during OOHW
NCA 3	**63 dB(A)**	**58 dB(A)**	**56 dB(A)**	**44 dB(A)**	**75 dB(A)**	**Refer Table 10**	**54 dB(A)**	**65 dB(A)**
Scenario 1 (excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 2 (piling, dump trucks)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St	Predicted exceedances of 10 – 15 dB above NML at: - Little Eveleigh St - Eveleigh St - Lawson St	Predicted exceedances of 10 – 15 dB above NML at: - Little Eveleigh St - Eveleigh St - Lawson St	Predicted exceedances of 20 – 25 dB above NML at: - Little Eveleigh St - Eveleigh St - Lawson St - Chippen St	No highly affected receivers predicted	Predicted exceedances at: - The Key College	Predicted exceedances at: - Little Eveleigh St - Lawson St - Eveleigh St	Predicted exceedances at: - Little Eveleigh St
Scenario 3 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - The Key College	No works proposed during OOHW	No works proposed during OOHW
Scenario 4 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - The Key College	No works proposed during OOHW	No works proposed during OOHW
Scenario 5 (piling, excavating)	-	Predicted exceedances 5 – 10 dB above NML at:	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St	Predicted exceedances of 10 – 15 dB above NML at:	No highly affected receivers predicted	Predicted exceedances at: - The Key College	Predicted exceedances at: - Little Eveleigh St	Predicted compliance at all residential receivers

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
		- Little Eveleigh St - Lawson St - Caroline Ln	- Eveleigh St - Lawson St - Caroline Ln	- Little Eveleigh St - Eveleigh St - Lawson St - Caroline Ln - Chippen St			- Eveleigh St - Lawson St - Caroline Ln	
Scenario 6 (piling, excavating)	Predicted exceedances of up to 5 dB above NML at: - Little Eveleigh St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - The Key College	No works proposed during OOHW	No works proposed during OOHW
Scenario 7 (piling, excavating)	Predicted exceedances of up to 5 dB above NML at: - Little Eveleigh St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - The Key College	No works proposed during OOHW	No works proposed during OOHW
Scenario 8 (Crane, trucks)	-	Predicted exceedances of 10 – 15 dB above NML at: - Little Eveleigh St - Lawson St	Predicted exceedances of 10 – 15 dB above NML at: - Little Eveleigh St - Lawson St - Caroline Ln	Predicted exceedances of 20 – 25 dB above NMLat: - Little Eveleigh St - Eveleigh St - Lawson St	No highly affected receivers predicted	Predicted exceedances at: - The Key College	Predicted exceedances at: - Little Eveleigh St - Eveleigh St - Lawson St	Predicted exceedances at: - Little Eveleigh St

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
				- Caroline Ln - Caroline St				
Scenario 9 (Crane, trucks)	-	Predicted exceedances 15 – 20 dB above NML at: - Little Eveleigh St - Lawson St	Predicted exceedances 15 – 20 dB above NML at: - Little Eveleigh St - Lawson St - Caroline Ln	Predicted exceedances of 20 – 25 dB above NML at: - Little Eveleigh St - Eveleigh St - Lawson St - Caroline Ln - Caroline St	No highly affected receivers predicted	Predicted exceedances at: - The Key College	Predicted exceedances at: - Little Eveleigh St - Lawson St	Predicted exceedances at: - Little Eveleigh St
Scenario 10 (Crane, trucks)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - The Key College	No works proposed during OOHW	No works proposed during OOHW
Scenario 11 (Excavating, compacting)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 12 (Excavating, compacting)	Predicted compliance at	-	-	-	No highly affected	Predicted compliance at all non-	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
	all residential receivers				receivers predicted	residential receivers		
Scenario 13 (Excavating, compacting, saw cutting)	Predicted exceedances of 5 – 10 dB above NML at: - Little Eveleigh St - Lawson St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 14 (Excavating, compacting, rolling, jackhammer)	Predicted exceedances of 10 – 15 dB above NML at: - Little Eveleigh St - Lawson St - Eveleigh St - Eveleigh Ln	-	-	-	Predicted exceedances at: - Little Eveleigh St - Lawson St	Predicted exceedances at: - The Key College - Lawson St - Redfern Railway Station	No works proposed during OOHW	No works proposed during OOHW
Scenario 15 (trucks, chain saws)	Predicted exceedances of 10 – 15 dB above NML at: - Little Eveleigh St - Lawson St - Eveleigh St	-	-	-	Predicted exceedances at: - Little Eveleigh St - Lawson St	Predicted exceedances at: - The Key College - Lawson St	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
	- Caroline Ln - Caroline St					- Redfern Railway Station		
NCA 4	**63 dB(A)**	**58 dB(A)**	**56 dB(A)**	**44 dB(A)**	**75 dB(A)**	**Refer Table 10**	**54 dB(A)**	**65 dB(A)**
Scenario 1 (excavating)	Predicted exceedances of up to 5 dB above NML at: - Marian St - Rosehill St - Gibbons St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 2 (piling, dump trucks)	Predicted exceedances of up to 5 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances of 20 – 25 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq - William Ln - Margaret St - Regent St	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve - The Watertower - Warsash Scientific (office) - NeuClone (office)	Predicted exceedances at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances at: - Marian St - Rosehill St - Gibbons St
Scenario 3 (piling, excavating)	Predicted exceedances	-	-	-	No highly affected	Predicted exceedances at:	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
	of 5 – 10 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St				receivers predicted	- Gibbons St Reserve		
Scenario 4 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve	No works proposed during OOHW	No works proposed during OOHW
Scenario 5 (piling, excavating)	-	Predicted exceedances of 10 – 15 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances of 10 – 15 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances of 20 – 25 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq - William Ln - Margaret St - Regent St	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve	Predicted exceedances at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances at: - Marian St - Rosehill St - Gibbons St

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
				- Cope St				
Scenario 6 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve	No works proposed during OOHW	No works proposed during OOHW
Scenario 7 (piling, excavating)	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve	No works proposed during OOHW	No works proposed during OOHW
Scenario 8 (Crane, trucks)	-	Predicted exceedances of 10 – 15 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St	Predicted exceedances of 10 – 15 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances of 20 – 25 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve	Predicted exceedances at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances at: - Marian St - Rosehill St - Gibbons St

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
				- Margaret St - Regent St				
Scenario 9 (Crane, trucks)	-	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Gibbons St	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Gibbons St	Predicted exceedances of 20 – 25 dB above NML at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq - Margaret St - Regent St - Cornwallis St	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve	Predicted exceedances at: - Marian St - Gibbons St - Redfern St - Lawson Sq	Predicted exceedances at: - Marian St
Scenario 10 (Crane, trucks)	Predicted exceedances of 5 – 10 dB above NML at: - Marian St - Rosehill St - Redfern St	-	-	-	No highly affected receivers predicted	Predicted exceedances at: - Gibbons St Reserve	No works proposed during OOHW	No works proposed during OOHW
Scenario 11 (Excavating, compacting)	Predicted exceedances of up to 5 dB above NML at: - Marian St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 12 (Excavating, compacting)	Predicted exceedances of up to 5 dB above NML at: - Marian St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 13 (Excavating, compacting, saw cutting)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 14 (Excavating, compacting, rolling, jackhammer)	Predicted exceedances of 10 – 15 dB above NML at: - Marian St - Rosehill St - Cornwallis St - Redfern St - Lawson Sq - Gibbons St	-	-	-	Predicted exceedances at: - Gibbons St	Predicted exceedances at: - Gibbons St	No works proposed during OOHW	No works proposed during OOHW
Scenario 15 (trucks, chain saws)	Predicted exceedances of 10 – 15 dB above NML at: - Marian St - Rosehill St	-	-	-	Predicted exceedances at: - Gibbons St	Predicted exceedances at: - Gibbons St	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
	- Redfern St - Lawson Sq - Gibbons St							
NCA 5	**54 dB(A)**	**49 dB(A)**	**49 dB(A)**	**42 dB(A)**	**75 dB(A)**	**Refer Table 10**	**52 dB(A)**	**65 dB(A)**
Scenario 1 (excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 2 (piling, dump trucks)	Predicted compliance at all residential receivers	Predicted exceedances of up to 5 dB above NML at: - Regent St	Predicted exceedances of up to 5 dB above NML at: - Regent St	Predicted exceedances of 5 – 10 dB above NML at: - Regent St - Cope St - Wyndham St	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted exceedances at: - Regent St - Cope St	Predicted compliance at all residential receivers
Scenario 3 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 4 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 5 (piling, excavating)	-	Predicted exceedances of up to 5 dB above NML at: - Regent St - Cope St	Predicted exceedances of up to 5 dB above NML at: - Regent St - Cope St	Predicted exceedances of 5- 10 dB above NML at: - Regent St - Cope St - Wyndham St	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted exceedances at: - Regent St	Predicted compliance at all residential receivers
Scenario 6 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 7 (piling, excavating)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 8 (Crane, trucks)	-	Predicted exceedances of up to 5 dB above NML at: - Regent St	Predicted exceedances of up to 5 dB above NML at: - Regent St	Predicted exceedances of 5 – 10 dB above NML at: - Regent St - Cope St - Wyndham St	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted exceedances at: - Regent St - Cope St	Predicted compliance at all non-residential receivers

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
Scenario 9 (Crane, trucks)	-	Predicted exceedances of up to 5 dB above NML at: - Regent St	Predicted exceedances of up to 5 dB above NML at: - Regent St	Predicted exceedances of 5 – 10 dB above NML at: - Regent St - Cope St - Cornwallis St - Garden St	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	Predicted exceedances at: - Regent St	Predicted compliance at all non-residential receivers
Scenario 10 (Crane, trucks)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 11 (Excavating, compacting)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 12 (Excavating, compacting)	Predicted compliance at all residential receivers	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 13	Predicted compliance at	-	-	-	No highly affected	Predicted compliance at all non-	No works proposed during OOHW	No works proposed during OOHW

Construction scenario	Areas where noise levels may exceed construction NMLs						Areas where Sleep disturbance and/or awakening levels may be exceeded at residential buildings	
	Residential receivers					Non-residential receivers		
	Standard hours	OOHW Period 1 (daytime)	OOHW Period 1 (Evening)	OOHW Period 2 (night)	Highly Noise affected	All Periods	Sleep disturbance	Awakening reaction
(Excavating, compacting, saw cutting)	all residential receivers				receivers predicted	residential receivers		
Scenario 14 (Excavating, compacting, rolling, jackhammer)	Predicted exceedances of up to 5 dB above NML at: - Regent St - Cope St - Redfern St - wyndham St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW
Scenario 15 (trucks, chain saws)	Predicted exceedances of up to 5 dB above NML at: - Regent St - Cope St - Redfern St - wyndham St	-	-	-	No highly affected receivers predicted	Predicted compliance at all non-residential receivers	No works proposed during OOHW	No works proposed during OOHW

Table 21: Summary of construction vibration impact and human comfort assessment on sensitive receivers

Construction scenario	Nearest receiver (group)	Predicted PPV at nearest receiver, PPV (mm/s)	Areas where vibration levels may exceed structural construction limits, PPV			Predicted VDV at nearest receiver, VDV ($m/s^{1.75}$) x 10^{-3}	Areas where vibration levels may exceed human comfort limits (BS 6472-1), VDV		
			Commercial	Dwellings	Heritage		Dwellings	Commercial	Workshops
			25 mm/s	7.5 mm/s	2.5 mm/s		0.26 max	0.8 max	1.6 max
NCA1									
Scenario 1 (excavating)	Eveleigh Facility (commercial)	10	Predicted compliance structural vibration target	N/A	N/A	5.2	N/A	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment
NCA3									
Scenario 1 (excavating)	Eveleigh Chief Mechanical Engineer's Office (Heritage)	1	Predicted compliance structural vibration target	N/A	Predicted compliance structural vibration target	5.2	N/A	Compliant with low probability of adverse comment	N/A
Scenario 9 (Crane, trucks)	Little Eveleigh St (residential)	0.8	N/A	Predicted compliance structural vibration target	N/A	N/A	N/A	N/A	N/A
Scenario 10 (Crane, trucks)	Little Eveleigh St (residential)	1	N/A	Predicted compliance structural	N/A	N/A	N/A	N/A	N/A

Construction scenario	Nearest receiver (group)	Predicted PPV at nearest receiver, PPV (mm/s)	Areas where vibration levels may exceed structural construction limits, PPV			Predicted VDV at nearest receiver, VDV ($m/s^{1.75}$) x 10^{-3}	Areas where vibration levels may exceed human comfort limits (BS 6472-1), VDV		
			Commercial	Dwellings	Heritage		Dwellings	Commercial	Workshops
			25 mm/s	7.5 mm/s	2.5 mm/s		0.26 max	0.8 max	1.6 max
				vibration target					
Scenario 12 (Excavating, compacting)	Little Eveleigh St (residential)	2.4	N/A	Predicted compliance structural vibration target	N/A	1.4	N/A	Compliant with low probability of adverse comment	N/A
Scenario 14 (Excavating, compacting, rolling, jackhammer)	Little Eveleigh St (residential)	10	N/A	Predicted exceedance of structural vibration target: - Little Eveleigh St	N/A	6.1	N/A	Compliant with low probability of adverse comment	N/A
Scenario 15 (trucks, chain saws)	Little Eveleigh St (residential)	3.3	N/A	Predicted compliance structural vibration target	N/A	N/A	N/A	N/A	N/A
NCA4									
Scenario 1 (excavating)	The Watertower (residential & commercial)	1.6	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	5.2	N/A	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment

Construction scenario	Nearest receiver (group)	Predicted PPV at nearest receiver, PPV (mm/s)	Areas where vibration levels may exceed structural construction limits, PPV			Predicted VDV at nearest receiver, VDV ($m/s^{1.75}$) x 10^{-3}	Areas where vibration levels may exceed human comfort limits (BS 6472-1), VDV		
			Commercial	Dwellings	Heritage		Dwellings	Commercial	Workshops
			25 mm/s	7.5 mm/s	2.5 mm/s		0.26 max	0.8 max	1.6 max
Scenario 2 (piling, dump trucks)	The Watertower (residential & commercial)	1	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	0.7	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A
Scenario 3 (piling, excavating)	The Watertower (residential & commercial)	1.2	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	0.9	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A
Scenario 4 (piling, excavating)	The Watertower (residential & commercial)	1	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	0.7	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A
Scenario 5 (piling, excavating)	The Watertower (residential & commercial)	0.5	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	0.3	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A
Scenario 6 (piling, excavating)	The Watertower (residential & commercial)	0.6	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	0.4	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A

Construction scenario	Nearest receiver (group)	Predicted PPV at nearest receiver, PPV (mm/s)	Areas where vibration levels may exceed structural construction limits, PPV			Predicted VDV at nearest receiver, VDV ($m/s^{1.75}$) x 10^{-3}	Areas where vibration levels may exceed human comfort limits (BS 6472-1), VDV		
			Commercial	Dwellings	Heritage		Dwellings	Commercial	Workshops
			25 mm/s	7.5 mm/s	2.5 mm/s		0.26 max	0.8 max	1.6 max
Scenario 7 (piling, excavating)	The Watertower (residential & commercial)	1.6	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	1.1	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A
Scenario 8 (Crane, trucks)	The Watertower (residential & commercial)	0.4	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	N/A	N/A	N/A	N/A
Scenario 11 (Excavating, compacting)	The Watertower (residential & commercial)	1.2	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	0.7	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A
Scenario 13 (Excavating, compacting, saw cutting)	Lawson Square (residential & commercial)	2.4	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	1.4	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A
Scenario 14 (Excavating, compacting, rolling, jackhammer)	The Watertower (residential & commercial)	4	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	6.1	Compliant with low probability of adverse comment	Compliant with low probability of adverse comment	N/A

Construction scenario	Nearest receiver (group)	Predicted PPV at nearest receiver, PPV (mm/s)	Areas where vibration levels may exceed structural construction limits, PPV			Predicted VDV at nearest receiver, VDV ($m/s^{1.75}$) x 10^{-3}	Areas where vibration levels may exceed human comfort limits (BS 6472-1), VDV		
			Commercial	Dwellings	Heritage		Dwellings	Commercial	Workshops
			25 mm/s	7.5 mm/s	2.5 mm/s		0.26 max	0.8 max	1.6 max
Scenario 15 (trucks, chain saws)	The Watertower (residential & commercial)	1.3	Predicted compliance structural vibration target	Predicted compliance structural vibration target	N/A	N/A	N/A	N/A	N/A

Based on the construction scenarios provided, exceedances of the vibration target levels have been identified at NCA3 as a result of works of construction scenario 14. Figure 4 illustrates vibration impacts due to construction scenario 14 which correspond to roadworks occurring along Little Eveleigh Street. The yellow line defines the screening limit of vibration levels for residential properties while the red line defines the predicted vibration level exceedance as detailed in Table 21.

Specific construction schedules may change and works may differ throughout the construction period. As detailed in Section 8.4, a soft start approach to vibratory works is required when undertaking vibration-based works. This will identify potential exceedances of vibration target levels for affected properties in the vicinity of the works.

In accordance with CoA D26, where these properties have been identified to be at risk of exceeding vibration target levels, the owners and occupiers of such properties must be notified before work that generates vibration commences in the vicinity of those properties. Where 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 exceedance period unless otherwise agreed by the owner and occupier.

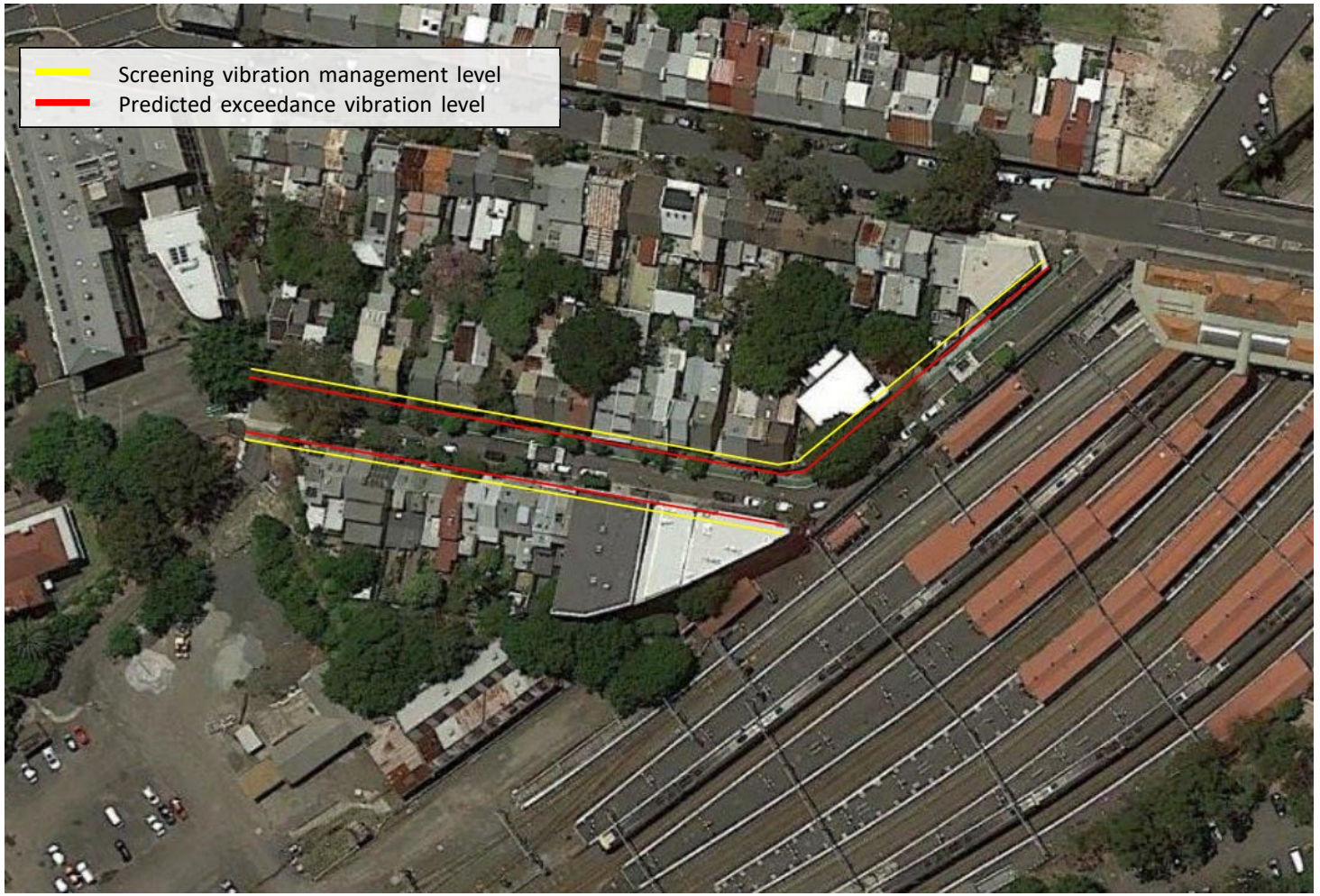

Figure 4: Predicted exceedances of vibration due to construction scenario 14 works on Little Eveleigh Street

8. Mitigation and management measures

In addition to existing mitigation and management measures addressed within the Construction Environmental Management Framework (CEMF), this section presents controls to minimise and manage noise and vibration with:

- General mitigation
- Mitigation for areas above NMLs
- Monitoring requirements

8.1 Works within minimum working distance

If the predicted ground-borne vibration levels exceed the cosmetic damage objectives in the CNVS, a different construction method with lower source vibration levels must be used where feasible and reasonable. Otherwise construction works should not proceed unless attended vibration measurements are undertaken at the commencement of the works to determine if there is risk of exceeding of the cosmetic damage objective, a permanent vibration monitoring system should be installed, to warn plant operators (for example via flashing light, audible alarm, SMS) when vibration levels are approaching the cosmetic damage objective. The is consistent with the soft start approach described in Section 8.4.3.

8.2 General mitigation measures

General mitigation measures that apply in the management of potential noise and vibration impacts on sensitive receivers are provided in Table 22. General mitigation measures shall be applied and implemented to mitigate noise and vibration impacts of the project where reasonable and practicable. This should include those presented within the CNVS. Additional mitigation measures are detailed in Table 2 which are revised specifically for this Project.

Table 22: General mitigation measures to manage noise and vibration

Control	Applies to	Timing	details
Noise attenuation to be installed in prior to main construction works	Airborne noise	Prior to construction	Where possible, noise attenuation measures such as site barriers and hoardings shall be installed prior to construction commencing
Positioning of trucks and plant to minimise noise and vibration impacts	Airborne noise Vibration	During construction	Trucks and plant shall be orientated away from sensitive receivers to minimise noise and vibration impacts
Ensure delivery truck tailgates are clear and unlocked when unloading and loading	Airborne noise	During construction	Practicably reduce noise impacts when unloading and loading construction equipment and supplies
Avoid transport resonance particularly during night-time works	Airborne noise Vibration	During construction	Manage on site vehicle speeds and avoid using audible reversing alarms. Site paths should be maintained to avoid unnecessary noise sources such as potholes and loose items

Control	Applies to	Timing	details
Undertake construction activities within the nominated hours of work	Airborne noise Vibration	During construction	Where possible, maintain within the nominated construction hours of work
Advise local residents when unavoidable OOHW will occur and the nature of the works to be expected	Airborne noise Vibration	Prior to construction	In conjunction with the community and stakeholder management personnel, advise local residents about the duration and type of works to be undertaken during the OOHW periods
Limit the hours of work in response to community concerns	Airborne noise Vibration	During construction	Where possible, limit the hours of work when the community have expressed concerns regarding construction impacts
Schedule noisy construction activities during less sensitive periods.	Airborne noise Vibration	During construction	Schedule noisy activities during less sensitive periods noting that community consultation may be required to determine a specific period that is acceptable. This can be during OOHW periods.
Provide periods of respite from high noise and vibration impact works	Airborne noise Vibration	During construction	Provide respite periods such as extended work breaks, later start times and/or intermittent no-work periods where appropriate
All equipment must be serviced and maintained according to manufacturer's recommendations.	Airborne noise Vibration	During construction	All equipment utilised are expected to be serviced and maintained consistently to ensure they are operating effectively to minimise additional noise and vibration being generated
Implement appropriate project traffic management to minimise noise and vibration impacts	Airborne noise Vibration	During construction	Adjust traffic management plans to minimise travel paths and avoid laydown locations near sensitive receivers
Use only broadband alarms on site for reversing vehicles and plant	Airborne noise	During construction	Use only broadband alarms and/or accommodate forward moving paths
Utilise the lowest noise and vibration work practices and plant that meet the demands of the job	Airborne noise Vibration	During construction	Minimise noise and vibration impacts for works by utilising the lowest noise and vibration emission equipment suitable for the job
Locate site buildings, staff ingress/egress points, laydown yards to minimise disturbance on the community	Airborne noise	During construction	Minimise the use of heavily frequented community areas as locations for site access and buildings. Where possible, dedicated access should be utilised for the project.
Use temporary enclosures around noise works	Airborne noise	During construction	Where possible, utilise localised temporary enclosures to shield noise generating activities
Ensure noise attenuation of fixed and mobile plant are	Airborne noise	During construction	Ensure noise attenuation measures such as mufflers or silencers are installed to minimise noise emissions. Any

Control	Applies to	Timing	details
fitted with appropriate mufflers to minimise noise impacts			implemented noise attenuation measure on equipment shall be consistently maintained.
Turn off plant when not in use	Airborne noise	During construction	Turn off plant when not in use and locate them away from sensitive receivers. Avoid idling when possible.
Avoid heavy handling of materials and equipment	Airborne noise Vibration	During construction	Avoid dropping heavy items or heavy handling of plant to minimise noise and vibration impacts
Register of noise and vibration sensitive receivers	Airborne noise Vibration	Prior to construction	A register of the most affected noise and vibration sensitive receivers shall be made available on site which would include the address, category of receiver and contact details
Site inductions (including 'Tool box talks')	Airborne noise Vibration	Prior to construction	All employees, contractors and subcontractors are to receive an environmental induction which shall contain noise mitigation measures and management actions to be adopted by all. 'Toolbox talks' will also be conducted prior to works to identify noise and vibration risks.
Minimum working distances	Vibration	During construction	Construction methods should be revised when predicted ground borne vibration exceeds vibration objectives. Monitoring and alert systems should be utilised when approaching cosmetic damage objective.
Implement stakeholder consultation measures	Airborne noise Vibration	Prior to construction	Periodic notification (monthly letterbox drop and website notification) detailing upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works and the likely impacts. In addition to periodic notification, additional strategies can be implemented as detailed in Section 9.4.

8.3 Mitigation measures for areas above NMLs

High level mitigation is presented for areas that have been predicted to exceed the NMLs and are provided in Table 23. Mitigation presented are in accordance with Section 8.2 of the CNVS which are recommended actions which are to be implemented in accordance with Section 8.2.2.1. of the CNVS and the current Project OOHWP. Specific mitigation measures that are most reasonable and practicable shall be included within the Environmental Risk Action Plans (ERAPs) under the Construction Environmental Management Plan. The predicted noise emissions are presented as noise contour plots in Appendix A.

Table 23: Mitigation measures for areas above NMLs

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
1	Scenario 1	Predicted exceedances of NMLs at: - Clara St - Henderson St - Railway Pde - Explorer St	- - - - PN,V
2	Scenario 1	Predicted exceedances of NMLs at: - Ivy Ln - Little Eveleigh St	- - -
2	Scenario 2	Predicted exceedances of NMLs at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St - Wilson Ln - Lawson St - Caroline Ln - Louis St - Hugo St - Abercrombie St Predicted exceedances of sleep disturbance at: - Ivy Ln - Little Eveleigh St - Lawson St - Louis St Predicted exceedances of awakening reaction at: - Little Eveleigh St	 - - PN,V, SN, RO^, RP#,DR# - - PN,V, SN, RO^, RP#,DR# PN PN PN -
2	Scenario 3	Predicted exceedances of NMLs at: - Ivy Ln - Little Eveleigh St - Lawson St - Louis St	 - PN,V PN,V -
2	Scenario 4	Predicted exceedances of NMLs at: - Little Eveleigh St - Wilson St	- PN,V -
2	Scenario 5	Predicted exceedances of NMLs at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St - Wilson Ln - Lawson St - Caroline Ln - Caroline St	 - - PN,V, SN, RO^, RP#,DR#,AA - - PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR#

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		- Louis St - Hugo St - Abercrombie St Predicted exceedances of sleep disturbance at: - Little Eveleigh St - Lawson St - Louis St	PN,V, SN, RO^, RP#,DR# PN -
2	Scenario 6	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St - Louis St	 PN,V PN,V -
2	Scenario 7	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St - Louis St	 PN,V - -
2	Scenario 8	Predicted exceedances at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St - Wilson Ln - Lawson St - Caroline Ln - Caroline St - Louis St - Hugo St Predicted exceedances of sleep disturbance at: - Ivy St - Little Eveleigh St - Wilson St - Lawson St - Louis St - Caroline St - Caroline Ln Predicted exceedances of awakening reaction at: - Little Eveleigh St	 PN PN PN,V, SN, RO^, RP#,DR# PN PN PN,V, SN, RO^, RP#,DR# PN PN PN,V, SN, RO^, RP#,DR# PN
2	Scenario 9	Predicted exceedances of NMLs at: - Ivy Ln - Ivy St - Little Eveleigh St - Wilson St - Wilson Ln - Lawson St	 PN PN PN,V, SN, RO^, RP#,DR# - - PN,V, SN, RO^, RP#,DR#

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		Predicted exceedances sleep disturbance at: - Ivy St - Little Eveleigh St Predicted exceedances awakening reaction at: - Little Eveleigh St	
2	Scenario 10	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St - Louis St - Wilson St	 PN,V - - -
2	Scenario 11	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St - Caroline Ln	 PN,V - -
2	Scenario 12	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St	 PN,V -
2	Scenario 13	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St - Louis St - Hugo St	 PN,V PN,V PN,V -
2	Scenario 14	Predicted exceedances of NMLs at: - Ivy St - Ivy Ln - Wilson St - Wilson Ln - Little Eveleigh St - Lawson St - Louis St - Hugo St - Abercrombie St Predicted highly affected receivers at: - Little Eveleigh St - Lawson St - Ivy St - Abercrombie St - Wilson St Predicted exceedances of non-residential receivers NMLs at: - Little Eveleigh St - Lawson St - Wilson St	 PN,V,SN PN,V PN,V PN,V PN,V,SN PN,V,SN PN,V PN,V PN,V PN,V,SN PN,V,SN PN,V,SN PN,V,SN PN,V,SN
2	Scenario 15	Predicted exceedances of NMLs at:	

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		- Ivy St - Ivy Ln - Wilson St - Wilson Ln - Little Eveleigh St - Lawson St - Louis St - Hugo St Predicted highly affected receivers at: - Little Eveleigh St - Lawson St Predicted exceedances of non-residential receivers NMLs at: - Little Eveleigh St - Lawson St	PN,V PN,V PN,V - PN,V,SN PN,V,SN - - PN,V,SN PN,V,SN
3	Scenario 2	Predicted exceedances of NMLs at: - Little Eveleigh St - Eveleigh St - Lawson St - Chippen St Predicted exceedances of non-residential receiver NMLs at: - The Key College Predicted exceedances of sleep disturbance at: - Little Eveleigh St - Lawson St - Eveleigh St Predicted exceedances of awakening reaction at: - Little Eveleigh St	 PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# -
3	Scenario 3	Predicted exceedances of NMLs at: - Little Eveleigh St Predicted exceedances of non-residential receiver NMLs at: - The Key College	-
3	Scenario 4	Predicted exceedances of NMLs at: - Little Eveleigh St Predicted exceedances of non-residential receiver NMLs at: - The Key College	-
3	Scenario 5	Predicted exceedances of NMLs at:	

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		- Little Eveleigh St - Eveleigh St - Lawson St - Caroline Ln - Chippen St Predicted exceedances of non-residential receiver NMLs at: - The Key College Predicted exceedances of sleep disturbance at: - Little Eveleigh St - Eveleigh St - Lawson St - Caroline Ln	PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# -
3	Scenario 6	Predicted exceedances of NMLs at: - Little Eveleigh St Predicted exceedances of non-residential receiver NMLs at: - The Key College	-
3	Scenario 7	Predicted exceedances of NMLs at: - Little Eveleigh St Predicted exceedances of non-residential receiver NMLs at: - The Key College	-
3	Scenario 8	Predicted exceedances of NMLs at: - Little Eveleigh St - Eveleigh St - Lawson St - Caroline Ln - Caroline St Predicted exceedances of non-residential receiver NMLs at: - The Key College Predicted exceedances of sleep disturbance at: - Little Eveleigh St - Eveleigh St - Lawson St Predicted exceedances of awakening reaction at: - Little Eveleigh St	PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN PN
3	Scenario 9	Predicted exceedances of NMLs at: - Little Eveleigh St	PN,V, SN, RO^, RP#,DR#,AA

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		- Eveleigh St - Lawson St - Caroline Ln - Caroline St Predicted exceedances of non-residential receiver NMLs at: - The Key College Predicted exceedances of sleep disturbance at: - Little Eveleigh St - Eveleigh St - Lawson St Predicted exceedances of awakening reaction at: - Little Eveleigh St	PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN PN
3	Scenario 10	Predicted exceedances of NMLs at: - Little Eveleigh St Predicted exceedances of non-residential receiver NMLs at: - The Key College	PN,V
3	Scenario 13	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St	-
3	Scenario 14	Predicted exceedances at: - Little Eveleigh St - Lawson St - Eveleigh St - Eveleigh Ln Predicted highly affected receivers at: - Little Eveleigh St - Lawson St Predicted exceedances of non-residential receiver NMLs at: - The Key College - Lawson St - Redfern Railway Station	PN,V,SN PN,V,SN PN,V - PN,V,SN PN,V,SN
3	Scenario 15	Predicted exceedances of NMLs at: - Little Eveleigh St - Lawson St - Eveleigh St - Caroline Ln - Caroline St	PN,V,SN PN,V,SN - - -

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		Predicted highly affected receivers at: - Little Eveleigh St - Lawson St Predicted exceedances of non-residential receiver NMLs at: - The Key College - Lawson St - Redfern Railway Station	 PV,N,SN PV,N,SN
4	Scenario 1	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St	 - PN,V -
4	Scenario 2	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq - William Ln - Margaret St - Regent St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve - The Watertower - Warsash Scientific (office) - NeuClone (office) Predicted exceedances of sleep disturbance at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq Predicted exceedances of awakening reaction at: - Marian St - Rosehill St - Gibbons St	 PN,V, SN, RO^, RP#,DR#,AA PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN
4	Scenario 3	Predicted exceedances at: - Marian St - Rosehill St - Gibbons St - Redfern St	 PN,V, SN, RO^, RP#,DR#,AA PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR#

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve	
4	Scenario 4	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St - Redfern St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve	 PN,V, SN, RO^, RP#,DR#,AA PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR#
4	Scenario 5	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq - William Ln - Margaret St - Regent St - Cope St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve Predicted exceedances of sleep disturbance at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq Predicted exceedances of awakening reaction at: - Marian St - Rosehill St - Gibbons St	 PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN PN
4	Scenario 6	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St - Redfern St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve	 - - - -

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
4	Scenario 7	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St - Redfern St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve	 - - - -
4	Scenario 8	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq - Margaret St - Regent St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve Predicted exceedances of sleep disturbance at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq Predicted exceedances of awakening reaction at: - Marian St - Rosehill St - Gibbons St	 PN,V, SN, RO^, RP#,DR#,AA PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN
4	Scenario 9	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq - Margaret St - Regent St - Cornwallis St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve	 PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN,V, SN, RO^, RP#,DR# PN PN PN,V, SN, RO^, RP#,DR#

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		Predicted exceedances of sleep disturbance at: - Marian St - Rosehill St - Gibbons St - Redfern St - Lawson Sq Predicted exceedances of awakening reaction at: - Marian St	
4	Scenario 10	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Redfern St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St Reserve	 PN,V - -
4	Scenario 11	Predicted exceedances of NMLs at: - Marian St	 -
4	Scenario 12	Predicted exceedances of NMLs at: - Marian St	 -
4	Scenario 14	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Cornwallis St - Redfern St - Lawson Sq - Gibbons St Predicted highly affected receivers at: - Gibbons St Predicted exceedances of non-residential receiver NMLs at: - Gibbons St	 PN,V,SN PN,V,SN - - - PN,V,SN
4	Scenario 15	Predicted exceedances of NMLs at: - Marian St - Rosehill St - Redfern St - Lawson Sq - Gibbons St Predicted highly affected receivers at: - Gibbons St Predicted exceedances of non-residential receiver NMLs at:	 PN,V,SN PN,V - - PN,V

NCA	Construction scenario	Potential areas for levels to be above NMLs	Management measures (abbreviations)
		- Gibbons St	
5	Scenario 2	Predicted exceedances of NMLs at: - Regent St - Wyndham St Predicted exceedances of sleep disturbance at: - Regent St - Cope St	 PN PN
5	Scenario 5	Predicted exceedances of NMLs at: - Regent St - Wyndham St Predicted exceedances of sleep disturbance at: - Regent St	 PN PN
5	Scenario 8	Predicted exceedances of NMLs at: - Regent S - Wyndham St Predicted exceedances of sleep disturbance at: - Regent St - Cope St	 PN -
5	Scenario 9	Predicted exceedances of NMLs at: - Regent St - Cornwallis St - Garden St Predicted exceedances of sleep disturbance at: - Regent St	 PN PN -
5	Scenario 14	Predicted exceedances of NMLs at: - Regent St - Cope St - Redfern St - wyndham St	 - - - -
5	Scenario 15	Predicted exceedances of NMLs at: - Regent St - Cope St - Redfern St - wyndham St	 - - - -

Notes: PN = Project notification
V = Verification
RP = Respite Period
AA = Alternative accommodation
SN = Specific notification, individual briefings, or phone call
RD = Duration reduction
RO – Project Specific respite offer

8.4 Monitoring requirements

Additional management actions are presented as further alternative measures to assist in managing noise and vibration impacts in a practical manner. Management actions are effective in investigating the specific

source of noise and vibration impacts during construction and can be used to define appropriate mitigation measures for the community. The following are required as part of monitoring program activities undertaken for the project:

- Monitoring shall be conducted by a suitably qualified and experienced person in undertaking noise and vibration measurements in the field.
- Noise and vibration monitoring shall be conducted at a location most representative of the impacts outlined in Section 6 and details in Table 23. If this is not possible an alternative location shall be selected to enable construction noise and vibration levels to be confirmed.
- Monitoring shall be conducted during the day, evening and night where the works have been identified to have caused impacts outlined in Section 6 or OOHW noise assessments. This may or may not include all time periods depending on the construction activity.
- Reported monitoring results shall include but not limited to the following parameters:
  (a) **Noise**: $L_{Aeq,\ 15min}$, $L_{A90,\ 15min}$, $L_{A1,\ 1min}$ (for the duration of measurement period)
  (b) **Vibration**: PPV in mm/s, Frequency of maximum vibration (Hz) (for the duration of measurement period)
- Monitoring duration is dependent on the nature of the works however the parameters to be measured indicate the required minimum duration for measurement. That is, monitoring will continue until there is sufficient data for a noise analysis to be conducted.
- Where monitoring levels have indicated exceedances of the construction noise and vibration management levels, additional mitigation measures shall be developed in consultation with a qualified acoustic consultant and the Project Environment Team.
- Measurements shall be repeated at the same location (where applicable) where exceedances have been identified following the implementation of additional mitigation measures to confirm construction noise and vibration levels.
- The frequency for reporting monitoring results is to be every quarter (3 months) from the beginning of construction.
- Monitoring results shall be issued to the TfNSW the AA and ER in the form of a quarterly Construction Noise and Vibration Monitoring Report which details the above monitoring requirements for the preceding period. It will be issued to TfNSW 7 days following the end of each quarter. TfNSW will issue the quarterly Noise and Vibration Monitoring Report to the Planning Secretary within 21 days of the end of each quarter during construction.

8.4.1 Monitoring

Noise and vibration monitoring will be an important aspect in managing impacts throughout the construction phase of the project.

Verification monitoring of noise and/ or vibration during construction may be conducted at affected sensitive receivers or an equally representative location which will provide data for evaluating the potential impacts of construction with respect to the NMLs.

Verification monitoring shall also be used to validate that the predicted construction noise and vibration assessments are consistent with the measured levels to ensure mitigation measures are appropriate for the relevant construction works.

Monitoring may also be required and can be conducted during construction of the project as a response to community complaints and/or impacts investigation. The following program in Table 24 form the basis of the monitoring to be undertaken (other than reactive monitoring). Note that these are recommended monitoring program requirements and monitoring shall not be limited by the recommendations. Monitoring shall be considered on a case-by-case basis to determine if more detailed monitoring will be required.

Table 24: recommended monitoring program and reporting requirements

Type	Monitoring recommended	Details	Reporting requirements
Noise	Prior to the beginning of each construction stage	This shall include the ambient noise levels at the centre of the works area and at the nearest sensitive receiver. This monitoring shall not include any existing noise other than ambient noise.	Reporting shall demonstrate the ambient background noise levels at the works area and the nearest noise sensitive receiver for the specific construction stage
Noise	During each construction stage	This shall include the ambient noise levels during each construction stage at the works boundary area and at the nearest sensitive receiver	Reporting shall demonstrate the ambient background noise levels at the works area and the nearest noise sensitive receiver for the specific construction stage. Maximum noise levels at the works boundary area should also be included.
Vibration	At the beginning of each construction stage	This shall include a soft start approach as described in Section 8.4.3 of the plant used in that construction stage	Reporting shall demonstrate the PPV levels and the references distances that vibration from plant was measured. The frequency content of maximum measured PPV levels shall also be included.
Vibration	During each construction stage	This shall include measurements at the nearest sensitive receiver	Reporting shall demonstrate the PPV levels and the references distances that vibration from plant was measured. The frequency content of maximum measured PPV levels shall also be included.

8.4.2 Noise monitoring

Verification noise monitoring shall be conducted at noise affected receiver(s) or an equivalent representative location in accordance with the noise parameters of the construction noise criteria in Section 5.1. The

purpose of verification monitoring is to confirm that construction noise and vibration from the project are consistent with the predictions in the noise assessment and that the mitigation and management of construction noise is suitable for receivers affected by the works. Verification monitoring shall take place when construction works exceed the CNVS noise and vibration objectives or in response to complaints or verification requests.

For other noise monitoring in response to community reactions or impacts investigations, noise monitoring may include:

- Ambient noise monitoring (in the absence of construction) to determine the construction NMLs if data collected during the EIS stage is not representative of all affected residential receivers
- Compliance monitoring to check compliance with the NMLs in any period
- Noise monitoring due to complaints/communication from stakeholders
- Unattended Noise monitoring in areas where predicted exceedances of the NMLs have been assessed
- Attended noise monitoring for construction scenarios that have been predicted to cause an exceedance of the NMLs as required by the CNVS (Table 9)
- Noise monitoring to assist in the investigation of noise impacts to determine appropriate design of mitigation

The suitability of unattended and attended monitoring will be determined on a case by case basis in order to provide the most effective evaluation of the surrounding environment and its correlation to the measured data. The duration and frequency of noise monitoring shall be undertaken to an extent that is reasonable and practicable to achieve the required outcomes of noise impact investigations and compliance of the NMLs.

Noise monitoring conducted in response to complaints should be managed in accordance with the Communications Liaison Management Plan (CLMP). This reactive monitoring should be at a suitable location to best capture the noise source triggering the complaint to be determined by a suitably qualified Acoustic Engineer conducting measurements.

8.4.2.1 Noise monitoring requirements

All construction noise monitoring will be conducted in compliance with AS1055.1-1997 *Acoustics – Description and measurement of environmental noise Part 1: General Procedures*. Results and observations of noise monitoring are to be recorded.

- Noise measurements would be undertaken by personnel trained in undertaking noise measurements.
- Use of Type 1 or Type 2 sound level meters which have been NATA calibrated within the last 2 years.
- The microphone of the sound level meter should be located between a height of 1.2 and 1.5 metres above the ground.
- The sound level meter is to be calibrated before and after each set of noise monitoring.
- The measurement point should be no less than 3.5 metres from any reflective surface, such as walls or buildings, other than the ground. Where achieving a distance of 3.5 metres away from the façade cannot be achieved, the measurement location should be 1 metre away and an adjustment of –2.5 dB should be made to the measured sound pressure level.
- Noise measurements that are affected by rain and/or the wind speed which exceeds 5m/s identified and excluded from the analysis of the data set.

- The measurement is to be a 15-minute LAeq with extraneous noise such as road traffic excluded where possible for measurement. The LA90 LA10 and LAmax should also be recorded. In circumstances where the noise source is constant it may be determined that a noise measurement shorter than 15-minutes is appropriate.

8.4.3 Vibration monitoring

Verification vibration monitoring shall be conducted at vibration affected receiver(s) or an equivalent representative location in accordance with the vibration parameters of the construction vibration criteria in Section 5.2.

For other vibration monitoring in response to community reactions or impacts investigations (including heritage structures), vibration monitoring may include:

- Monitoring where construction work is at risk of exceeding the VMLs
- Monitoring to manage risk of exceeding VMLs where there is potential for causing damage. This should be conducted in conjunction with a soft start procedure which typically consists of:
    - Conduct vibration measurements with the equipment at a distance from the sensitive receptor where compliance with the vibration targets is easily achieved
    - Depending on the vibration levels measured, the equipment is moved progressively closer to the receptor until the levels measured are close to the relevant vibration target. This will be the closest distance that the equipment can operate with respect to the receptor. (Alternatively measurements can be undertaken at various distances from the equipment to determine the distance at which the vibration target is expected to be exceeded.)
- Real time vibration monitoring will be undertaken at heritage sites and where there is risk of damage to buildings
- In response to complaints/communication from stakeholders
- For vibration monitoring at heritage listed structures, a heritage specialist is required to advise on appropriate location and installation of monitoring equipment prior to conducting monitoring.

8.4.3.1 Vibration monitoring requirements

- Vibration monitors will be used with either a triaxial geophone or accelerometer/transducer which are capable of measuring Peak Particle Velocity (mm/s) across a frequency range of at least 6.3 Hz – 8kHz
- The vibration criteria detailed in Section 5.2 identify two vibration metrics:
    - Peak Particle Velocity (PPV) and
    - Vibration Dose Value (VDV)
- Under the project vibration guidelines, PPV is used to assess if buildings and services may be at risk of structural damage, while the VDV is used to assess human comfort levels
- It is possible to calculate PPV from VDV if the frequency of the source, the material propagation coefficient and duration of impacts are known.

Vibration monitoring will be undertaken as follows:

- Vibration measurements will be attended (short term) or unattended (long term)

- Vibration measurements would be undertaken by personnel trained in undertaking vibration measurements.

Vibration monitoring will be undertaken when there has been a risk identified of exceeding the construction vibration criteria. Typically, this is required if vibration-generating works are carried out within the minimum working distances provided in the CNVS. This will allow for adequate time for reactive mitigation measures to be investigated before progressing with construction and inducing further impacts. The specific mitigation measures implemented will be subject to the CoA D18 which addresses consultation with the community when determining appropriate respite measures.

9. Communication and consultation

Communication with the relevant community groups and stakeholders shall be managed according to the CLMP. Noise and vibration complaints shall be managed collectively in accordance with this CNVMP and the CLMP. Key risk areas should also be communicated to all staff to ensure that sensitive receivers are managed appropriately during construction.

9.1 Response to complaints and work variations

Response to noise and/or vibration complaints shall be managed through the CLMP with regard to community consultation. Reactive monitoring or investigative actions will be conducted in accordance with the procedure as detailed in Section 8. Monitoring results would be communicated to the Communications and Stakeholder Team to convey the outcomes as required. Corrective actions (if required) would follow in a timely manner where reasonable and practicable. This shall be in the form of a verbal response within 2 hours for complaints. All enquiries require a verbal response within 24 hours during standard construction hours, or on the next working day during OOHW.

As a standard response, complaints regarding construction noise shall be responded to by verifying noise levels are within noise predictions as soon as reasonably practical. The procedure for handling responses and requirements for notifications to the public is addressed in the CLMP.

Where emergency works are required the contractors must notify the ER, Planning Secretary and the EPA of the reasons for the need to undertake work in an emergency case. The proposed emergency works must be made aware to all affected noise and/or vibration sensitive receivers of the likely impacts and the duration of these emergency works as soon as possible.

Similarly, out of hours works should also be made aware to all affected noise and/or vibration sensitive receivers of the out of hours works schedule, a description of the work, location and duration as well as the mitigation and management measures considered to be implemented. Community consultation should be undertaken to identify and define suitable changes to construction schedule and/or mitigation and management measures.

Both residential and non-residential sensitive receivers must be considered in accordance with the CoA. Where works result in noise and vibration management levels would be exceeded for non-residential sensitive receivers, works must not be scheduled within sensitive periods, unless other reasonable arrangements with the affected receivers can be made at no cost to the affected receivers.

9.2 Roles and responsibilities

The roles, responsibilities of key project personnel are detailed in Table 25: Key noise and vibration roles and responsibilities5.

Table 25: Key noise and vibration roles and responsibilities

Role	Responsibility
TfNSW Project Director	▪ Decision-making authority over all aspects of the environmental performance of the Project, including construction noise and vibration management. ▪ Ensure appropriate resource needs for noise and vibration management are considered, identified and established. ▪ Review the CEMP and this CNVMP.
Construction Directors	▪ Manage the delivery of the construction process in relation to noise and vibration management in conjunction with the Project Environment Manager.
Environment Team	▪ The Environment Team is led by the Project Environment Manager and includes Environment Coordinators/Advisers. The Environment Team is responsible for the implementation of this Plan.
Stakeholder and Communications Team	▪ The Stakeholder and Communications Team are responsible for providing a communication interface between the different Project Stakeholders.
Governance & Compliance Director	▪ The Governance & Compliance Director oversees the Environment Team and provides support to the Project Director and Environment Manager in delivery of regulatory and Project noise and vibration requirements.
Acoustic Consultant	▪ The Acoustic Consultant provides qualified and competent support to the Project to ensure noise and vibration monitoring and modelling is performed in accordance to regulatory and Project requirements.
Site / Project Engineer	▪ Ensure the Construction Packages and Construction Procedures have relevant noise and vibration management controls
Foreman / Superintendent	▪ Ensure site controls for noise and vibration management are implemented in conjunction with the Environment Team.

9.3 Training and awareness

The Project workforce personnel are to be provided with relevant environmental and sustainability information and training where applicable to ensure that they are aware of their responsibilities and are competent to carry out the work in a compliant and environmentally responsible and sustainable manner. These responsibilities are to be communicated to workforce personnel during sure induction and regularly highlighted through on-going training via tool box meetings, briefings, notifications and similar types of delivery forums. The following must be covered as a minimum in training:

- Purpose, objectives and key issues
- Applicable policies and procedures for managing the environment and sustainability aspects and associated key performance indicators

- Due diligence, duty of care and responsibilities
- Relevant conditions of any environmental licence and/or the relevant conditions of approval
- Site specific issues and controls including those described in the environmental and sustainability documentation
- Reporting procedure for environmental hazards and incidents
- Communication protocols
- Tool box talks will be held on a regular basis in order to provide a project or site wide update, including any key or recurring environmental issues
- Topic specific environmental training should be based upon issue specific sub-plans which is this case are noise and vibration aspects covered within this plan.

All personnel working on the site will undertake a site induction, which will provide initial training on various environmental aspects including noise and vibration. Further to this, noise and vibration management requirements are to be regularly highlighted. Project Induction will include noise and vibration information on:

- Normal working hours
- OOHW
- Unavoidable works
- Sensitive receivers
- Noise and vibration mitigation and management measures
- Areas predicted to exceed noise and vibration criteria
- Construction practices to avoid unnecessary noise and vibration

A Training Needs Analysis (TNA) should also be conducted which:

- Identifies that all staff are to receive and environmental induction and undertake environmental awareness training.
- Identifies the competency requirements of staff that hold environmental roles and responsibilities documented within the CEMP and associated sub-plans
- Identifies appropriate training courses/events and the frequency of training to achieve and/or maintain these competency requirements
- Implements and documents as part of the CEMP a training schedule that plans attendance at environmental training events, provides mechanisms to notify staff of their training requirements, and identifies staff who did not attend scheduled training events or who have overdue training requirements

9.4 Additional community engagement strategies

Additional engagement strategies could be used to inform the community on ongoing project updates and upcoming interruptions. The Implementation of measures for managing potential noise and vibration impacts to be observed in line with the Project's Communications Strategy.

- A project website (as part of the TfNSW) is a key resource for stakeholders to seek further information about the project, noise and vibration management plans and mitigation measures, current and upcoming construction activities. The website shall be updated frequently to be in line with the construction works.
- Project Infoline and 24-hour construction response line should be made available to provide contact point for interested and affected stakeholders. These lines are managed via a professional answering service and are key mechanism for the receipt of enquiries/complaints to the Communications and Community Relations Team. These lines should be advertised in all project related communication correspondence with the community.
- Email distribution lists are to be used to disseminate project information in advance to interested stakeholders and can be used to notify of anticipated construction activities that may cause excessive noise. By providing advance warning, it can assist to reduce the perceived impact of project works experienced by stakeholders.
- Project signage are to be used to disseminate project information on site where project details should be made available. Project emergency and enquiry contact information should also be visible where possible and appropriate.
- In the event of emergency works including emergency works to occur out of hours, it may be suitable to commence an immediate community notification strategy. The strategy may include door knock visits to impacted sensitive receivers, distribution of project contact information and post-emergency works notifications. Any emergency works must be made aware to the Communications and Community Relations Team as soon as it has been made aware of an emergency.
- Community and stakeholder meetings and/or community based forums (if required by conditions of approval) can also be programmed to address concerns and an additional source of further information about Project impacts. This can be conducted on a case-by-case basis where it is deemed necessary to undertake consultation with the community and stakeholders.

10. References

- Australian Standard AS 1055 (2018) – Acoustics—Description and measurement of environmental noise
- Australian Standard AS 2436 (2010), Guide to noise and vibration control on construction, demolition and maintenance sites
- Australia Standard AS IEC 61672.1 (2019) - Electroacoustics – Sound level meters Specifications
- Australian Standard AS1055.1-1997 Acoustics – Description and measurement of environmental noise Part 1: General procedures
- British Standard 5228: Part 1 (2009 including amendment 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise
- British Standard BS6472-1:2008. Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration sources other than blasting
- British Standard 7385: Part 2 (1993) Evaluation and Measurement of Vibration in Buildings
- EPA NSW, (2009) Interim Construction Noise Guideline
- EPA NSW, (2006) Assessing Vibration: A Technical Guideline
- EPA NSW, (2011) NSW Road Noise Policy
- EPA NSW, (2008) Development Near rail Corridors and Busy Roads
- DIN Standard 4150: Part 3 (2016) Vibration in Buildings - Effects on Structures
- Environment Protection Authority (2013) Noise Guide for Local Government
- Environment Protection Authority (2013) Rail Infrastructure Noise Guideline
- Environment Protection Authority (2017) Noise Policy for Industry
- CONCAWE – Environmental science for European refining: The propagation of noise from petroleum and petrochemical complexes to neighbouring communities
- International Standard ISO 9613-2 (1996) - Acoustics -- Attenuation of sound during propagation outdoors - Part 2: General method of calculation
- Transport for NSW (2019) Construction Noise and Vibration Strategy
- *Construction Noise and Vibration Strategy* (CNVS) Addendum (Nov 2019), Transport for NSW, 2019
- AECOM, (2020) Redfern Railway Station Upgrade – New Southern Concourse Environmental Impact Statement
- AECOM, (2020) Redfern Railway Station Upgrade – New Southern Concourse – Technical Report 4 – Noise and Vibration
- AECOM, (2020) Redfern Railway Station Upgrade – New Southern Concourse – Technical Report 5 – Non-Aboriginal Heritage
- Aurecon, (2020) Redfern Railway Station Upgrade – New Southern Concourse – Appendix G – Geotechnical and Contamination Investigation Reports
- RSU – Construction Staging Diagrams – NovoRail (2 September 2020)

Appendices

Appendix A – RSU Noise Prediction Contours

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 1 - Site Establishment and Enabling Works

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

1:9162

0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 2 - Hoarding and Piling Works - Platform 6 - 10

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <		<= 50
50 <		<= 55
55 <		<= 60
60 <		<= 65
65 <		<= 70
70 <		<= 75
75 <		

N

1:9162

0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 3 - Foundation and Piling Works - Platform 6 - 10 & Marian St

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<=	50
50 <	<=	55
55 <	<=	60
60 <	<=	65
65 <	<=	70
70 <	<=	75
75 <		

N

1:9162

0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 4 - Foundation and Piling Works - Platform 4 - 9 & Marian St

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

1:9162

0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 5 - Sky Bridge - Platform 8 - 9

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

1:9162

0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 6 - Piling Works - Platform 1 - 5 & Marian St

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 7 - FRP Works Platform 1 - 5 & Marian St Ground Works

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<=	50
50 <	<=	55
55 <	<=	60
60 <	<=	65
65 <	<=	70
70 <	<=	75
75 <		

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 8 - Super T Beam Installation - Platform 7 - 10

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<=	50
50 <	<=	55
55 <	<=	60
60 <	<=	65
65 <	<=	70
70 <	<=	75
75 <		

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 9 - Super T Beam Installation - Platform 1 - 4

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 10 - Bridge Installation and Connection Slab - Platform 1 - 7

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 11 - Asphalting - Platform 10

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <		<= 50
50 <		<= 55
55 <		<= 60
60 <		<= 65
65 <		<= 70
70 <		<= 75
75 <		

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 12 - Asphalting - Platform 1 - 5

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <		<= 50
50 <		<= 55
55 <		<= 60
60 <		<= 65
65 <		<= 70
70 <		<= 75
75 <		

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 13 - Trenching and Combined Services Route Works

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall

Noise level Leq dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 14 - Little Eveleigh St and Marian St Roadworks

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall
- Line source

Noise level Leq max dB(A)

45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	<= 70
70 <	<= 75
75 <	

N

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0 45 90 180 270 m

aurecon

Redfern Station Upgrade

Predicted Construction Noise Emission Contour

Construction Noise and Vibration Management Plan

Scenario 15 - Tree Removal and Pruning

Propagation at 1.5m Above Ground Level

Legend

- Point source
- Buildings
- Wall
- Line source

Noise level Leq dB(A)

45 <		<= 50
50 <		<= 55
55 <		<= 60
60 <		<= 65
65 <		<= 70
70 <		<= 75
75 <		

N

1:9162

0 45 90 180 270 m

Appendix C – Consultation Summary

Appendix C – Dilapidation Survey List

Address	Type of Property	Radius to excavation
108 Lawson Street	2 level Business/residential	Within 15m of roadwork
110 Lawson Street	2 level residential	Within 18m of roadwork
112 Lawson Street	2 level residential	Within 20m of roadwork
114 Lawson Street	2 level residential	within 25m of roadwork
116 Lawson Street	2 level Business/residential	within 30m of roadwork
118 Lawson Street	3 level Business/residential	within 34m of roadwork
120 -122 Lawson Street	2 level Business/residential	within 36m of roadwork
115 Lawson Street	2 commercial and 5 units	within 5m of roadwork
117 Lawson Street	2 level residential	within 23m of roadwork
119 Lawson Street	2 level residential	within 29m of roadwork
121 Lawson Street	2 level residential	within 33m of roadwork
123 Lawson Street	2 level residential	within 36m of roadwork
125 Lawson Street	2 level residential	within 39m of roadwork
122 Little Eveleigh Street	Commercial 2 storey Henry George House and outdoor parking area and Key College	within 5m of roadwork and 50m of piling
124 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling
126 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling
128 Little Eveleigh Street	2 level residential and garage	within 5m of roadwork and 50m of piling
125 - 127 Little Eveleigh Street (BIB)	3 level commercial	within 5m of roadwork and 1m of piling
129 - 131 Little Eveleigh Street	3 storey building 2 commercial and 6 residential units plus associated garages/parking area	within 5m of roadwork and 10m of piling
130 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling
132 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling
133 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling
134 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling
135 Little Eveleigh Street	2 level residential	

136 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling in BIB
137 Little Eveleigh Street	2 level residential	
138 Little Eveleigh Street	1 level commercial	within 5m of roadwork and 50m of piling in BIB
139 Little Eveleigh Street	2 level residential	
140 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling in BIB
141 Little Eveleigh Street	1 level residential	within 5m of roadwork and 50m of piling in BIB
142 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling in BIB
143 Little Eveleigh Street	1 level residential	within 5m of roadwork and 50m of piling in BIB
144 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling in BIB
145 Little Eveleigh Street	1 level residential	
146 Little Eveleigh Street	2 level residential	within 5m of roadwork and 50m of piling in BIB
147 Little Eveleigh Street	2 level residential	within 5m of roadwork
148 Little Eveleigh Street	small park	within 5m of roadwork
149 Little Eveleigh Street	1 level residential	within 5m of roadwork
150 Little Eveleigh Street	2 level residential	within 5m of roadwork
151 Little Eveleigh Street	2 level residential	within 5m of roadwork
152 Little Eveleigh Street	2 level residential	within 5m of roadwork
153 Little Eveleigh Street	2 level residential	within 5m of roadwork
154 Little Eveleigh Street	2 level residential	within 5m of roadwork
155 Little Eveleigh Street	2 level residential	within 5m of roadwork
156 Little Eveleigh Street	2 level residential	within 5m of roadwork
157 Little Eveleigh Street	1 level residential and garage to side of building	within 5m of roadwork and adjacent to rail access gate
158 Little Eveleigh Street	2 level residential plus attic and garage to side of building	within 5m of roadwork and opposite rail access gate
162 Little Eveleigh Street	2 level residential	within 5m of roadwork and opposite rail access gate
164 Little Eveleigh Street	2 level residential	within 5m of roadwork and opposite rail access gate
166 Little Eveleigh Street	2 level residential	within 5m of roadwork and opposite rail access gate

The Foundry	4 commercial and residential 36 units	within 5m of roadwork and 50m of piling for new residents car park
The Watertower - 1-9 Marian Street	66 units plus swimming pool, common central area, car park and basement levels	within 5m of roadwork and 50m of piling
505 Wilson Street - Railway Engineers Building	large heritage building and grounds	
Engine shop, Transport Heritage NSW- within ATP land	2 level commercial building	within 150m of piling and bridge work
Heritage building opposite Transport Heritage NSW	2 level commercial building	within 150m of piling and bridge work
Water Tower for old engines	water tower within ATP land and adjacent to Cornwallis St	within 150m of piling and bridge work and 30m of road work
Cornwallis Street stairs and brickwork entry to ATP	grounds and brickwork only	within 150m of piling and bridge work and 30m of road work
within rail corridor off Little Eveleigh Street	Sydney Trains Heritage telecoms building	within 150m of piling for new residents car park and BIB piling
Road Condition Surveys		
Marian Street	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Rosehill Street	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Cornwallis Street	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Lawson Street, between Gibbons and Abercrombie Streets	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Little Eveleigh Street	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Gibbons Street	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	

Ivy Lane, between Little Eveleigh St and Lawson St	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Ivy Street, between Wilson Street and Abercrombie St	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Carriage works Way	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Wilson Street, between Queen St and Golden Grove St	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Golden Grove St between Wilson St and Darlington Road	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	
Darlington Road between King St and Golden Grove St	Include road, adjacent footpath, gutters, drainage pits, Telstra pits, etc.	

Appendix D – Endorsement Memo

MCW Environmental Consulting Pty Ltd

[redacted]

18 December 2020

Attention: Tara Wilcoxon

Transport for NSW
7 Harvest Street
Macquarie Park NSW 2113
Email address: [redacted]

Dear Tara

Subject: Environmental Representative (ER) Approval: Construction Noise and Vibration Management Plan (CNVMP): Redfern Station Upgrade (SSI 10041)

I refer to Transport for NSW's (TfNSW) submission of the following document required by Conditions C6(d); C7; and C8 of the Redfern Station Upgrade Project (SSI 10041) which was approved by the Department of Planning, Industry and Environment (DPIE) on 10 December 2020:

- Construction Noise and Vibration Management Plan (CNVMP) (Revision 3 – FINAL dated 16 December 2020).

It is noted that:

- A suitably qualified and experienced person prepared the CNVMP;
- Previous versions of the document have been reviewed and updated following comment from the ER.
- The CNVMP has been provided to the City of Sydney Council and Heritage NSW for their review and comment.
- TfNSW has separately reviewed this and previous versions of the CNVMP and has endorsed the CNVMP (Revision 3);
- TfNSW has commissioned an Acoustic Advisor for the project who has reviewed previous versions of the document and has endorsed this version of the document as being suitable for approval by the Environmental Representative.
- Following the above reviews, the CNVMP is considered to contain information required by conditions of approval (SSI 10041).

As the approved Environmental Representative for the Redfern Station Upgrade; and as required by Conditions A29(d) and C9, on the basis of the above comments I approve the Construction Noise and Vibration Management Plan (Revision 3). The Project is reminded to ensure the document is made publicly available on the Project's website.

Yours sincerely,

Michael Woolley
Environment Representative for the Redfern Station Upgrade

ENDORSEMENT
REDFERN STATION ACOUSTIC ADVISOR

Review of	**Construction Noise and Vibration Management Plan**	**Document reference:**	Redfern Station Construction Noise and Vibration Management Plan, version 3, 16 December 2020
Prepared by:	Sav Shimada		
Date of issue:	17 December 2020		

The Redfern Station Upgrade Project was approved by the Department of Planning, Industry and Environment (DPIE) on 10 December 2020.

As requested by Transport for NSW, I as Acoustic Advisor for the Redfern Station Upgrade project have reviewed and provided comment on previous drafts of the Construction Noise and Vibration Plan. The acoustic review and comments considered:

- Infrastructure Approval for Redfern Station Upgrade (SSI 10041) including Conditions of Approval (Minister for Planning and Public Spaces) – 10 December 2020
- The Redfern Station Upgrade project Environmental Impact Statement (EIS) – May 2020
- Redfern Station Upgrade – New Southern Concourse Response to Submissions (Transport for NSW) – September 2020
- TfNSW IPD Construction Noise and Vibration Management Strategy (2018) and Amended Tables 8 and 9 (November 2019)
- Redfern Station Upgrade – New Southern Concourse Environmental Management Framework (TfNSW) – October 2020

I have now reviewed revision 3 of the Plan and note that all my comments have been addressed.

I endorse revision 3 of this Plan and consider that it is suitable for approval by the Environmental Representative.

Sav Shimada, Redfern Station Upgrade Acoustic Advisor

Ref: 6545004

MEMO

TO: Eddie Wu

FROM: Justin Perrott

CC: Tara Wilcoxon, Hannah Barker, Rubelle Lat, Larry Melnick, Laura Atencio, James Renwick

DATE: 17 December 2020

SUBJECT: Redfern Station Upgrade: New Southern Concourse - Endorsement of Construction Noise and Vibration Management Plan

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Eddie,

I refer to the following document as submitted by Novo Rail for the Redfern Station Upgrade: New Southern Concourse (the Project), as detailed in the following table.

Document	Revision	Submission Date
Construction Noise and Vibration Management Plan	Rev 3	16 December 2020

The Plan has been prepared to address the following planning approvals and has been reviewed by TfNSW:

Document	Date
Infrastructure Approval for Redfern Station Upgrade (SSI 10041), (Minister for Planning and Public Spaces) including Conditions of Approval	10 December 2020
Redfern Station Upgrade – New Southern Concourse Environmental Impact Statement (Transport for NSW)	May 2020
Redfern Station Upgrade – New Southern Concourse Response to Submissions (Transport for NSW)	September 2020
Redfern Station Upgrade – New Southern Concourse Construction Environmental Management Framework (Transport for NSW).	October 2020

The document is **endorsed** for Work, subject to approval of the document from the independent Environment Representative.

Should you have any enquires in relation to this approval and the associated condition, please contact Tara Wilcoxon, Senior Manager, Environment on [redacted] or email at [redacted].

Regards,

Justin Perrott,
Associate Director, Environmental Management
Safety Environment and Regulation

Transport for NSW