

Sydney Metro West, Power Enabling Works

Construction Noise and Vibration Management Plan

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8 June 2021

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Document Approval / Endorsement

Stuart [REDACTED]

23/06/2021

Dear Mr [REDACTED]

**Sydney Metro West (SSI 10038)
Phase A Power and Enabling Works
Construction Noise and Vibration Management Plan and Monitoring Program**

I refer to your submission dated 25 May 2021 requesting approval of the Sydney Metro West Power Enabling Works (Phase A) Construction Noise and Vibration Management Plan and Monitoring Program, in accordance with Conditions C7 and C21 of SSI 10038. I also acknowledge your response to the Department's review comments and requests for additional information.

I note that the Sydney Metro West Power Enabling Works (Phase A) Construction Noise and Vibration Management Plan and Monitoring Program:

- has been prepared in consultation with Inner West Council, Place Management NSW and the EPA
- has been reviewed by Sydney Metro and no issues have been raised
- has been endorsed by the project's Environmental Representative and Acoustic Advisor
- contains the information required by the conditions of approval.

As nominee of the Planning Secretary, I approve the Sydney Metro West Power Enabling Works (Phase A) Construction Noise and Vibration Management Plan and Monitoring Program, Revision E dated 8 June 2021, pursuant to conditions C7 and C21.

You are reminded that under condition C10 construction must not commence until the CEMP and all CEMP sub plans have been approved by the Planning Secretary or endorsed by the project's Environmental Representative.

You are also reminded that if there is any inconsistency between the approved Construction Noise and Vibration Management Plan and Monitoring Program and the conditions of approval, then the requirements of the conditions of approval will prevail.

Please ensure that you make the Construction Noise and Vibration Management Plan and Monitoring Program publicly available on the project website.

If you wish to discuss the matter further, please contact Matthew [REDACTED] on [REDACTED]

Yours sincerely

Jake [REDACTED]

Director – Infrastructure Management

As nominee of the Planning Secretary

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Glossary / Abbreviations

Term	Definition
AR	SMW Concept and Stage 1 Amendment Report (2020)
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CNVS	Sydney Metros Construction Noise and Vibration Standard
Contractor	Quickway Constructions Pty Ltd
dB	Decibels - A measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm (to base 10) of the ratio of a given sound power to a reference power. Typically uses the A-weighted scale (i.e. dBA) measured according to the frequency of the human ear.
DECC	Former Department of Environment and Climate Change (NSW) now NSW Department of Planning, Industry and Environment.
DPIE	NSW Department of Planning, Infrastructure and Environment
Eastern Creek	Eastern Creek Pre-Cast Facility Power Supply Works site
EIS	SMW Project Environmental Impact Statement (Jacobs/Arcadis 2020)
EPA	NSW Environment Protection Authority
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act, 1999</i>
EPL	NSW Environment Protection Licence under the <i>Protection of the Environment Operations Act 1997</i> .
ESCP	Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statements
Feasible and reasonable	Feasible relates to engineering considerations and what is practical to build. Reasonable considers mitigation benefits versus social, economic and environmental costs. Note, consideration of what is feasible and reasonable is not static or fixed, except at a particular point in time, and can be updated as additional details of the work or surrounding environment become apparent or confirmed.
Highly noise affected	As defined in the ICNG
Highly noise intensive works	Works which are defined as annoying under the ICNG, including: (a) use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work; (b) grinding metal, concrete or masonry; (c) rock drilling; (d) line drilling; (e) vibratory rolling; (f) bitumen milling or profiling; (g) jackhammering, rock hammering or rock breaking; (h) rail tamping and regulating; and (i) impact piling.
ICNG	Interim Construction Noise Guideline (DECC 2009)
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause non-compliance with the conditions of this approval <i>Note: "material harm" is defined in this approval</i>
Minister, the	NSW Minister for Planning
MCoA	NSW Minister for Planning Condition of Approval

Term	Definition
L _{A90}	The noise level exceeded 90% of the measurement period, typically considered the average minimum noise level and used to establish background noise levels
L _{Aeq} (15min)	The A-weighted equivalent continuous (energy average) A-weighted sound pressure level over a 15-minute period.
L _A (max)	The A-weighted maximum noise level, measured using the fast time weighting on a sound level meter.
NCA	Noise Catchment Area
NML	The Noise Management Level (L _{Aeq} (15min)) providing a target noise level, where, if exceeded, all reasonable and feasible noise mitigation and management measures would be considered for implementation.
OOHW	Out of Hours Work
RBL	The Rating Background Level for each period is the median value of the L _{A90} values for the period over all of the days measured. There is an RBL value for each period (day, evening and night).
RNP	Road Noise Policy (EPA 2011)
REF	SMW Eastern Creek Precast Facilities Review of Environmental Factors (Jacobs 2020)
RMS	NSW Roads and Maritime Services now TfNSW
Secretary	Secretary of the Department of Planning and Environment
SMW	Sydney Metro West
SR	SMW Concept and Stage 1 Submissions Report (2020)
SWL	Sound Power Level the acoustic power output of a source expressed in decibels. Sound power level is calculated from measured sound pressure levels.
Sound Pressure Level	This is the level of noise, usually expressed in dB(A), as measured by a standard sound level meter with a pressure microphone.
the Project	SMW Power Supply Works
The Bays	Power Supply Works from Manning St to White Bay
TfNSW	Transport for NSW
VDV	Vibration Dose Value

1. Introduction

1.1 Context

This Construction Noise and Vibration Management Plan (CNVMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the power enabling works (the Project), which is part of the Sydney Metro West Project (SMW Project).

This CNVMP has been prepared to outline how Quickway will comply with the applicable NSW Minister for Planning's Conditions of Approval (MCoA), approval conditions for the REF (REF-MCoA), and the Sydney Metro (SM) Construction Environmental Management Framework (CEMF) during construction of the Project.

It also outlines how Quickway will minimise environmental risks and achieve environmental outcomes on the project by creating a well-defined approach to the implementation of EIS Revised Environmental Management Measures (REMM) and REF Management and Mitigation Measures (MMM).

The CNVMP has been prepared in accordance with the following, collectively referred to as the 'Project requirements' herein:

- The EIS approval including the MCoA and REMMs
- The REF approval including REF-MCoA and MMMs
- The obligations allocated under the CEMF as per the Phasing Report

1.2 Project Background

The SM Project EIS included (Chapter 11) an assessment of the impacts of noise and vibration from construction and operation of the Project for The Bays work location, while an REF assessed the impacts of Noise and Vibration from construction and operation of the Project for the Eastern Creek Pre-cast Facility (Chapter 8.1); these documents are collectively referred to the Approval documents.

The Approval documents concluded that sensitive receivers in the vicinity of the project would be impacted by noise and vibration from the construction works, however these impacts would be managed through the implementation of mitigation and management measures described in this CNVMP and in line with the Sydney Metro Construction Noise and Vibration Standard (CNVS) which provides standard mitigation measures and additional mitigation measures for certain noise and vibration impact levels. The potential impacts from noise and vibration during construction are discussed in [Section 7.2](#). These management measures are described in this CNVMP in [Section 9](#).

Please refer to Chapter 1 of the CEMP for Project background and statutory context and Chapter 4 for Project description.

1.3 Scope of the Sub-plan

The scope of this Plan is to describe the procedures and processes of how Quickway propose to manage potential noise and vibration impacts during construction of the Project.

This document is not intended to provide an assessment of potential noise and vibration outcomes as a result of the work, nor the site/activity specific noise and vibration mitigation measures that may be required. That detailed will be provided within the Detailed Noise and Vibration Impact Assessment

(DNVIS) which is required under MCoA D43. The DNVIS will identify expected impacts (based on noise and vibration modelling) at potentially affected receivers along the alignment, and include specific mitigation measures to be implemented for the duration of those works. The DNVIS will be prepared in consultation with the AA and ER, and will be endorsed by the AA prior to implementation. Further detail on the DNVIS can be found within this document in [Section 8.1](#).

Operational management measures do not fall within the scope of this Plan and as such are not included in management processes.

1.4 Implementation of the Sub-plan

In accordance with MCoA C4, and with the exception of any CEMP Sub-plans expressly nominated by the Planning Secretary to be endorsed by the ER (MCoA C7), the CEMP Sub-plans must be endorsed by the Environmental Representative (ER) and then submitted to the Secretary for approval no later than one month prior to the commencement of the construction activities to which they apply. In addition, the CNVMP must also be endorsed by the AA before submission to the Secretary.

In accordance with MCoA C8 the CEMP Sub-plans not requiring the Planning Secretary's approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all relevant undertakings made in the documents listed in MCoA A1. Construction of the relevant phase must not commence until the CEMP and all CEMP Sub-plans have been approved by the ER or Secretary. The CEMP and CEMP Sub-plans, as approved by the Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction.

2. Purpose and Objectives

2.1 Purpose

The purpose of this CNVMP is to describe how construction related noise and vibration impacts will be minimised and managed.

2.2 Objectives

The key objective of this Plan is to ensure all Project requirements relevant to noise and vibration management and allocated under the SMW Phasing Report are described, scheduled and assigned responsibility, as well as relevant legislation and other requirements described in [Section 3](#) of this Plan.

2.3 Targets

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

- Minimise unreasonable noise and vibration impacts on residents and businesses as identified through noise and vibration specific complaints;
- Avoid structural damage to buildings or heritage items as a result of construction as identified through pre and post construction condition surveys;
- Undertake active community consultation evidence by compliance with the CCS (i.e. no non-conformances with the CCS).

- Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners evidence by compliance with the CCS (i.e. no non-conformances with the CCS).

2.4 Hold Points

The relevant hold points related to noise and vibration are identified in the CEMF as follows:

Table 1 Hold Points

Hold Point	Release of Hold Point	By Whom	Where addressed
Out of hours works	Noise assessment	Quickway Environment Manager	Section 8
Construction identified as affecting buildings	Building Condition survey	Appropriate Professional nominated by Sydney Metro	Section 10.5.1

3. Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Appendix A1 of the CEMP contains details of the legislation relevant to this management plan.

3.1.2 Guidelines and standards

Non-statutory guidelines and standards that provide for noise and vibration management are listed in [Table 2](#).

Table 2 Non-statutory guidelines and standards

Guidelines and standards
Airborne Noise
NSW Interim Construction Noise Guideline (ICNG)
Sydney Metro Construction Noise and Vibration Standard (CNVS)
Sleep disturbance
Construction noise – NSW EPA Noise Policy for Industry
Road traffic noise – RNP and the Roads and Maritime Environmental Noise Management Manual (ENMM) Practice Note 3
Ground-borne noise
NSW Interim Construction Noise Guideline (ICNG)
Australian Standard AS/NZS 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors
Construction related road traffic noise
No specific guidelines, but guidance taken from the NSW Interim Construction Noise Guideline (ICNG) and the NSW Road Noise Policy (RNP).

Guidelines and standards
Vibration (disturbance to building occupants)
NSW DECC's Assessing vibration; a technical guideline, published in February 2006.
British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1–80Hz).
Vibration (structural damage to buildings)
British Standard 7385:1993 Evaluation and measurement of vibration in buildings – Part 2 Guide to damage from ground-borne vibration.
Vibration (structural damage to buried services and screening criteria for heritage structures)
German Standard DIN 4150:2016 – Part 3 Structural vibration in buildings – Effects on structures
Vibration (sensitive scientific and medical equipment) (guidance only)
ASHRAE Applications Handbook (SI) 2003, Chapter 47 Sound and Vibration Control
Gordon GC 28 September 1999 Generic Vibration Criteria for Vibration Sensitive Equipment
Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration

3.2 CNVMP requirements

The MCoAs relevant to this CNVMP are listed [Table 3](#), the REF-CoAs are listed in [Table 4](#), all CEMF requirements relevant to this CNVMP are listed in [Table 5](#). Refer to [Section 8](#) for all REMMs and MMMs relevant to the development of this Plan and management of noise and vibration impacts for the Project. A cross reference is also included in these tables to indicate where the condition is addressed in this CNVMP or other Project management documents.

Table 3 Minister's Conditions of approval relevant to the CNVMP

MCoA	Condition requirements	Document Reference	Timing
A6	Where the conditions of this approval require a document or monitoring program to be prepared, or a review to be undertaken, in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Planning Secretary with the document. The evidence must include: (a) documentation of the engagement with the party identified in the condition of approval that has occurred before submitting the document for approval; (b) a log of the dates of engagement or attempted engagement with the identified party and a summary of the issues raised by them; (c) documentation of the follow-up with the identified party(s) where feedback has not been provided to confirm that the party(s) has none or has failed to provide feedback after repeated requests; (d) outline of the issues raised by the identified party(s) and how they have been addressed; and (e) a description of the outstanding issues raised by the identified party(s) and the reasons why they have not been addressed.	Appendix F	Prior to construction
A34	The Proponent must cooperate with the AA by: (a) providing access to noise and vibration monitoring activities as they take place; (b) providing access to the Complaints Register if requested; (c) providing for review of noise and vibration documents required to be prepared under the conditions of this approval; and (d) considering any recommendations to improve practices and demonstrating, to the satisfaction of the AA, why any recommendation is not adopted.	Section 3.3	Throughout construction

MCoA	Condition requirements	Document Reference	Timing
A36	<p>The approved AA must:</p> <ul style="list-style-type: none"> (a) receive and respond to communication from the Planning Secretary in relation to the performance of Stage 1 of the CSSI in relation to noise and vibration; (b) consider and inform the Planning Secretary on matters specified in the conditions of this approval relating to noise and vibration; (c) consider and recommend, to the Proponent, improvements that may be made to avoid or minimise adverse noise and vibration impacts; (d) review all proposed night-time works (with the exception of low risk activities) to determine if sleep disturbance would occur and recommend measures to avoid sleep disturbance or appropriate additional alternative mitigation measures; (e) review all noise and vibration documents required to be prepared under the conditions of this approval and, should they be consistent with the conditions of this approval, endorse them before submission to the Planning Secretary (if required to be submitted to the Planning Secretary) or before implementation (if not required to be submitted to the Planning Secretary); (f) regularly monitor the implementation of all noise and vibration documents required to be prepared under the conditions of this approval to ensure implementation is in accordance with what is stated in the document and the conditions of this approval; (g) review the Proponent's notification of incidents in accordance with Condition A43 of this schedule; (h) in conjunction with the ER (where required), the AA must: <ul style="list-style-type: none"> (i) as may be requested by the Planning Secretary or Community Complaints Mediator (required by Condition B8 of this schedule), help plan, attend or undertake audits of noise and vibration management of Stage 1 of the CSSI including briefings, and site visits, (ii) in the event that conflict arises between the Proponent and the community in relation to the noise and vibration performance of Stage 1 of the CSSI, follow the procedure in the Overarching Community Communication Strategy referenced in Condition C-B1 of this schedule to attempt to resolve the conflict, and if it cannot be resolved, notify the Planning Secretary, (iii) if requested by the ER, consider relevant minor amendments made to the Site Establishment Management Plan, CEMP, relevant sub-plans and noise and vibration monitoring programs that require updating or are of an administrative nature, and are consistent with the conditions of this approval and the management plans and monitoring programs approved by the Planning Secretary and, if satisfied such amendment is necessary, endorse the amendment, (this does not include any modifications to the conditions of this approval), (iv) if requested by the ER, review the noise impacts of minor ancillary facilities, and (v) prepare and submit to the Planning Secretary and other relevant regulatory agencies, for information, a Monthly Noise and Vibration Report detailing the AA's actions and decisions on matters for which the AA was responsible in the preceding month. The Monthly Noise and Vibration Report must be submitted within seven (7) days following the end of each month for the duration of the AA's engagement for Stage 1 of the CSSI, or as otherwise agreed by the Planning Secretary. 	Section 3.3	Throughout construction
C1	<p>Construction Environmental Management Plans (CEMPs) and CEMP Sub-plans must be prepared in accordance with the Construction Environmental Management Framework (CEMF) included in the documents listed in Condition A1 of this schedule to detail how the performance outcomes, commitments and mitigation measures specified in the documents listed in Condition A1 of this schedule will be implemented and achieved during construction.</p>	Table 3 This Plan	Prior to construction

MCoA	Condition requirements	Document Reference	Timing						
C5	<p>Of the CEMP Sub-plans required under Condition C1 of this schedule, the following CEMP Sub-plans must be prepared in consultation with the relevant government agencies identified for each CEMP Sub-plan. Details of issues raised by a government agency during consultation must be included in the relevant CEMP Sub-plan, including copies of all correspondence from those government agencies as required by Condition A6 of this schedule. Where a government agency (ies) request(s) is not included, the Proponent must provide the Planning Secretary / ER (whichever is applicable) justification as to why:</p> <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>Noise and vibration</td><td>SOPA (in respect of Sydney Olympic Park), Place Management NSW (in respect of The Bays) and Relevant Council(s)</td></tr></table>		Required CEMP Sub-plan	Relevant government agencies to be consulted for each CEMP Sub-plan	(a)	Noise and vibration	SOPA (in respect of Sydney Olympic Park), Place Management NSW (in respect of The Bays) and Relevant Council(s)	<p>This Plan</p> <p>Evidence provided in accordance with MCoA A6</p> <p>CEMP Section 5.2</p>	Prior to construction
	Required CEMP Sub-plan	Relevant government agencies to be consulted for each CEMP Sub-plan							
(a)	Noise and vibration	SOPA (in respect of Sydney Olympic Park), Place Management NSW (in respect of The Bays) and Relevant Council(s)							
C6	<p>The CEMP Sub-plans must state how:</p> <p>(a) the environmental performance outcomes identified in the documents listed in Condition A1 of this schedule will be achieved;</p> <p>(b) the mitigation measures identified in the documents listed in Condition A1 of this schedule will be implemented;</p> <p>(c) the relevant conditions of this approval will be complied with; and</p> <p>(d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed through SMART principles.</p>	<p>Section 2</p> <p>Section 9.1</p> <p>Section 3</p> <p>Section 7.2</p>	Prior to construction						
C7	With the exception of any CEMP Sub-plans expressly nominated by the Planning Secretary to be endorsed by the ER, all CEMP Sub-plans must be submitted to the Planning Secretary for approval.	<p>Section 1.4</p>	Prior to construction						
C8	The CEMP Sub-plans not requiring the Planning Secretary’s approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all relevant undertakings made in the documents listed in Condition A1 of this schedule. Any of these CEMP Sub-plans must be submitted to the ER with, or subsequent to, the submission of the CEMP but in any event, no later than one (1) month before construction or where construction is phased no later than one (1) month before the commencement of that phase.	<p>Section 1.4</p>	Prior to construction						
C9	Any of the CEMP Sub-plans to be approved by the Planning Secretary must be submitted to the Planning Secretary with, or subsequent to, the submission of the CEMP but in any event, no later than one (1) month before construction or where construction is phased no later than one (1) month before the commencement of that phase.	<p>Section 1.4</p>	Prior to construction						
C10	Construction must not commence until the CEMP and all CEMP Sub-plans have been approved by the Planning Secretary or endorsed by the ER (whichever is applicable), unless otherwise agreed by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by the Planning Secretary or endorsed by the ER (whichever is applicable), including any minor amendments approved by the ER, must be implemented for the duration of construction. Where construction of Stage 1 of the CSSI is phased, construction of a phase must not commence until the CEMP and CEMP Sub-plans for that phase have been approved by the Planning Secretary or certified by the ER upon nomination by the Planning Secretary (whichever is applicable).	<p>This Plan</p>	Prior to construction						
D34	A detailed land use survey must be undertaken to confirm sensitive receivers (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration and construction ground-borne noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area before the commencement of work which generate construction noise, vibration or ground-borne noise in that area. The results of the survey must be included in the Noise and Vibration CEMP Sub-plan required under Condition C5 of this schedule.	<p>Appendix A</p>	Prior to construction						

MCoA	Condition requirements	Document Reference	Timing
D35	<p>Work must only be undertaken during the following hours:</p> <ul style="list-style-type: none"> (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 6:00pm Saturdays; and (c) at no time on Sundays or public holidays. 	Section 6.2	Throughout construction
D36	<p>Except as permitted by an EPL, highly noise intensive work that result in an exceedance of the applicable NML at the same receiver must only be undertaken:</p> <ul style="list-style-type: none"> (a) between the hours of 8:00 am to 6:00 pm Monday to Friday; (b) between the hours of 8:00 am to 1:00 pm Saturday; and (c) if continuously, then not exceeding three (3) hours, with a minimum cessation of work of not less than one (1) hour. <p>For the purposes of this condition, 'continuously' includes any period during which there is less than one (1) hour between ceasing and recommencing any of the work.</p>	Section 6.2	Throughout construction

D37	<p>Notwithstanding Conditions D35 and D36 of this schedule work may be undertaken outside the hours specified in the following circumstances:</p> <p>(a) Safety and Emergencies, including:</p> <p>(i) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or</p> <p>(ii) 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.</p> <p>On becoming aware of the need for emergency work in accordance with (a)(ii) above, the AA, the ER, the Planning Secretary and the EPA must be notified of the reasons for such work. The Proponent must use best endeavours to notify as soon as practicable all noise and/or vibration affected sensitive land user(s) of the likely impact and duration of those work.</p> <p>(b) Low impact, including:</p> <p>(i) construction that causes LAeq(15 minute) noise levels:</p> <ul style="list-style-type: none"> no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and <p>(ii) construction that causes LAFmax(15 minute) noise levels no more than 15 dB(A) above the rating background level at any residence; or</p> <p>(iii) construction that causes:</p> <ul style="list-style-type: none"> continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006). <p>(c) By Approval, including:</p> <p>(i) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or</p> <p>(ii) works which are not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition D38 of this schedule; or</p> <p>(iii) negotiated agreements with directly affected residents and sensitive land user(s).</p> <p>(d) By Prescribed Activity, including:</p> <p>(i) tunnelling (excluding cut and cover tunnelling and surface works) are permitted 24 hours a day, seven days a week; or</p> <p>(ii) concrete batching at the Clyde construction site is permitted 24 hours a day, seven days a week; or</p> <p>(iii) delivery of material that is required to be delivered outside of standard construction hours in Condition D35 of this schedule to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Five Dock and Westmead construction sites and to / from Burwood North construction site using any roads / streets other than directly from Parramatta Road; or</p> <p>(iv) haulage of spoil except between the hours of 10:00 pm and 7:00 am to / from the Five Dock and Westmead construction sites and to / from Burwood North construction site using any roads / streets other than directly from Parramatta Road; or</p> <p>(v) work within an acoustic shed where there is no exceedance of noise levels under Low impact circumstances identified in (b) above, unless otherwise agreed by the Planning Secretary.</p> <p>Note: Tunnelling does not include station box excavation.</p>	Section 6.3.3	Throughout construction
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MCoA	Condition requirements	Document Reference	Timing
D38	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of work which are outside the hours defined in Conditions D35 and D36 of this schedule. The Protocol must be approved by the Planning Secretary before commencement of the out-of-hours work. The Protocol must be prepared in consultation with the ER, AA and EPA. The Protocol must provide:</p> <ul style="list-style-type: none"> (a) identification of low and high-risk activities and an approval process that considers the risk of activities, proposed mitigation, management, and coordination, including where: <ul style="list-style-type: none"> (i) the ER and AA review all proposed out-of-hours activities and confirm their risk levels; (ii) low risk activities can be approved by the ER in consultation with the AA; and (iii) high risk activities that are approved by the Planning Secretary; (b) a process for the consideration of out-of-hours work against the relevant NML and vibration criteria; (c) a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition D50 of this schedule. The measures must take into account the predicted noise levels and the likely frequency and duration of the out-of-hours works that sensitive land user(s) would be exposed to, including the number of noise awakening events; (d) 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; and (e) notification arrangements for affected receivers for all approved out-of-hours works and notification to the Planning Secretary of approved low risk out-of-hours works. <p>This condition does not apply if the requirements of Condition D37(b) of this schedule are met.</p> <p>Note: Out-of-hours work is any work that occurs outside the construction hours identified in Condition D35 and D36 of this schedule.</p>	Appendix C	Prior to construction
D39	<p>All reasonable and feasible mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <ul style="list-style-type: none"> (a) construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009); (b) vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure); (c) Australian Standard AS 2187.2 - 2006 "Explosives - Storage and Use - Use of Explosives" (for human exposure); (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 for structurally unsound heritage items). <p>Any work identified as exceeding the noise management levels and / or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan.</p> <p>Note: The ICNG identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.</p>	Section 9 Section 6.3	Throughout construction

MCoA	Condition requirements	Document Reference	Timing
D40	<p>All reasonable and feasible mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:</p> <ul style="list-style-type: none"> (a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and (b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A). <p>The mitigation measures must be outlined in the Noise and Vibration CEMP Sub-plan, including in any Out-of-Hours Work Protocol, required by Condition D38 of this schedule.</p>	Appendix B	Throughout construction
D41	Noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.	Section 9.1	Throughout construction
D42	<p>Industry best practice construction methods must be implemented where reasonably practicable to ensure that noise levels are minimised around sensitive land user(s). Practices must include, but are not limited to:</p> <ul style="list-style-type: none"> (a) use of regularly serviced low sound power equipment; (b) temporary noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities such as rock hammering and concrete cutting; and (c) use of alternative construction and demolition techniques. 	Section 9.1	Throughout construction
D43	Detailed Noise and Vibration Impact Statements (DNVIS) must be prepared for any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in Conditions D39 and D40 of this schedule at any residence outside construction hours identified in Condition D35 of this schedule, or where receivers will be highly noise affected. The DNVIS must include specific mitigation measures identified through consultation with affected sensitive land user(s) and the mitigation measures must be implemented for the duration of the works. A copy of the DNVIS must be provided to the AA and ER before the commencement of the associated works. The Planning Secretary and the EPA may request a copy (ies) of the DNVIS.	Section 8.1	Prior to construction
D44	DNVIS must be prepared for each construction site before construction noise and vibration impacts commence and include specific mitigation measures identified through consultation with affected sensitive land users.	Section 8.1	Prior to construction
D45	Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before works that generate vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owners and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Sub-plan	Section 6.4.3 Section 9 Appendix G	Throughout construction
D46	Vibration testing must be conducted during vibration generating activities that have the potential to impact on Heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and attended monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures. Such measures must include, but not be limited to, review or modification of excavation techniques.	Section 6.4.4 Section 9 Appendix G	Throughout construction
D47	The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring at Heritage items.	Appendix B Section 6.4.4	Throughout construction
D49	If a Heritage item is found to be structurally unsound (following inspection) a more conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) must be applied.	Section 6.4.4	Throughout construction

MCoA	Condition requirements	Document Reference	Timing
D50	<p>All work undertaken for the delivery of Stage 1 of the CSSI, including those undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided. The Proponent must:</p> <ul style="list-style-type: none"> (a) reschedule any work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with Condition D51 of this schedule; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the AA in support of any decision made by the Proponent in relation to respite or mitigation. <p>The consideration of respite must also include all other approved Critical SSI, SSI and SSD projects which may cause cumulative and / or consecutive impacts at receivers affected by the delivery of Stage 1 of the CSSI.</p>	Section 6.3.3.2	Throughout construction
D51	<p>In order to undertake out-of-hours work outside the work hours specified under Condition D35 of this schedule, appropriate respite periods for the out-of-hours work must be identified in consultation with the community at each affected location on a regular basis. This consultation must include (but not be limited to) providing the community with:</p> <ul style="list-style-type: none"> (a) a progressive schedule for periods no less than three (3) months, of likely out-of-hours work; (b) a description of the potential work, location and duration of the out-of-hours work; (c) the noise characteristics and likely noise levels of the work; and (d) likely mitigation and management measures which aim to achieve the relevant NMLs under Condition D39 (including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers). <p>The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour work must be provided to the AA, EPA and the Planning Secretary.</p> <p>Note: 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 RBL at any residence.</p>	Appendix C	Throughout construction
D58	<p>Stage 1 of the CSSI must be designed and constructed with the objective of minimising impacts to, and interference with, third party property and infrastructure, and that such infrastructure and property is protected during construction.</p>	Section 9.1	Throughout construction
D59	<p>The utilities and services (hereafter “services”) potentially affected by construction must be identified to determine requirements for diversion, protection and / or support. Alterations to services must be determined by negotiation between the Proponent and the service providers. Disruption to services resulting from construction must be avoided, wherever possible, and advised to customers where it is not possible.</p>	Section 9.1	Throughout construction
D60	<p>A suitably qualified and experienced person must undertake condition surveys of all buildings, structures, utilities and the like identified in the documents listed in Condition A1 of this schedule as being at risk of damage before commencement of any work that could impact on the subject surface / subsurface structure. The results of the surveys must be documented in a Pre-construction Condition Survey Report for each item surveyed. Copies of Pre-construction Condition Survey Reports must be provided to the relevant owners of the items surveyed in the vicinity of the proposed work, and no later than one (1) month before the commencement of the work that could impact on the subject surface / subsurface structure.</p>	Section 10.5.1 Section 7.12 of the CEMP	Prior to construction

MCoA	Condition requirements	Document Reference	Timing
D61	Condition surveys of all items for which condition surveys were undertaken in accordance with Condition D60 of this schedule must be undertaken by a suitably qualified and experienced person after completion of the work identified in Condition D60 of this schedule. The results of the surveys must be documented in a Post-construction Condition Survey Report for each item surveyed. Copies of Post-construction Condition Survey Reports must be provided to the landowners of the items surveyed, and no later than three (3) months following the completion of the work that could impact on the subject surface / subsurface structure unless otherwise agreed by the Planning Secretary.	Section 10.5.1 Section 7.12 of the CEMP	Throughout construction
D62	The Proponent, where liable, must rectify any property damage caused directly or indirectly (for example from vibration or from groundwater change) by the work at no cost to the owner. Alternatively, the Proponent may pay compensation for the property damage as agreed with the property owner. Rectification or compensation must be undertaken within 12 months of completion of the work identified in Condition D60 of this schedule unless another timeframe is agreed with the owner of the affected surface or sub-surface structure or recommended by the IPIAP.	Section 10.5.1 Section 7.12 of the CEMP	Throughout construction
D63	Appropriate equipment to monitor areas in proximity of construction sites and the tunnel route during construction must be installed with particular reference to at risk buildings, structures and utilities identified in the condition surveys required by Condition D60 of this schedule and / or geotechnical analysis as required. If monitoring during construction indicate exceedance of the vibration criteria identified in the DNVIS prepared under Condition D43 of this schedule, then all construction affecting settlement must cease immediately and must not resume until fully rectified or a revised method of construction is established that will ensure protection of affected buildings.	Section B.4.2.3	Throughout construction

Table 4 REF CoAs relevant to the CNVMP

REF-CoA	Condition requirements	Document Reference	Timing
NV1	During construction receivers that would potentially be affected by noise and/or vibration from the works would be appropriately notified before the relevant works start.	CCS Section 9.1	Throughout construction
NV2	Noise monitoring at the most affected receiver(s) would be undertaken at the start of construction works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate, further mitigation measures would be considered and implemented where feasible and reasonable.	Appendix B	Throughout construction

Table 5 Relevant requirements of the CEMP

CEMF Ref.	Requirement	Document Reference	Timing
12.2 a)	Principal Contractors will develop and implement a Construction Noise and Vibration Management Plan for their scope of works consistent with the Interim Construction Noise Guidelines (Department of Environment and Climate Change, 2009). The Construction Noise and Vibration Management Plan will include as a minimum:	-	Prior to construction
i.	Identification of work areas, site compounds and access points;	Section 7.1	
ii.	Identification of sensitive receivers and relevant construction noise and vibration goals;	Section 5.1 CEMP Environmental Control Maps	
iii.	Be consistent with, and include the requirements of the noise and vibration mitigation measures as detailed in, the environmental approval	Section 9	

CEMF Ref.	Requirement	Document Reference	Timing
	documentation and the Sydney Metro Construction Noise and Vibration Standard (CNVS);		
iv.	Details of construction activities and an indicative schedule for construction works, including the identification of key noise and/or vibration generating construction activities (based on representative construction scenarios) that have the potential to generate noise or vibration impacts on surrounding sensitive receivers, in particular residential areas;	Section 7.1	
v.	Identification of feasible and reasonable procedures and mitigation measures to ensure relevant vibrations and blasting criteria are achieved, including a suitable blast program;	Note: No blasting is proposed as part of the Project	
vi.	Community consultation requirements and Community notification provisions specifically in relation to blasting;	Note: No blasting is proposed as part of the Project	
vii.	The requirements of any applicable licence or approval (for example EPL);	Section 6.3.3 Appendix C	
viii.	Additional requirements in relation to activities undertaken 24 hours of the day, 7 days per week;	Not applicable- no works will be undertaken 24/7 on the project	
ix.	Pre-construction compliance requirements and hold points;	Section 2.4	
x.	The responsibilities of key project personnel with respect to the implementation of the plan;	Section 10.1	
xi.	Noise monitoring requirements;	Appendix B	
xii.	Compliance record generation and management; and	Section 10.5	
xiii.	An Out of Hours Works Protocol applicable to all construction methods and sites	Appendix C	
b)	Detailed Construction Noise and Vibration Impact Statements will be prepared for noise-intensive construction sites and or activities, to ensure the adequacy of the noise and vibration mitigation measures. Specifically, Construction Noise and Vibration Impact Statements will be prepared for works proposed to be undertaken outside of standard construction hours and to support applications to undertake out of hours works (this includes variations of EPL's and applications to relevant agencies).	Section 8.1	Prior to construction
c)	Noise and vibration monitoring would be undertaken for construction as specified in the CNVS.	Section 8.1 Appendix B	Throughout construction
d)	The following compliance records would be kept by Principal Contractors: <ul style="list-style-type: none"> i. Records of noise and vibration monitoring results against appropriate NMLs and vibration criteria; and ii. Records of community enquiries and complaints, and the Contractor's response. 	Section 10.5	Throughout construction
3.16 a)	Principal Contractors will maintain appropriate records of the following: <ul style="list-style-type: none"> i. Site inspections, audits, monitoring, reviews or remedial actions; ii. Documentation as required by performance conditions, approvals, licences and legislation; iii. Modifications to site environmental documentation (eg CEMP, sub-plans and procedures); and 	Section 10.5 Section 6.8 of CEMP	Throughout construction

CEMF Ref.	Requirement	Document Reference	Timing
	iv. Other records as required by this Construction Environmental Management Framework.		
3.16 b)	Records must be accessible onsite for the duration of works	Section 10.5 Section 6.8 of CEMP	Throughout construction
3.16 c)	Additionally records will be retained by the Principal Contractor for a period of no less than 7 years. Records will be made available in a timely manner to Sydney Metro (or their representative) upon request.	Section 10.5 Section 6.8 of CEMP	Throughout construction
3.17 a)	Principal Contractors will ensure the continual review and improvement of the management systems. This will generally occur in response to: <ul style="list-style-type: none"> i. Issues raised during environmental surveillance and monitoring; ii. Expanded scope of works; iii. Environmental incidents; and iv. Environmental non-conformances. 	Section 11 Section 6.9 and 6.10 of the CEMP.	Throughout construction

3.3 Acoustic Advisor

As required by MCoA A33, work must not commence until an AA has been nominated by the Proponent and approved by the Planning Secretary. A description of the requirements and responsibilities of the AA is provided in MCoA A36 listed below.

In accordance with MCoA A36 the approved AA must:

- a) receive and respond to communication from the Planning Secretary in relation to the performance of Stage 1 of the CSSI in relation to noise and vibration;
- b) consider and inform the Planning Secretary on matters specified in the conditions of this approval relating to noise and vibration;
- c) consider and recommend, to the Proponent, improvements that may be made to avoid or minimise adverse noise and vibration impacts;
- d) review all proposed night-time works (with the exception of low risk activities) to determine if sleep disturbance would occur and recommend measures to avoid sleep disturbance or appropriate additional alternative mitigation measures;
- e) review all noise and vibration documents required to be prepared under the conditions of this approval and, should they be consistent with the conditions of this approval, endorse them before submission to the Planning Secretary (if required to be submitted to the Planning Secretary) or before implementation (if not required to be submitted to the Planning Secretary);
- f) regularly monitor the implementation of all noise and vibration documents required to be prepared under the conditions of this approval to ensure implementation is in accordance with what is stated in the document and the conditions of this approval;
- g) review the Proponent's notification of incidents in accordance with Condition A43 of this schedule;
- h) in conjunction with the ER (where required), the AA must:
 - i. as may be requested by the Planning Secretary or Community Complaints Mediator (required by Condition B8 of this schedule), help plan, attend or undertake audits of noise and vibration management of Stage 1 of the CSSI including briefings, and site visits,
 - ii. in the event that conflict arises between the Proponent and the community in relation to the noise and vibration performance of Stage 1 of the CSSI, follow the procedure in the

Overarching Community Communication Strategy referenced in Condition C-B1 of this schedule to attempt to resolve the conflict, and if it cannot be resolved, notify the Planning Secretary,

- iii. if requested by the ER, consider relevant minor amendments made to the Site Establishment Management Plan, CEMP, relevant sub-plans and noise and vibration monitoring programs that require updating or are of an administrative nature, and are consistent with the conditions of this approval and the management plans and monitoring programs approved by the Planning Secretary and, if satisfied such amendment is necessary, endorse the amendment, (this does not include any modifications to the conditions of this approval),
- iv. if requested by the ER, review the noise impacts of minor ancillary facilities, and
- v. prepare and submit to the Planning Secretary and other relevant regulatory agencies, for information, a Monthly a Monthly Noise and Vibration Report detailing the AA's actions and decisions on matters for which the AA was responsible in the preceding month. The Monthly Noise and Vibration Report must be submitted within seven (7) days following the end of each month for the duration of the AA's engagement for Stage 1 of the CSSI, or as otherwise agreed by the Planning Secretary.

In accordance with MCoA A34 the Quickway will cooperate with the AA by:

- a) providing access to noise and vibration monitoring activities as they take place;
- b) providing access to the Complaints Register if requested;
- c) providing for review of noise and vibration documents required to be prepared under the conditions of this approval; and
- d) considering any recommendations to improve practices and demonstrating, to the satisfaction of the AA, why any recommendation is not adopted.

4. Construction Activities

4.1 General Construction

The Project is located across two areas in the Greater Sydney Region:

- The Bays: Begins at the Manning St Substation in Rozelle, and extends for approximately two kilometres, ending at Robert St adjacent to White Bay ([Figure 1](#)).
- The Eastern Creek Pre-Cast Yards located along Lenore Drive and extends for less than 200 metres along this road ([Figure 2](#)).

Quickway will be undertaking the following activities to perform the works across the two sites, as described below.

Table 6 Description of construction activities at Eastern Creek and The Bays

Works category	Description of activities
The Bays	
Mobilisation, site set-up	<ul style="list-style-type: none"> • Site compound setup for site offices, amenities and material storage • Site compound setup for materials, spoil and waste management and handling – segregation of waste management bays

Works category	Description of activities
	<ul style="list-style-type: none"> Environmental controls setup – chemical storage container, sediment controls Site security measures Delivers of permanent material – i.e. conduits, cover strip, spacers Progressive removal of spoil material and importing of quarry materials.
Service locating, potholing, investigations, site preparation works	<ul style="list-style-type: none"> Existing service locating and space / design proving of the alignment in pinch point locations Locating of “challenging” excavation spots – i.e large/ major utility crossings Waste material sampling and classifications Open excavations rock hammering for rock strength and level testing Survey works Tree branch trimming and removal where required. Tree protection where required.
Traffic control, pedestrian/ cyclists management	<ul style="list-style-type: none"> Traffic management – partial, full road closures, detours Parking removal Pedestrians and cyclists management Concurrent trenching crews operating at once. Out of hours work required on state, regional roads due to traffic flows and road occupancy licences.
Trench excavation, conduit installation, backfilling, temporary restorations – approximately 1.7km	<ul style="list-style-type: none"> Trenching installations will works will consist of open excavations, conduit installation, backfilling and temporary restorations and will progressively move along the trench alignment. Trench depths ranging from 1000mm to approximately 3200mm and widths ranging from 725mm out to 2800mm wide in some areas. All of the trenching works occurs within the road carriageway or road shoulder lanes. Open excavations when deeper than 1500mm or in poor ground conditions trenches will be shored with either vertishores or shoring boxes. Excavation will occur to separate via material layer type – i.e. truck will be loaded with road surface material (concrete/ asphalt / roadbase) then tipped. Then loaded with any GSW material in trench (if found). Clean material, and rock will be loaded into truck separately to ensure maximisation suitable material for re-use. Majority excavations will likely encounter sandstone rock, at least in the base, referring to project geotechnical logs. This will required rock hammering methods. Once excavation has achieved the required depth, conduits with spacers every 2 metre centres will be installed and jointed with PVC glues. These conduits will be secured to prevent floatation during wet mix TSB backfill. Wet mix thermally stable backfill (TSB) is installed around the conduits as the pipe embedment material. This TBS is poured from a concrete agitator truck into the trench. The assistance of excavator bucket for pouring of TSB may be required in some tight work areas. The wet mix TSB is worked around the conduits to ensure no voids. The wet mix TSB then need to ‘set’ before backfill and compacting to prevent damage to installed conduits. Polymeric (HDPE) cable cover strips are laid on-top of the TSB pipe embedment. Native backfill material will be placed, compacted and vibrated in approximately 150mm layers above the cover strip with a 2ton trench pad-foot roller. This process will be repeated for multiple layers until the underside of road subgrade is met (approximately 350mm below road surface level). Compacting testing will occur progressively during backfilling and layers. Compaction sand or stabilised sand would be placed for backfill immediately around existing utilities crossed. Stabilised sand may required water conditioning during placement, however does not required vibration compaction from 2ton trench roller, instead isolated handheld jumping jack leveling. Soft electrical warning marker tape is rolled out and installed on the top of the trench backfill and below the road subgrade level. Imported DGB-20 roadbase material will make up the 300mm thick subgrade level below the road surface. Roadbase will be placed in 150mm layers, compacted and

Works category	Description of activities
	<p>rolled with a 2ton smooth drum roller or wacker plate. Compacting testing will occur progressively during backfilling and layers.</p> <ul style="list-style-type: none"> Temporary road and footpath restorations will be made with the placement of approximately 50-75mm of AC10 or AC14 hotmix. Hotmix will be placed from excavator bucket, spread and rolled with 2ton smooth drum roller. Any open excavations at the end of each shift withing trafficable lanes to be re-opened will be road plated, pinned in accordance with TfNSW M209 temporary restorations specification, which includes pins and hotmix transition ramps on all sides. Any open excavations within the secured site road plated and covered between shifts to ensure public safety of any unauthorised entry in the site. Trenching works will progress approximately 6-18 metres per dayshift, and approximately 4-12 metres per nightshift pending ground conditions.
HDD bore underneath Victoria Rd & Darling St intersection – dual 130m HDD bores	<ul style="list-style-type: none"> Road surface monitoring targets are placed prior to bore with baseline measurements required. Survey setout of bore. Utility investigation to validate locations and depths before trenchless drilling. Excavation of entry pit and exit pits. Individual pits are approximately 3000mm long, 1200mm wide and 1500mm deep. Due to parallel bores combing these pits may be possible to aid traffic management arrangements. 'Pilot bore' drilled from the entry pit along alignment and is tracked from road surface level to ensure drill as per design alignment and depth. Pilot drill exits at exit pit. "Reamers" are placed onto drilling rods, pulled back concentrically cutting and increasing the bore diameter of the bore profile. Increasing reamer sizes are progressively installed until the design diameter is achieved. Prior to pipe installation works the bore profile is "cleaned" with various passes of the design diameter reamer. Concurrently to HDD boring works, high density polyethylene (HDPE) pipes we plastic butt welded together and internally debaded. HDPE pipes are welded into a string to match the length of the HDD bore. Pipe will be dragged from its welding location along the road. It is then connected to the drilling roads before being pulled into the bore hole Drilling fluid is pumped through the drill rods during the HDD bore to displace bore cuttings and to hydrostatic support bore annulus when being pumped, flow controlled and levels monitored. Drilling fluid is removed from entry and exit pits with a vacuum truck. The vacuum truck will either tip the drilling fluid into a sealed liquid waste hook skin bin or bring directly to liquid waste tip. Drilling fluid is disposed offsite at licenced waste facility. Once pipe is installed, grout will be installed via gravity pour at the entry and exit pits and pumping through a tremie line installed. During the HDD bore, and for a set schedule after competition, road monitoring targets are monitored to ensure no road surface movement
Case bore underneath Sydney Water culvert on Robert St – dual 12m long case bores	<ul style="list-style-type: none"> Excavate, shore of launch shaft approximately 11m long, 5m wide, and 4.5m deep, and exit shaft approximately 4m long, 5m wide, and 4.5m deep. Concrete/ secure drilling frame into launch shaft. Load auger bores and steel casings as the bore progresses Remove case boring machine once steel casing installed and augers retracted. Installed pre-staged carrier conduit pipes and spacers.
Remove decommissioned Ausgrid 132kV cable	<ul style="list-style-type: none"> Quickway scope will excavate down to cover strip/ tiles on decommissioned 132kV cables Ausgrid will purge, cut and remove redundant cable and dispose
Joint-bay construction and installation	<ul style="list-style-type: none"> Excavation, shore of joint bay shaft approximately 12m long, 4m wide, and 3-3.5m deep. Excavation will likely encounter rock, and require rock hammering, road sawing and rock grinding. Roadbase layer placed in based level and compacted.

Works category	Description of activities
	<ul style="list-style-type: none"> Mobile crane lift pre-cast segmented joint bay into excavation. Each piece will be added and jointed together. Following, vertical earthing rods will be drilled into the ground and connection to earthing bars of joint bay. Temporary backfill and restorations
Cable installation, jointing works	<ul style="list-style-type: none"> Roping, and mandrelling (proving) of conduits. Re-opening of joint bay excavations. Cable winch pulling. Various open points along the alignment for cable pushing bays Cable jointing hut/ covers installed over joint bays for jointing works. Cable testing Joint bay backfill and restorations
Supply and install padmounted high voltage customer kiosks (HVCs)	<ul style="list-style-type: none"> Construction of reinforced concrete footing with exiting conduits Cranage, installation securing of HVCs. Cable terminations into HVCs, testing and commissioning works
Permanent restorations and handover	<ul style="list-style-type: none"> Return once all conduit installation works and cable pulling, testing works are completed. Mill and re-sheet impacted lane with permanent road pavement material. Restore any footpath materials to pre-existing materials -i.e. concrete or pavers where appropriate
Eastern Creek	
Mobilisation, site set-up	<ul style="list-style-type: none"> Site compound setup for site offices, amenities, material storage and stockpile Environmental controls setup – chemical storage container, sediment controls Site security measures Delivers of permanent material – i.e. conduits, cover strip, spacers
Traffic management	<ul style="list-style-type: none"> Traffic management – lane merge and closures only Pedestrians and cyclists management Out of hours work may be required to cumulative traffic management arrangement with adjoining pre-cast facility earthworks contractor(s).
Investigations	<ul style="list-style-type: none"> Utility investigation and potholing works Soil waste sampling and classifications
Site clearance, tree removal, and levelling	<ul style="list-style-type: none"> Removal of trees where classing with trench alignment on the northern side of project alignment Leveling of mound adjacent to property boundary
Trench excavation, conduit installation, backfilling, restorations – approx. 100m long	<ul style="list-style-type: none"> Trenching installations will works will consist of open excavations, conduit installation, backfilling and restorations and will progressively move along the trench alignment. Trenching works will progress approximately 12-28 metres per dayshift. All of trenching works are withing footpath or nature strip areas. Trench is approximately 900mm deep and 500mm Once excavation has achieved the required depth, sand bedding placedm conduits will be installed and jointed with PVC glues. Sand pipe embedment material placed around conduits and spread. Polymeric (HDPE) cable cover strips are laid on-top of the sand material Native backfill material (clays) will be placed, compacted and vibrated in approximately 150mm layers above the cover strip with a handheld jumping jack. Soft electrical warning marker tape is rolled out and installed approximately 300m below existing ground level Any open excavations will be ATF fenced and covered with plywood sheets between shifts to ensure public safety of any unauthorised entry in the site. Footpaths will have footpath place installed
Supply and install padmounted high	<ul style="list-style-type: none"> Leveling of site area for installation. Placement of sand/ roadbase layer and compact. Strip concrete footing may be required pending ground conditions.

Works category	Description of activities
voltage customer kiosk (HVC)	<ul style="list-style-type: none"> Hiab crane truck to lift kiosk with pre-cast concrete base to location
Cable installation, jointing and commissioning	<ul style="list-style-type: none"> Cable pulling with winches. Cable jointing and terminations Cable testing and commissioning works
Restorations, demobilisation and handover	<ul style="list-style-type: none"> Grass seeding of nature stirp areas Any permanent restorations to concrete footpaths

While the potential for noisy works such as rock breaking exists generally along the alignment for the purpose of excavation of the trench, the expected key noise and vibration generating activities will be associated with the joint bays along The Bays alignment. This is a result of the increased size and depth required for the excavation of the joint bays in comparison to the general trench for the remainder of the alignment.

The horizontal directional drill and case bore activities, while required to be undertaken at night, are expected to have reduced interface with hard rock material, and as such less high noise and vibration emitting activities.

The proposed construction program, weather and site conditions pending, is detailed in [Table 7](#).

Table 7 Proposed Construction Duration

Project Location	Commencement	Completion
The Bays	Early Works – May 2021 Main Construction Works – July 2021	March 2022
Eastern Creek	June 2021	August 2021



Figure 1 Overview of the Bays Power Supply Route



Figure 2 Overview of the Power Supply route at the Pre-Cast Yard at Eastern Creek

4.2 Ancillary facilities

Temporary construction ancillary facilities are needed to facilitate construction of the project at the following locations:

- **The Bays**
 - E1(a) (refer to [Figure 3](#))
 - E1(b) (refer to [Figure 3](#))
 - E1(c) (refer to [Figure 3](#))
 - Minor Ancillary Facility Area O1 (refer to [Figure 5](#))
- **Eastern Creek** (refer to [Figure 4](#))

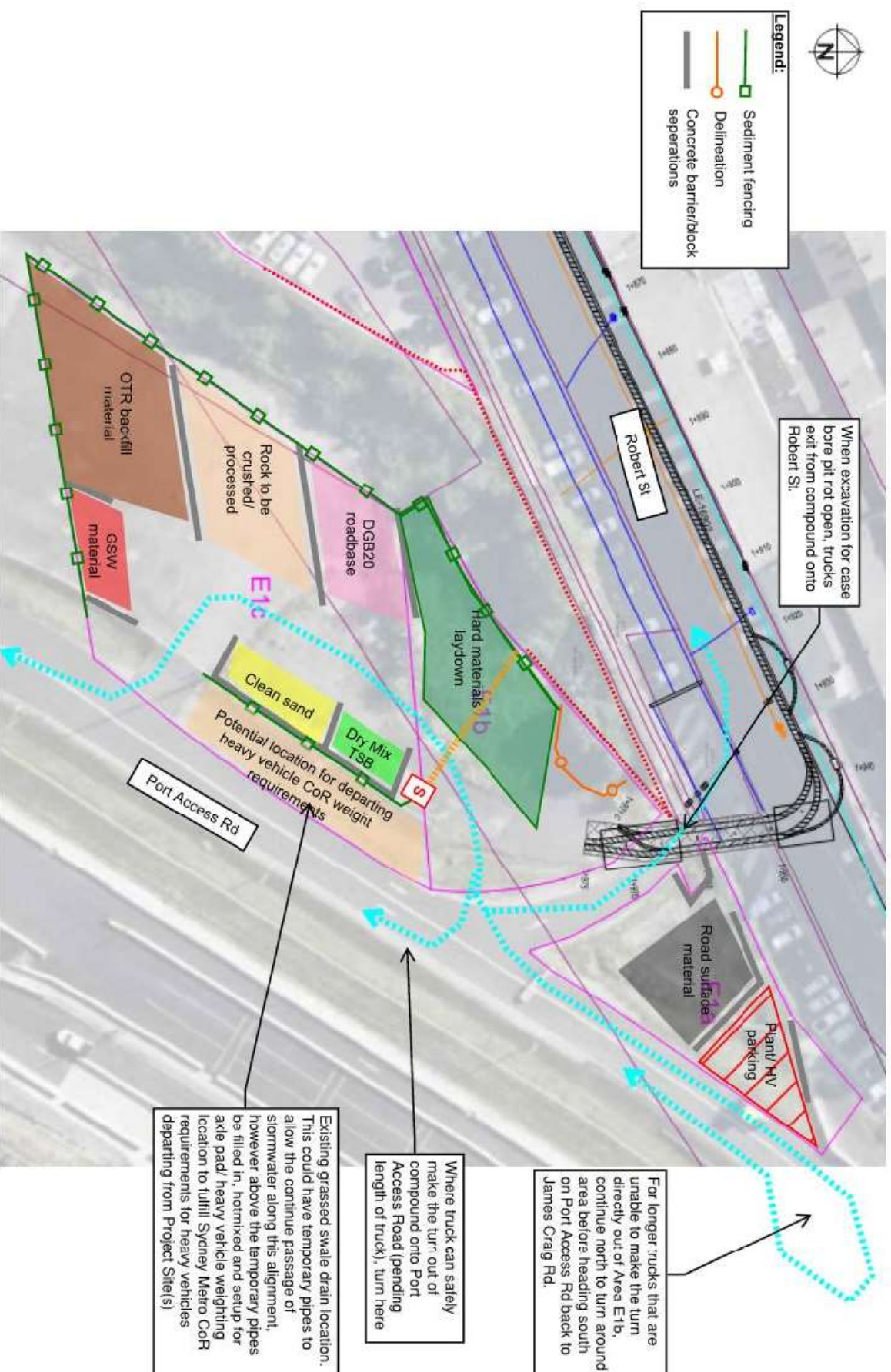


Figure 3 Indicative site layout for Ancillary Facility Sites E1a, E1b, E1c

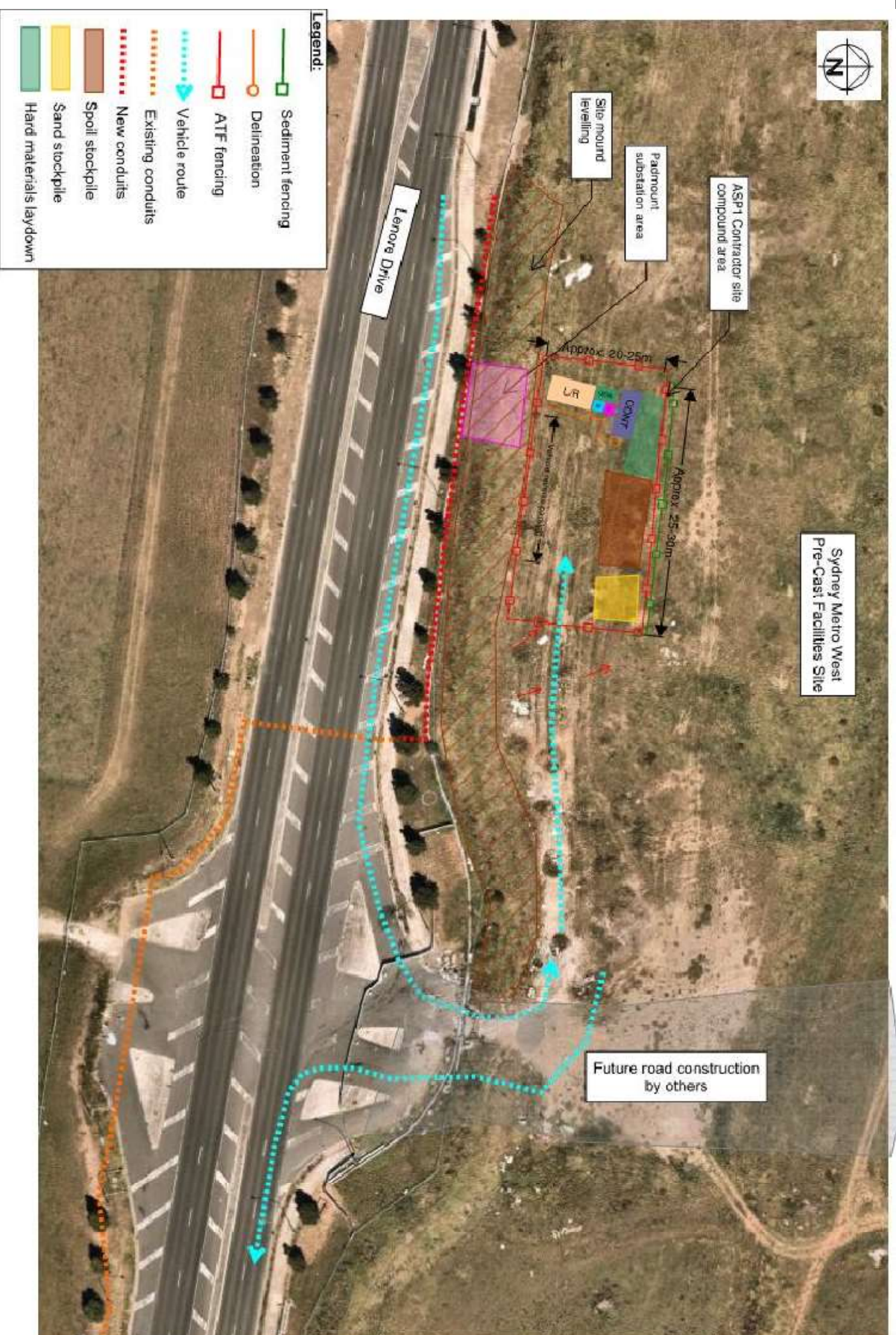


Figure 4 Indicative site layout for Ancillary Facility Site at Eastern Creek

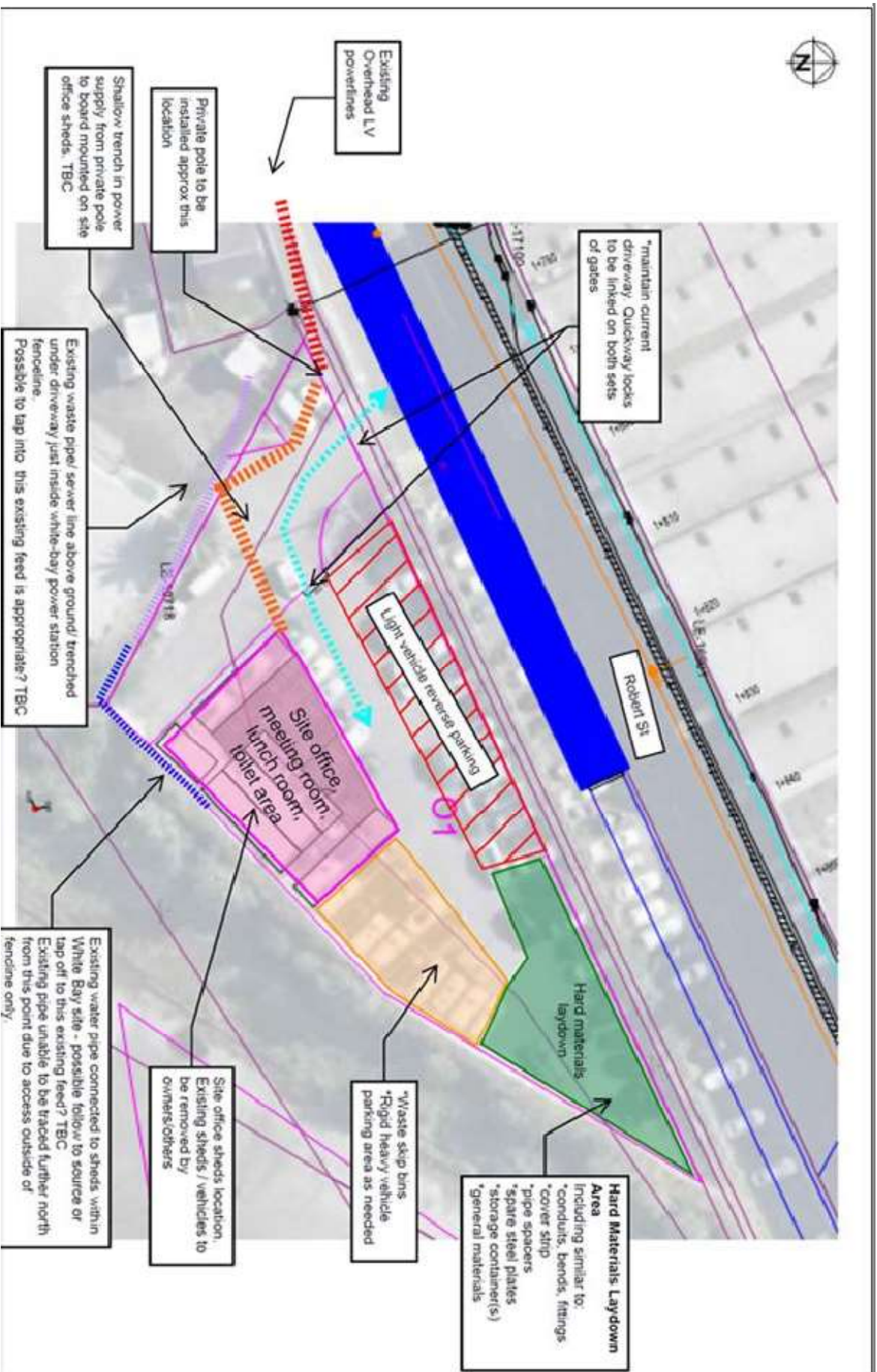


Figure 5 Indicative site layout for Minor Ancillary Facility Area O1

Site establishment will generally require the following activities:

- Site preparation:
 - Provision of site security such as ATF fencing panels and signage
- Survey and site investigation work including:
 - Ground penetrating radar or electromagnetic ground investigation
 - Contamination investigation
- Site establishment:
 - Installation of environmental controls
 - Installation of noise attenuation measures (as required)
 - Treatment of contaminated materials (if required)
 - Delineation of sensitive areas and installation of temporary fencing.
- Site access
 - Establishment of traffic management controls, including adjustments to road signage where required (showing changes to traffic movements and speed limits)
 - Construction of site access and the provision of property access including any required adjustments to pedestrian and cycle paths, as required
 - Installation of gates
- Site preparation
 - Removal of any remnant waste materials on site
 - Protection of existing services
 - Management of contamination
 - Vegetation and tree removal, clearing, chipping and mulching where required
 - Installation of new services, drainage and communications
- Site installation:
 - Installation of office block, and shipping containers for storage
 - Installation of fuel and chemical storage activities (as required)
 - Formalisation of onsite car parking
 - Formalisation of roads and external connections
 - Establishment and use of crane
 - Establishment of stockpile areas

An indicative list of plant and equipment required for site establishment and operation includes:

- Vacuum truck
- Excavator(s)

- Chainsaw, grinder, mulcher (where vegetation removal/tree trimming is required)
- Forklift / telehandler
- Elevated work platform
- Mobile crane or Franna (pick & carry crane)
- Light vehicles
- Heavy vehicles / trucks
- Roller
- Power generator
- Concrete saw
- Hand tools and equipment
- Water cart as required

General construction and operation of ancillary facilities will be required outside standard construction hours.

5. Existing Environment

The following sections summarise what is known about factors influencing Noise and Vibration impacts within and adjacent to the Project corridor. As the Project extends over two sites the characteristics of each site are detailed below, taken from the following key reference documents:

- The Bays: EIS Chapter 11 Noise and Vibration
- Eastern Creek: REF Chapter 8.1 Noise and Vibration

5.1 Sensitive Receivers

5.1.1 The Bays

A noise assessment was conducted as part of the development of the SMW EIS and forms EIS Technical Paper 2: Noise and Vibration. The EIS noted that the noise environment in the study area is typically dominated by traffic on major roads adjacent to the study area.

Existing noise levels around The Bays SMW construction site are dominated by road traffic noise from Victoria Road and Anzac Bridge, and industrial noise from White Bay and Glebe Island. The Project alignment dissects through areas of commercial/industrial use and large areas of residential receivers. In addition to the residential, commercial and industrial receivers, a number of other sensitive receivers (including educational facilities, child care centres, recording studios and medical facilities) were identified as being potentially impacted by the Project.

In order to comply with MCoA D34 required for The Bays Project area, a Land Use Survey has been completed in areas where works could impact on sensitive receivers (refer to [Appendix A](#)). Physical ground truthing of sensitive receivers was completed as part of the development of the land use survey and will continue to be undertaken throughout the delivery of Project. Where other sensitive receivers are identified throughout the delivery of the Project, the land use survey will be revised. Noise and vibration modelling will then account for these additional sensitive receivers, and appropriate mitigation measures will be implemented.

5.1.1.1 Heritage items

The project corridor traverses through an area rich in heritage including parts of the White Bay Power Station the Valley Heritage Conservation Area, churches, homes, and schools. These items will be considered for impacts of vibration-intensive activities and are listed in [Table 8](#).

Table 8 Heritage items adjacent to the project corridor

Heritage item	Address	Proximity to construction corridor
White Bay Power Station	Victoria Road, Rozelle, NSW 2039	Alignment and ancillary site directly adjacent to the item
The Valley Heritage Conservation Area	Balmain	Alignment passes through this area
White Bay Power Station inlet canal	Victoria Road, Leichhardt, NSW 2136	Alignment and ancillary site directly adjacent to the item
White Bay Power station outlet canal	Glebe Island, NSW 2040	Alignment and ancillary site directly adjacent to the item
Beattie Street Stormwater Channel No.15	Robert Street to Beattie Street, Rozelle / Balmain, NSW	Alignment and ancillary site directly adjacent to the item
Sewage Pumping Station No. 7	169, Roberts Street Rozelle, 2039	Alignment and ancillary site directly adjacent to the item
Rozelle Public School	663 Darling Street, Rozelle, 2039	Alignment directly adjacent to the item
St Pauls Church and neighbourhood centre	665A Darling Street, Rozelle, 2039	Alignment directly adjacent to the item
St Thomas Church group	668 Darling Street, Rozelle, 2039	Alignment directly adjacent to the item
York Buildings	678 Darling Street, Rozelle, 2039 128 Victoria Road, Rozelle, 2039 130 Victoria Road, Rozelle, 2039 132 Victoria Road, Rozelle, 2039	Alignment directly adjacent to the item
Former corner shop and residences	80 Mansfield Street, Rozelle, 2039 94 Evans Street, Rozelle, 2039	Alignment directly adjacent to the item
Terraces	76 Mansfield Street, Rozelle, 2039 78 Mansfield Street, Rozelle, 2039	Alignment directly adjacent to the item
Former police station	707 Darling Street, Rozelle, 2039	Alignment directly adjacent to the item

5.1.2 Eastern Creek

Receivers potentially sensitive to noise and vibration have been categorised as residential buildings, commercial/ industrial buildings, or 'other sensitive' land uses which includes educational institutions, childcare centres, medical facilities, places of worship, outdoor recreation areas, or commercial and industrial buildings.

The broad noise study area assessed within the REF includes residential buildings and other sensitive land uses such as schools, and commercial and industrial buildings. However, these are not located in close proximity to the works, with the closest sensitive receivers (residential) being approximately 650 metres from the works.

5.2 Noise Catchment Areas

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

5.2.1 The Bays

The EIS assessment process identified a total of 22 NCAs for the full SMW Project alignment. Review of the EIS assessment process determined that NCAs 19-22 were applicable to The Bays Project area. These are presented in [Table 9](#) with a description of the noise characteristics of each area. NCAs are also presented in [Figure 6](#) and in the Land Use Survey (refer to [Appendix A](#)).

Table 9 NCAs relevant to the Bays site

NCA Reference	Description	Main sources of background noise
NCA19	This catchment is mainly residential. 'Other sensitive' receivers include the Sydney University College of the Arts, Rozelle Community Child Care Centre, and several outdoor recreation areas.	The noise environment is largely influenced by road traffic noise on Balmain Road and from Iron Cove Bridge.
NCA20	located west of Victoria Road at Rozelle. This catchment is comprised of residential receivers, commercial receivers and educational facilities (such as Little Zaks Academy Rozelle).	The noise environment is largely influenced by road traffic noise on Darling Street and Victoria Rd.
NCA21	NCA21 is located north of the Anzac Bridge and east of Victoria Road at Rozelle. This catchment is comprised of commercial/industrial buildings associated with White Bay, Glebe Island and Rozelle Bay. A large commercial area is also located near Robert Street. Large areas of residential receivers are also located to the north west of the catchment. The Bald Rock Hotel is located around 130 metres north of the construction site on Mansfield Street.	The noise environment is largely influenced by road traffic noise on Victoria Rd, Darling Street, and Mullens Street; as well as construction noise from works associated with WestConnex Rozelle interchange along Victoria Rd and at construction areas near White Bay and Rozelle Bay.
NCA22	located south of the Anzac Bridge and is comprised of residential areas near Glebe Point Road and recreation areas including Jubilee Park and Blackwattle Bay Park.	The noise environment is influenced by road traffic noise along the Anzac Bridge.

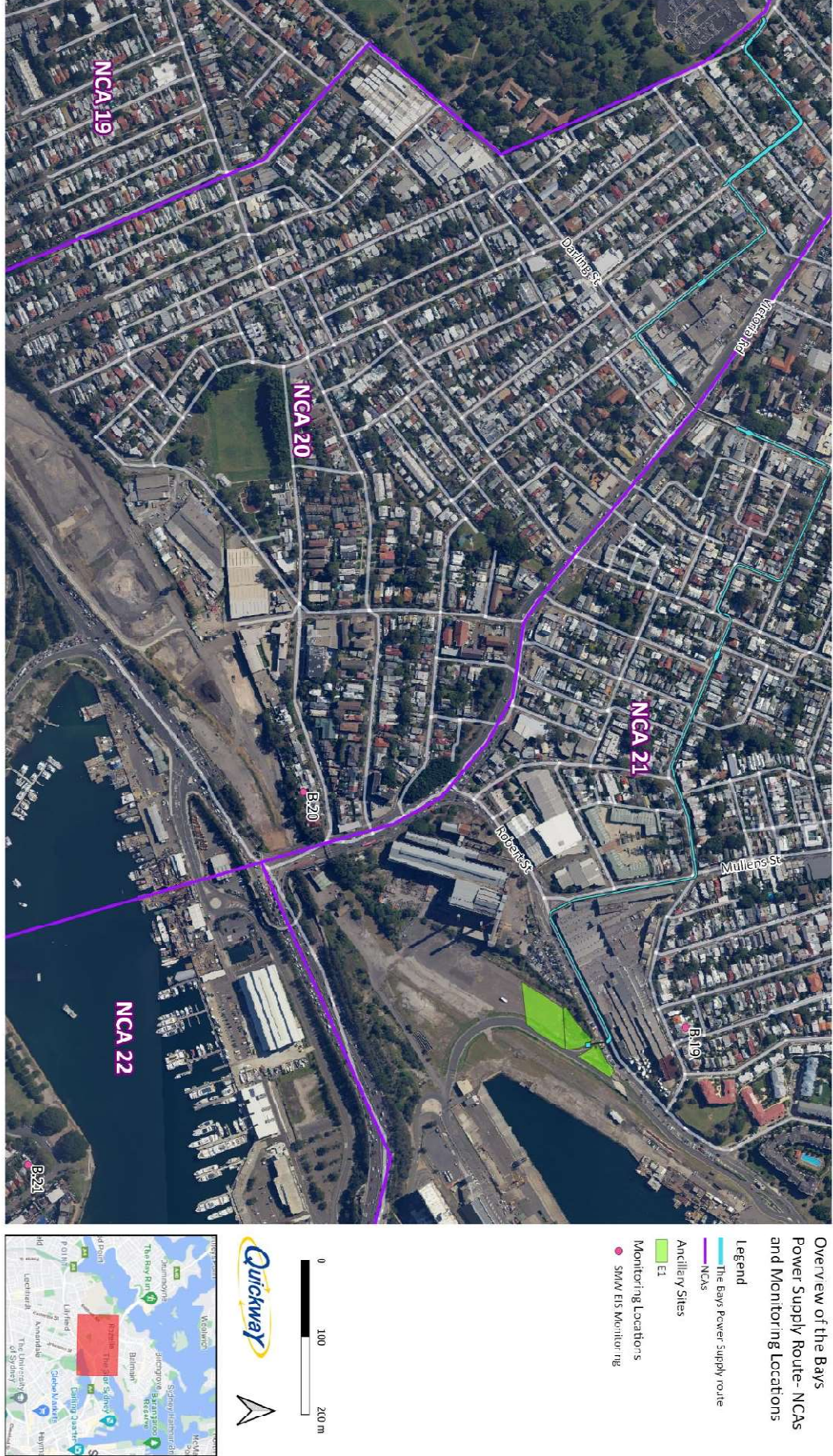


Figure 6 The Bays NCAs

5.2.2 Eastern Creek

Existing noise levels in the proposal site are generally controlled by road traffic noise from distant major roads, including the M4 Motorway and Great Western Highway, along with industrial noise from the surrounding existing industrial/commercial facilities. The NCAs for Eastern Creek Project area are presented in [Table 10](#) with a description of the noise characteristics of each area.

Table 10 NCAs relevant to Eastern Creek

NCA Reference	Description	Main sources of background noise
NCA01	Located west of the project in Erskine Park. This catchment is mostly residential with the nearest receivers about 375 metres to the west of the proposal. A small number of commercial receivers are in this catchment at the Erskine Park Shopping Centre, which is off Shallow Drive.	The noise environment is largely influenced by road traffic noise from the M4 Motorway.
NCA02	Located to the north of the project in Minchinbury, between the M4 Motorway and Great Western Highway. This catchment consists of commercial and industrial receivers to the immediate north of the proposal, and residential receivers to the north-east and north-west. The nearest receivers in this catchment are about 1.7 kilometres away	The noise environment is largely influenced by road traffic noise from the M4 Motorway and the Great Western Highway.
NCA03	Located to the east of the project in Eastern Creek and west of M7 Motorway. This catchment is commercial and industrial. No residential land uses are located within this catchment. The nearest receiver is about 800 metres east of proposal.	The noise environment is largely influenced by road traffic noise from the M4 Motorway and industrial noise associated with the area usage.
NCA04	Located to the south of the project in Erskine Park (to the south-west), Eastern Creek (to the south) and Horsley Park (further south). This catchment is commercial and industrial. The nearest receivers in this catchment are about 800 metres away. No residential land uses are located within this catchment.	The noise environment is largely influenced by industrial noise associated with the area usage.

5.3 Ambient noise

Ambient noise levels were established as part of the EIS and REF through background noise monitoring at representative locations undertaken in 2019, with results summarised for each NCA. Additional background noise monitoring was conducted in 2021 for the Bays site to refine the NCAs outlined in the EIS.

Noise levels in the project area generally display a typical diurnal trend with lower levels during the night-time than the daytime and evening periods (with some exceptions). This is characteristic of urban and suburban areas where the ambient noise environment is primarily influenced by road traffic.

The baseline information was used to establish the Rating Background Level (RBL), which represents the average minimum background sound level for each measurement period, averaged over the measurement days, this is provided in [Table 11](#).

Table 11 RBLs for NCAs at The Bays and Eastern Creek Project areas

Noise Catchment Area (NCA)	Noise level (dBA)		
	Day RBL	Evening RBL	Night RBL
The Bays			
NCA 19			
NCA 20	51	51	45
NCA 21	43	43	35
NCA 22	48	47	39
Eastern Creek			
NCA 1	37	37 ¹ (actual 40)	37 ¹ (actual 39)
NCA 2	41	41 ¹ (actual 45)	41
NCA 3	-	-	-
NCA 4	-	-	-

Note 1: RBL for evening set at no greater than the daytime, and RBL for night-time set no greater than the day or evening following conservative principles outlined in the NPfI.

A review of the EIS noise monitoring data by Quickway found that with additional background monitoring, the NCAs could be improved to better represent the acoustic environment. Additional monitoring may therefore be undertaken by Quickway prior to commencement of the Project and in line with relevant Construction Noise and Vibration Monitoring Program in [Appendix B](#). The results will be added to the CNVMP following relevant review and approval as required.

6. Noise and vibration criteria

The EPA recommends management levels and goals when assessing construction noise and vibration. These are outlined in:

- ICNG
- Sydney Metro Construction Noise and Vibration Standard
- Assessing Vibration: a technical guideline (for human exposure)
- German Standard DIN 4150-3: Structural Vibration - effects of vibration on structures (for structural damage).

Relevant elements of these documents are summaries and discussed in this Chapter.

6.1 Construction noise and assessment objectives

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

The main objectives of the ICNG are to:

- Identify and minimise noise from construction works
- Focus on applying all 'feasible' and 'reasonable' work practices to minimise construction noise impacts

- Encourage construction during the recommended standard hours only, unless approval is given for works that cannot be carried out during these hours
- Reduce time spent dealing with complaints at the Project implementation stage
- Provide flexibility in selecting site-specific feasible and reasonable work practices to minimise noise impacts.

6.2 Construction hours

6.2.1 The Bays

Working hours for The Bays are set by MCoA D35 to D39. Construction hours as approved in MCoA D35 are as follows:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 8:00 am to 6:00 pm
- At no times on Sundays and Public Holidays.

In accordance with MCoA D36 highly noise intensive works that result in an exceedance of the applicable NML at the same receiver will 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 hours, with a minimum cessation of work of not less than one hour.

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

Construction activities which are defined as annoying under the Interim Construction Noise Guideline (ICNG) are defined as 'highly noise intensive works'. These include:

- Using power saws (for cutting timber, masonry, road pavement or steel work)
- Grinding metal, concrete or masonry
- Rock drilling
- Line drilling
- Vibratory rolling
- Bitumen milling and profiling
- Jackhammering
- Rock-hammering or rock-breaking
- Impact piling.

Work may also be undertaken outside of approved construction hours would be permitted providing they meet the requirements of MCoA D37 (refer to Section [6.3.3.1](#)), or if they are undertaken as per the Out-of-Hours Work (OOHW) Protocol required under MCoA D38 (refer to Section [6.3.3.2](#)).

A Detailed Construction Noise and Vibration Impact Statement (DNVIS) (refer to [Section 8.1](#)) will also be prepared for the Project to identify potential noise impacts and required mitigation measures both during construction and for OOHW to ensure compliance with relevant standards and criteria.

6.2.2 Eastern Creek

The approved working hours for the Eastern Creek site are the standard construction hours as defined by the Sydney Metro CNVS:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 8:00 am to 1:00 pm
- At no times on Sundays and Public Holidays.

No out of hours works were anticipated as part of the Project. If out of hours works are required Quickway would follow the Out of Hours Works Assessment Protocol in [Appendix C](#) to obtain the necessary approvals.

6.3 Quantitative noise assessment criteria

6.3.1 Interim Construction Noise Guideline (DECC, 2009)

Table 2 of the ICNG (table 1 of the CNVS), reproduced in [Table 12](#) below, shows how Noise Management Levels (NMLs) at residences are determined and how they are to be applied.

Table 12 Noise Management Levels at Residential Receivers

Time of Day	Noise Management Level $L_{Aeq(15min)}^2$	How to Apply
Standard hours ¹ : Monday to Friday 7 am to 6 pm Saturday 8.00 am to 6.00 pm (the Bays) Saturday 8.00 am to 1.00 pm (Eastern Creek)	RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent would also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent would consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent would communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

Time of Day	Noise Management Level $L_{Aeq} (15min)^2$	How to Apply
Outside recommended standard hours	Noise affected RBL + 5 dB(A)	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent would negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG.</p>

Note 1: Standard hours are taken from the SSI Project Approval for The Bays Project area and the Project Approval for the Eastern Creek Project area.

Note 2: Noise levels apply at the property boundary that is most exposed to construction noise. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise affected point within 30 m of the residence.

The RBL is used when determining the NML and is the overall single-figure background noise level measured in each relevant assessment period (as defined in the EPA's Noise Policy for Industry dated October 2017). NMLs apply only when the property is being used, for example, classrooms during school hours. Internal noise levels are to be assessed at the centre of the occupied room. External noise levels are to be assessed at the most-affected point within 50 m of the area boundary. The difference between the internal noise level and the external noise level is typically 10 dB with windows open for adequate ventilation, as detailed within the ICNG. This figure has been adopted by this plan.

Non-mandatory NMLs for non-residential properties which are sensitive to noise impacts are presented in [Table 13](#). These values are established on the principle that the typical activities for each use would not be unduly disturbed by the proposed allocated NML.

The NML for commercial and industrial premises are defined as per the land use in [Table 13](#) and are assessed at the most affected point of the premises.

Other noise-sensitive businesses require separate specific noise goals and it is suggested in the ICNG that the internal construction noise levels at these premises are to be referenced to the 'maximum' internal levels presented in AS 2107. Recommended 'maximum' internal noise levels from AS 2107 are reproduced in [Table 13](#) for other sensitive receiver types.

Table 13 Noise at sensitive land uses (non-residential) using quantitative assessment

Land Use	Management Level $L_{Aeq} (15minute)$ (Applies When Land Use is being Utilised)
Classrooms at schools and other educational institutions Hospital wards and operating theatres Places of worship Childcare Centres (internal play/sleep areas)	45 dB(A) (internal) 55 dB(A) (external)
Active recreational areas and Outdoor Childcare playgrounds (such as parks and sports grounds or playgrounds)	65 dB(A) (external)

Land Use	Management Level ^(15minute) (Applies When Land Use is being Utilised)
Passive recreational areas (such as outdoor grounds used for teaching, outdoor cafes or restaurants)	60 dB(A) (external)
Industrial premises	75 dB(A)
Office, retail outlets, small commercial premises	70 dB(A)
Hotel – Bars and lounges (day and evening) ¹	50 dB(A) (Internal)
Hotel – Sleeping areas: Hotels near major roads (night) ¹	40 dB(A) (Internal)
Café (Coffee Bar)	50dB(A) (Internal) 60dB(A) (External)
Bar/Restaurant (Bars and Lounges/Restaurant)	50dB(A) (Internal) 60dB(A) (External)
Library (Reading Areas)	45 dB(A) (Internal)
Recording Studio (Music Recording Studios)	25dB(A) (Internal)
Theatre/ Auditorium (Drama Theatres)	30dB(A) (Internal)

6.3.2 Sleep Disturbance

Maximum noise level events from construction activities during the night-time period can trigger both awakenings and disturbance to sleep stages. In line with the CNVS, the approach to managing events that cause sleep disturbance shall be consistent with the Noise Policy for Industry (EPA, 2017). A detailed maximum noise level even assessment is required where night-time noise levels at a residential location exceed the:

- LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or the
- LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater

The detailed assessment will cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.

Maximum noise level event assessments should be based on the LAFmax descriptor on an event basis under 'fast' time response. The detailed assessment will consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels for night-time activities.

As per MCoA A36, the AA will review all proposed night-time works (with the exception of low risk activities) to determine if sleep disturbance would occur and recommend measures to avoid sleep disturbance or appropriate additional alternative mitigation measures.

6.3.3 Out-of-Hours Works

6.3.3.1 The Bays

In accordance with MCoA D37 work may be undertaken outside the hours specified in the following circumstances:

a) Safety and Emergencies, including:

- i. for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or
- ii. 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.

On becoming aware of the need for emergency work in accordance with (a)(ii) above, the AA, the ER, the Planning Secretary and the EPA must be notified of the reasons for such work. The Proponent must use best endeavours to notify as soon as practicable all noise and/or vibration affected sensitive land user(s) of the likely impact and duration of those work.

b) Low Impact, including:

- i. construction that causes LAeq(15 minute) noise levels:
 - no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and
 - no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and
- ii. construction that causes LAFmax(15 minute) noise levels no more than 15 dB(A) above the rating background level at any residence; or
- iii. construction that causes:
 - continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or
 - intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006).

Note, where any OOHW are proposed under Low Impact, the preparation of a noise and vibration assessment (Section 8) or use of an existing noise and vibration assessment from the DNVIS (refer to Section 8.1), will be required to confirm compliance with the above criteria. This assessment will form part of the preparation of the OOHW Permit (refer to Appendix C). The OOHW Permit will be completed and submitted to the proponent, the AA and ER for review and to confirm compliance with the Low Impact definition.

c) By Approval, including:

- i. where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or
- ii. works which are not subject to an EPL that are approved under an **Out-of-Hours Work Protocol** (refer to **Appendix C**) as required by Condition D38 of this schedule; or
- iii. negotiated agreements with directly affected residents and sensitive land user(s).

d) By Prescribed Activity, including:

- i. tunnelling (excluding cut and cover tunnelling and surface works) are permitted 24 hours a day, seven days a week; or
- ii. concrete batching at the Clyde construction site is permitted 24 hours a day, seven days a week; or
- iii. delivery of material that is required to be delivered outside of standard construction hours in Condition D35 of this schedule to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Five Dock and Westmead construction sites and to / from Burwood North construction site using any roads / streets other than directly from Parramatta Road; or
- iv. haulage of spoil except between the hours of 10:00 pm and 7:00 am to / from the Five Dock and Westmead construction sites and to / from Burwood North construction site using any roads / streets other than directly from Parramatta Road; or
- v. work within an acoustic shed where there is no exceedance of noise levels under Low impact circumstances identified in (b) above.

6.3.3.2 Out of Hours Work Protocol

Where proposed OOHW do not meet the definition of 'Low Impact' under MCoA D37 (b), they must be considered in accordance with an OOHW Protocol as described in MCoA D38.

The OOHW Protocol must be prepared to identify a process for the consideration, management and approval of work which are outside approved construction hours, for works not subject to an EPL. The Protocol must be approved by the Planning Secretary before commencement of the out of hours work.

The Protocol must be prepared in consultation with the ER, AA and EPA. The Protocol must provide:

- a) identification of low and high-risk activities and an approval process that considers the risk of activities, proposed mitigation, management, and coordination, including where:
 - i. the ER and AA review all proposed out-of-hours activities and confirm their risk levels;
 - ii. low risk activities can be approved by the ER in consultation with the AA; and
 - iii. high risk activities that are approved by the Planning Secretary;
- b) a process for the consideration of out-of-hours work against the relevant NML and vibration criteria;

- c) a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition D50 of this schedule. The measures must take into account the predicted noise levels and the likely frequency and duration of the out-of-hours works that sensitive land user(s) would be exposed to, including the number of noise awakening events;
- d) 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; and
- e) notification arrangements for affected receivers for all approved out-of-hours works and notification to the Planning Secretary of approved low risk out-of-hours works.

The above requirements are met through implementing the Out of Hours Works Protocol in [Appendix C](#).

6.3.4 Eastern Creek

There is a possibility that OOOH may occur in order to effectively coordinate adjacent works for the pre-cast yard establishment. As there are no sensitive receivers immediately adjacent it is proposed that this works will proceed as low risk works. If out of hours works are required Quickway would follow the attached Out of Hours Works Protocol in [Appendix C](#) to obtain the necessary approvals.

6.3.5 Noise Management Levels

In accordance with Table 2 of the ICNG, Project-specific construction NML for each NCA have been determined using the measured ambient noise levels (RBLs) described in [Section 5.3](#). These NMLs are presented in [Table 14](#).

As discussed in [Section 5.3](#), review of the EIS noise monitoring data by Quickway found that there is opportunity to improve the NCAs through additional background noise monitoring. Additional monitoring may therefore be undertaken by Quickway prior to commencement of the Project and in line with relevant guidance described in [Appendix B](#). The results will be added to the CNVMP following relevant review and approval as required.

Table 14 Project Noise Management Levels

NCA	Noise Monitoring Location	Noise Management Level dB(A)			
		Approved Hours	OOHW		
			Day	Day ^{2, 3}	Evening
The Bays					
19	-	46	41	41	38
20	22 Lilyfield Road, Rozelle	61	56	56	50
21	21 Mansfield Street, Rozelle	53	48	48	40
22	-	58	53	52	44
Eastern Creek					
1	82 Weaver Street, Erskine Park	47	42	42	42
2	8 Farrington Street, Minchinbury	51	46	46	46
3 ¹	-	75	-	-	-
4 ¹	-	75	-	-	-

Note 1: No residential receivers in the NCA

Note 2: Daytime out of hours is 8 am to 6 pm on Sunday and public holidays for the Bays

Note 3: Daytime out of hours is, 1pm to 6pm on Saturday and 8am to 5pm on Sunday and public holidays for Eastern Creek

6.3.6 Ground-Borne noise

Ground-borne (regenerated) noise is noise generated by vibration transmitted through the ground into a structure. Ground-borne noise caused, for example by underground works such as tunnelling, can be more noticeable than airborne noise. The following ground-borne noise levels for residences are nominated in the ICNG and indicate when management actions would be implemented. These levels recognise the temporary nature of construction and are only applicable when ground-borne noise levels are higher than airborne noise levels. Any levels exceeding objectives should be considered in the context of any existing exposure to ground-borne noise.

The ground-borne noise management levels are given below:

- Evening (6.00 pm to 10.00 pm) Internal Residential: 40 dB LA_{eq(15minute)}
- Night-time (10.00 pm to 7.00 am) Internal Residential: 35 dB LA_{eq(15minute)}

The evening and night-time criteria are only applicable to residential receivers. The internal noise levels are to be assessed at the centre of the most-affected habitable room. For a limited number of discrete, ongoing ground-borne noise events, such as drilling or rockhammering, The LA_{max} noise descriptor using a slow response on the sound level meter may be better than the LA_{eq} noise descriptor (15 min) in describing the noise impacts. The level of mitigation of ground-borne noise would depend on the extent of

impacts and also on the scale and duration of works. Any restriction on the days when construction work is allowed would take into account whether the community:

- Has identified times of day when they are more sensitive to noise (for example Sundays or public holidays).
- Is prepared to accept a longer construction duration in exchange for days of respite.

There is no guidance in the ICNG for acceptable ground-borne noise levels in commercial and other potentially sensitive receivers. However, the following has been applied as an initial screening approach for commercial and potentially sensitive other receivers in use outside daytime hours:

- Where an external ICNG NML applies, a level of 10 dB(A) below the NML has been adopted. This is based on the assumption that a 10 dB(A) noise reduction typically applies from external to internal for partially open windows as described in the NSW Road Noise Policy; or
- Where an internal ICNG NML applies, the objective for ground borne noise has also been set at this internal NML level.

These objectives are summarised in [Table 15](#).

Table 15 Ground-borne noise objectives

Time	Ground-borne noise objectives
Residential Receiver	
Evening (6 pm to 10 pm)	40 dB(A) L_{Aeq} (15 min)
Night-time (10 pm to 7 am)	35 dB(A) L_{Aeq} (15 min)
Commercial and other receivers	
Evening and Night (when in use)	10 dB(A) below ICNG external target or ICNG/AS2107 internal target

6.4 Vibration

Approval condition MCoA D39 requires that the project be constructed with the aim of achieving the following vibration goals:

- For structural damage, the vibration limits set out in the German Standard *DIN 4150-3: Structural Vibration – effects of vibration on structures*;
- The vibration limits set out in the British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings Part 2 – Guide for measurement of vibration and evaluation of their effects on buildings (as they are “applicable to Australian conditions”);
- For human exposure, the acceptable vibration values set out in *Environmental Noise Management Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006);

Further details of each of these references are provided below.

6.4.1 Vibration Criteria

Construction vibration is associated with three main types of impact:

- Disturbance to building occupants
- Potential damage to buildings
- Potential damage to sensitive equipment in a building.

Generally, if disturbance to building occupants is controlled, there is limited potential for structural damage to buildings.

6.4.2 Human exposure to vibration

Tactile vibration potentially disturbing human occupants of buildings is managed by reference to Assessing Vibration; a technical guideline (DECC, 2006). This document provides criteria which are based on the British Standard BS 6472-2008 Evaluation of human exposure to vibration in buildings (1-80Hz).

Vibration sources are defined as Continuous, Impulsive or Intermittent. [Table 16](#) provides a definition and examples of each type of vibration.

Table 16 Types of vibration

Types of vibration	Definition	Examples
Continuous	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as roadheader excavation).
Impulsive	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing the duration is short (typically less than 2 seconds)	Infrequent: Activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, they would be assessed against impulsive vibration criteria.

Preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in [Table 17](#).

Table 17 Preferred and maximum levels for human comfort (continuous and impulsive vibration)

Location	Assessment period ¹	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration ³ (weighted rms Acceleration, m/s ² , 1-80Hz)					
Critical areas ²	Day or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
Workshops	Day or night-time	0.04	0.029	0.080	0.058
Impulsive vibration ³ (Weighted rms Acceleration, m/s ² , 1-80Hz)					
Critical areas ²	Day or night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Notes:

1. Daytime is 7.00am to 10.00pm and night-time is 10.00pm to 7.00am
2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Stipulation of such criteria is outside the scope of their policy and other guidance documents (eg. relevant standards) and should be referred to. Source: BS 6472-2008
3. Source: Table 2.2, Assessing Vibration; a technical guideline, Department of Environment and Climate Change 2006.

When assessing intermittent vibration, the vibration dose value (VDV) is used. VDV accumulates the vibration energy received over the daytime and night-time periods. As such, the vibration dose value is dependent upon the level and duration of the short term vibration event, as well as the number of events occurring during the daytime or night-time period.

The vibration dose values recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected are presented in [Table 18](#).

Table 18 Vibration Dose Value Ranges above which various degrees of Adverse Comment may be expected in Residential Buildings

Place and Time	Low Probability of Adverse Comment (m/s ^{1.75})	Adverse Comment Possible (m/s ^{1.75})	Adverse Comment Probable (m/s ^{1.75})
Residential buildings 16 hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hr night	0.13	0.26	0.51

6.4.3 Structural damage to buildings

There is no current Australian Standard for assessing structural building damage caused by vibration.

Potential damage of buildings and structures by vibration is typically managed by ensuring vibration at the structure does not exceed limits and standards described in British Standard 7385: Part 2. In addition, guidance values in German Standard DIN 4150-3, are generally used in reference to heritage structures and items.

British Standard BS 7385: Part 2 'Evaluation and measurement of vibration in buildings' can be used as a guide to assess the likelihood of building damage from ground vibration. The standard suggests levels at which 'cosmetic', 'minor' and 'major' categories of damage might occur. Damage consists of minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load-bearing walls. 'Minor' damage is considered possible at vibration magnitudes which are twice those given and 'major' damage to a building structure may occur at levels greater than four times those values.

BS 7385 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4 Hz to 250 Hz, being the range usually encountered in buildings. At frequencies below 4 Hz, a maximum displacement value is recommended. The values set in the standard relate to transient vibrations and to low-rise buildings. Continuous vibration can give rise to dynamic magnifications due to resonances and may need to be reduced by up to 50 per cent. [Table 19](#) sets out the BS 7385 safe limits for cosmetic damage.

Table 19 BS 7385 cosmetic damage safe limits

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Un-reinforced 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

For most construction activities involving intermittent vibration sources such as rock hammers, 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, the following vibration level (PPV) has been adopted as the assessment criteria for sound structures:

- Reinforced or framed structures – 25 mm/s
- Unreinforced or light framed structures – 7.5 mm/s.

For assessment purposes, a conservative vibration damage screening level of 7.5 mm/s has been adopted for sound structures to identify where further investigation is required.

For structures 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 done during detailed design to determine the applicable safe vibration level and approach to construction near the structure.

As per MCoA D45, owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before works that generate vibration commences in the vicinity of those properties. Additionally, 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. The process for detailed understanding of impact and impact duration is via the DNVIS (refer to Section 8.1) and for community notification is detailed in the OCCS.

Based on the above screening criteria, an indication of heritage items at risk of exceedance are provided in Appendix G with an allowance for two hammer sizes included. This information will be refined as part of the DNVIS process (refer to Section 8.1). Vibration testing will be undertaken during activities that have the potential to exceed the screening criteria, to validate minimum working distances to prevent cosmetic damage; refer to the Noise and Vibration Monitoring Program for more detail (Appendix B).

6.4.4 Heritage items

Heritage items are considered on a case-by-case basis, and care should be taken as these structures can be difficult to repair in the case of damage. It should be noted that British Standard BS 5228-2:2009 states that 'a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive' (p.39) when compared to other structures.

In accordance with MCoA D49 a conservative vibration damage screening level of 2.5 mm/s has been adopted for heritage structures until such time as it can be confirmed that the building is structurally sound. This includes heritage structures within the White Bay Power Station Heritage Curtilage. Note, exceedance of this criteria does not necessarily reflect that there would be a vibration impact on the structure if this level is exceeded, instead it is a suitable vibration level that is used as part of the construction vibration management process to trigger further investigation on building stability.

The general approach to managing potential vibration impacts on heritage items would be to:

- 1) Identify heritage items where the 2.5 mm/s peak component particle velocity objective may be exceeded during specific construction activities
- 2) Carry out a structural engineering report on identified heritage items, to confirm structural integrity of the building and confirm if item is 'structurally sound'

- 3) Adopt the appropriate screening level from BS7385 Part 2 if the item was confirmed as 'structurally sound', or
- 4) Adopt the more conservative cosmetic damage level of 2.5 mm/s peak component particle velocity if the item was confirmed as 'structurally unsound'.

Based on the above screening criteria, an indication of heritage items at risk of exceedance are provided in Appendix G with an allowance for two hammer sizes included. This information will be refined as part of the DNVIS process (refer to Section 8.1). Vibration testing will be undertaken during activities that have the potential to impact structurally sensitive (i.e. structurally unsound) heritage items, to validate minimum working distances to prevent cosmetic damage; refer to the Noise and Vibration Monitoring Program for more detail (Appendix B). Vibration monitoring would be undertaken at White Bay Power Station, and other heritage assets at the request of the asset owners where feasible and reasonable.

In the event that the vibration testing and attended monitoring shows that the preferred values for vibration are likely to be exceeded, all vibration generating works will cease pending a revised construction methodology or alternative measures being implemented to reduce vibration to within the required criteria. This would include all construction affecting settlement as required under MCoA D63.

Advice from a heritage specialist will be obtained on methods and locations for installing equipment used for vibration, movement and noise monitoring at heritage-listed structures, prior to monitoring commencing.

6.4.5 Damage to vibration-sensitive equipment

Some high technology manufacturing facilities, hospitals and laboratories use equipment that is highly sensitive and susceptible to vibration, for example scanning electron microscopes and micro-electronic manufacturing facilities. In addition, buildings housing sensitive computer or telecommunications equipment may require assessment against stricter criteria than those nominated for building damage.

There is no explicit guidance on acceptable vibration levels for sensitive equipment, so recommended vibration levels should be obtained from instrument manufacturers. In the absence of equipment-specific data provided by manufacturers, there are generic Vibration Criterion (VC) curves can be used.

[Table 20](#) summarises a range of suitable vibration limits that are applicable to buildings housing vibration-sensitive equipment which may potentially be affected by construction works associated with the project.

Table 20 Acceptable vibration limits on building structure housing sensitive equipment

Criterion Curve	Max level (um/sec, RMS)	Detail size (um)	Description of use
VC-A	50	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	12.5	1	A good standard for most lithography and inspection equipment to 1 micron detail size.
VC-D	6	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs and SEMs) and E-Beam systems, operating to the limits of their capability.

Criterion Curve	Max level (um/sec, RMS)	Detail size (um)	Description of use
VC-E	3	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems requiring extraordinary dynamic stability.

6.4.6 Existing rail tunnels

Any development that occurs within a distance of 25 metres horizontally from first reserve (dependent on tunnel dimensions), as defined in Asset Standards Authority (ASA) standard Development Near Rail Tunnels (ASA 2018), must consider vibration impacts on existing rail tunnels. The assessment requirement is a maximum peak particle velocity (PPV) of 15 mm/s at the tunnel lining for brick or mass concrete in good condition, or maximum PPV of 20 mm/s at the tunnel lining for cast iron, steel or concrete segment lining.

6.4.7 Damage to buried utilities

Section 5.3 of DIN 4150: Part 3 sets out guideline values for vibration velocity to be used when evaluating the effects of vibration on buried pipework. These values, which apply at the wall of the pipe, are reproduced and presented in [Table 21](#). As part of detailed design, these vibration limits would be considered to minimise the potential for damage to buried utilities from vibration impacts.

Table 21 Acceptable vibration limits for effects of short-term vibration on buried pipework

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

Notes:

1. Consideration must also be given to pipe junctions within the building structure as potential substantial changes in mechanical loads on the pipe must be considered.

For long-term vibration, the vibration limits presented in [Table 21](#) should be halved.

Recommended vibration goals for electrical cables and telecommunication utilities such as fibre optic cables range from 50 mm/s to 100 mm/s. Although cables may sustain these vibration levels, the utilities they are connected to, such as transformers and switch blocks, may not. If such equipment is encountered during the construction process, an individual vibration assessment would be carried out addressing impact on the utility, and consultation with the utility provider, to confirm specific vibration requirements.

6.4.8 Safe working distances for vibration intensive plant

The propagation of vibration emitted from a source is site-specific, with the level of vibration potentially experienced at a receiver dependent on the vibration energy generated by the source, the main frequencies of vibration, the localised geotechnical conditions and the interaction of structures and features which can dampen vibration.

As per section 4.1.6 of the CNVS, validation monitoring would be undertaken at the start of any new activity to determine site specific safe working distances for the project.

7. Environmental aspects and impacts

7.1 Construction activities

The Project is located across two areas in the Greater Sydney Region:

- The Bays: Begins at the Manning St Substation in Rozelle, and extends for approximately two kilometres, ending at Robert St adjacent to White Bay ([Figure 1](#)).
- The Eastern Creek Pre Cast Yards located along Lenore Drive and extends for less than 200 metres along this road ([Figure 2](#)).

The Project will involve a number of activities incorporating various heavy machinery, plant and equipment that will operate in a number of locations across the Project. In order to assess the level of potential impact on noise and vibration sensitive receivers, the broad categories of construction activity likely to interact with these receivers are identified in [Table 22](#).

Table 22 Overview of construction activities at Eastern Creek and the Bays

Component	Typical Activities
Site establishment and enabling works (where permitted under MCoA framework)	<ul style="list-style-type: none"> • Traffic management measures • Install safety and environmental controls • Install site fencing and hoarding • Establish temporary noise attenuation measures • Carry out site clearing • Heritage salvage or conservation works (if required) • Establish construction ancillary facilities and access • Establish temporary pedestrian and cyclist diversions as required.
Civil Work	<ul style="list-style-type: none"> • Trench and install conduits • Installation of cable pulling pits • Installation of thrust bore receiving pit • Excavation for HDD under bore • Excavation of joint bays • Backfilling of excavated areas
Cable work	<ul style="list-style-type: none"> • Install cables through conduits using infrastructure set up in civil work.

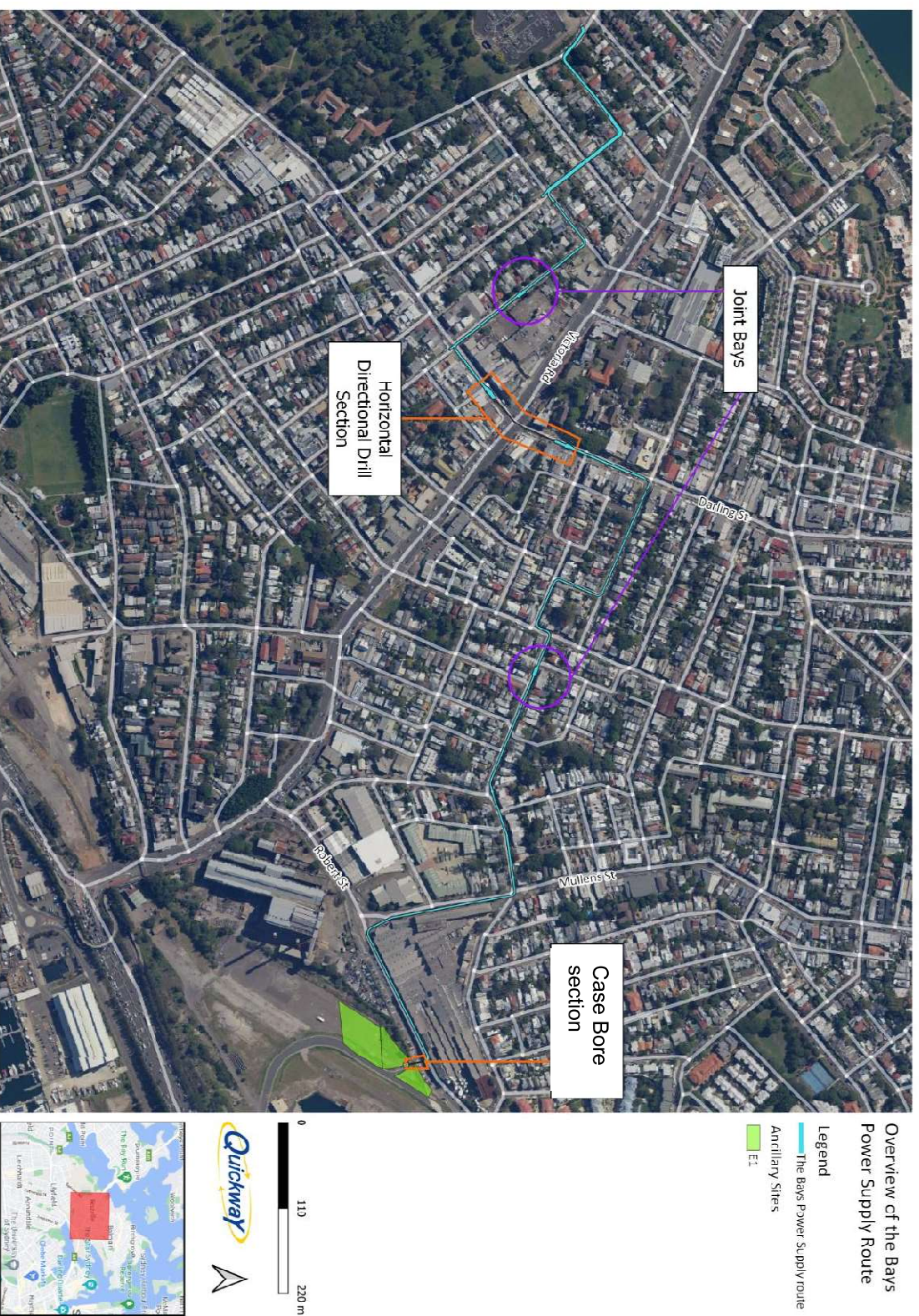


Figure 7 Overview of the Bays Power Supply Route



Figure 8 Overview of the Power Supply route at the Pre-Cast Yard at Eastern Creek

7.2 Impacts

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

- The type of equipment in use
- The number of equipment simultaneously in use
- Proximity to sensitive receivers
- Topography and other physical barriers
- Hours/duration of construction works
- Ground conditions
- The physical condition of the structure the receiver is in
- Presence of existing background noise (e.g. from heavy traffic areas).

Relevant aspects and the potential related impacts from noise and vibration identified in the Approval documents are presented below. These are general in nature as the Power Supply Works were not the focus of these approvals.

In accordance with MCoA D43 and D44, a DNVIS will be prepared to supplement the CNVMP and refine impact predictions presented in the EIS.

7.2.1 The Bays

The assessment undertaken as part of the EIS noted that noise impacts associated with utility works would be temporary and would move progressively along the utility service corridor resulting in impacts at particular receivers for only a limited period of time.

Relatively high noise impacts are likely where noise intensive plant items are required near adjacent receivers. On typical streets where the closest receivers are about 15 metres from the road, noise levels between 80 to 86 dBA are possible when noise intensive plant items are in use.

7.2.2 Where night-time works are required, worst-case exceedances of greater than 25 to 30 dB above NML are likely where noise intensive plant items are in use. Eastern Creek

The assessment undertaken as part of the REF shows the construction works are anticipated to comply with the relevant criteria with the exception of a minor exceedance of the NMLs in NCA01 during the noisiest scenario which is Site Establishment – Earthworks. This potential exceedance would be experienced by a small number of residential receivers (those closest to the site) for a short period of time during daytime when earthworks are occurring.

The predicted levels of construction noise would be similar to the existing ambient levels of noise in the catchment.

8. Construction noise and vibration assessment

8.1 DNVIS

In accordance with MCoA D43 and D44, a DNVIS will be prepared to supplement the CNVMP and refine impact predictions presented in the EIS, through the use of the Projects predictive modelling tool and taking into consideration actual construction methodologies, plant and equipment, location and duration. The DNVIS will be prepared by an appropriately qualified and experienced acoustic consultant prior to the triggers identified in MCoA D43, being:

- any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in MCoA D39 and D40 at any residence outside construction hours identified in MCoA D35
- where receivers will be highly noise affected (at any time).

The DNVIS will be provided to the ER for review and to the AA for review and endorsement prior to the commencement of associated works. In accordance with the MCoA A36, work that trigger the DNVIS cannot proceed until the DNVIS is endorsed by the AA.

The DNVIS will be a key site management tool that will give Quickway clear instructions for managing noise and vibration by providing activity specific noise and vibration predictions and specific mitigation measures identified through consultation with affected sensitive land user(s) to be implemented for the duration of the works. The DNVIS will also provide data for the Quickway OOHW Permit which will demonstrate compliance regarding the assessment of OOHW activities. Further detail is provided in the OOHW Protocol, attached as [Appendix C](#).

The DNVIS will address:

- Scope of work covered by DNVIS
- Nearest noise and vibration sensitive receivers, based on land use survey
- Construction noise and vibration objectives
- Construction noise and vibration assessment
- Mitigation options and preferred management measures
- Activity specific noise and vibration monitoring requirements additional to those outlined in the Noise and Vibration Monitoring Program ([Appendix B](#))

Monitored noise and vibration levels will be analysed against the predictions made in the relevant DNVIS or using the Project's predictive tools, incorporating standard project mitigation measures as described in the CNVMP. This will allow a like-for-like comparison of actual and predicted noise levels (incorporating relevant mitigation measures) and will allow for ongoing review, verification and, where required, amendment of the predictive model.

Monitoring will be compared against the predictive modelling rather than the EIS to ensure relevant reasonable and feasible mitigation measures are included consistently within the model and on the ground.

DNVIS's will be prepared in consideration of the ICNG, Assessing Vibration: A Technical Guideline and German Standard DIN 4150, Part 3: Structural Vibration in Buildings: Effects on Structures and the Project Approvals.

8.2 Ongoing impact assessment

Assessment of noise and vibration impacts during the project will be undertaken at three key stages, which are described in further detail in the next sections:

1. Risk assessment within this CNVMP – high level assessment for establishing appropriate control measures.
2. Where works may exceed the noise management levels, vibration criteria and/or ground-borne noise levels at any residence outside approved construction hours or where receivers will be highly noise affected, detailed noise and vibration impact statements (DNVIS) would be prepared prior to commencement of those works.
3. During planning for out-of-hours works and works not included in the NVMP or DNVIS. This will be completed using project-specific noise and vibration assessment tools, which have been developed by the project acoustic consultant and utilised by the project team

8.2.1 Project-specific noise and vibration assessment tools

Where any variations to the activities or locations in the DNVIS are proposed during the Project, such as out-of-hours work (as per out-of-hours protocol in Appendix C) or works outside the project footprint, Quickway would use the noise and vibration self-assessment tool KNOWnoise™.

This tool is developed for specific projects by acoustic consultants Hutchison Weller and allows the project team to plan its works quickly and accurately with noise and vibration impacts as key input.

Use of KNOWnoise for planning of works will allow early impact prediction, better construction planning and early informed impacted receivers. More detail on KNOWnoise is provided in [Appendix E](#).

Verification of the prediction tool will occur throughout construction via monitoring. Noise and vibration monitoring data will be collected in accordance with the Noise and Vibration Monitoring Program ([Appendix B](#)). This feedback will ensure the prediction tool is suitably accurate various sections of the project.

9. Environmental Control Measures

In accordance with MCoA D39, reasonable and feasible noise mitigation measures (such as those listed within Chapter 6 of the ICNG and Section 5 of the CNVS) will be implemented with the aim of achieving the noise and vibration criteria specified in [Section 5](#) of this plan. The proposed reasonable and feasible noise mitigations are included in the following sections.

9.1 Mitigation Measures

In accordance with MCoA D58, the Project must be constructed with the objective of minimising impacts to, and interference with, third party property and infrastructure, and that such infrastructure and property is protected during construction. The process of identification, protection methods, and specific vibration criteria (where relevant) is ongoing and undertaken in consultation with the asset owners.

In accordance with MCoA D59, the services potentially affected by construction must be identified to determine requirements for diversion, protection and / or support. In general, due to the location of the trenching alignment specifically utilised existing underground utilities corridors, works along the

alignment will be in close proximity to existing utilities and services. In some locations the proposed alignment crosses existing utilities, these are identified in [Table 23](#).

Alterations to services will be determined by negotiation with the service providers. This will be managed in accordance with the specific process of the asset owner, and as identified in the Project Interface Management Plan. Disruption to services resulting from construction will be avoided, wherever possible, and advised to customers where it is not possible.

Table 23 Services potentially affected by construction.

Location & Asset Owner	Details on asset and Project activity
<p>Approx. CH.585m</p> <p>Corner of Waterloo St & Darling St, Balmain.</p> <p>Sydney Water DN525 & DN375 Watermains</p>	<ul style="list-style-type: none"> • DN525 and DN375 CICL pipe, presumably lead-jointed, was constructed in 1916 and 1937 respectively. • Both pipes will be prone to damage/defect when constructing close to. Lead-jointed cast iron pipes are vulnerable to damage by small ground movement. Also, aggressive soil and groundwater would erode/attack the external protective coating over time. • The following options for crossing of these services are being explored, in consultation with the service provider include but not limited to; <ul style="list-style-type: none"> - Open Cut Excavation Under Shutdown / Depressurization - Asset Relocation / replacement - Bed Bore • Consultation is being conducted as part of the Sydney Water Building Over and Around (BOA) applications
<p>Approx. CH.1520m</p> <p>Mansfield St, Balmain</p> <p>Sydney Water Beattie Street Stormwater Culvert</p>	<ul style="list-style-type: none"> • Heritage listed stormwater culvert • Transition of conduits from a "2x3 conduit formation" to a "3x2 conduit formation" with an approved reduced clearance over the top of the Beattie St culvert.
<p>Approx. CH.1560m</p> <p>Corner of Mansfield St & Mullens St, Balmain</p> <p>Sydney Water DN450 Watermains</p>	<ul style="list-style-type: none"> • DN450 CICL pipe, presumably lead-jointed, was constructed in 1897. • The pipes will be prone to damage/defect when constructing close to. Lead-jointed cast iron pipes are vulnerable to damage by small ground movement. Also, aggressive soil and groundwater would erode/attack the external protective coating over time. • The following options for crossing of these services are being explored, in consultation with the service provider include but not limited to; <ul style="list-style-type: none"> - Open Cut Excavation Under Shutdown / Depressurization - Asset Relocation / replacement - Bed Bore • Consultation is being conducted as part of the Sydney Water Building Over and Around (BOA) applications
<p>Approx. CH.1950m</p> <p>Roberts St, Balmain</p> <p>Sydney Water Beattie Street Stormwater Culvert</p>	<ul style="list-style-type: none"> • Heritage listed stormwater culvert • Dual case bore under stormwater culvert into The Bays Station Site with minimum 1m clearance from top of case bore to underside of Beattie St stormwater culvert

As noted in MCoA D42, industry best practice construction methods must be implemented where reasonably practicable to ensure that noise levels are minimised around sensitive land user(s). Practices must include, but are not limited to:

- a) use of regularly serviced low sound power equipment;

- b) temporary noise barriers (including the arrangement of plant and equipment) around noisy equipment and activities such as rock hammering and concrete cutting; and
- c) use of alternative construction and demolition techniques.

Further to this, a range of environmental requirements and control measures are identified in the Approval documents as well as Sydney Metro documents. Specific measures and requirements to address the CEMF, MCoA, REMMs, REF-CoA, and MMMs in relation to impacts from noise and vibration are outlined in [Table 24](#). These mitigation measures would be implemented through the following means:

- All employees, contractors and subcontractors are to receive a Project induction which would detail specific noise and vibration mitigation measures
- Additionally, mitigation measures would be regularly communicated through toolbox talks
- Mitigation measures would be referred to during site inspections to be implemented where reasonable and feasible

Table 24 Noise and Vibration mitigation measures

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
All	NV/1	Training will be provided to relevant Project personnel, including relevant sub-contractors on noise and vibration requirements from this plan through inductions, toolboxes and targeted training.	Best Practice	Training records	Prior to construction Construction	Environmental Manager
All	NV/2	All employees, contractors and subcontractors are to receive a Project induction. The environmental component may be covered in toolboxes and will include: <ul style="list-style-type: none"> • Relevant approval conditions • Permissible hours of work • Any limitations on high noise generating activities • Location of nearest sensitive receivers • Construction employee parking areas • Relevant site specific mitigation measures • Appropriate behavioural practices 	Best Practice	Site induction records	Prior to construction Construction	Environmental Manager
The Bays	NV/3	Drivers will be advised of designated vehicle routes, parking locations, acceptable delivery hours specific to the site and other relevant practices (i.e. minimising the use of engine brakes and no extended periods of engine idling).	REMM NV/14	Vehicle movement plans Training records	Construction	Site Supervisor Project Engineer Operator

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
The Bays	NV/5	Air brake silencers would be used on heavy vehicles that access construction sites multiple times per night or over multiple nights.	REMM NV/05	Construction Traffic Management Plan (CTMF)	Construction	Operator Site supervisor
All	NV/4	Out-of-hours deliveries will be minimised where possible.	Best Practice	CTMP	Construction	Site supervisor Project Engineer Operator
All	NV/5	All construction plant and equipment used on site will be fitted with properly maintained noise suppression devices in accordance with the manufacturer's specifications.	Best Practice MCoA D42	Plant inspection records	Construction	Site supervisor
All	NV/6	All construction plant and equipment used on the site will be maintained in an efficient condition.	Best Practice MCoA D42	Plant inspection records	Construction	Site supervisor
All	NV/7	All construction plant and equipment used on the site will be operated in a proper and efficient manner.	Best Practice	Site inspection records Safety observations	Construction	Site supervisor
All	NV/8	Non-tonal movement alarms will be used in place of tonal movementalarms	Best Practice	Plant inspection records	Construction	Project Engineer
All	NV/9	Plant and machinery will be switched off when it is not in use for more than 15 minutes	Best Practice	Site inspection records	Construction	Operators Site supervisor
All	NV/10	Where possible, maintenance work on plant and equipment will be undertaken off site. If maintenance is to be onsite the task will be carried out away from noise sensitive receivers where reasonable and feasible.	Best Practice	Plant inspection records	Construction	Operators Site supervisor

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
All	NV/11	Consider noise when selecting construction methods and substitute for quieter methods where reasonable and feasible.	Best Practice REMM NV/02 MCoA D42	Plant inspection records	Construction	Operators Site supervisor
All	NV/12	Use appropriately sized equipment, avoiding over-powered plant.	Best Practice	Site inspection records	Construction	Project Engineer Site supervisor
The Bays	NV/13	Additional temporary screening or enclosures will be considered for equipment where additional measures are required to meet relevant NMLs.	REMM NV/02	Site inspection records	Construction	Site supervisor
The Bays	NV/14	Stationary noise sources would be enclosed or shielded where reasonable and feasible.	REMM NV/02	Site inspection records	Construction	Site supervisor
The Bays	NV/15	Construction activities associated with the Project will be carried out in accordance with the hours in Section 6.2.	MCoA D35	Site inspection records	Construction	Site supervisor
The Bays	NV/16	Except as permitted by an EPL, highly noise intensive works (as defined in Section 5.2 that result in an exceedance of the applicable NML at the same receiver will only be carried out: <ul style="list-style-type: none"> Between 8:00 am and 6:00 pm Monday to Friday Between 8:00 am and 1:00 pm Saturday In continuous blocks not exceeding three (3) hours each with a minimum respite from those activities and works of not less than one (1) hour between each block. 	MCoA D36	Site inspection records	Construction	Project Manager Project Engineer Site Supervisor Environmental Manager

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
The Bays	NV/17	OOHW is to be carried out in accordance with: <ul style="list-style-type: none"> The Project's Out-of-Hours-Works Protocol (Appendix C) 	MCoA D38	OOHW Permits Site inspection records	Construction	Project Manager Project Engineer Site Supervisor Environmental Manager
The Bays	NV/20	Perimeter site hoarding would be designed with consideration of on-site heavy vehicle movements with the aim of minimising sleep disturbance impacts.	REMM NV/06	Site inspection records	Prior to construction Construction	Site supervisor Project Engineer
The Bays	NV/21	Portable noise barriers would be used around particularly noisy equipment, such as concrete saws	REMM NV/02 MCoA D42	Site inspection records	Prior to construction Construction	Site supervisor Project Engineer
The Bays	NV/22	Site access and egress points will be located as far as feasible and reasonable from noise sensitive receivers.	REMM NV/14	Site inspection records	Prior to construction	Project Engineer Environmental Manager
All	NV/23	Residences / sensitive receivers will be notified of construction activities that are likely to affect their noise and vibration amenity in accordance with the CCS. Information provided will include: <ul style="list-style-type: none"> The types of activities to be undertaken The timing of activities including expected start and finish The location of activities Details of the community information line and how to make an enquiry and/or complaint. 	REF-CoA NV/1 MMM NV/1	Community notifications	Prior to construction Construction	Community Liaison

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
The Bays	NV/24	Noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetable within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.	MCoA D41	Consultation records	Prior to construction Construction	Community Liaison Environmental Manager
The Bays	NV/25	Further engagement and consultation would be carried out with: <ul style="list-style-type: none"> The affected communities to understand their preferences for mitigation and management measures. 'Other sensitive' receivers such as schools, medical facilities or places of worship to understand periods in which they are more sensitive to impacts. Based on this consultation, appropriate mitigation and management options would be considered and implemented where feasible and reasonable to minimise the impacts	REMM NV/01	Consultation records	Prior to construction Construction	Community Liaison Environmental Manager

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
The Bays	NV/26	The use of noise intensive equipment at construction sites with 'moderate' and 'high' out-of-hours noise management level exceedances would be scheduled for approved construction hours, where feasible and reasonable. Where this is not feasible and reasonable, the works would be undertaken as early as possible in each work shift.	REMM NV/04	OOHW Permits	Construction/Prior to any OOHW	Site supervisor Project Engineer
All	NV/27	Detailed Noise and Vibration Impact Statements (DNVIS) must be prepared for any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels at any residence where work is occurring outside approved construction hours or where receivers will be highly noise affected.	MCoA D43 CEMF 12.2b)	DNVIS	Prior to construction Construction	Environmental Manager Noise and Vibration Specialist
All	NV/28	All complaints, including those related to property damage, will be managed in accordance with the CCS.	CCS	Complaints register	Construction	Community Liaison

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
The Bays	NV/29	Owners and occupiers at risk of exceeding the screening criteria for cosmetic damage (as outlined in the DNV/IS) will be notified before works that generate vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owner and occupiers will 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.	MCoA D45	Consultation records	Prior to construction Construction	Community Liaison Project Engineer Project Manager Environmental Manager Noise and Vibration Specialist
The Bays	NV/30	Vibration testing must be conducted during vibration generating activities that have the potential to impact on Heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and attended monitoring shows that the preferred values for vibration are likely to be exceeded, Quickway must review the construction methodology and, if necessary, implement additional mitigation measures. Such measures must include, but not be limited to, review or modification of excavation techniques.	MCoA D46	Monitoring records	Construction	Project Engineer Project Manager Environmental Manager Noise and Vibration Specialist

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
The Bays	NV/31	The likelihood of cumulative construction noise impacts would be reviewed during detailed design when detailed construction schedules are available. Co-ordination would occur between potentially interacting projects to minimise concurrent or consecutive works in the same areas, where possible. Specific mitigation strategies would be developed to manage impacts. Depending on the nature of the impact, this could involve adjustments to construction program or activities of Sydney Metro West or of other construction projects.	REMM NV/18	Consultation records OOHW permits	Construction	Environmental Manager Noise and Vibration Specialist
Eastern Creek	NV/32	Noise monitoring at the most affected receiver(s) would be undertaken at the start of construction works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate, further mitigation measures would be considered and implemented where feasible and reasonable.	REF-CoA NV/2 MMM NV/2	Monitoring records	Construction	Environmental Manager Noise and Vibration Specialist

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
All	NV/33	Appropriate respite would be provided to affected receivers in accordance with the Sydney Metro Construction Noise and Vibration Standard. This would include consideration of impacts from Stage 1 utility and power supply works when determining appropriate respite periods for affected receivers. When determining appropriate respite, the need to efficiently undertake construction would be balanced against the communities' preferred noise and vibration management approach.	REMM NV/03	Monitoring records	Prior to construction Construction	Project Engineer
The Bays	NV/34	Feasible and reasonable measures would be implemented to minimise ground-borne noise where exceedances are predicted. This may require implementation of less ground-borne noise and less vibration intensive alternative construction methodologies.	REMM NV/09	DNVIS	Construction	Environmental Manager
All	NV/35	Select the smallest rock hammers capable of efficiently completing the work, where feasible and reasonable.	Best Practice	Site inspection records	Construction	Site supervisor Project Engineer
All	NV/36	No swearing or unnecessary shouting or loud stereos/radios on site. Dropping of materials from height, throwing of metal items and slamming of doors will also be avoided.	Best Practice	Site inspection records	Construction	Site supervisor Project Engineer

Applicable site	ID	Measure / Requirement	Source of req.	Evidence	When to implement	Responsibility
All	NV/37	The safe working distances for vibration intensive plant would be complied with where feasible and reasonable. This would include the consideration of smaller equipment when working in close proximity to existing structures. Where the safe working distance cannot be achieved vibration monitoring will be carried out.	Best Practice	Site inspection records	Construction	Site supervisor Project Engineer Environmental Manager Noise and Vibration Specialist
The Bays	NV/38	Further assessment of construction traffic would be completed during detailed design, including consideration of the potential for exceedances of the NSW Road Noise Policy base criteria (where greater than 2 dB increases are predicted). The potential impacts would be managed using the following approaches, where feasible and reasonable: <ul style="list-style-type: none"> On-site spoil storage capacity would be maximised to reduce the need for truck movements during sensitive times Vehicle movements would be redirected away from sensitive receiver areas and scheduled during less sensitive times The speed of vehicles would be limited and the use of engine compression brakes would be avoided Heavy vehicles would not be permitted to idle near sensitive receivers. 	REMM NV/14	-	Construction	Sydney Metro

9.2 Additional noise and vibration mitigation measures

In instances where noise levels are still predicted to exceed the NML at receivers after the application of the measures described in [Table 24](#), the CNVS directs that the Project should consider implementing additional mitigation measures where feasible and reasonable, which are included here as [Table 25](#), [Table 26](#) and [Table 27](#), as recommended in the CNVG.

In accordance with MCoA A36, the selection and implementation of feasible and reasonable mitigation measures will be regularly monitored and reviewed by the AA.

Table 25 Triggers for Additional Mitigation Measures- Airborne Noise (Table 16 CNVS)

Time Period		Mitigation Measures			
		Predicted LAeq (15minute) noise level Above NML			
		0 to 10 dB	>10 to 20 dB	>20 to 30 dB	> 30 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	-	LB	LB, M, SN	LB, M, SN
	Sat (8.00 am - 6.00 pm) (the Bays)				
	Sat (8.00 am - 1.00 pm) (Eastern Creek)				
	Sun/Pub Hol (Nil)				
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M	LB, M, SN, RO	LB, M, SN, IB, PC, RO
	Sat (6.00 pm - 10.00 pm) (the Bays)				
	Sat (1.00 pm - 10.00 pm) (Eastern Creek)				
	Sun/Pub Hol (8.00 am - 6.00 pm)				
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB	LB, M, SN, RO	LB, M, SN, IB, PC, RO, AA	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)				
	Sun/Pub Hol (6.00 pm - 7.00 am)				

KEY: **AA**- Alternative Accommodation, **M**- Monitoring, **IB**- Individual Briefings, **LB**- Letter Box Drops, **RO**- Project specific respite offer, **PC**- Phone Calls and Emails, **SN**- Specific notification.

Table 26 Additional Mitigation Measures – Ground Borne Construction Noise (Table 17 CNVS)

Time Period		Mitigation Measures		
		Predicted LAeq (15minute) noise level Above NML		
		0 to 10 dB	>10 to 20 dB	> 20 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	No NML for GBN during standard hours		
	Sat (8.00 am - 61.00 pm) (the Bays)			
	Sat (8.00 am - 1.00 pm) (Eastern Creek)			
	Sun/Pub Hol (Nil)			
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M	LB, M, SN, IB, PC, RO
	Sat (61.00 pm - 10.00 pm) (the Bays)			
	Sat (1.00 pm - 10.00 pm) (Eastern Creek)			
	Sun/Pub Hol (8.00 am - 6.00 pm)			
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB	LB, M, SN, RO	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)			
	Sun/Pub Hol (6.00 pm - 7.00 am)			

KEY: **AA-** Alternative Accommodation, **M-** Monitoring, **IB-** Individual Briefings, **LB-** Letter Box Drops, **RO-** Project specific respite offer, **PC-** Phone Calls and Emails, **SN-** Specific notification.

Table 27 Additional Mitigation Measures - Ground-borne Vibration

Time Period		Mitigation Measures
		Predicted Vibration Levels Exceed Maximum Levels
Standard	Mon-Fri (7.00 am - 6.00 pm)	LB, M, RO
	Sat (8.00 am - 61.00 pm) (the Bays)	
	Sat (8.00 am - 1.00 pm) (Eastern Creek)	
	Sun/Pub Hol (Nil)	
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB, M, IB, PC, RO, SN
	Sat (61.00 pm - 10.00 pm) (the Bays)	
	Sat (1.00 pm - 10.00 pm) (Eastern Creek)Sat	
	Sun/Pub Hol (8.00 am - 6.00 pm)	
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB, M, IB, PC, RO, SN, AA
	Sat (10.00 pm - 8.00 am)	
	Sun/Pub Hol (6.00 pm - 7.00 am)	

KEY: **AA-** Alternative Accommodation, **M-** Monitoring, **IB-** Individual Briefings, **LB-** Letter Box Drops, **RO-** Project specific respite offer, **PC-** Phone Calls and Emails, **SN-** Specific notification.

9.3 Scheduling and Respite

Respite offers, alternative accommodation offers and the requirement to schedule works, both internally and works being undertaken by other projects within the potentially impacted area, to ensure that the intent of the respite periods are not negated, is discussed in the OOHW Protocol as part of the effective management of OOHW.

Programming for works undertaken outside approved hours will also consider works being undertaken by third parties. Where potential programming conflict occurs, respite will be coordinated to ensure agreed respite is provided and works will be scheduled to minimise or avoid any impact to agreed respite due to:

- other works, which may have been approved via other pathways, such as community agreement (MCoA D37(c)(iii)).
- works associated with other major projects or known third parties works which may also reduce the respite provided to the community.

Currently, the primary third party for coordination is the CSSI WestConnex Rozelle Interchange, however it is acknowledged that this is an active area for construction and any new projects will be considered for inclusion in the works coordination process as they are initiated.

Further detail on the strategies of scheduling and respite (being respite offers and alternative accommodation) can be found within the OOHW Protocol (refer to Section 7 of that document). The OOHW Protocol has been prepared as a contractor-specific document, applicable specifically to the works undertaken by Quickway for the power enabling works package.

10. Compliance Management

10.1 Roles and Responsibilities

The organisational structure and overall roles and responsibilities for the Project team are outlined in Section 6.2.1 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of the CEMP.

Of specific relevance is the role of the AA, which has the following responsibilities as defined in MCoA A36:

- (a) receive and respond to communication from the Planning Secretary in relation to the performance of Stage 1 of the CSSI in relation to noise and vibration;
- (b) consider and inform the Planning Secretary on matters specified in the conditions of this approval relating to noise and vibration;
- (c) consider and recommend, to the Proponent, improvements that may be made to avoid or minimise adverse noise and vibration impacts;
- (d) review all proposed night-time works (with the exception of low risk activities) to determine if sleep disturbance would occur and recommend measures to avoid sleep disturbance or appropriate additional alternative mitigation measures;
- (e) review all noise and vibration documents required to be prepared under the conditions of this approval and, should they be consistent with the conditions of this approval, endorse them before submission to the Planning Secretary (if required to be submitted to the Planning Secretary) or before implementation (if not required to be submitted to the Planning Secretary);
- (f) regularly monitor the implementation of all noise and vibration documents required to be prepared under the conditions of this approval to ensure implementation is in accordance with what is stated in the document and the conditions of this approval;
- (g) review the Proponent's notification of incidents in accordance with Condition A43 of this schedule;
- (h) in conjunction with the ER (where required), the AA must:
 - (i) as may be requested by the Planning Secretary or Community Complaints Mediator (required by Condition B8 of this schedule), help plan, attend or undertake audits of noise and vibration management of Stage 1 of the CSSI including briefings, and site visits,
 - (ii) in the event that conflict arises between the Proponent and the community in relation to the noise and vibration performance of Stage 1 of the CSSI, follow the procedure in the Overarching Community Communication Strategy referenced in Condition C-B1 of this schedule to attempt to resolve the conflict, and if it cannot be resolved, notify the Planning Secretary,
 - (iii) if requested by the ER, consider relevant minor amendments made to the Site Establishment Management Plan, CEMP, relevant sub-plans and noise and vibration monitoring programs that require updating or are of an administrative nature, and are consistent with the conditions of this approval and the management plans and monitoring programs approved by

the Planning Secretary and, if satisfied such amendment is necessary, endorse the amendment, (this does not include any modifications to the conditions of this approval),

(iv) if requested by the ER, review the noise impacts of minor ancillary facilities, and

(v) prepare and submit to the Planning Secretary and other relevant regulatory agencies, for information, a Monthly Noise and Vibration Report detailing the AA's actions and decisions on matters for which the AA was responsible in the preceding month. The Monthly Noise and Vibration Report must be submitted within seven (7) days following the end of each month for the duration of the AA's engagement for Stage 1 of the CSSI, or as otherwise agreed by the Planning Secretary.

10.2 Training

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

- Existence and requirements of this Sub-plan
- Normal construction hours and exemptions
- Location of noise sensitive areas
- How to implement noise and vibration management measures

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in noise and vibration management. Examples of training topics include:

- Relevant legislation and guidelines
- Complaints reporting and recording
- The process for seeking approval for out-of-hours works, including consultation
- Specific responsibilities to minimise impacts on the community and built environment from noise and vibration associated with the works

Further details regarding staff induction and training are outlined in Section 6.3 of the CEMP.

10.3 Monitoring and Inspection

Inspections of sensitive areas and activities with the potential generate noise and vibration impacts will occur for the duration of the Project. Requirements and responsibilities in relation to monitoring and inspections are documented in Section 6.7 of the CEMP.

Noise and vibration monitoring will also occur routinely for the duration of the Project, in accordance with the Project's Noise and Vibration Monitoring Program (refer to [Appendix B](#)). Where recommended by a DNVIS, additional monitoring may be required to supplement the Monitoring Program.

Monitored noise and vibration levels will be analysed against the predictions made in the relevant DNVIS or using the Project's predictive tool. Where monitored noise levels are found to be above modelling predictions or vibration goals are exceeded, the following actions will be undertaken:

- Confirm the monitored levels are not being impacted by other noise or vibration sources
- Confirm if the exceedance is due to an uncharacteristically loud piece of equipment
- Identify if the equipment can be swapped out for another piece of equipment or alternative equipment or plant
- Confirm if the exceedance is due to an uncharacteristically vibratory piece of equipment
- Confirm that the modelling reflects the actual activity being undertaken
- Implement other feasible and reasonable measures which may include reducing plant size, modifying time of works, changing operational settings (such as turning off the vibratory function of the machine), and utilising alternative construction methodology or a combination of these
- Review work practices to ensure compliance with the ICNG
- Review and revise mitigation measures as appropriate
- Ensure that the learnings from the above are fed back into the noise modelling assessment process for fine-tuning
- Communicate lessons learnt to relevant personnel.

Quickway will review the work or activity or combination of simultaneous works or activities as soon as practicable and where possible, modify the work or activity to prevent any recurrence. In the case of above prediction monitoring results, the need for modelling to be reviewed will also be considered. Lessons learnt will be communicated to relevant personnel in toolbox talks.

10.4 Complaints

Complaints will be recorded and managed as detailed in Section 6.5.4 of the CEMP.

10.5 Reporting and Records

Reporting requirements and responsibilities are documented in Section 6.8 of the CEMP. Additional reporting will also be generated as required in DNVIS documents. Records will be accessible onsite for the duration of works, will be retained for no less than seven years and will be made available to Sydney Metro upon request.

Specific reports prepared in response to noise and vibration will include:

- The locations and descriptions of monitoring carried out including conditions and equipment used (personnel should also be listed in internal records)
- A tabulation of results (e.g. for noise including L_A (max) and L_{A90} and L_{Aeq} noise levels) together with notes identifying the principle sources and operations
- Records of noise and vibration monitoring results against appropriate NMLs and vibration criteria
- Records of community enquiries and complaints, and the Contractor's response (as part of CCS)
- Summary of any measurements exceeding the nominated criteria, and descriptions of the plan or operations causing these exceedances

- Detail of any corrective actions

10.5.1 Condition Surveys

In accordance with MCoA D60, A suitably qualified and experienced person must undertake condition surveys of all buildings, structures, utilities and the like identified in the documents listed in MCoA A1 at risk of damage before commencement of any work that could impact on the subject surface / subsurface structure. As per the Phasing Report, this requirement has been divided with Quickway being responsible for application for all structures and utilities, with Sydney Metro retaining responsibility for all buildings.

The results of the surveys must be documented in a Pre-construction Condition Survey Report for each item surveyed. Copies of Pre-construction Condition Survey Reports must be provided to the relevant owners within one month before the commencement of the work that could impact on the subject surface / subsurface structure.

This process of condition surveys will be repeated after completion of the work and results documented in a Post-construction Condition Survey Report as per MCoA D61. The Post-construction Condition Survey Reports will be provided to the landowners within three months following the completion of the work.

Where liable, any property damage caused directly or indirectly (for example from vibration or from groundwater change) by the work will be rectified in accordance with MCoA D62.

11. Review and Improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement. This process will be

The continuous improvement process will be designed to:

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

11.1 CNVMP update and amendment

The processes of document review and update are described in Section 6.9 and 6.10 of the CEMP.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 6.8.2 of the CEMP.

Appendix A Land Use Survey

Land Use Survey

This Land Use Survey (LUS) has been prepared for The Bays project areas as required under MCoA D34, which states:

A detailed land use survey must be undertaken to confirm sensitive receivers (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration and construction ground-borne noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area before the commencement of work which generate construction noise, vibration or ground-borne noise in that area. The results of the survey must be included in the Noise and Vibration CEMP Sub-plan required under Condition C5 of this schedule.

To comply with MCoA D34, the LUS has been completed in areas where works could impact on sensitive receivers. Physical ground truthing of sensitive receivers was completed as part of the development of the LUS; where changes occur to local land use or other sensitive receivers are identified throughout the delivery of the Project, the LUS will be revised.

The LUS maps will be used to rapidly identify the nearest noise and vibration sensitive receivers to the Project, and to help inform appropriate mitigation measures to be implemented to minimise impacts to these receivers. The mapping has been highlighted in areas of high noise and vibration intensive activities, being the joint bay locations, which have larger excavation requirements and longer duration of noise and vibration intensive activities. Refer to the Construction Noise and Vibration Management Plan for further detail on works activities along the Project alignment.

The LUS mapping is supported by a full list of sensitive receiver addresses and land use types, which is used for implementing community consultation undertaken in accordance with the Overarching Community Consultation Strategy. A sub-section of this list, showing those non-residential sensitive receivers in order to protect potentially sensitive information, has been included below. Note that all residential receivers are considered to be sensitive receivers for the purpose of the Project.

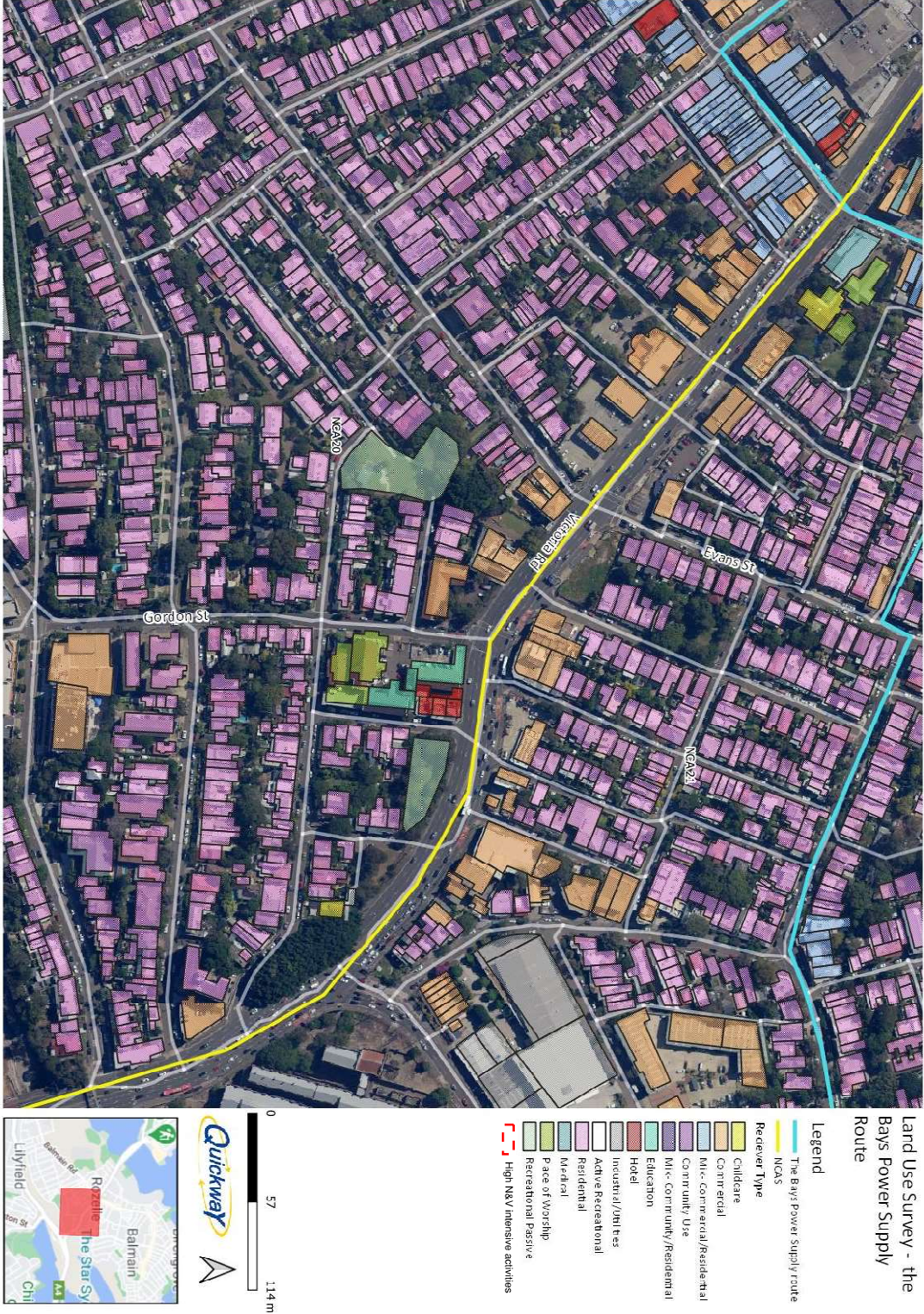
Land Use Survey – The Bays 33kV

Survey conducted: 26/03/2021

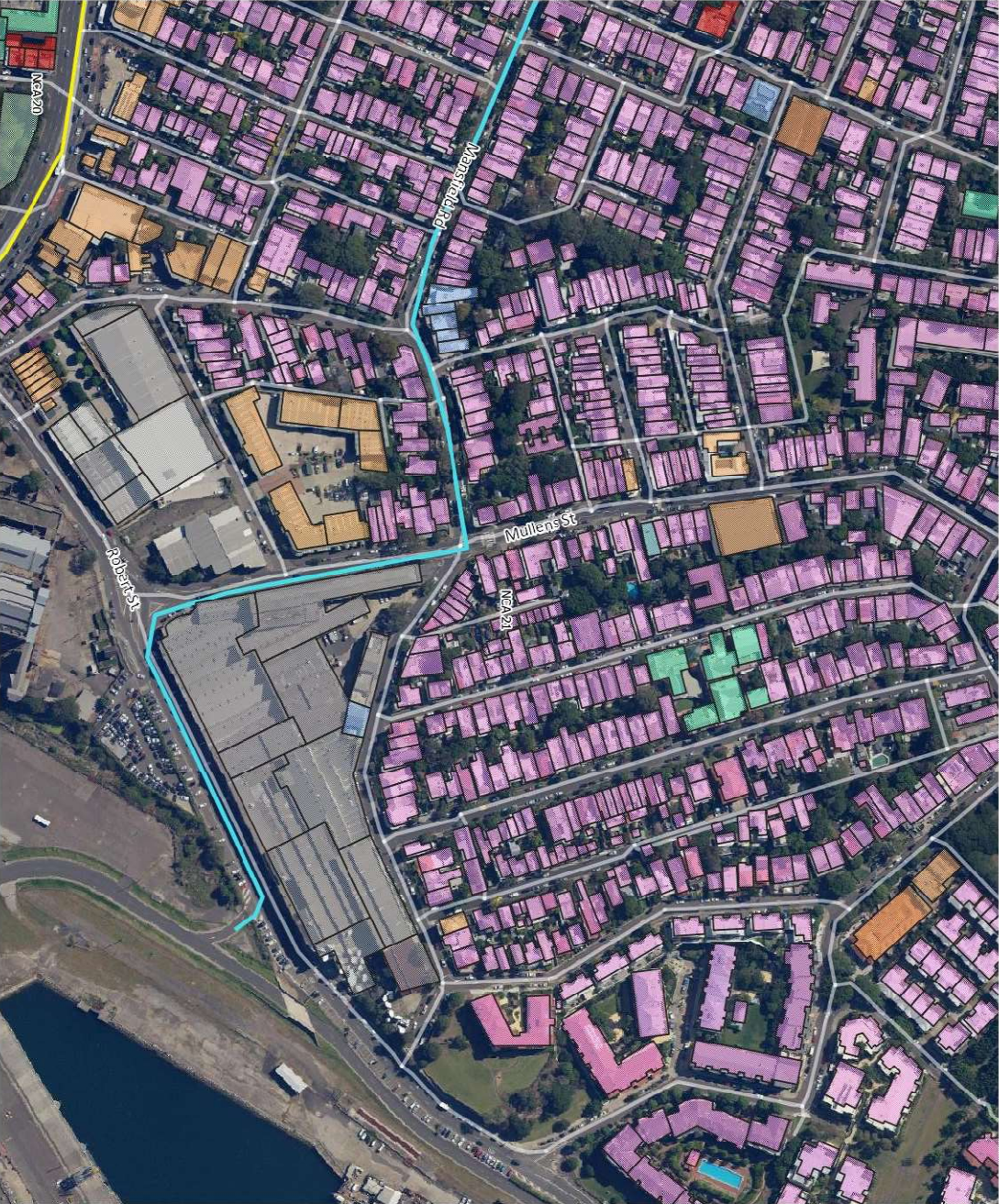
Non-residential sensitive land uses in the study area			
NCA	Description Address	Address	Land use
NCA19	King George Park	KING GEORGE PARK, MANNING ST, ROZELLE NSW, 2039	Recreational Active
NCA19	Rozelle Community Child Care Centre	450 BALMAIN RD, ROZELLE, NSW, 2039	Childcare
NCA19	The Centre for Education and Work Force Development	BUILDING 301 CNR CECILY ST & BALMAIN RD, ROZELLE, NSW, 2039	Education
NCA20	Little Zak's Academy Rozelle	6-8 WATERLOO ST, ROZELLE NSW 2039	Childcare
NCA20	Home based Childcare and Preschool	743 DARLING ST, ROZELLE NSW 2039	Childcare
NCA20	Sydney Montessori Training Centre	756 DARLING ST, ROZELLE NSW 2039	Education
NCA20	Rozelle Neighbourhood Centre Inc.	756 DARLING ST, ROZELLE NSW 2039	Community use
NCA20	Callan Park Hotel	726 DARLING ST, ROZELLE NSW 2039	Hotel
NCA20	Clover Hostel	675-677 DARLING ST, ROZELLE NSW 2039	Hotel/Hostel
NCA20	Sydney Community College	2A-2B GORDON ST, ROZELLE NSW 2039	Education
NCA20	St Joseph's Catholic Church	2A-2B GORDON ST, ROZELLE NSW 2039	Place of Worship
NCA20	Rosebud Cottage Child Care	5 QUIRK ST, ROZELLE NSW 2039	Childcare
NCA20	Hannan Reserve	GRAHAM ST, ROZELLE NSW, 2039	Recreational Passive
NCA20	O'Connor Reserve	QUIRK ST, ROZELLE NSW, 2039	Recreational Passive
NCA20	The Merton	38 VICTORIA RD, ROZELLE NSW, 2039	Hotel
NCA21	The Bridge Hotel	119 VICTORIA RD, ROZELLE NSW, 2039	Hotel
NCA21	Elliot Park	WULUMAY CL, ROZELLE NSW, 2039	Recreational Passive
NCA21	The Evans Street Clinic	111 EVANS ST, ROZELLE, NSW 2039	Medical
NCA21	Rozelle Medical Centre	672 DARLING ST, ROZELLE NSW 2039	Medical
NCA21	Helios Healthcare Centre	54 NELSON ST, ROZELLE NSW 2039	Medical

Non-residential sensitive land uses in the study area			
NCA	Description Address	Address	Land use
NCA21	Melinda Webb- Health Practitioner	154 MULLENS ST, ROZELLE	Medical
NCA21	Soothing Care Dental	667 DARLING ST, ROZELLE	Medical
NCA 21	Complete Smiles- Dentist Rozelle	632 DARLING ST, ROZELLE	Medical
NCA21	St Thomas Childcare Centre	668 DARLING ST, ROZELLE NSW 2039	Childcare
NCA21	Chapel Hill Rozelle Presbyterian Church	665A DARLING ST, ROZELLE NSW 2039	Place of Worship
NCA21	Darling Street Anglican Church	668 DARLING ST, ROZELLE NSW 2039	Place of Worship
NCA21	Rozelle public school	663 DARLING ST, ROZELLE NSW 2039	Education
NCA21	Hannaford Community Centre	608 DARLING ST, ROZELLE NSW 2039	Community use
NCA21	Sackville Hotel	599 DARLING ST, ROZELLE NSW 2039	Hotel
NCA21	Balmain high school	25-33 TERRY ST, ROZELLE NSW 2039	Education
NCA21	City Light Church	482 DARLING ST, BALMAIN NSW 2041	Place of Worship
NCA21	KU Phoenix Preschool	36 EVANS ST, BALMAIN NSW 2041	Education
NCA21	Welcome Hotel	91 EVANS ST, ROZELLE NSW 2039	Hotel
NCA21	Inner Sydney Montessori School	44-46 SMITH ST, ROZELLE NSW 2039	Education
NCA21	Bridgewater Park	BRIDGEWATER PARK, MARGARET ST, ROZELLE NSW, 2039	Recreational Active

Land Use Survey Maps

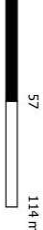


A1: Land Use Survey Map 1

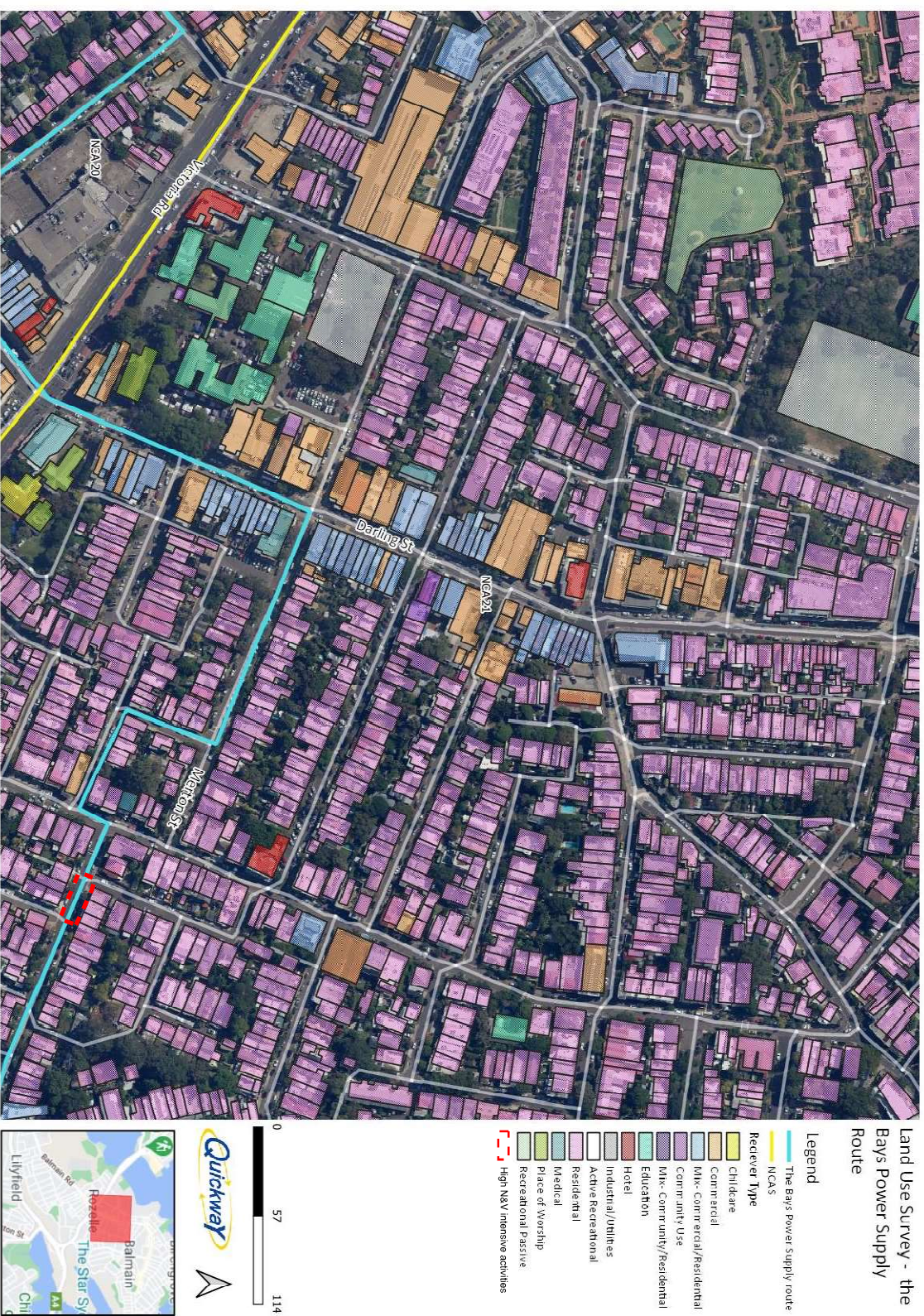


Land Use Survey - the
Bays Power Supply
Route

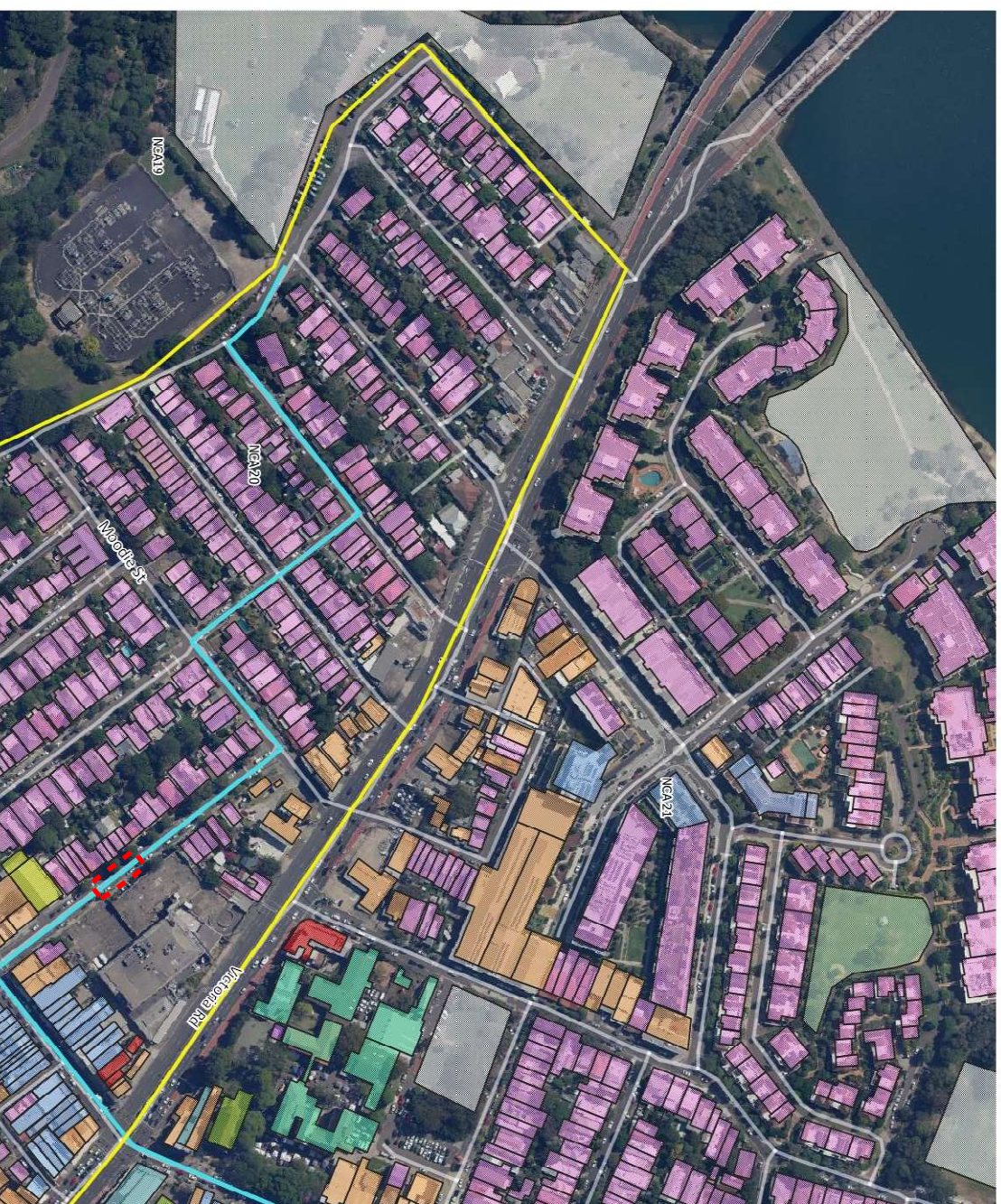
- Legend**
- The Bays Power Supply route
 - NCA's
 - Receiver Type
 - Childcare
 - Commercial
 - Mix-Commercial/Residential
 - Community Use
 - Mix-Community/Residential
 - Education
 - Hotel
 - Industrial/Utilities
 - Active/Recreational
 - Residential
 - Medical
 - Place of Worship
 - Recreational Passive
 - High N&V intensive activities



A2: Land Use Survey Map 2

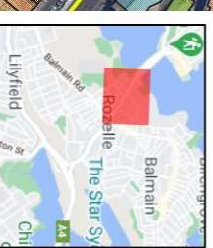
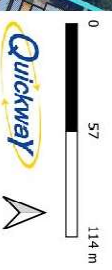


A3: Land Use Survey Map 3

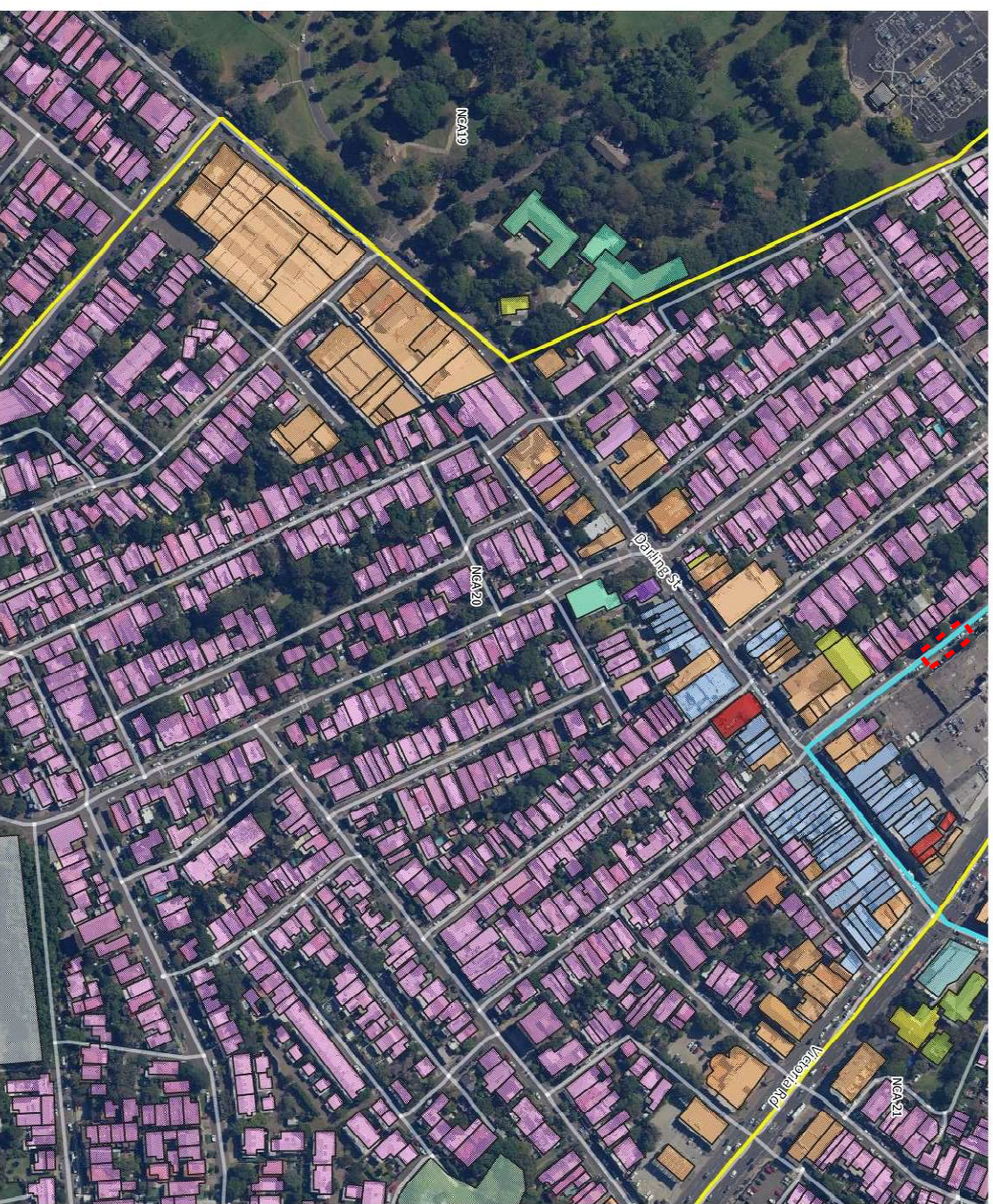


Land Use Survey - the
Bays Power Supply
Route

- Legend**
- The Bays Power Supply route
 - NCA19
 - NCA20
 - NCA21
 - Recreator Type
 - Childcare
 - Commercial
 - Mix: Commercial/Residential
 - Community Use
 - Mix: Community/Residential
 - Education
 - Hotel
 - Industrial/Utilities
 - Active Recreational
 - Residential
 - Medical
 - Place of Worship
 - Recreational Passive
 - High N&V intensive activities

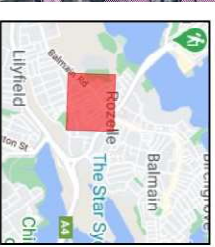
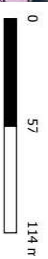


A4: Land Use Survey Map 4



Land Use Survey - the
Bays Power Supply
Route

- Legend**
- The Bays Power Supply route
 - NCAS
 - Receiver Type
 - Childcare
 - Commercial
 - Mix- Commercial/Residential
 - Community Use
 - Mix- Community/Residential
 - Education
 - Hotel
 - Industrial/Utilities
 - Active Recreational
 - Residential
 - Medical
 - Place of Worship
 - Recreational Passive
 - High NAB intensive activities



A5: Land Use Survey Map 5

Appendix B Noise Monitoring Program

B.1 Introduction

B.1.1 Context

This Noise and Vibration Monitoring Program (monitoring program) has been prepared to address the requirements of the Minister's Condition of Approval (MCoA) C14 to C23 and should be read in conjunction with the Noise and Vibration Management Plan (CNVMP) prepared in accordance with MCoA C5.

B.1.2 Scope of the monitoring program

The scope of this monitoring program is to describe how Quickway proposes to carry out noise and vibration monitoring during construction of the Project at the Bays site. Monitoring will be undertaken:

- for modelling verification at sensitive receivers,
- to assess compliance in response to complaints,
- for equipment spot checks,
- where recommended by a DNVIS and in accordance with that document
- as required in the CNVS

Operational noise and vibration monitoring does not fall within the scope of this monitoring program and therefore is not included within the processes contained within this monitoring program.

B.1.3 Purpose and objectives

The purpose of this monitoring program is to describe how Quickway proposes to conduct noise and vibration monitoring during construction of the Project. This monitoring program will apply for the duration of the Project's construction works, unless a longer period is specified by the Secretary of the Department of Planning, Industry and Environment (DPIE).

The key objective of the monitoring program is to ensure all MCoA, environmental management measures and licence/permit requirements relevant to noise and vibration monitoring, as outlined in the EIS are described, scheduled and assigned responsibility.

In accordance with MCoA C20 construction must not commence until the Planning Secretary has approved, or the ER has endorsed this Monitoring Program.

B.1.4 Environmental requirements

The main guidelines, specifications and policy documents relevant to this Monitoring Program include:

- Sydney Metro Construction Noise and Vibration Standard (CNVS) 2020
- NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
- NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
- NSW Noise Policy for Industry, Environment Protection Authority 2017

- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Australian Standard 1055 Acoustics – Description and Measurement of Environmental Noise
- Australian Standard AS/NZS 2107:2016 Acoustics - Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS 2187.2 Explosives - Storage and use - Part 2 Use of explosives
- Australian Standard AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites Australian Standard 2659.1 – 1998 Guide to the use of sound measuring equipment – portable sound level meters
- Australian Standard 2775 Mechanical Mounting of Accelerometers
- Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
- Australian Standard IEC 61672.1 Electroacoustic – Sound Level Meters – Specifications
- British Standard BS 6472-2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)
- British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
- German Standard DIN4150-3:2016 Vibration in buildings – Part 3: Effects on structures
- ISO 3744 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
- ISO 3746 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane
- ISO 6395 Earth-moving machinery - Determination of sound power level - Dynamic test conditions.

B.1.5 Consultation

This monitoring program has been provided to the EPA, Place Management NSW and relevant councils in accordance with MCoA C14 for review and comment.

Community feedback and complaints relating to noise and vibration will be dealt with in accordance with Section 9.4 of the CNVMP and related documents, including the CCS.

In accordance with MCoA C18 with the exception of any Construction Monitoring Programs expressly nominated by the Planning Secretary to be endorsed by the ER, all Construction Monitoring Programs must be submitted to the Planning Secretary for approval. In line with MCoA C19 the Construction Monitoring Programs not requiring the Planning Secretary's approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all other relevant requirements.

B.1.6 Monitoring Program requirements

The MCoAs relevant to this monitoring program are listed, the REF-CoAs are listed in [Table B1](#), the REMMs in [Table B2](#) and all CEMF requirements relevant to this CNVMP are listed in [Table B3](#). Refer

to Section 6 for all REMMs and MMMs relevant to the development of this Plan and management of noise and vibration impacts for the Project. A cross reference is also included in these tables to indicate where the condition is addressed in this CNVMP or other Project management documents.

Table B1 MCoA Requirements of the Noise and Vibration Management Plan

MCoA	Condition requirements	Document Reference
C14	<p>The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies identified for each to compare actual performance of construction of Stage 1 of the CSSI against the performance predicted in the documents listed in Condition A1 of this schedule or in the CEMP:</p> <p>(a) Noise and vibration Monitoring program; consult with EPA, SOPA (in respect of Sydney Olympic Park), Place Management NSW (in respect of The Bays) and Relevant Council(s)</p> <p>(b) Blasting Monitoring program; consult with SOPA (in respect of Sydney Olympic Park), Place Management NSW (in respect of The Bays) and Relevant Council(s)</p> <p>(c) Surface water quality Monitoring program; consult with DPIE Water, Relevant Council(s) and Sydney Water (if any Sydney Water assets are impacted)</p> <p>(d) Groundwater Monitoring program; consult with DPIE Water and SOPA (in respect of Sydney Olympic Park)</p> <p>Note: The Blasting Construction Monitoring Program is only required to be prepared if blasting is proposed to be conducted during construction.</p>	<p>Note, as per Phasing Report only item (a) applies.</p> <p>Noise and Vibration Monitoring Program</p> <p>Note, no blasting is proposed.</p>
C15	<p>Each Construction Monitoring Program must provide:</p> <p>(a) details of baseline data available including the period of baseline monitoring;</p> <p>(b) details of baseline data to be obtained and when;</p> <p>(c) details of all monitoring of the project to be undertaken;</p> <p>(d) the parameters of the project to be monitored;</p> <p>(e) the frequency of monitoring to be undertaken;</p> <p>(f) the location of monitoring;</p> <p>(g) the reporting of monitoring results and analysis results against relevant criteria;</p> <p>(h) details of the methods that will be used to analyse the monitoring data;</p> <p>(i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts;</p> <p>(j) a consideration of SMART principles; and</p> <p>(k) any consultation to be undertaken in relation to the monitoring programs; and</p> <p>(l) any specific requirements as required by Conditions C16 to C17 of this schedule.</p>	<p>Section B.2</p> <p>CNVMP Section 4.3</p> <p>Section B.3</p> <p>Section B.4</p> <p>Section B.3.1 Section B.3.2 Section B..1</p> <p>Section B.4</p> <p>Section B.3.1 Section B.3.2 Section B.4.1 (Note: The criteria referred to is in Section 6 of the CNVMP)</p> <p>Section B.8</p> <p>Section B.7</p> <p>Section B.7.1</p> <p>Section B.1.5</p> <p>Refer to row below.</p>

MCoA	Condition requirements	Document Reference
C16	<p>The Noise and vibration Construction Monitoring Program and Blasting Construction Monitoring Program must include:</p> <p>(a) noise and vibration monitoring determined in consultation with the AA to confirm the best-achievable construction noise and vibration levels with consideration of all reasonable and feasible mitigation and management measures that will be implemented;</p> <p>(b) for the purposes of (a), noise monitoring must be undertaken during the day, evening and night-time periods and within the first month of work as well as throughout the construction period and cover the range of activities being undertaken at the sites; and</p> <p>(c) a process to undertake real time noise and vibration monitoring. The results of the monitoring must be readily available to the construction team, the Proponent, ER and AA. The Planning Secretary and EPA must be provided with access to the results on request.</p>	<p>Section B.3 This Monitoring Program</p> <p>Note, no blasting is proposed.</p>
C18	With the exception of any Construction Monitoring Programs expressly nominated by the Planning Secretary to be endorsed by the ER, all Construction Monitoring Programs must be submitted to the Planning Secretary for approval.	Section B.1.5
C19	The Construction Monitoring Programs not requiring the Planning Secretary's approval must obtain the endorsement of the ER as being in accordance with the conditions of approval and all undertakings made in the documents listed in Condition A1 of this schedule. Any of these Construction Monitoring Programs must be submitted to the ER for endorsement at least one (1) month before the commencement of construction or where construction is phased no later than one (1) month before the commencement of that phase.	Section B.1.5
C20	Any of the Construction Monitoring Programs which require Planning Secretary approval must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month before the commencement of construction or where construction is phased no later than one (1) month before the commencement of that phase.	=
C21	Unless otherwise agreed with the Planning Secretary, construction must not commence until the Planning Secretary has approved, or the ER has endorsed (whichever is applicable), all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section B.1.3
C22	The Construction Monitoring Programs, as approved by the Planning Secretary or the ER has endorsed (whichever is applicable), including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary or the ER (whichever is applicable), whichever is the greater.	Section B.1.3
C23	<p>The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, ER and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.</p> <p>Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.</p>	Section B.8

Table B2 REF CoAs relevant to the Noise and Vibration Management Plan

REF-CoA	Condition requirements	Document Reference
NV2	Noise monitoring at the most affected receiver(s) would be undertaken at the start of construction works to check the levels are as predicted and to confirm that the standard mitigation measures are adequate, further mitigation measures would be considered and implemented where feasible and reasonable.	Appendix B

Table B3 CEMF requirements relevant to the Noise and Vibration Management Plan

CEMF Req.	Condition requirements	Document Reference
3.14a)	Issue specific environmental monitoring will be undertaken as required or as additionally required by any approval, permit or licence conditions.	Section B.3 Section B.4
3.14b)	The results of any monitoring undertaken as a requirement of a licence or permit that is required to be published will be published on the Principal Contractor's, or a project specific, website within 14 days of obtaining the results.	Section B.8
3.16a)	Principal Contractors will maintain appropriate records of the following: <ul style="list-style-type: none"> i. Site inspections, audits, monitoring, reviews or remedial actions; ii. Documentation as required by performance conditions, approvals, licences and legislation; iii. Modifications to site environmental documentation (eg CEMP, sub-plans and procedures); and iv. Other records as required by this Construction Environmental Management Framework. 	Section B.7 Section 9
3.16b)	Records must be accessible onsite for the duration of works.	Section 9
3.16c)	Additionally records will be retained by the Principal Contractor for a period of no less than 7 years. Records will be made available in a timely manner to Sydney Metro (or their representative) upon request.	Section 9
3.17a)	Principal Contractors will ensure the continual review and improvement of the management systems. This will generally occur in response to: <ul style="list-style-type: none"> i. Issues raised during environmental surveillance and monitoring; ii. Expanded scope of works; iii. Environmental incidents; and iv. Environmental non-conformances. 	Section 10 Section B.7
8.2c)	Noise and vibration monitoring would be undertaken for construction as specified in the CNVS.	Noise and Vibration Monitoring Program
8.2d)	The following compliance records would be kept by Principal Contractors: <ul style="list-style-type: none"> i. Records of noise and vibration monitoring results against appropriate NMLs and vibration criteria; and ii. Records of community enquiries and complaints, and the Contractor's response. 	Section 9

B.2 Baseline monitoring data

As part of the EIS process, baseline noise monitoring was conducted in 2019 at a total of 3 locations. The baseline noise monitoring locations were selected to be representative of the appropriate Noise Catchment Areas (NCAs) within and around the Project, across a mix of existing land uses including residential, commercial, industrial, and educational.

For further information regarding baseline noise monitoring refer to [Section 4](#) of the CNVMP and Chapter 11 of the EIS.

A review of the EIS noise monitoring data by Quickway found that the Project may benefit from additional background monitoring to supplement that done as part of the EIS. This supplementary monitoring would help to improve the NCAs to better represent the acoustic environment. Additional monitoring may therefore be undertaken by Quickway prior to commencement of the project and in line with relevant guidance described in Section B.1.4 and results will be added to the CNVMP.

B.3 Noise monitoring method

B.3.1 Attended and unattended airborne noise monitoring

B.3.1.1 Frequency and location of noise monitoring

Attended monitoring of construction noise levels will be undertaken as follows:

- To confirm operating sound power level (refer to [Section B.3.1.3](#))
- At the commencement of construction activities to confirm actual noise levels and the management measures that have been implemented are appropriate (this will be especially prudent at areas of deeper excavation such as joint bays and HDD pits)
- Where a change in methodology, plant or equipment is anticipated to result in a significant increase in construction noise impact that has not previously been monitored.
- Where appropriate in response to a noise related complaint(s) (determined on a case-by-case basis)
- Following the implementation of mitigation measures or noise attenuation due to exceedance of predicted noise levels
- As otherwise required by the DNVIS or Out of Hours Works (OOHW) Protocol,

Unattended (real time) airborne noise monitoring will also be completed, using a noise logger deployed to obtain noise results over longer periods. This may be done for baseline monitoring to supplement noise monitoring data obtained by the EIS, or as require in accordance with MCoA C16.

The number and location of real time monitors, and the duration of each monitoring activity during construction, will be determined with the aim of capturing the peak impact of the works at the worst affected receiver near each work location. Monitoring will be undertaken at least monthly over six months from the commencement of construction, at which time the real time unattended monitoring program will be reviewed in consultation with the AA and ER.

Monitoring will be undertaken for a minimum of 24 hours prior to the activity commencing (to obtain background vibration levels) and will continue for a minimum of 48 hours of the activity commencing.

Where this duration does not include the peak noise generating activity, monitoring will continue until the completion of the peak noise generating activity.

As the work progress along the alignment the locations of unattended noise monitoring will change throughout the project. Appropriate locations will be finalised in consideration of:

- Sensitivity of surrounding receivers
- Access to the proposed monitoring location
- Any property owner permissions that may be required
- Offset distance of noise-intensive activities
- Potentially confounding non-project related noise inputs
- Power availability
- Security

Some locations may be the boundary of ancillary sites while others will be within the property of sensitive receivers, where access is granted. The location of the real-time noise monitoring equipment will be selected in consultation with the Acoustic Advisor (AA).

B.3.1.2 General noise monitoring methodology

Attended and unattended noise monitoring locations will vary and be determined on a case-by-case basis by a DNVIS, the Project's predictive noise and vibration tool or in response to complaints.

Where possible, monitoring will be undertaken at the most affected noise sensitive receiver's location in proximity to the Project's construction activities. Noise monitoring locations will consider factors including:

- The location of previous monitoring sites,
- The proximity of the receiver to a Project worksite,
- The sensitivity of the receiver to noise,
- Predicted noise levels outlined in the DNVIS or KNOWnoise report, or actual noise levels
- Duration of the impact
- Background noise levels and
- The expected duration of the impact.

In accordance with the ICNG the duration and amount of noise monitoring will depend on the scale of the construction activities and extent of expected noise impacts. Noise monitoring will cover a representative period of the construction activity.

During unattended monitoring, noise loggers will record audio (triggered by noisy events) to allow for the identification of construction noise contribution and the presence of any extraneous noise, if privacy concerns can be overcome. The use of unattended airborne noise monitoring will be determined on a case-by-case basis and will be subject to any access approval.

All environmental noise monitoring will be undertaken with a fast time constant (i.e. 125 milliseconds), and A-weighted frequency weighting.

All outdoor noise measurements will be undertaken with a windscreen over the microphone. In accordance with the Noise Policy for Industry, monitoring should not be conducted (or monitoring data are to be excluded) when average wind speeds are greater than 5 metres per second at microphone height, or during rain. Exceptions to this rule are allowed, provided the proponent is able to show that the wind induced noise on the microphone and sound levels due to rain are at least 10 dB(A) below the background noise levels under investigation.

Where high background noise levels obscure construction noise contribution during attended noise measurements, operators will either:

- measure closer to the source and calculate back to the required position, or
- measure with the source noise off and then on (where possible) and calculate the difference or
- use the 'pause and back-erase feature on the sound level meter to try to exclude as much of the extraneous noise as possible.

Environmental noise monitoring (excluding spot checks of plant and equipment) will be recorded over 15-minute sample intervals, excluding periods of extraneous noise, until a representative sample has been obtained. A representative sample will be determined by the operator, who will be competent, suitability trained and experienced in undertaking noise measurements and familiar with the relevant Australian Standards (as detailed in [Section B.1.4](#)).

The minimum range of noise metrics to be stored in the memory for later retrieval include the following A-weighted noise levels: LA90, LAeq, LA10, LA1 and LA (max).

For spot checks of noise intensive plant and equipment, duration of monitoring will depend on the source of noise being monitored. Sources of continuous noise (such as generators), measurements will be monitored over one-to-two-minute intervals. For dynamic plant, such as front-end loaders, spot checks will capture a representative activity, such as one truck-and-dog load cycle.

Real-time noise monitoring will be recorded over 15-minute sample intervals, where every 15 minutes the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in the memory for later retrieval include the following A-weighted noise levels: LA90, LAeq, LA1 and LA (max). For each monitoring event, the following information shall be recorded:

- Results of monitoring measurements (including level of noise at the closest sensitive receivers),
- Date and time of measurements,
- Weather conditions including wind speed, rain and cloud coverage
- Name of person undertaking the measurements,
- Type and model number of instruments
- Sample times, measurement time intervals and time of day
- Applicable criteria for receivers (As outlined in Section 6 of the CNVMP)- including applicable mitigation measures

- Map of area showing measurement location, source location and sensitive receivers
- Measurement location details and number of measurements at each location
- Operation and load conditions of the plant under investigation

B.3.1.3 Plant noise auditing

Plant or equipment operating on the Project shall have an operating sound power level (SWL) which is no higher than the corresponding SWL presented in Table 13 of the CNVS unless justified. In line with [Section B.3.1.1](#) all significant noise generating items of plant would have noise audits conducted upon arrival at the Project site and at 6-month intervals thereafter. The purpose of these audits is to validate that individual items of plant and equipment fall within the aforementioned SWL's.

For all measurements, the plant or equipment under test would be measured while operating under typical operating conditions. If this is not practical, it may be appropriate to conduct a stationary test at high idle.

In the case of an exceedance in Sound Power Levels the item of plant would either be replaced, or the advice of an acoustic consultant would be sought to provide suitable mitigation measures, which may include:

- ensuring all bolts are tightened and no parts are loose
- cleaning and/or lubricating moving parts
- replacing old or worn parts
- implementing additional or upgrading existing muffling devices
- building enclosures around items of stationary plant (e.g. pumps or generators).

A register of measured sound power levels for each item of plant would be kept for reference where future noise audits are conducted. The register would be reviewed annually in conjunction with this strategy and corresponding revisions made to the Sound Power Levels presented in Section 4.3 of the CNVS to represent contemporary plant noise emission levels.

B.3.2 Attended and unattended ground-borne noise monitoring

B.3.2.1 Frequency and location of ground born noise monitoring

Attended monitoring of ground-borne construction noise levels will be undertaken where appropriate in response to a noise related complaint(s) (determined on a case-by-case basis) or as otherwise required by the DNVIS or OOHV Protocol.

B.3.2.2 General ground borne noise monitoring methodology

Monitoring will be undertaken in the most affected habitable room of the residence or other sensitive building and will be conducted in conjunction with vibration measurements whenever practicable. The room selected for noise monitoring should be well shielded from airborne noise intrusions, such as road traffic noise to allow the ground-borne noise to dominate over non-construction generated airborne noise.

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

Given that ground-borne noise is mostly noticed during the evening or at night, noise loggers may also be left in place over night and picked up at a mutually agreed time with the resident. In these instances, noise loggers will record audio to allow for the identification construction noise contribution and the presence of any extraneous noise, if privacy concerns can be overcome. Where the resident or receiver will not allow the noise logger to record audio, attended noise monitoring will be offered instead.

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

All environmental noise monitoring will be undertaken with a fast time constant (i.e. 125 milliseconds), and A-weighted frequency weighting.

Where high background noise levels obscure construction noise contribution during attended noise measurements, operators will either:

- measure closer to the source and calculate back to the required position, or
- measure with the source noise off and then on (where possible) and calculate the difference or
- use the 'pause and back-erase' feature on the sound level meter to try to exclude as much of the extraneous noise as possible.

Where possible, noise monitoring is to be carried out at least 3.5 m from any reflective surface (other than the ground) with the preferred microphone/measurement height at 1.2-1.5 m above the ground while using a tripod.

Ground-borne noise monitoring will be recorded over 15-minute sample intervals, where every 15 minutes the data is to be processed statistically and stored in memory. The minimum range of noise metrics to be stored in the memory for later retrieval include the following A-weighted noise levels: LA90, LAeq, LA1 and LA (max).

Measurements taken inside buildings should be at least one metre from walls or other reflective surface, and about 1.5 metres from windows, where such instrument siting is possible.

For each monitoring event, the following information shall be recorded:

- Date and time of measurements, name of person undertaking the measurements,
- Type and model number of instruments
- Sample times, measurement time intervals and time of day
- Map of area showing measurement location, source location and sensitive receivers
- Details of the relevant criteria of surrounding sensitive receivers (as outlined in Section 6 of the CNVMP) including applicable mitigation measures
- Measurement location details and number of measurements at each location

- Operation and load conditions of the plant under investigation
- Estimated contribution of the Project's activities vs. noise from extraneous and environmental sources (e.g. traffic, aircraft, trains, dogs barking, insects).

B.4 Vibration monitoring method

B.4.1. Short term attended and unattended vibration

B.4.1.1 Frequency and location of attended vibration monitoring

Quickway have prepared preliminary vibration contours based on certain types of plant, to be utilised across the Project as part of the approved construction activities. These vibration contours aim to provide an early identification of key risk locations and activities which may exceed the criteria adopted for heritage structures which have not yet been confirmed as structurally sound, and standard building damage. Attended vibration monitoring will be undertaken as described below, with vibration monitoring outcomes being used to validate the preliminary assessments and confirm assumptions utilised in the vibration modelling process. This will, if required, lead to a revision of the model to apply revised assumptions based on the conditions encountered, i.e. creating a 'site law'.

Monitoring will be undertaken where the preliminary vibration contours indicate works will generate vibration levels which have the potential to exceed adopted vibration criteria (outlined in Section 6 of the CNVMP), and as follows:

- 1 At the commencement of operation of plant or activities where preliminary vibration modelling has indicated cosmetic damage vibration criteria is likely to be exceeded
- 2 At the commencement of operation of plant or activities where preliminary vibration modelling has indicated heritage vibration criteria is likely to be exceeded, in accordance with MCoA D46
- 3 Where appropriate in response to a vibration related complaint(s) (determined on a case-by-case basis)
- 4 As otherwise required by the DNVIS or OOHV Protocol.

Where monitoring is undertaken at the commencement of activities under items one and two above, and monitoring outcomes are considered consistent with the model predictions to the degree that no change to the model inputs are required, no further monitoring for that specific plant/activity is required. This does not preclude similar monitoring required for new plant/activities triggered under items one and two, above.

Where monitoring outcomes differ from monitoring predictions, requiring the model to be revised, repeated monitoring will be undertaken to ensure the revised model is consistent with monitoring outcomes. This process will be repeated until the model predictions and monitoring outcomes are consistent.

Routine unattended monitoring, as discussed in [Section B4.2](#), will act as an ongoing mechanism to continue to apply the 'site law' validation process (i.e. confirming model predictions and monitoring outcomes are consistent, and updating the model as required).

B.4.1.2 General attended vibration monitoring methodology

Vibration monitoring will be undertaken in accordance with the relevant vibration measurement requirements in the reference standards and documents in [Section B.1.4](#).

Where human comfort is a concern, vibration monitoring results will be assessed and reported against the values set out in Tables 2.2 and 2.4 of the EPA's Assessing Vibration – a technical guideline.

Where property damage is a concern, vibration monitoring results will be assessed and reported against the British Standard 7385, as presented in the CNVMP.

For heritage structures, BS7385-2:1993 does not provide numerical vibration levels to prevent structural damage. The approach that will be adopted for the Project to assess and manage potential vibration impact on heritage structures is outlined in [Section 6.4](#) of the CNVMP.

Vibration monitoring shall be undertaken in accordance with the vibration measurement requirements stipulated in the reference standards and documents listed above, including the following aspects of mounting the device.

- Vibration monitoring equipment shall be placed outside at the footings or foundations of the building of interest, closest to the vibrating plant,
- The surface should be solid and rigid to best represent the vibration entering the structure of the building under investigation,
- The vibration sensor or transducer shall not be mounted on loose tiles, loose gravel or other resilient surfaces,
- The vibration sensor or transducer shall be directly mounted to the vibrating surface using either bees wax or a magnetic mounting plate onto a steel washer, plate or bracket which shall be either fastened or glued to the surface of interest, and
- Where a suitable mounting surface is unavailable, then a metal stake of at least 300mm in length shall be driven into solid ground adjacent to the building of interest and the vibration sensor or transducer shall be mounted on that.
- In accordance with MCoA D47 Where monitoring equipment is to be installed at heritage items seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring.

For each monitoring event, the following information shall be recorded:

- Results of monitoring measurements
- Date and time of measurements,
- Name of person undertaking the measurements,
- Type and model number of instruments
- Sample times, measurement time intervals and time of day
- Applicable vibration criteria for receivers (as outlined in Section 6 of the CNVMP) including applicable mitigation measures
- Map of area showing measurement location, source location and sensitive receivers
- Measurement location details and number of measurements at each location
- Operation and load conditions of the plant under investigation

Where the monitoring duration is planned to extend over a longer period than practicable for attended monitoring, such as when works will remain within the safe minimum working distance to prevent cosmetic damage, the monitoring instrumentation will be fitted with the ability to warn plant operators via flashing light, SMS, or email that vibration is approaching levels and where there is potential for cosmetic damage to buildings and structures.

Where unattended vibration monitors are left in place on a private property they will be picked up at a mutually agreed time with the resident.

Vibration data will be processed statistically and stored in memory. The minimum range of vibration metrics to be stored in memory for later retrieval is the following:

- Root-Mean-Square acceleration (RMS), or
- Vector-sum peak-particle velocity (PPV).

All short term attended vibration monitoring will be recorded over a representative sampling interval where the worst-case vibration levels can be captured. Where unattended vibration monitoring is proposed, monitoring will be undertaken continuously whilst the vibrating plant is operational to capture the worst-case vibration levels within the pre-determined 'minimum working distance' from the potentially affected building.

Equipment such as rock hammers, vibratory trench rollers and plate compactors would be used throughout excavation and backfilling of trenches. Ideally, vibration would be measured directly on a structure. Where access is not available, vibration will be monitored in proximity to the equipment and measured levels extrapolated to the nearest structure based on the following equation for geometric damping (conservatively ignoring material damping).

$$PPV_2 = PPV_1 \left(\frac{R_1}{R_2} \right)^n$$

Where:

PPV – Peak Particle Velocity at the source (PPV₁) and Receiver (PPV₂)

R – distance from source of reference level (R₁) and distance from source of receiver (R₂)

n – ground factor assumed as 1 for body waves

B.4.2. Real-time (unattended) vibration monitoring

B.4.2.1 Frequency and location of real time (unattended) vibration monitoring

Real-time (unattended) vibration monitoring will be undertaken to satisfy MCoA C16.

In accordance with MCoA D63, real-time vibration monitors will be installed at potentially sensitive receivers that meet one or more of the following criteria:

- 'at risk' buildings, structures and utilities identified by pre-construction condition survey
- receivers within the preliminary (or revised following model corrections undertaken following the 'site law' process described in [Section B4.1](#)) vibration contours for cosmetic damage or heritage criteria.

As the work progress along the alignment the locations of unattended vibration monitoring will change throughout the project. Appropriate locations will be finalised in consideration of:

- Sensitivity of surrounding receivers
- Access to the proposed monitoring location
- Any property owner permissions that may be required
- Offset distance of vibration-intensive activities
- Potentially confounding non-project related vibration inputs
- Power availability
- Security

Some locations may be the boundary of ancillary sites, similar to noise monitoring locations, while others will be within the property of sensitive receivers, where access is granted. The location of the real-time vibration monitoring equipment will be selected in consultation with the Acoustic Advisor (AA).

The number and location of real time monitors, and the duration of each monitoring activity during construction, will be determined with the aim of capturing the peak impact of the works at the worst affected receiver near each work location. Monitoring will be undertaken at least monthly over six months from the commencement of construction, at which time the real time unattended monitoring program will be reviewed in consultation with the AA and ER.

Monitoring will be undertaken for a minimum of 24 hours prior to the activity commencing (to obtain background vibration levels) and will continue for a minimum of 48 hours of the activity commencing, or should this not include the peak vibration generating activity, until the completion of the peak vibration generating activity.

B.4.2.2 General real time vibration monitoring methodology

The monitors will be installed by a person appropriately trained in the measurement and assessment of construction noise and vibration, who is familiar with the requirements of the relevant standards and procedures and the establishment of real-time monitoring equipment.

The real-time monitoring data will be made available to Quickway, Sydney Metro, the Environmental Representative (ER) and AA.

The real-time monitoring data will be available to DPIE and EPA on request following an initial screening review, to identify any anomalies or corruption in the dataset.

Real time vibration monitoring will continuously monitor PPV.

For each monitoring event, the following information shall be recorded:

- Date and time of measurements
- Name of person undertaking the measurements
- Type and model number of instruments
- Sample times, measurement time intervals and time of day

- Results of measurements
- Extrapolated (calculated) vibration levels if the monitor is not able to be located at the sensitive receiver location
- Map of area showing measurement location, source location and sensitive receivers
- Measurement location details and number of measurements at each location
- Operation and load conditions of the plant under investigation

B.4.2.3 Vibration generating works affecting settlement

Appropriate equipment will be installed for the purpose of monitoring, which will be undertaken during vibration generating activities as described in Section B.4.1.1 and B.4.2.1.

Should monitoring indicate exceedance of the criteria defined in CNVMP Section 486.4 or as otherwise identified by the DNVIS (refer to CNVMP Section 8.1), all vibration generating works will cease pending a revised construction methodology or alternative measures being implemented to reduce vibration to within the required criteria.

This would include all construction affecting settlement as required under MCoA D63.

B.5 Calibration, QA and competency

All monitoring will be undertaken by competent personnel, suitability trained and experienced in undertaking noise and vibration measurements.

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

Noise monitoring would be completed using at minimum Type 2 instruments, as per Australian Standard IEC 61672.1.

All monitoring records will be retained throughout delivery of the Project by Quickway.

B.6 Heritage listed structures

In accordance with MCoA D46, Quickway will conduct vibration monitoring during vibration generating activities that have the potential to impact on heritage items as identified through preliminary (or updated based on 'site law') vibration contours. The results will be utilised to confirm model predictions and confirm minimum working distances (i.e. 'site law') to prevent cosmetic damage. Should vibration testing and monitoring show that the preferred values for vibration (being 2.5 mm/second unless the building has been inspected and confirmed as structurally sound) are likely to be exceeded, Quickway will follow the process in Section 10 of the CNVMP.

In line with MCoA D47, Quickway will seek the advice of the Project's heritage and noise and vibration specialists, on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures.

B.7 Continual improvement and corrective action

Monitored noise and vibration levels will be analysed against the predictions that have been made in the relevant DNVIS or using the Project's predictive tools, incorporating the standard project mitigation

measures as described in the CNVMP. This will allow a like-for-like comparison of actual and predicted noise levels (incorporating relevant mitigation measures) and will allow for ongoing review, verification and, where required, amendment of the predictive model.

Monitoring results will be compared against the predictive modelling (not the EIS) for the activity, to ensure relevant reasonable and feasible mitigation measures are included consistently between the model and as implemented on the ground.

Where noise monitoring outcomes differ by greater than 5dB above or below the model, these differences will be discussed in the monitoring report and the following investigations undertaken:

1. review the activities that were undertaken against those that are modelled in all aspects (i.e. noise mitigation measures, weather, traffic, location, plant and equipment used in operation) to identify the potential cause of this difference. Confirm there are no extraneous noise sources, noise from adjacent projects, and the activity and model are 'like-for-like'.
2. Check modelling assumptions (e.g. assessment type, standards used, height of predicted receiver/source, usage factors, applied 'reductions')
3. Check the model itself to ensure it is correct i.e. all buildings are in the right spot with correct heights, correct facades and floors (where relevant) there hasn't been a change in terrain or other topographic or structural barriers are inconsistent.

If site conditions are the cause of the difference (i.e. Step 1) then this will be justified in the monitoring reports. If site conditions are not found to be the cause of the difference, the modelling assumptions will be checked and updated in the model as required. The DNVIS will be reviewed to determine if these assumptions are incorrect for any other activities.

Finally, if the discrepancy cannot be resolved, a full review of the model will be undertaken to ensure all parameters are correct. Should the model be deemed inconsistent, the model parameters will be altered appropriately to better align with the monitoring outcomes, and DNVIS revised in consultation with the AA.

Monitored vibration levels will be analysed against predictions made in the relevant DNVIS and Project's predictive tools, ensuring a like-for-like approach is taken. This means the activity must be undertaken in accordance with the model inputs (including location of monitoring, plant and equipment in use, etc). This will result in the development of a vibration 'site law' (i.e. a refined model appropriate to site conditions, as validating by monitoring results) for the project, which will routinely be checked against through the process of unattended vibration monitoring.

Real time observations at attended monitoring events and, where unattended monitoring is occurring, alerts of exceedances sent via text message directly to the relevant party responsible for that monitoring, will be utilised to implement the following actions, in the case noise or vibration criteria are approached or exceeded:

- Cease the noise/vibration generating plant or activity which causes the exceedance
- Confirm the monitored levels are not being impacted by other noise or vibration sources
- Confirm if the exceedance is due to an uncharacteristically noisy or vibration-intensive piece of equipment

- Confirm that the modelling reflects the actual activity being undertaken
- Implement other feasible and reasonable measures which may include reducing plant type or size, modifying time of works, changing operational settings (such as turning off the vibratory function of the machine), utilising alternative construction methodology or a combination of these
- Ensure that the learnings from the above are fed back into the noise/vibration assessment process and/or predictive tools for fine-tuning
- Continue work where impacts can be reduced to below the relevant criteria or otherwise comply as a result of new information (e.g. revised equipment sound power level or elimination of confounding inputs)
- Implement appropriate mitigation and management measures based on new noise/sound criteria
- Communicate lessons learnt to relevant personnel including relevant stakeholders as soon as practicable.

Quickway will review the activity and where possible, modify the work or activity to prevent any recurrence. Lessons learnt will be communicated to relevant personnel in toolbox talks.

B.7.1 Monitoring Targets

- Every exceedance that is detected will be followed up within 24 hours;
- All monitoring reports will be stored on file for the duration of the project;
- All monitoring reports will be published on the project website within 14 days of obtaining the results;
- Where exceedances of the relevant noise and vibration criteria are detected the appropriate CNVS mitigation measures will be implemented as soon as practicable

B.8 Reporting of monitoring results

At the completion of monitoring in line with the methods outlined in the above sections, all data will be downloaded by a suitable competent person to be analysed. These results would then be evaluated in comparison to relevant predictions and criteria. The data along with the information recorded about each event (time, weather, type of work etc.) will help to develop a complete picture of the real time noise and/or vibration environment. This would aid in:

- Validating modelling done as part of the project;
- Validating any complaints made by the community
- Improving work methods to minimise impacts

Data from noise and vibration monitoring will be reported on a monthly basis in a Construction Monitoring Report in line with MCoA C23. The Construction Monitoring Report will be supplied Sydney metro within seven days of preparation. The Monitoring Report will then be provided to the AA and ER for review and submitted to the Secretary of the DPIE and relevant regulatory authorities for information.

The results of any monitoring undertaken will be published on the Quickway project specific website within 14 days of obtaining the results.

Separate from the Construction Monitoring Report, additional records relating to noise and vibration training, toolbox talks, monitoring results and audit results will be prepared, maintained, and stored in line with the CEMP and Section 9 of the CNVMP. The complaints management and reporting procedure is described in the CEMP and Section 9.4 of the CNVMP.

Appendix C Out of Hours Works Protocol

Sydney Metro West, Power Enabling Works

Out Of Hours Works Protocol

3869-SMW-PRT-001

Revision 0.0

8 June 2021

DOCUMENT CONTROL & APPROVAL			PROJECT NO.		3869
ISSUE	DATE	ISSUE DETAILS / REMARKS	AUTHOR	CHECKED	APPROVED
Draft A	30/04/2021	Prepared for review			
Draft B	12/5/2021	Prepared for second review			
Draft C	08/06/2021	Updated following DPIE comments			
Rev 0.0	08/06/2021	No changes to document. Approved document issued for use.			
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Document Approval / Endorsement

Stuart [REDACTED]
[REDACTED]

23/06/2021

Dear Mr [REDACTED]

**Sydney Metro West (SSI 10038)
Phase A Power and Enabling Works
Out of Hours Works Protocol**

I refer to your submission dated 25 May 2021 requesting approval of the Sydney Metro West Power Enabling Works (Phase A) Out of Hours Works Protocol, in accordance with Condition D38 of SSI 10038. I also acknowledge your response to the Department's review comments and requests for additional information.

I note that the Sydney Metro West Power Enabling Works (Phase A) Out of Hours Works Protocol:

- has been prepared in consultation with the EPA, the Environmental Representative and the Acoustic Advisor
- has been reviewed by Sydney Metro and no issues have been raised
- has been endorsed by the Environmental Representative and the Acoustic Advisor
- contains the information required by the conditions of approval.

As nominee of the Planning Secretary, I approve the Sydney Metro West Power Enabling Works (Phase A) Out of Hours Works Protocol, Revision C dated 8 June 2021, pursuant to condition D38.

You are required to inform the Planning Secretary via weekly submission or presentation of approved low risk out-of-hours works.

You are reminded that if there is any inconsistency between the approved Out of Hours Works Protocol and the conditions of approval, then the requirements of the conditions of approval will prevail.

Please ensure that you make the Out of Hours Works Protocol publicly available on the project website.

If you wish to discuss the matter further, please contact Matthew [REDACTED]

Yours sincerely

[REDACTED]
[REDACTED]
Jake [REDACTED]
[REDACTED]

As nominee of the Planning Secretary

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1. Introduction

This Out-of-Hours Work (OOHW) Protocol (herein referred to as the Protocol) for the Sydney Metro West Power Supply Works (the Project) ‘The Bays’ package has been prepared in accordance with Ministers Conditions of Approval (MCoA) D38.

This Protocol defines the process for assessment and approval of work undertaken outside standard construction hours (out-of-hours work) that is not subject to an Environment Protection Licence (EPL) and should be read in conjunction with the Construction Noise and Vibration Management Plan (CNVMP).

This document has also been written to align with Sydney Metro documents, including:

- Sydney Metro Construction Noise and Vibration Standard (SM ES-PW-310/4.0) (Sydney Metro, 2020)
- Out of Hours Works Assessment Procedure (SM-20-00098866) (Sydney Metro, 2016)

1.1 Scope

This Protocol is prepared for all works proposed to be undertaken outside of approved construction hours, with the exclusion of those where requirements of Condition D37(b) (being 'Low Impact') are met. More detail on Low Impact OOHW is provided in Section 6.3.3 of the CEMP.

This document applies for works not subject to an EPL. As the activities approved for the Project are not included under the definitions of a Scheduled Activity under the Protection of the Environment Operations Act (1997), an EPL is not proposed to be obtained for any works for this Project.

This Protocol applies to The Bays however does not apply to works undertaken on behalf of Sydney Metro for any other areas (i.e. Eastern Creek Pre-Cast Yard) for which these MCoA do not apply.

This Protocol outlines the consideration, management and approval of works outside the approved construction hours, as required under the MCoA D38. The requirements of MCoA D38 and where they are addressed in this document are provided in Table 1.

Table 1 Requirements of MCoA D38

MCoA	Requirement	Where addressed
D38	An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of work which are outside the hours defined in Conditions D35 and D36 of this schedule. The Protocol must be approved by the Planning Secretary before commencement of the out-of-hours work. The Protocol must be prepared in consultation with the ER, AA and EPA. The Protocol must provide:	This Protocol Section 1.2
(a)	identification of low and high-risk activities and an approval process that considers the risk of activities, proposed mitigation, management, and coordination, including where: (i) the ER and AA review all proposed out-of-hours activities and confirm their risk levels; (ii) low risk activities can be approved by the ER in consultation with the AA; and (iii) high risk activities that are approved by the Planning Secretary;	Section 5
(b)	a process for the consideration of out-of-hours work against the relevant NML and vibration criteria;	Section 4

MCoA	Requirement	Where addressed
(c)	a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition D50 of this schedule. The measures must take into account the predicted noise levels and the likely frequency and duration of the out-of-hours works that sensitive land user(s) would be exposed to, including the number of noise awakening events;	Section 6
(d)	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; and	Section 7
(e)	notification arrangements for affected receivers for all approved out-of-hours works and notification to the Planning Secretary of approved low risk out-of-hours works.	Section 6.2 and 6.3
	This condition does not apply if the requirements of Condition D37(b) of this schedule are met.	Note
	<i>Note: Out-of-hours work is any work that occurs outside the construction hours identified in Condition D35 and D36 of this schedule.</i>	Note

1.2 Protocol Review and Approval

In accordance with MCoA D38 the Out of Hours Work Protocol must meet the following consultation, review and approval requirements:

- Be prepared in consultation with the NSW Environment Protection Authority (EPA)
- Be prepared in consultation with the Acoustic Advisor (AA) and Environmental Representative (ER)
- Be approved by the Planning Secretary before the commencement of the OOHW.

This document has been provided to the EPA for consultation and both the AA and ER have reviewed and commented on this document prior to submission and approval from the Planning Secretary. The AA has provided endorsement of this document as part of the CNVMP.

1.3 Roles and Responsibilities

Acoustics Advisor - MCoA A32 requires an AA to be appointed. The AA is to act as an independent point of contact for all noise and vibration matters under the planning approval. Refer to MCoA A36 for a comprehensive description of the AA's responsibilities.

[Section 5](#) includes descriptions of the AA's responsibilities with respect to reviewing and identifying risk level for OOHW.

Environmental Representative - The CSSI planning approval conditions require an ER to be appointed to the project. The ER is to act as an independent point of contact for all environmental and planning approval compliance matters. Refer to MCoA A30 for a comprehensive list of the ER's responsibilities.

[Section 5](#) includes descriptions of the ER's responsibilities with respect to reviewing and approving OOHW.

Place Manager (Community) – A Sydney Metro Place Manager has been allocated to the Project. The Place Manager is responsible for ensuring that all project communication requirements with the surrounding community are being complied.

Quickway Environmental Manager – The Quickway Environment Manager is responsible for ensuring environmental risks of the Project are identified and appropriate mitigation measures implemented. The Environment Manager is also responsible for ensuring environmental compliance with statutory, approval and proponent requirements. It is their duty to obtain and update all environmental licences, approvals and permits as required.

Sydney Metro Environmental Manager - The Sydney Metro Environment Manager is responsible for ensuring that all environmental management requirements associated with this Project are being complied.

2. Management Documents and Requirements

2.1 Ministers Conditions of Approval

The Ministers CoA relevant to this Protocol are listed in Table 2 below.

Table 2 Relevant MCoAs to the Protocol

MCoA	Requirement	Document Reference
D35	Work must only be undertaken during the following hours: (a) 7:00am to 6:00pm Mondays to Fridays, inclusive; (b) 8:00am to 6:00pm Saturdays; and (c) at no time on Sundays or public holidays.	Section 3.1
D36	Except as permitted by an EPL, highly noise intensive work that results in an exceedance of the applicable 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.	Section 7.1
D37	Notwithstanding Conditions D35 and D36 of this schedule work may be undertaken outside the hours specified in the following circumstances:	Section 3.1
a)	(a) Safety and Emergencies, including: (i) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or (ii) 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. On becoming aware of the need for emergency work in accordance with (a)(ii) above, the AA, the ER, the Planning Secretary and the EPA must be notified of the reasons for such work. The Proponent must use best endeavours to notify as soon as practicable all noise and/or vibration affected sensitive land user(s) of the likely impact and duration of those work.	Note, as per MCoA D38 this Protocol does not apply to those works meeting the definition of Low Impact OOHV.

MCoA	Requirement	Document Reference
b)	<p>(b) Low impact, including:</p> <p>(i) construction that causes LAeq(15 minute) noise levels: no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and</p> <p>(ii) construction that causes LAFmax(15 minute) noise levels no more than 15 dB(A) above the rating background level at any residence; or</p> <p>(iii) construction that causes: continuous or impulsive vibration values, measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), or intermittent vibration values measured at the most affected residence are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006).</p>	
c)	<p>(c) By Approval, including:</p> <p>(i) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or</p> <p>(ii) works which are not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition D38 of this schedule; or</p> <p>(iii) negotiated agreements with directly affected residents and sensitive land user(s).</p>	
d)	<p>(d) By Prescribed Activity, including:</p> <p>(i) tunnelling (excluding cut and cover tunnelling and surface works) are permitted 24 hours a day, seven days a week; or</p> <p>(ii) concrete batching at the Clyde construction site is permitted 24 hours a day, seven days a week; or</p> <p>(iii) delivery of material that is required to be delivered outside of standard construction hours in Condition D35 of this schedule to directly support tunnelling activities, except between the hours 10:00 pm and 7:00 am to / from the Five Dock and Westmead construction sites and to / from Burwood North construction site using any roads / streets other than directly from Parramatta Road; or</p> <p>(iv) haulage of spoil except between the hours of 10:00 pm and 7:00 am to / from the Five Dock and Westmead construction sites and to / from Burwood North construction site using any roads / streets other than directly from Parramatta Road; or</p> <p>(v) work within an acoustic shed where there is no exceedance of noise levels under Low impact circumstances identified in (b) above.</p>	Section 3.1

MCoA	Requirement	Document Reference
D39	<p>All reasonable and feasible mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:</p> <p>(a) construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009);</p> <p>(b) vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure);</p> <p>(c) Australian Standard AS 2187.2 - 2006 "Explosives - Storage and Use - Use of Explosives" (for human exposure);</p> <p>(d) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and</p> <p>(e) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage for structurally unsound heritage items).</p> <p>Any work identified as exceeding the noise management levels and / or vibration criteria must be managed in accordance with the Noise and Vibration CEMP Sub-plan.</p> <p>Note: The ICNG identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.</p>	Section 6
D40	<p>All reasonable and feasible mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:</p> <p>(a) evening (6:00 pm to 10:00 pm) — internal LAeq(15 minute): 40 dB(A); and</p> <p>(b) night (10:00 pm to 7:00 am) — internal LAeq(15 minute): 35 dB(A).</p> <p>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 D38 of this schedule.</p>	Section 6
D41	<p>Noise generating work in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.</p>	Section 6.1
D43	<p>Detailed Noise and Vibration Impact Statements (DNVIS) must be prepared for any work that may exceed the NMLs, vibration criteria and / or ground-borne noise levels specified in Conditions D39 and D40 of this schedule at any residence outside construction hours identified in Condition D35 of this schedule, or where receivers will be highly noise affected. The DNVIS must include specific mitigation measures identified through consultation with affected sensitive land user(s) and the mitigation measures must be implemented for the duration of the works. A copy of the DNVIS must be provided to the AA and ER before the commencement of the associated works. The Planning Secretary and the EPA may request a copy (ies) of the DNVIS.</p>	The DNVIS

MCoA	Requirement	Document Reference
D50	<p>All work undertaken for the delivery of Stage 1 of the CSSI, including those undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided. The Proponent must:</p> <ul style="list-style-type: none"> (a) reschedule any work to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with Condition D51 of this schedule; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the AA in support of any decision made by the Proponent in relation to respite or mitigation. <p>The consideration of respite must also include all other approved Critical SSI, SSI and SSD projects which may cause cumulative and / or consecutive impacts at receivers affected by the delivery of Stage 1 of the CSSI.</p>	Section 7.2
D51	<p>In order to undertake out-of-hours work outside the work hours specified under Condition D35 of this schedule, appropriate respite periods for the out-of-hours work must be identified in consultation with the community at each affected location on a regular basis. This consultation must include (but not be limited to) providing the community with:</p> <ul style="list-style-type: none"> (a) a progressive schedule for periods no less than three (3) months, of likely out-of-hours work; (b) a description of the potential work, location and duration of the out-of-hours work; (c) the noise characteristics and likely noise levels of the work; and (d) likely mitigation and management measures which aim to achieve the relevant NMLs under Condition D39 (including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers). <p>The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour work must be provided to the AA, EPA and the Planning Secretary.</p> <p>Note: 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 RBL at any residence.</p>	Section 7.1

2.2 Sydney Metro Construction Noise and Vibration Standard

Sydney Metro has developed a Construction Noise and Vibration Standard (CNVS) to:

- Establish a framework for managing construction noise and vibration impacts and adopting appropriate mitigation measures (including minimum requirements);
- Form part of the Project's Environmental Impact Statement;
- Form part of the contract requirements that Sydney Metro's Principal Contractors must comply with; and
- Set minimum requirements around all works undertaken outside approved hours, including the need for and development of Detailed Construction Noise Impacts Statements (DNVIS).

The CNVS establishes a consistent strategy for the assessment, mitigation and monitoring of noise and vibration generated by construction activities. It defines a minimum standard for managing noise and vibration impacts that considers currently best practice guidelines and other regulatory requirements. It is

included in all Sydney Metro Environmental Assessments. This Protocol has been prepared in accordance with the CNVS.

2.3 Sydney Metro Out of Hours Works Assessment Procedure

Sydney Metro has prepared an Out of Hours Works Assessment Procedure. This procedure outlines the process for preparing, assessing and approving Sydney Metro OOWH works.

This Protocol has been prepared in accordance with the Sydney Metro Out of Hours Works Assessment Procedure

2.4 Construction Noise and Vibration Management Plan

In accordance with MCoA C5 Quickway has prepared a Construction Noise and Vibration Management Plan (CNVMP), which forms part of the Construction Environmental Management Plan (CEMP) suite of documentation.

The function of the CNVMP is to provide a strategic overview of how the requirements of the CNVS will be applied to activities or locations for the Project, as well as meeting relevant requirements under the MCoA and Environmental Impact Statement. The CNVMP includes an outline of how quantitative noise and vibration assessments will be undertaken across worksites and/or activities, and an indicative construction schedule. The CNVMP also links to the community and stakeholder consultation processes and explains how receivers will be consulted throughout the construction phase with regard to impacts and mitigations.

2.5 Detailed Noise and Vibration Impact Statements (DNVIS)

While quantitative noise assessments are documented in initial environmental assessments (the EIS), a more refined assessment is undertaken as part of a DNVIS prepared under MCoA D43, based upon an improved understanding of the exact equipment and construction methodology to be used for the Project, not known at the time of the preparation of the EIS.

In accordance with the CNVS, the DNVIS is required to be developed to support applications for OOHW. In this context, the DNVIS has been prepared to address all expected OOHW activities and activities generating highly noise affected impacts on receivers, for the entirety of the Project. The DNVIS:

- assesses and documents the anticipated noise impacts at noise sensitive receivers of proposed construction activities, prior to the commencement of those activities.
- removes assumptions made in the Environmental Impact Assessment including the Noise and Vibration Technical Paper.
- is written with a focus on specific activities or locations and considers works carried out inside and outside of standard working hours.
- includes mitigation measures identified through consultation with affected sensitive land user(s).

The AA will review and endorse the DNVIS (as per AA role described at MCoA A36(e)) and a copy of the DNVIS must be provided to the AA and ER before the commencement of the associated works.

The DNVIS includes a noise and vibration assessment of the proposed works, however it is acknowledged that additional OOHW or minor changes to proposed methodologies may occur. Additionally, the DNVIS is written at the commencement of the Project, at which point specific dates and approvals (for example, Road Occupancy Licenses) may not be known. As such, the DNVIS is supported by the Quickway Out-of-

Hours Work Permit, which is prepared closer to the time of the works and provides a record with of compliance with the requirements of this Protocol (refer to Section 3.3 for additional information).

3. OOHW Assessment and Approval

3.1 OOHW

OOHW are any works that are undertaken outside of approved hours defined in the Project MCoA. This may be required for a variety of reasons, including oversized deliveries, emergency works, reduced impacts on the community and/or environment, etc.

MCoA D35 establishes works are to be carried out only during the following hours:

- 7:00am to 6:00pm Mondays to Fridays, inclusive;
- 8:00am to 6:00pm Saturdays; and
- at no time on Sundays or public holidays.

MCoA D37 recognises there are times where works outside the above hours are unavoidable and may be undertaken under specific circumstances, including:

- In the case of safety and other emergencies
- Low Impact Works for which noise and vibration activities are below a set criteria
- By approval under this Protocol or by negotiated agreements
- By prescribed activity

Due to greater community sensitivity to noise and vibration impacts from works undertaken outside approved hours, an OOHW process is required to address preparing, assessing and approving all OOHW prior to their commencement.

3.2 OOHW Justification

Construction work associated with the Project will be undertaken in accordance with the assessment and management approach outlined in the Interim Construction Noise Guidelines (ICNG). The ICNG requires that work proposed outside of approved construction hours must be appropriately justified. In general, OOHW undertaken during public infrastructure projects, necessary to sustain the operational integrity of roads, is considered justified in the ICNG.

3.3 OOHW Permit

As per MCoA D38(a) approval of OOHW is dependent upon the types of activity proposed. The works must be categorised by risk and the approved framework as follows:

- i. the ER and AA review all proposed out-of-hours activities and confirm their risk levels;
- ii. low risk activities can be approved by the ER in consultation with the AA; and
- iii. high risk activities are approved by the Planning Secretary;

To facilitate this process, the Quickway Out-of-Hours Work Permit will be utilised (refer to [Appendix A](#)).

The OOHW Permit is to be used for all OOHW applications to ensure due diligence is undertaken by requiring the applicant to:

- Provide justification for the works to be undertaken outside of approved hours;
- Adequately assess the noise impacts at nearest receivers;
- Demonstrate mitigation measures being implemented; and
- Request formal review and approval by TfNSW prior to commencement.

The OOHW Permit ensures that a preliminary quantitative noise assessment is undertaken for every application, supported by the DNVIS and noise and vibration impact assessments as described in this Protocol.

Once prepared the OOHW Permit is submitted to the Place Manager, Sydney Metro Environment Manager, AA and ER for review. Any of the reviewers may provide comments on the application, which need to be adequately addressed by the contractor in a resubmitted application to the satisfaction of the comment provider(s).

3.4 OOHW Review and Approval

All OOHW work for The Bays Project requires review and endorsement by the AA and, in accordance with MCoA D38, approval by either the ER, or in the case of 'high risk' works, by the Secretary. The requirements of these conditions are to be specifically addressed in each OOHW application as relevant.

Further details about the classification of 'high risk' work is detailed in [Section 5](#).

For any proposed OOHW, process identified as described below and shown in [Figure 1](#) will be undertaken:

1. An OOHW Permit will be prepared that summarises the activities, equipment required, location and duration and includes a detailed justification for works.
2. The OOHW Permit will be submitted to the Environment Team to include assessment outcomes. Where an existing activity has been assessed under the DNVIS, no further assessment is required. New activities or changes activities described in the DNVIS will be assessed (refer to [Section 4](#)) to determine predicted noise impacts and appropriate mitigation measures (refer to [Section 6.1](#)).
3. The Quickway Environment Manager will determine whether the justification for the OOHW works is satisfactory and that the noise assessment and mitigation measures are appropriate, and will allocate the appropriate risk category.
4. The OOHW Permit will be submitted to the ER/AA/Sydney Metro for review and confirmation of risk allocation (ER and AA only). The AA will endorse the OOHW Permit and if confirmed as low risk, the ER will approve, or if confirmed as high risk, approval will be sought from the Planning Secretary (refer to [Section 5](#)).
5. Community consultation and notification will be undertaken in accordance with the Project Communication Strategy (refer to [Section 6](#)).
6. Mitigation measures and monitoring as identified in the OOHW Permit will be undertaken during the works (refer to [Section 8](#) and the Project's Construction Noise and Vibration Monitoring Program).

The process for undertaking planned OOHW is provided in [Figure 1](#).

Sydney Metro West, Power Enabling Works Out Of Hours Work (OOHW) Process

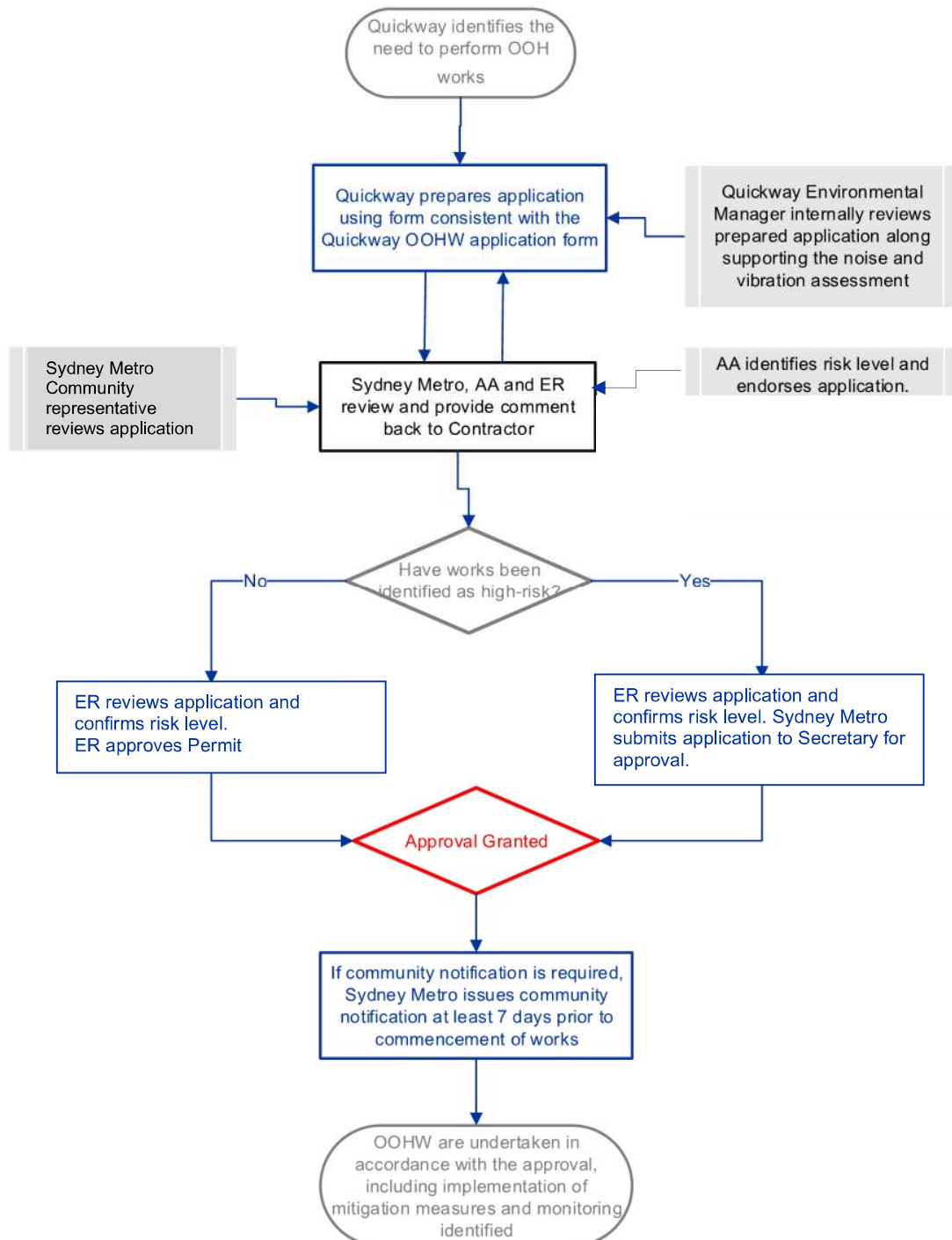


Figure 1 OOHW Process flow chart

3.5 Emergency Works

Occasionally there may be a need to undertake emergency works outside of standard working hours, including:

- for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or
- where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm.

On becoming aware of the need for emergency work in accordance with (a)(ii) above, Quickway will notify Sydney Metro, the AA, the ER, and Sydney Metro will notify the Planning Secretary and the EPA (if required) providing the reasons for such work.

Best endeavours will be made to notify as soon as practicable all noise and/or vibration affected sensitive land user(s) of the likely impact and duration of those work, with as much details as possible regarding:

- (a) Scope;
- (b) Location;
- (c) Hours;
- (d) Duration;
- (e) Types of equipment to be used; and
- (f) Likely impacts.

On the following workday of completion of any emergency works being undertaken, a summary will be provided to Sydney Metro, the AA and ER, including:

- (a) Date, time, duration and cause of the emergency;
- (b) Description of emergency works undertaken;
- (c) Mitigation measures implemented to address the impacts of the emergency works; and
- (d) Actions/Measures taken or to be taken to prevent or mitigate recurrence of the emergency.

The process for undertaking emergency OOHW is provided in [Figure 2](#).

Sydney Metro West, Power Enabling Works Emergency Out Of Hours Work (OOHW) Process

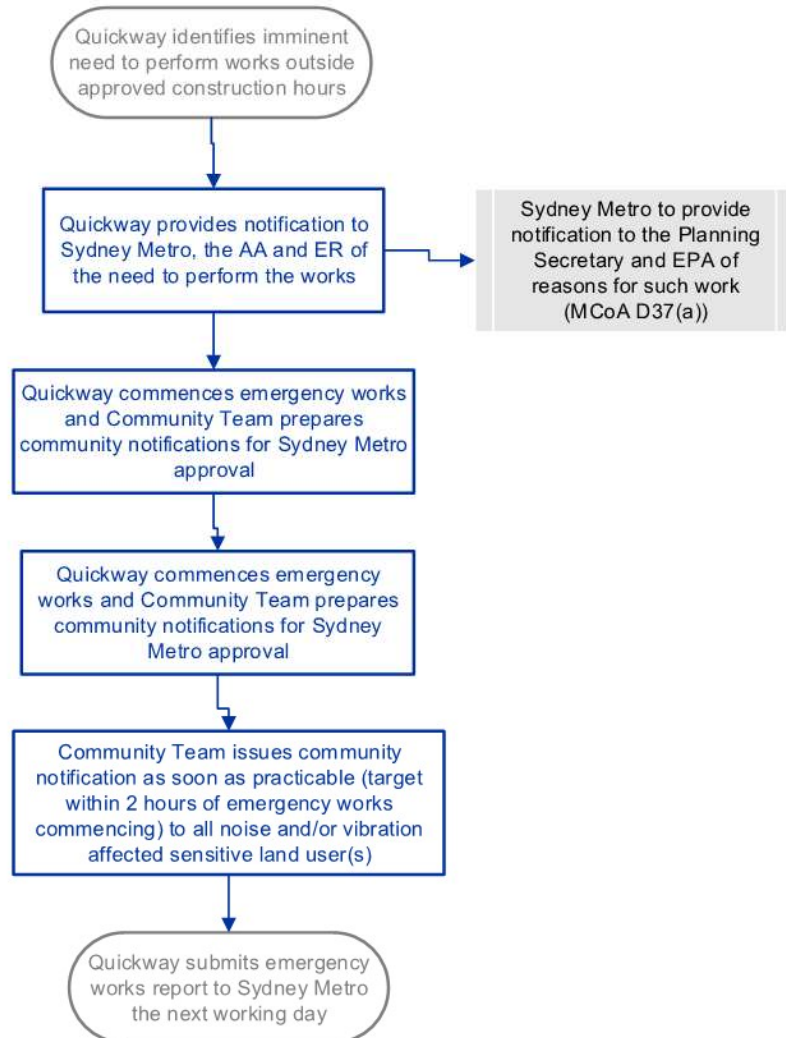


Figure 2 Emergency OOHW flowchart

4. OOHW Impact assessment

4.1 Noise and vibration assessment criteria

Guidelines for establishing project-specific noise and vibration criteria to guide the application of mitigation measures are described in Section 5 of the CNVMP and the Noise Vibration Monitoring Program (included in the CNVMP) and include the following.

- (a) Airborne and ground-borne noise - the Interim Construction Noise Guideline (DECC, 2009);

Note: *The Interim Construction Noise Guideline identifies ‘particularly annoying’ activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level (NML).*

- (b) Vibration (human comfort) - *Assessing vibration: a technical guideline* (DEC, 2006)
- (c) Building damage - BS 7385 Part 2-1993 “*Evaluation and measurement for vibration in buildings Part 2*” as they are “applicable to Australian conditions”
- (d) Heritage items - *German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures* (for structural damage) (applicable when a heritage-listed structure is identified in poor condition)
- (e) Additional mitigation for residual impacts - RMS Construction Noise and Vibration Guideline – Version 1, 2016

Project-specific noise management levels (NMLs) and sleep disturbance criteria have been calculated for each Noise Catchment Area (NCA) within the Project area and are summarised in Section 5.3 of the CNVMP. Construction NML criteria for non-residential, commercial and industrial receivers have also defined.

Vibration criteria adopted for the project are summarised in Section 5.4 of the CNVMP.

4.2 Noise and vibration assessment

4.2.1 Assessment Method

Where OOHW is proposed, modelling undertaken for the DNVIS will be used to predict noise and vibration impacts. Where the proposed OOHW activity is different from those presented in the DNVIS a noise assessment to determine the noise and vibration impacts of the proposed OOHW will be undertaken. These supplementary assessments will use an appropriately detailed noise prediction tool developed by the project acoustic consultant Hutchison Weller. KNOWnoise is a web-based noise prediction tool designed for use by the project team to complete its own assessment. This provides opportunity to proactively plan OOHW works and make adjustments as necessary.

KNOWnoise is based on the same 3D noise modelling done in Soundplan noise prediction software, as that done for the DNVIS, and is therefore considered an extension or replication of the modelling processes used for the DNVIS. KNOWnoise includes all terrain, buildings, noise walls as well as air and ground absorption for accurate results.

Each assessment of proposed OOHW will incorporate quantitative prediction of the noise level and extent of noise impact that activities will have on potentially affected sensitive receivers, based on inputs including location, and the types and number of construction machinery operating at any one time.

Vibration will be automatically assessed within KNOWnoise based initially on standard safe working distances of selected vibration-intensive equipment, and subsequent site laws updated into KNOWnoise following initial vibration monitoring (as described in the Noise and Vibration Monitoring Program). Advice will be provided on whether the human comfort, cosmetic damage or heritage criteria may be exceeded, with appropriate mitigation measures recommended.

Details on KNOWnoise are provided in Appendix D of the CNVMP.

4.2.2 Reporting

A report for each assessment is automatically generated and must be attached to the OOHW permit application and includes:

- details of the nature and scope of each activity, including times, location(s) of works, duration,
- plant and equipment to be used with estimated equipment sound power levels (including 5 dB penalty where applicable for annoying characteristics)
- justification of the need to work outside approved hours
- relevant noise management levels and vibration criteria
- an evaluation of predicted noise levels with a summary of the number of exceedances and predicted maximum noise levels
- assessment of sleep disturbance
- assessment of vibration (whether works are likely to be within safe working distances for selected plant)
- recommended standard and additional mitigation measures. Additional mitigation measures will be recommended based on the CNVS and predicted levels of exceedance at each identified sensitive receiver.

5. High and low risk activities approval

The proposed OOHW will be classified as either low or high risk, which will then be subject to the relevant approval pathway:

1. Low risk activities can be approved by the ER in consultation with the AA, and
2. High risk activities are approved by the Planning Secretary.

The following definition of high and low risk activities has been prepared to minimise the frequency and duration of works with unacceptable noise and/or vibration impacts, as shown in Table 3.

Table 3 Classification of Low and High risk OOHW

Low risk	High risk
<p>Works that do not trigger the three 'high risk' criteria for residential receivers</p> <p>Works that are not considered high risk following consultation with the AA and Sydney Metro Communications Manager</p>	<p>As a default risk level, OOHW will be categorised as 'high risk' if all of the following three criteria apply:</p> <ul style="list-style-type: none"> • The type and sensitivity of the affected noise sensitive receivers is categorised as either Moderate Impact receivers (e.g. standard residential/typical density) or High Impact receivers (e.g. elderly/high density/persistent complainers/residents experiencing construction noise fatigue); and • The predicted noise level of the OOHW has a likelihood for potential sleep disturbance (i.e. Rating Background Level + 15 dB or more); and • The type of and intensity of noise emitted from the OOHW is categorised as High Impact (e.g. prolonged high noise and/or vibration intensive activities), <p>For non-residential receivers, OOHW may be considered as 'high risk' if undertaken during trading hours and in close proximity to their place of business (for example, during Saturday evening trading hours). Since each non-residential receiver has different business needs, it is imperative that the Sydney Metro Communications Manager and the AA discuss each OOHW application to better understand how the proposed OOHW would impact the business.</p>

As part of their review, using the default risk level as a 'starting point', the AA and ER will consider all other relevant factors to confirm or adjust the nominated risk level. These relevant factors include:

- Those identified in Section 6.4 of the CNVS
- Those listed in [Table 4](#) of this document;
- Third Party permits; and
- Any other factors the AA considered relevant in their professional opinion.

These factors may cause the default risk level to be modified from either 'high risk' to 'low risk' (or vice-versa), as the AA/ER deems appropriate in their professional opinion.

Once the AA & ER has confirmed the final risk level for the OOHW application and indicated the risk level on the application (including any risk identification commentary), they will sign and date the application in the format of *endorsement* for the AA and *review* for the ER. Following this, approval will be granted by the ER in consultation with the AA (for low risk works) or DPIE (for high risk works).

Table 4 Risk Level Considerations

Type	Risk Level Considerations
Predicted Noise Exceedance	The degree of predicted noise level exceedance above the RBL or NML as appropriate
Certainty	Whether RBLs, NMLs or predicted noise impacts are not well understood
Past Experience	Nature of works are new, in a new location or have not been undertaken by the contractor on the project already
Negotiated Agreement with Sensitive Receivers	Whether negotiated agreements have been obtained in accordance with MCoA D38
Potential Sleep Disturbance	Whether the activity is likely to exceed the Project's sleep disturbance criteria
Non-Residential Receivers	Whether the impacted non-residential receivers operate within the same time period as scheduled OOHW.
Special Events	The timing and location of special events in the area of the proposed OOHW may be schedules at the same time or immediately before or after the special event (e.g. festivals, public gatherings etc.)

Following approval by the ER or the Planning Secretary, the approved OOHW Permit will be provided to the construction team by the Quickway Environment Manager. Mitigation measures that relate to the OOHW will be:

- Implemented prior to OOHW (such as specific conditions that relate to the community).
- Communicated to relevant workforce and site personnel before each shift to introduce/reinforce work restrictions, management measures and expected workforce behaviour.
- Implemented during OOHW and monitored by the Quickway Environment Team to confirm/validate the noise predictions where required by the permit.

Following the OOHW, Quickway will review any lessons learnt and monitoring data to help inform future OOHW activities and mitigation measures and minimise impacts.

5.1 External Approval Authorities for OOHW

In accordance with CoA D38(a)(iii), if the proposed OOHW includes high risk activities, approval of the OOHW will be sought from the Secretary.

Additionally, the Planning Secretary will be informed by Sydney Metro of all upcoming low risk out-of-hours works in an agreed format. This is likely to take the format of a weekly submission or presentation of a four week look-ahead of works, however the final process for provision of this information will be determined by Sydney Metro in consultation with DPIE.

6. Mitigation measures and consultation

6.1 Mitigation

Works outside approved hours are typically undertaken at a time most people are more sensitive to noise and vibration and background levels of noise are quieter. This increases the level of risk for adverse impacts on the community.

Quickway will implement all reasonable and feasible measures for noise mitigation and management described in its CNVMP (Section 8) regardless of predicted noise levels. These actions will include as a minimum:

- management of behaviour such as avoiding shouting and swearing, turning off idling equipment when not in use, avoiding impulsive noise (metal on metal contact),
- selection of quieter equipment such as smaller, lower powered, newer, or better maintained.
- examining alternative technologies and methods to complete activities more quietly
- programming to avoid noisy activities after midnight as far as practicable (such as hammering, sawing etc)
- use of screens and enclosures to reduce noise emissions from equipment.
- adequate consultation and notification (as described below)
- noise and vibration monitoring in line with the Noise and Vibration Monitoring Program (Appendix B of the CNVMP).

In addition to the above standard mitigation measures, the additional mitigation measures described in the CNVS (Section 5) and referenced in Section 8.2 of the CNVMP will be implemented as far as they are reasonable and feasible.

6.2 Consultation

Consultation on respite with the affected community will be undertaken to meet the requirements of MCoA D51, as described in Section 7.1.

In line with MCoA D41, noise generating work in the vicinity of potentially affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution. Sensitive periods and potential alternative arrangements will be determined by the consultation process described on the Community Consultation Strategy to be implemented by Sydney Metro.

6.3 Community Notifications

Community notifications can be used as a mitigation measure for receivers of noise and vibration impacts as a result of OOHW.

Community notifications usually comprise of letterbox-dropped or hand-distributed notification letters to identified stakeholders prior to the commencement of works. Communities are more likely to understand and accept the impacts from noise and vibration if they are provided with honest detailed information and

commitments on mitigation measures to be implemented that are adhered to by the project prior to the works commencing.

Community notification requirements are included in the CNVS and outlined in the Community Communications Strategy. Specific notifications of OOHW events will be issued to potentially affected sensitive receivers at least five days, and not more than 14 working days, prior to the OOHW commencing.

OOHW notifications will be prepared generally in accordance with the CNVS and will:

- Be undertaken by letterbox drop or email
- Clearly outline the reason that the work is required to be undertaken outside standard construction hours specified
- Include a diagram that clearly identifies the location of the proposed works in relation to nearby cross streets and local landmarks
- Include details of relevant time restrictions that apply to the proposed works
- Clearly outline in plain English, the location, nature, type of work, scope and days and dates and hours of the proposed works
- Detail the expected noise impact of the works on potentially affected noise sensitive receivers
- Detail mitigation and management measures and proposed respite periods
- Clearly state how complaints may be made and additional information obtained
- Include the number of the 24-hour telephone complaints line, site contact (where available and the Project website address).

In accordance with MCoA D45, landowners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage will also be notified prior to OOHW that generate vibration commencing near those properties.

If the potential exceedance is to occur more than once, or extend over a period of 24 hours, landowners and occupiers would be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the landowner and occupier.

6.4 Negotiated Agreements

A negotiated agreement for particular OOHW may be formed with the potentially affected sensitive receivers in accordance MCoA D37(c)(iii). These negotiated agreements would be undertaken and documented by the Sydney Metro Place Manager, and will be included as evidence for relevant OOHW applications.

A substantial majority of those sensitive receivers that are contactable need to agree to support the negotiated agreement for it to be considered. 'Contactable' is defined as having received correspondence (either verbal or written) from receivers within a two-week timeframe. The Land Use Survey (included in the CNVMP), noise and vibration assessment for OOHW (either as part of or in addition to the DNVIS) and the Place Manager will advise of potentially affected sensitive receivers to be contacted.

Upon approval of any OOHW applications containing negotiated agreements, Sydney Metro will forward the negotiated agreement documentation to the Secretary for information at least one week prior to the OOHW commencing.

7. Scheduling and respite

7.1 Respite

Providing respite is an important component of reducing impacts to potentially affected receivers. OOHW, including work undertaken by other projects, must be coordinated to ensure respite periods are not impacted (discussed further in Section 7.2).

Consultation will be critical in ensuring the community's expectations are managed, their concerns are heard, appropriate respite and other mitigation is implemented and works outside of approved hours are not unexpected. As per MCoA D51, appropriate respite periods for the OOHW will be identified in consultation with the community at each affected location on a regular basis. This consultation will include providing the community with:

- (a) a progressive schedule for periods no less than three (3) months, of likely out-of-hours work;
- (b) a description of the potential work, location and duration of the out-of-hours work;
- (c) the noise characteristics and likely noise levels of the work; and
- (d) likely mitigation and management measures which aim to achieve the relevant NMLs under MCoA D39 (including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers).

The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour work will be provided to the AA, EPA, ER and the Planning Secretary.

Respite periods can be any combination of days or hours during which receivers are not impacted by works resulting in noise levels greater than 5 dB(A) above the RBL at any residence. There are three main forms of respite to be considered for the Project, described further below.

7.1.1 High noise or vibration emitting works

For high noise or vibration emitting works a respite scenario of three hours on followed by one hour off will be implemented in accordance with MCoA D36 and CNVS Section 4.2. This will apply to the following activities unless otherwise agreed by potentially impacted receivers:

- use of power saws, such as used for cutting timber, masonry, road pavement or steel work;
- grinding metal, concrete or masonry;
- rock drilling;
- line drilling;
- vibratory rolling;
- bitumen milling or profiling;
- jackhammering, rock hammering or rock breaking;
- rail tamping and regulating; and
- impact piling.

7.1.2 Project specific respite offers

The CNVS (Section 5) requires project specific respite offers are to be made for all OOHW that are predicted to generate impacts that exceed the criteria (refer to CNVS Section 5.1) for the applicable OOHW period. The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration a respite from an ongoing impact. Respite may be offered in the form of a reduction or absence of noise emissions for a period of time, or by removing the affected receiver from the noise emission point source (e.g. dinner/movie tickets).

If a project specific respite offer is required, a decision on the type of offer will be determined on a case-by-case basis and considering, but not limited to, the following factors:

- the predicted maximum exceedance level
- the predicted exceedance levels and associated duration and timings of those exceedance levels
- the overall duration of the predicted exceedance levels
- surrounding land uses
- community feedback
- any other OOHW (Sydney Metro or otherwise) that have affected or will affect the same receivers concurrently or within three days of either the start or end of the proposed OOHW.

7.1.3 Alternative Accommodation

As described in the CNVS (Section 5), alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts over an extended period of time. Specific triggers for alternative accommodation are provided in CNVS Section 5.1.

As per the project specific respite offers, alternative accommodation will be determined on a case-by-case basis, in consideration of the same contributing factors as listed in 7.1.2. Alternative accommodation will be offered by the Place Manager in consultation with each triggered receivers, to understand and align with their respite preferences.

7.2 Scheduling

As part of the noise and vibration assessment process under MCoA D50, Quickway will ensure all OOHW undertaken for the delivery of the CSSI, including works undertaken by a third party, are co-ordinated to implement appropriate respite and/or mitigation measures for potentially affected sensitive receivers and ensure respite would be coordinated to ensure agreed respite is provided.

Works undertaken as part of this OOHW Protocol will be scheduled to minimise or avoid any impact to agreed respite due to:

- other works, which may have been approved via other pathways, such as community agreement (MCoA D37(c)(iii)).
- works associated with other major projects (e.g. M4-M5 Link Rozelle Interchange) or known third parties works which may also reduce the respite provided to the community.

Scheduling of these activities will consider in each case the reduction in respite due to other approved works. Ideally, works will be scheduled to occur within the same OOHW period to preserve non-work

periods. To achieve this, consultation will be undertaken with the Environment Manager, Place Manager, Quickway engineers and where possible applicable third parties, to ensure works can be coordinated to satisfy MCoA D37(d).

Scheduling will be facilitated using KNOWnoise, which captures all works within a calendar view for simple communication of upcoming activities. All relevant team members will have access to KNOWnoise to schedule specific OOHW works.

Cumulative impacts from works being undertaken at the same time are also assessed within KNOWnoise.

8. OOHW Monitoring

Noise and vibration monitoring of OOHW will be conducted as determined by DNVIS or KNOWnoise assessments (see [Section 4.2](#)) or as triggered by the additional mitigation measures described in the CNVS. These monitoring requirements will be identified on the OOHW Permit.

Monitoring will be undertaken as described in the Project's Noise and Vibration Monitoring Program.

Appendix A OOHW Permit

Sydney Metro West, Power Enabling Works

Quickway Out of Hours Permit: The Bays 33kV

3869-SMW-PER-001

Revision 0.0

8 June 2021

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1. Permit Reference

This Out of Hours Works Permit (the Permit) is to be used for review and approval of out of hours works (OOHW) on the Sydney Metro West project within The Bays Power Enabling Works scope.

This Permit is **not** required for the Eastern Creek Power Enabling Works scope – for which OOHW will be assessed under a General Noise and Vibration Impact Assessment (GNVIS).

Each Permit and all relevant information must be submitted to Sydney Metro by 15 business days prior to the commencement of the proposed OOH work.

1	Permit Reference	
1a	Application Title: E.g. 'Smith St service relocation works'.	
1b	Application Number:	
1c	Application Date: (resubmission date in parentheses if applicable).	
1d	Revision Number:	
1e	Description of works location and layout figure attached as Appendix A (Y/N):	

2. Out of Hours Works (OOHW) Details

2 OOHW Details	
2a	Activity reference from DNVIS:
2b	<p>Are the works consistent with the description in the DNVIS (Y/N)?</p> <p>If 'No', detail any changes from the activity description provided in DNVIS:</p> <p>Or</p> <p>Description of activities if not included in DNVIS:</p> <ul style="list-style-type: none"> • Work methodologies • Plant/equipment to be used • Location of works or plant/equipment offset from receivers • Justification
2c	<p>Timing details, including:</p> <ul style="list-style-type: none"> • Duration - commencement and completion of total activity • Start and end times per shift • Breakdown of major activities across each shift including any activity/plant specific timing or duration restrictions to be applied <p>Please include this as a separate attachment if works exceed one shift.</p>
2d	<p>Are the works being undertaken under a Third Party permits (e.g. Road Occupancy Licenses)? (Y/N)</p> <p>Include evidence in Appendix E</p>
2e	<p>Applicable category of OOHW as described in MCoA D37 (Environmental Manager to assist)</p> <p>(a) Safety and Emergencies (b) Low Impact (c) By Approval (d) By prescribed activity</p>

3. Noise and Vibration assessment outcomes and mitigation measures

3	Noise and Vibration assessment outcomes and mitigation measures	
3a	<ol style="list-style-type: none"> For works consistent with DNVIS attach: <ol style="list-style-type: none"> relevant list of worst-case scenario receiver noise levels divided by required additional mitigation measures (AMM) (as per Sydney Metro CNVS) as Appendix B. Noise and vibration contour maps as Appendix C. For works not consistent with DNVIS please complete a Noise and Vibration Model using KnowNoise and attach outcomes as Appendix B and C as described above. Process for modelling is described in DNVIS 	
3b	Confirmation works comply with definition of Low Impact OOHV as per MCoA D37 (b)	
3c	Outline the activity specific noise mitigation measures to be implemented for these works:	
3d	Describe any AMM that are identified as applicable for consideration but not being implemented, with justification as to why not:	
3e	Are any residential receivers or other sensitive receivers identified as triggering the noise sleep disturbance criteria as described in the DNVIS?:	
3f	<p>Is there vibration generating activities proposed to be undertaken inside the following criteria, if yes please provide addresses?:</p> <ol style="list-style-type: none"> 2.5mm/s PPV vibration contour (worst case scenario) for Heritage Items (note, The Valley Heritage Conservation Area is not applicable as a heritage item in this context.) 	
	<ol style="list-style-type: none"> Vibration contour (worst case scenario) for the Human Comfort VDV criteria relevant to the proposed works (time and durations) as defined in the DNVIS. 	
	<ol style="list-style-type: none"> Vibration contour (worst case scenario) for the Cosmetic Damage PPV criteria applicable to the proposed works (frequency) as described in the DNVIS. 	

4. Monitoring Summary

4	Monitoring Summary		
	Type of monitoring required: e.g. <ul style="list-style-type: none"> Noise or Vibration Attended or Unattended. 	Reason for monitoring, e.g. <ul style="list-style-type: none"> Heritage item Triggered by noise impacts Potential sleep disturbance Potential vibration impact 	Proposed location of monitoring (note subject to change based on location of closest sensitive receiver at the time the monitoring is occurring).
4a			
4b			
4c			

5. Cumulative Impacts

5	Cumulative Impacts	
5a	Will any other surface OOHW activities impact receivers identified in the noise contours, either concurrently or upon the following night period of the start or end of these proposed works?	
5b	If yes, how have the proposed works been coordinated to ensure appropriate respite is provided?	

6. Community Consultation

6	Community Consultation (Sydney Metro West Community Team)	
6a	What community consultation has been undertaken already?	
6b	What community consultation is planned to be undertaken?	
6c	If drafted already, attach applicable Community Notification as Appendix D .	

7. Contractor's Signatures

7 Contractor's Signature				
Contractor's Identification of Risk Level: Does not apply to Low Impact OOH	Circle:	LOW	or	HIGH
Justification for Risk Level: Does not apply to Low Impact OOH				
Contractor's Signature:				
Name:				
Title:				
Contact Number:				
Date:				

8. Determination

Step 1: Review and Acceptance from Sydney Metro		Step 2a: AA confirmation of risk level (does not apply to Low Impact OOHw)	Step 3a: ER confirmation of risk level (does not apply to Low Impact OOHw)	Step 4: Approval <ul style="list-style-type: none">ER (Low Risk)DPIE (High Risk)N/A (Low Impact OOHw)
AA confirmed risk level (circle): LOW or HIGH	Step 2b: AA Endorsement	ER confirmed risk level (circle): LOW or HIGH	Step 3b: ER Review	
Signature:				
Name:				
Role:				
Date:				
Comments:				
Conditions:				

Appendix A Location of Works Map

Appendix B Receiver Noise Levels Table

Appendix C Noise and Vibration Contour Maps

Appendix D Community Notification

Appendix E Evidence of Third-Party Approvals

Appendix D Sydney Metro Construction Noise and Vibration Standard

Appendix D

Construction Noise and Vibration Standard

Sydney Metro Construction Noise and Vibration Standard

SM-20-00098866

Sydney Metro Integrated Management System (IMS)

Applicable to:	Sydney Metro West
Author:	Sydney Metro
System owner:	Sydney Metro
Status:	Final
Version:	4.3
Date of issue:	04/11/2020
Security classification:	Open Access
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1. PURPOSE AND SCOPE

This Standard applies to all Sydney Metro projects and covers all elements of the project lifecycle with the exception of operational activities. Additionally, this standard only applies to design activities insofar as design decisions affect construction-related noise and vibration impacts (such as route selection, at-grade or underground rail systems and tunnel depth).

1.1. Distribution and Use

This document may be used in the development of, or referred to in:

- Environmental Impact Assessment documents;
- Design and construction environmental management documents;
- Contract documents; or
- Approvals and licences (subject to the agreement of the relevant regulatory authority).

1.2. Strategic Objectives

Sydney Metro recognise that sources of Noise and Vibration originating from our activities have a significant impact to local communities. We have adopted several strategic objectives to understand and manage these impacts:

- Applying a risk-based approach and implementing an appropriate hierarchy of controls at each stage of the project lifecycle to minimise impacts.
- Building an approach to reducing Noise and Vibration risks within each stage of the project lifecycle through active collaboration with internal and external stakeholders.
- Developing a clear understanding of our Construction Noise and Vibration Impacts and applying best practice management techniques.
- Valuing genuine community engagement that is sensitive to the needs and expectations of local communities and businesses.
- Committing to the continual improvement of Noise and Vibration management.

1.3. Construction Noise and Vibration Terminology

Decibel (dB): Decibel, often expressed as an ‘A – weighted’ sound pressure level, which has been found to correlate well with human subjective reactions to moderate noise levels. For steady, broadband noise, an increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness and a change of 2 to 3 dB is subjectively barely perceptible.

Sound Pressure Level (SPL or L_p): Expressed in dB, it is the level of noise measured by a standard sound level meter. It must be accompanied by a description of the measurement distance from the source, if used in any noise predictions or calculations. In a free field (eg outside on flat ground), each doubling of distance results in approximately 6dB reduction in airborne sound pressure level due to distance attenuation.

Sound Power Level (SWL or L_w): Expressed in dB, it is the total acoustic energy radiated by a plant or equipment to the environment. Sound power level is independent of distance from the source of the noise.

Rating Background Level (RBL): Rating background level is the overall single-figure background level representing each assessment period (day/evening/night) over a measurement period. As defined in the EPA “Noise Policy for Industry” dated October 2017.

Vibration: Vibration may be expressed in terms of displacement, velocity and acceleration. Velocity (mm/s), acceleration (m/s²) and Vibration Dose Value (VDV, m/s^{1.75}) are most commonly used when assessing human comfort issues respectively. Peak Particle Velocity (PPV, mm/s) is typically used to assess impacts on structures.

Ground borne noise and Structure-borne noise: The transmission of noise energy as vibration travelling through the ground and / or structures and re-radiated as audible noise.

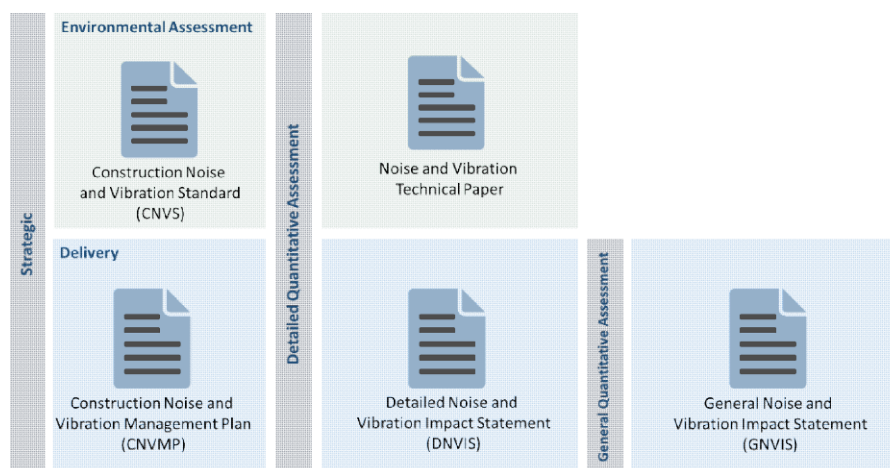
The three primary noise metrics used to describe construction noise emissions in the modelling and assessments are:

L_{A1(1minute)}	The typical ‘maximum noise level for an event’, used in the assessment of potential sleep disturbance during night-time periods. Alternatively, assessment may be conducted using the L _{Amax} or maximum noise level
L_{Aeq(15minute)}	The ‘energy average noise level’ evaluated over a 15-minute period. This parameter is used to assess the potential construction noise impacts.
L_{A90}	The ‘background noise level’ in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. The L _{Aeq(15minute)} construction noise management levels are based on the L _{A90} background noise levels.

1.4. Documentation Framework

There are five main documents (**Figure 1**) which comprise the noise and vibration documentation framework. Together they provide a comprehensive approach to the assessment and delivery of works which generate noise and vibration while mitigating the impacts.

Figure 1 - Noise and Vibration Documentation Framework



1.4.1. Construction Noise and Vibration Standard (CNVS)

The CNVS (this document) establishes a consistent strategy for the assessment, mitigation and monitoring of noise and vibration generated by construction activities. It defines a minimum standard for managing noise and vibration impacts that considers currently best practice guidelines and other regulatory requirements. It is included in all Sydney Metro Environmental Assessments.

1.4.2. Construction Noise and Vibration Management Plan (CNVMP)

Where works will cause significant noise and vibration impacts upon sensitive receivers Principal Contractors will be required to prepare and implement CNVMP's. These documents form part of the CEMP suite of documentation.

The function of the CNVMP is to provide a strategic overview of how the requirements of the CNVS will be applied to activities or locations under the control of the Principal Contractor. This overview includes an outline of how quantitative noise and vibration assessments will be undertaken across worksites and/or activities, and an indicative construction schedule.

The CNVMP also links to Community and Stakeholder consultation processes and explains how commercial and residential receivers will be consulted throughout the construction phase with regard to mitigating impacts upon them.

Further detail on the requirements for CNVMP's can be found in the Sydney Metro Construction Environmental Management Framework.

1.4.3. Noise and Vibration Technical Paper

The Noise and Vibration Technical Paper is produced as part of the Environmental Assessment carried out in the planning phase of Sydney Metro projects. This document is a Quantitative Noise Assessment based upon the information known at the time the assessment is undertaken and makes recommendations for mitigation.

Typically it will include a range of assumptions on equipment lists and construction methodologies on the basis of which the impact upon sensitive receivers will be determined. As such, these Quantitative Assessments are generally conservative and may over predict actual impacts during construction.

1.4.4. Detailed Noise and Vibration Impact Statements (DNVIS)

While quantitative noise assessments are documented in environmental assessments, Principal Contractors will have a better understanding of the exact equipment list and construction methodology to be used in carrying out their works. As a result, certain assumptions made in the Noise and Vibration Technical Paper can be clarified in a secondary quantitative assessment undertaken by the Principal Contractor. These documents are called Detailed Noise and Vibration Impact Statements.

They are typically written with a focus on specific activities or locations and consider works carried out inside and outside of standard working hours.

Where 24/7 works are approved under an SSI approval, a separate DNVIS should be carried out specifically for these activities.

Work described in a DNVIS's cannot proceed until the DNVIS is approved by an Acoustic Advisor appointed under an SSI approval or other delegate approved by Sydney Metro. Should the scope of work or the timing of works change, the Principal contractor must update the DNVIS and seek subsequent approval for the new version. See **Section 3.1** for more detail on DNVIS's.

1.4.5. General Noise and Vibration Impact Statements (GNVIS)

General Noise and Vibration Impact Statements are also secondary assessments and have the same purpose as DNVIS's except that the assessment process is simplified. A GNVIS may be undertaken for works not being carried out under an SSI Approval.

Work described in a GNVIS's cannot proceed until the GNVIS is approved by Sydney Metro. Should the scope of work or the timing of works change, the Principal contractor must update the GNVIS and seek subsequent approval for the new version. See **Section 3.2** for more detail on GNVIS's.

2. NOISE AND VIBRATION GUIDELINES

2.1. Construction Hours

Where possible, works will be completed during the standard day time construction hours of Monday to Friday 7.00 am to 6.00 pm and Saturdays 8.00 am to 1.00 pm. However, the nature of infrastructure projects means evening and night works are likely to be required throughout construction due to various considerations including avoiding sensitive periods for sensitive receivers, delivery of oversized plant or structures, emergency works, or other activities that require the temporary closure of roads. In some cases these standard working hours may be varied by the project planning approval in recognition that works will need to be consistently undertaken during certain times such as morning shoulders or Saturday afternoons. For other situations the impacts of works outside standard construction hours will be approved via updates to the relevant activities DNVIS or GNVIS.

In other cases there may be a need to assess activities that require 24 hour working for a significant portion of the construction period. Examples of construction scenarios that will require 24/7 works include:

- Excavation of station shafts;
- Truck movements to manage spoil;
- Excavation of the station caverns;
- Operation of tunnel boring machines;
- Spoil removal and transport from site; or
- Tunnel support works, including materials delivery.

Works requiring 24/7 activity are usually proposed in the environmental assessment and will be subsequently assessed in a secondary quantitative assessment during delivery. Where the need for 24 hours works arises post approval, a consistency assessment would be undertaken to determine if a modification to the planning approval is required.

2.2. Construction Noise Management Levels (NML)

Construction Noise Management Levels (NML) for all Sydney Metro projects are determined in accordance with the EPA's *Interim Construction Noise Guideline* dated July 2009 (ICNG) unless the planning approval recommends an alternate approach, or sets different NMLs. The following sections supplement this guideline with respect to Sydney Metro projects.

2.2.1. Residences and Other Sensitive Land Uses

Noise Management Levels and how they are applied is set out in **Table 1**. This approach is intended to provide respite for residents exposed to excessive construction noise whilst allowing construction to occur without undue constraints.

The Rating Background Level (RBL) is used when determining the management level and is the overall single-figure background noise level measured in each relevant assessment period (as defined in the EPA's *Noise Policy for Industry* dated October 2017).

Table 1: Noise Management Levels for different times of day and considerations on their application

Time of Day	Noise Management Level LAeq (15minute) ¹	Management Considerations
Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm	Noise affected RBL + 10 dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where the predicted or measured LAeq (15minute) is greater than the noise affected level, the proponent would apply all feasible and reasonable work practices to minimise noise.</p> <p>The proponent would also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</p>
	Highly noise affected 75 dB	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, the proponent would consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level.</p> <p>If no quieter work method is feasible and reasonable, and the works proceed, the proponent would communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.</p>
Outside recommended standard hours	Noise affected RBL + 5 dB	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent would apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent would negotiate with the community.</p> <p>For guidance on negotiating agreements see Section 7.2.2 of the ICNG.</p>

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence.

Non mandatory management levels for noise near properties which are sensitive to Noise Impacts are presented in **Table 2**. These values are set and based on the principle that the characteristic activities for each would not be unduly disturbed. The noise management levels apply only when the property is being used, for example, classrooms during school hours. Internal noise levels are to be assessed at the centre of the occupied room. External noise levels are to be assessed at the most-affected point within 50 m of the area boundary.

Table 2: Noise Management Levels for certain sensitive receivers

Land Use	Management Level, LAeq (15minute) (Applies When Land Use is being Utilised)
Classrooms at schools and other educational institutions	Internal noise level 45 dB
Hospital wards and operating theatres	Internal noise level 45 dB
Places of worship	Internal noise level 45 dB
Active recreation areas (such as parks and sports grounds or playgrounds)	External noise level 65 dB
Passive recreation areas (such as outdoor grounds used for teaching, outdoor cafes or restaurants)	External noise level 60 dB

Other noise-sensitive businesses require separate specific noise goals and it is suggested in the ICNG that the internal construction noise levels at these premises are to be referenced to the 'maximum' internal levels presented in AS 2107. Recommended 'maximum' internal noise levels from AS 2107 are reproduced in **Table 3** for other sensitive receiver types.

However, the ICNG and AS 2107 do not provide specific criteria for childcare centres. Childcare centres generally have internal play areas and sleep areas. For these facilities, where feasible and reasonable the objective should be to achieve levels for sleeping of 45 dB(A) (consistent with hospital wards/places of worship) and for play areas of 65 dB(A) (consistent with playgrounds).

Table 3 AS 2107 Recommended Maximum Internal Noise Levels

Land Use	Time Period	AS 2107 Classification	Recommended "Maximum" Internal LAeq (dBA)
Hotel	Daytime & Evening	Bars and Lounges	50 dB
	Night-time	Sleeping Areas: - Hotels near major roads	40 dB
Café	When in use	Coffee bar	50 dB
Bar/Restaurant	When in use	Bars and Lounges / Restaurant	50 dB
Library	When in use	Reading Areas	45 dB
Recording Studio	When in use	Music Recording Studios	25 dB
Theatre / Auditorium	When in use	Drama Theatres	30 dB

2.2.2. Commercial and Industrial Premises

Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining Noise Management Levels is separated into three categories. The external noise levels would be assessed at the most-affected occupied point of the premises:

- Industrial premises (external): 75 dB LAeq(15minute)
- Offices, retail outlets (external): 70 dB LAeq(15minute)
- Other businesses that may be very sensitive to noise, where the noise level is project specific as discussed below.

Examples of other noise-sensitive businesses are theatres, studios and child care centres. The proponent would undertake a special investigation to determine suitable noise levels on a project-by-project basis; the recommended internal noise levels presented in Table 1 of AS 2107 “Acoustics - Recommended design sound levels and reverberation times for building interiors” (Standards Australia 2000) may assist in determining relevant noise levels; however, an acoustic consultant would be engaged in order to determine corresponding external noise levels based on the published internal noise levels. The proponent would assess construction noise levels for the project, and consult with occupants of commercial and industrial premises prior to lodging an application where required. During construction, the proponent would regularly update the occupants of the commercial and industrial premises regarding noise levels and hours of work.

2.3. Ground-Borne Vibration

The effects of vibration in buildings can be divided into three main categories; those in which the occupants or users of the building are inconvenienced or possibly disturbed, those where the building contents may be affected and those in which the integrity of the building or the structure itself may be prejudiced.

2.3.1. Human Comfort Vibration

The DECCW’s “Assessing Vibration: a technical guideline” dated February 2006 (DEC, 2006) recommends the use of BS 6472-1992 for the purpose of assessing vibration in relation to human comfort.

British Standard 6472-1992 “*Guide to evaluation of human exposure to vibration in building*” nominates guideline values for various categories of disturbance, the most stringent of which are the levels of building vibration associated with a “low probability of adverse comment” from occupants.

BS 6472-1992 provides guideline values for continuous, transient and intermittent events that are based on a Vibration Dose Value (VDV), rather than a continuous vibration level. The vibration dose value is dependent upon the level and duration of the short term vibration event, as well as the number of events occurring during the daytime or night-time period.

The vibration dose values recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected are presented in **Table 4**.

Table 4: Vibration Dose Value Ranges above which various degrees of Adverse Comment may be expected in Residential Buildings

Place and Time	Low Probability of Adverse Comment (m/s ^{1.75})	Adverse Comment Possible (m/s ^{1.75})	Adverse Comment Probable (m/s ^{1.75})
Residential buildings 16 hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hr night	0.13	0.26	0.51

2.3.2. Structural Damage Vibration

Most commonly specified ‘safe’ structural vibration limits are designed to minimise the risk of threshold or cosmetic surface cracks, and are set well below the levels that have potential to cause damage to the main structure.

In terms of the most recent relevant vibration damage goals, Australian Standard AS 2187: Part 2-2006 ‘Explosives - Storage and Use - Part 2: Use of Explosives’ recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 ‘Evaluation and measurement for vibration in buildings Part 2’ as they “are applicable to Australian conditions”.

The Standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (e.g. compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

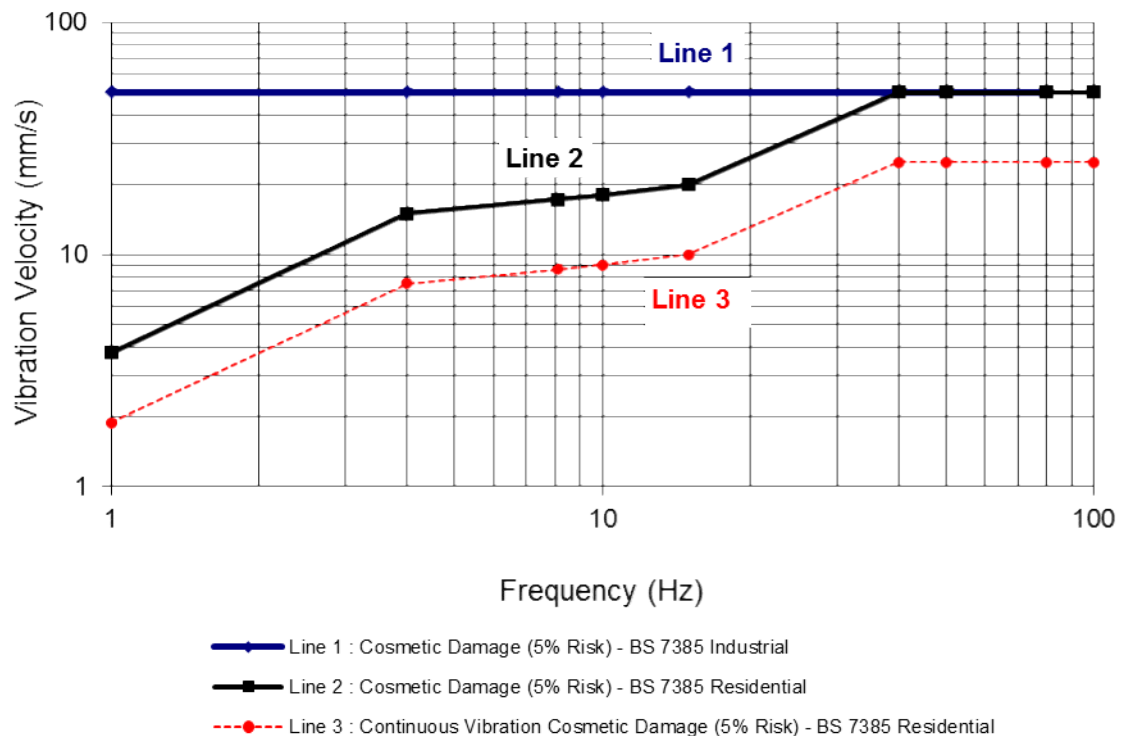
2.3.3. Cosmetic Damage Vibration

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in **Table 5** and graphically in **Figure 2**.

Table 5: Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

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

Figure 2: Graph of Transient Vibration Guide Values for Cosmetic Damage



The Standard goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 5**, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the Standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the guide values in **Table 5** would not be reduced for fatigue considerations.

In order to assess the likelihood of cosmetic damage due to vibration, AS2187 specifies that vibration measured would be undertaken at the base of the building and the highest of the orthogonal vibration components (transverse, longitudinal and vertical directions) would be compared with the guidance curves presented in **Figure 2**.

It is noteworthy that extra to the guide values nominated in **Table 5**, the standard states that:

“Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.”

Also that:

“A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.”

2.4. General Vibration Screening Criterion

The Standard states that the guide values in **Table 5** relate predominantly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings.

Where the dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in **Table 5** may need to be reduced by up to 50%.

Note: rock breaking/hammering and sheet piling activities are considered to have the potential to cause dynamic loading in some structures (e.g. residences) and it may therefore be appropriate to reduce the transient values by 50%.

Therefore 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: 7.5 mm/s

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

2.5. Guidelines for Vibration Sensitive and Special Structures

2.5.1. Heritage

Heritage buildings and structures would be assessed as per the screening criteria in **Section 2.4** 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 criteria of 2.5 mm/s peak component particle velocity (from DIN 4150) would be considered.

2.5.2. Sensitive Scientific and Medical Equipment

Some scientific equipment (e.g. electron microscopes and microelectronics manufacturing equipment) can require more stringent objectives than those applicable to human comfort.

Where it has been identified that vibration sensitive scientific and/or medical instruments are likely to be in use inside the premises of an identified vibration sensitive receiver, objectives for the satisfactory operation of the instrument would be sourced from manufacturer's data. Where manufacturer's data is not available, generic vibration criterion (VC) curves as published by the Society of Photo-Optical Instrumentation Engineers (Colin G. Gordon - 28 September 1999) may be adopted as vibration goals. These generic VC curves are presented below in **Table 6** and **Figure 3**.

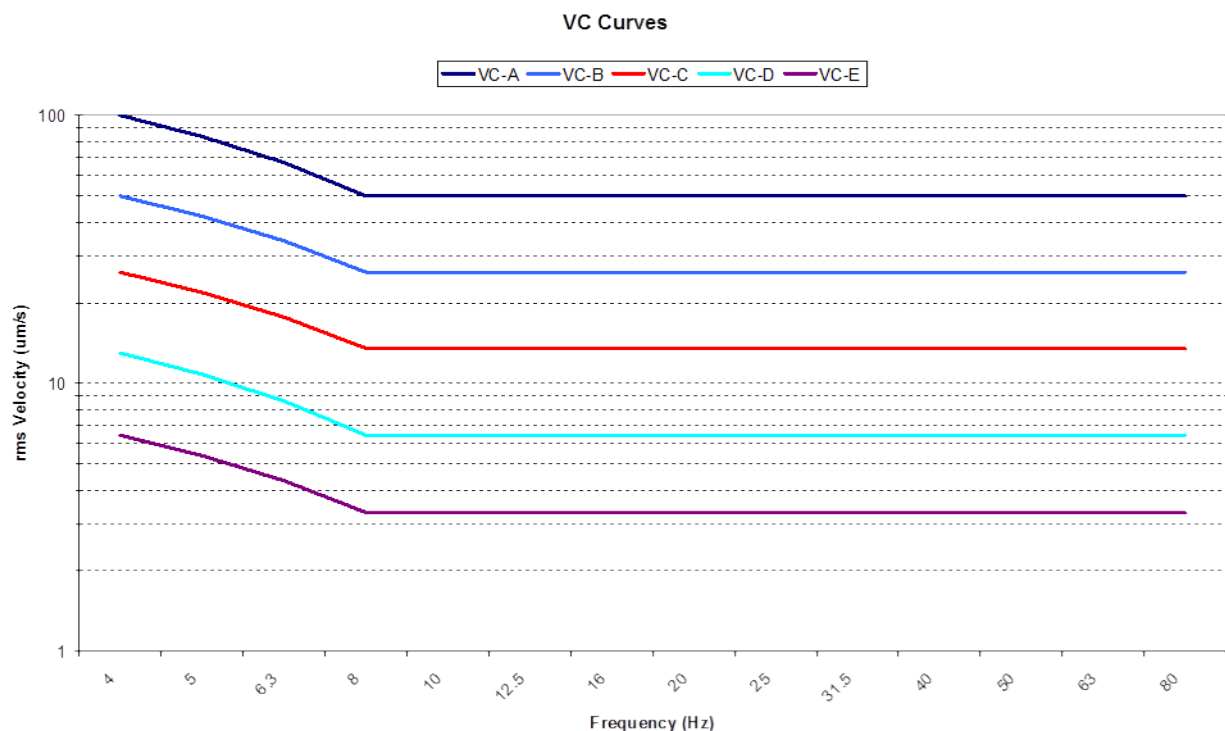
Table 6: Application and Interpretation of the Generic Vibration Criterion (VC) Curves
(as shown in Figure 3)

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

Note 1: As measured in one-third octave bands of frequency over the frequency range 8 to 100 Hz.

Note 2: The detail size refers to the line widths for microelectronics fabrication, the particle (cell) size for medical and pharmaceutical research, etc. The values given take into account the observation requirements of many items depend upon the detail size of the process.

Figure 3: Vibration Criterion (VC) Curves



2.5.3. Other Vibration Sensitive Structures and Utilities

Where structures and utilities are encountered which may be considered to be particularly sensitive to vibration, a vibration goal which is more stringent than structural damage goals presented in **Section 2.4** may need to be adopted. Examples of such structures and utilities include:

- Tunnels
- Gas pipelines
- Fibre optic cables

Specific vibration goals would be determined on a case-by-case basis. An acoustic consultant would be engaged by the construction contractor and would liaise with the structure or utility's owner in order to determine acceptable vibration levels.

2.6. Vibration and Overpressure from Blasting

The DECC's ICNG recommends that vibration and overpressure from blasting be assessed against the levels presented in the Australian and New Zealand Environment Council's (ANZEC) Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration (ANZEC, 1990).

The criteria set by this standard were based on practices undertaken more than 30 years ago and were targeted at operations that occur for long periods of time such as those at mining sites and hence are targeted at protecting human comfort vibration levels. As a result the vibration levels are conservative and can introduce unnecessary constraints when applied to construction projects which typically occur for much shorter time periods. Recent NSW infrastructure project approvals have recognised the restrictive nature of these blasting criteria when applied to construction projects and have therefore allowed the following vibration and overpressure limits:

- Vibration (PPV): 25 mm/s
- Overpressure: 125 dBL

These upper limits are deemed acceptable where the proponent has a written agreement with the relevant landowner to exceed the criteria and the Secretary has approved the terms of the written agreement. These upper limits to vibration and overpressure are intended to target the protection of building structures from cosmetic damage rather than human comfort criteria as construction works are considered short-term.

2.7. Ground-Borne (Regenerated) Noise

Ground-borne (regenerated) noise is noise generated by vibration transmitted through the ground into a structure. Ground-borne noise caused, for example by underground works such as tunnelling, can be more noticeable than airborne noise. The following ground-borne noise levels for residences are nominated in the ICNG and indicate when management actions would be implemented. These levels recognise the temporary nature of construction and are only applicable when ground-borne noise levels are higher than airborne noise levels. Any levels exceeding objectives should be considered in the context of any existing exposure to ground-borne noise.

The ground-borne noise management levels are given below:

- Evening (6.00 pm to 10.00 pm)
Internal Residential: 40 dB LAeq(15minute)
- Night-time (10.00 pm to 7.00 am)
Internal Residential: 35 dB LAeq(15minute)

The evening and night-time criteria are only applicable to residential receivers.

The internal noise levels are to be assessed at the centre of the most-affected habitable room. For a limited number of discrete, ongoing ground-borne noise events, such as drilling or rock-hammering, The LAmax noise descriptor using a slow response on the sound level meter may be better than the LAeq noise descriptor (15 min) in describing the noise impacts. The level of mitigation of ground-borne noise would depend on the extent of impacts and also on the scale and duration of works. Any restriction on the days when construction work is allowed would take into account whether the community:

- Has identified times of day when they are more sensitive to noise (for example Sundays or public holidays).
- Is prepared to accept a longer construction duration in exchange for days of respite.

2.8. Traffic Noise Assessment Goals

When trucks and other vehicles are operating within the boundaries of the various construction sites, road vehicle noise contributions are included in the overall predicted LAeq(15minute) construction site noise emissions. When construction related traffic moves onto the public road network a different noise assessment methodology is appropriate, as vehicle movements would be regarded as 'additional road traffic' rather than as part of the construction site.

The ICNG does not provide specific guidance in relation to acceptable noise levels associated with construction traffic. For assessment purposes, guidance is taken from the RNP.

One of the objectives of the RNP is to apply relevant permissible noise increase criteria to protect sensitive receivers against excessive decreases in amenity as the result of a proposal. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

On this basis, construction traffic NMLs set at 2 dB above the existing road traffic noise levels during the daytime and night-time periods are considered appropriate to identify the onset of potential noise impacts. Where the road traffic noise levels are predicted to increase by more than 2 dB as a result of construction traffic, consideration would be given to applying feasible and reasonable noise mitigation measures to reduce the potential noise impacts and preserve acoustic amenity.

In considering feasible and reasonable mitigation measures where the relevant noise increase is greater than 2 dB, consideration would also be given to the actual noise levels associated with construction traffic and whether or not these levels comply with the following road traffic noise criteria in the RNP:

- 60 dB LAeq(15hour) day and 55 dB LAeq(9hour) night for existing freeway/ arterial/ sub-arterial roads.
- 55 dB LAeq(1hour) day and 50 dB LAeq(1hour) night for existing local roads.

2.9. Sleep Disturbance and Maximum Noise Events

Maximum noise level events from construction activities during the night-time period can trigger both awakenings and disturbance to sleep stages. The approach to managing events that cause sleep disturbance shall be consistent with the Noise Policy for Industry (EPA, 2017). Where night-time noise levels at a residential location exceed the:

- LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or the
- LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

a detailed maximum noise level event assessment is to be undertaken.

The detailed assessment will cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period.

Maximum noise level event assessments should be based on the LAFmax descriptor on an event basis under 'fast' time response. The detailed assessment will consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels for night-time activities.

3. CONSTRUCTION NOISE & VIBRATION ASSESSMENT METHODOLOGY

There are planning processes at all levels of government that may apply to works carried out by Sydney Metro, some of these processes (particularly State and Federal planning processes) require a detailed Environmental Assessment of the construction phases for the proposal. As construction contractors are not typically appointed until later in a project's timeline, the exact construction methodology they will use for a particular project may not be known when the environmental assessment is being carried out (see Table 7).

With respect to the assessment of noise and vibration impacts in environmental assessments they are to include a detailed quantitative assessment that adopts conservative assumptions to account for uncertainty in the precise delivery methodology. In most circumstances the noise and vibration impacts predicted by an environmental assessment will overestimate real impacts during delivery. As a result, this strategy requires secondary quantitative assessments to be undertaken during delivery by the Principal Contractor to verify impacts and better inform how to mitigate impacts.

For construction works approved under Division 5.2 of the EP&A Act, further quantitative noise and vibration assessments will be undertaken for activities and/or locations where work will occur. These are called Detailed Noise and Vibration Impact Statements (DNVIS), and works subject to these assessments will not proceed until the DNVIS has been approved by an Acoustic Advisor appointed under an SSI approval, or where there is no SSI approval, approved by Sydney Metro. **Section 3.1** of this Standard provides information on the requirements for a DNVIS.

For construction works approved under any other planning approval pathway, the secondary quantitative noise assessment may take a less detailed approach and is referred to as a General Noise and Vibration Impact Assessment (GNVIS). **Section 3.2** of this Standard provides information on the requirements for a GNVIS.

In order to develop a comprehensive secondary assessment framework specific details of the construction methodology (including the size and type of equipment) is required. Detailed design, construction and engineering solutions are progressively developed and applied throughout the life-span of the project and consequently secondary assessments are to be updated to reflect changing design and/or construction methodologies. Secondary assessments may take one of two forms and each are updated when a change occurs:

- General Construction Activity for construction scenarios that are consistently the same and progressively move along the project alignment e.g. tunnelling, retaining walls.
- Location Specific for construction scenarios that are specific to a location.

How these statements are distributed across the scope of work is to be articulated in the Noise and Vibration Management Plan, or where one is not required, the CEMP.

In all cases the overriding objective of noise and vibration assessments is to firstly identify impact reduction techniques to reduce noise and vibration impacts below the NML using Standard Mitigation Measures (refer to **Section 4**) so that the reliance upon impact offset measures is removed or minimised (refer to **Section 5**).

Table 7: Summary of Assessment Detail Required During the Various Stages of the Project

Assessment Input	Environmental Impact Statement / Environmental Assessment	In Delivery
Construction Scenarios / Equipment List	Construction scenarios defined by project team, based on potential construction methodologies known at the time.	Construction scenarios defined by construction team. These are expected to include finalised equipment lists, itemising the realistic worst-case plant proposed to be used at any one time, and in any one location.
Modelled works location	Works location by scenario (or group of scenarios) i.e. different locations for different works.	Works location by works scenario i.e. specific locations for each works.
Background noise monitoring	Background noise monitoring required to determine RBL and other noise metrics at locations representative of worst-affected receiver areas adjacent to the works areas.	Supplementary noise monitoring may be required to determine in more detail the RBL or other noise metrics required by the planning approval at locations representative of worst-affected receiver areas adjacent to the works areas where noise survey data is not current (i.e. more than 5 years old).
Study Area	The study area must, as a minimum, include receivers subjected to predicted $L_{Aeq}(15\text{minute}) \geq RBL + 5\text{dB}$ for the applicable time period. Vibration level predictions up to 100m.	Predict noise and vibration levels to the sensitive receivers within the area surrounding the works, to include all receivers where the $L_{Aeq}(15\text{minute}) \geq RBL + 5\text{dB}$ and the vibration screening criteria are exceeded during the applicable time periods.
Assessment of mitigation	Demonstration that assessment of this stage includes reasonable and feasible mitigation measures if required.	Based on these predictions the Construction Noise and Vibration Management Plan (CNVMP) shall identify all feasible and reasonable mitigation measures to minimise noise and vibration from construction. Sections 4 and 5 identify the standard and additional mitigation measures to be included where applicable in the CNVMP. Eg. Detailed vibration assessments to include dilapidation surveys, continuous vibration monitoring and accurate vibration transfer measurements (site law measurements) for all buildings with the potential to exceed the screening criteria for vibration.
Documentation	Environmental Assessment and associated documentation	Activity or location specific Construction Noise Impact Statements Construction Noise and Vibration Management Plans OOHW Applications

3.1. Detailed Noise and Vibration Impact Statements

For all DNVIS reports the noise impacts are to be assessed based on construction scenarios. A construction scenario relating to noise impact is essentially a construction activity which is made up of the required plant and equipment. A number of construction scenarios will make up any one DNVIS report. In undertaking an assessment of the noise impact from a construction scenario(s) the following steps are to be taken:

- Identify all Noise and Vibration Sensitive Receivers (NSRs) which may be affected by the project.
 - Conduct background noise monitoring at representative NSRs to determine the rating background noise levels (RBLs) in accordance with the procedures presented in the EPA's Noise Policy for Industry, where RBLs have not been established in previous project stages.
 - Determine the appropriate noise and vibration management levels of each NSR.
 - Determine the source noise levels (Sound Power Levels) of each noise generating plant and equipment item required to undertake the construction scenario. Note: Sound Power Levels for each plant and equipment would be less than the maximum allowable levels found in Table 13 and Table 14.
 - Clearly indicate which mitigation measures identified in Section 4 have been/are to be incorporated into the noise assessment. Noise mitigation measures to be implemented will vary for reasons such as safety and space constraints, these are to be identified and the calculations adjusted accordingly.
 - For location specific construction scenarios and where applicable for generic scenarios, include the effects of noise shielding provided by site offices, residential fences, noise barriers or natural topographic features.
 - Where applicable include the effects of noise reflections and ground attenuation.
 - Calculate the L_{Aeq} noise or range of levels from construction scenarios at sensitive receiver groups, with the use of noise contour maps where appropriate and/or at 10 m, 25 m, 50 m, 75 m, 100 m and 200 m for more general construction activities.
 - Compare these against the goals identified for each NSR and identify predicted exceedances.
 - For night-time activities, calculate exceedances over the:
 - $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and
 - LAF_{max} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.
- Where exceedances are predicted to occur, undertake a detailed maximum noise level event assessment in accordance with the Noise Policy for Industry (EPA, 2017).
- On completion of all DNVIS reports for the subjective classification of the noise impact is to be evaluated and documented as:
 - Low Impact
 - Moderate Impact
 - High Impact

The classifications are to be determined on a case-by-case basis with consideration of the following points:

- The location of the works in relation to NSRs with consideration of noise attenuation features such as noise barriers including topographical features (earth-mounds), buildings, dividing fences etc (distance of works from sensitive receiver(s)).

- The type and sensitivity of the NSRs:
 - Low Impact: e.g. Commercial buildings/ Scattered Residential (low density)
 - Moderate Impact: e.g. Standard residential (typical density)
 - High Impact: e.g. Residential home for the elderly/high density unit blocks/persistent complainers/residents deemed to have “construction noise fatigue”.
- Land use zoning and planning amenity objectives for the area.
- Construction and architectural design of impacted building, particularly the presence of any existing noise mitigation including that provided under a Noise Abatement Program or required by the ISEPP, Council DCP or other planning instrument.
- Existing ambient levels.
- The extent of noise exceedance above Noise Management Level.
- The likelihood for potential sleep disturbance (as described in the NPfI).
- The type of and intensity of noise emitted from works (i.e. tonal or impulsive):
 - Lower Impact: No high noise and/or vibration intensive activities
 - Moderate Impact: Short/intermittent high noise and/or vibration intensive activities
 - High Impact: Prolonged high noise and/or vibration intensive activities.
- The duration of any OOHW required.
- The time frames for any OOHW:
 - Lower Impact: 6.00 pm till 10.00 pm weekdays 1.00 pm till 10.00pm Saturdays 8.00 am till 6.00 pm Sundays or Public Holidays.
 - Moderate Impact: 10.00 pm to 7.00 am Weekday Nights 10.00 pm to 8.00 am Saturdays.
 - High Impact: 6.00 pm to 7.00 am Sundays and Public Holidays.
- As a result of noise classification and/or the noise level exceedances at sensitive receivers provided by the DNVIS reports, appropriate reasonable and feasible noise mitigation is to be adopted and implemented. For sites where works are predicted to significantly exceed noise goals and impact on receivers for a significant period of time, additional reasonable and feasible noise mitigation measures such as those outlined in Section 5 would be considered if practical to reduce the noise levels and impact on sensitive receivers.

3.2. General Noise and Vibration Impact Assessments

For works other than those carried out under an SSI Approval a more generalised approach is adopted to assess impacts, this is called a GNVIS. These assessments rely upon indicative Sound Power Level's from typical plant and equipment (Table 8), auditing of plant and equipment during delivery, and typical variables that modify the transmission of noise and vibration to determine a predicted impact at the most affected NSR.

Where a change occurs in relation to works described in a GNVIS, it will be updated and resubmitted to Sydney Metro for approval. For example, works during standard working hours being rescheduled outside standard working hours.

The first step in the GNVIS is to determine the relevant period of time during which the works will occur. This is either during standard working hours, or outside standard working hours during daytime, evening or night. Depending on the timeframe there will be differing Noise Management Levels for the activity. Section 2.2 outlines how Noise Management levels (NML) are calculated.

Secondly, Table 8 is used to determine the Sound Power Level (SWL) of the Noisiest piece of Plant or Equipment. Each piece of plant or equipment is required by this standard to be audited regularly and the SWL confirmed to fall within the range indicated in Table 13 or Table 14.

Table 8 - Indicative SWL's for GNVIS Assessments

Plant/Equipment Noise Level at 10m		dBA
Including non-continuous use reduction (-5dBA) and annoying activity penalty (+5dBA) for as per ICNG (refer to ICNG Appendix B for predicted noise level data).	Impact sheet piling rig	100
	Hand-held tamper, excavator with hammer, rock-breaker, driven/vibratory piling, concrete saw, diamond saw, air track drill, large dozer, hand-held rail grinder	95
	Jackhammer, rock crusher, angle grinder, pneumatic hammer, medium dozer, tracked loader, impact wrench	90
	Mainline tamper, ballast regulator, dynamic track stabiliser, vibratory roller, mainline rail grinder, ballast train (pour/fill ballast), chainsaw, tub grinder/large mulcher, scraper, grader, super-sucker/vacuum truck, large backhoe/wheeled front-end loader, bored piling, pavement profiler, fixed crane, tracked excavator	85
	Small bulldozer, small excavator, tower crane, truck-mounted crane, forklift, bobcat, skid-steer front-end loader, road truck/truck and dog, dump truck, concrete truck/pump/mixer, compressor, non-vibratory/large pad foot roller, whacker packer/compactor, water cart, pavement laying machine, asphalt truck and sprayer, line marking truck, standard penetration testing, welder, pin puller	80
	Concrete vibrator, cherry-picker scissor lift/elevated work platform/Franna crane, small backhoe, front end loader, fence post driver, electric drill rig, hand held rattle gun, generator (diesel/petrol), spreader	75
	Lighting tower, medium-rigid truck/semi-trailer, welding equipment, small front end loader	70
	Light vehicle, hand-tools (no impact), small cement mixer, attenuated generator (inside housing)	65

Thirdly, the nearest residential and non-residential sensitive receivers are identified that are closest to the point at which the noisiest piece of plant or equipment will be operated.

Lastly, a series of factors are considered which have either exacerbating or mitigating effects (Table 10) on the transmission of noise and vibration to arrive at a predicted noise level at both the residential and non-residential receiver. The predicted level is then compared against the NML and an exceedance is calculated. The receiver with the highest exceedance determines the level of Additional Mitigation Measures which must be considered (see Section 5).

All this information is collated into a table similar to Table 9 below.

Table 9 - GNVIS Calculations

Period	Noisiest Plant/Equipment SWL	Receiver Type	Enter the most applicable values from Table 8, then add to determine the Predicted Noise Level				Predicted Noise Level (1 + 2 + 3 + 4)	NML	Exceedance (Predicted Noise Level minus NML)
			1. Plant/Equipment Noise Level	2. Multiple Plant/Equipment	3. Local Screening	4. Distance Attenuation			
Standard Hours		Residential							
		Non-Residential							
Daytime OOH *		Residential							
		Non-Residential							
Evening OOH *		Residential							
		Non-Residential							
Night Time OOH *		Residential							
		Non-Residential							

Table 10 - Exacerbating and Mitigating Factors

Exacerbating and Mitigating Factors		dBA
Multiple Plant	More than one of the noisiest plant being used simultaneously at roughly the same location	+5
Local Screening	Existing screening between site and receiver (buildings, cuttings, canopies, etc.)	- 5
	Temporary screening to be implemented near work site	- 10
	Acoustic shed or enclosure	- 25
Distance Attenuation	< 10 metres	0
	10 to 20 metres	- 5
	20 to 35 metres	- 10
	35 to 60 metres	- 15
	60 to 100 metres	- 20
	100 to 180 metres	- 25
	180 to 350 metres	- 30
	350 to 1,000 metres	- 40

3.3. Noise and Vibration Sensitive Receivers

The sensitivity of occupants to noise and vibration varies according to the nature of the occupancy and the activities performed within the affected premises. For example, recording studios are more sensitive to vibration and ground borne noise than residential premises, which in turn are more sensitive than typical commercial premises.

Specific noise and vibration sensitive receivers (NSRs) relevant to individual construction sites would be identified and addressed in the Environmental Assessment of each Sydney Metro project. Each receiver would be identified as falling into one of the following categories:

- Commercial
- Educational
- Industrial
- Mixed residential/commercial
- Residential
- Residential occupied by shift workers
- Place of Worship
- Medical facilities
- Other sensitive receivers

3.4. Ground-Borne (Regenerated) Noise

Ground-borne noise as a result of construction activities is usually associated with tunnelling projects where equipment such as tunnel boring machines, road headers, rock hammers and drilling rigs are operated underground. It is therefore anticipated that ground-borne noise may be an issue during the construction of Sydney Metro projects.

If NSR's may be affected by ground-borne noise as a result of construction activities, a DNVIS or GNVIS report specifically in relation to the assessment of ground-borne construction noise would be undertaken.

In undertaking a DNVIS or GNVIS report for ground-borne construction noise the following steps are to be taken:

- Identify and quantify if necessary, any significant extraneous sources of ground-borne noise.
- Determine the location of each plant and equipment item in relation to each receiver.
- On the basis of ground-borne noise versus distance prediction algorithms for each plant item, determine the level of ground-borne noise at each building location. For highly sensitive building occupancies, such as recording studios, the assessment may need to incorporate the acoustic properties of the building space and the structural response of the building. This is to be determined by a qualified acoustic consultant, should ground-borne noise be a potential issue.
- Include the effect of all relevant standard mitigation measures as part of the construction scenario.
- Calculate the $L_{Aeq}(15\text{minute})$ noise levels from the proposed construction activities at each receiver and compare these to the ground-borne noise management levels.

3.5. Ground-Borne Vibration

Vibration as a result of construction activities is usually associated with tunnelling projects where equipment such as tunnel boring machines, road headers, rock hammers and drilling rigs are operated underground. It is therefore anticipated that ground-borne vibration may be an issue during the construction of Sydney Metro projects.

If vibration impacts are anticipated as a result of construction activities, a DNVIS or GNVIS report specifically in relation to the assessment of construction vibration would be undertaken.

In undertaking a DNVIS or GNVIS report for ground-borne construction vibration the following steps are to be taken:

- Determine the location of each plant and equipment item in relation to each receiver.
- On the basis of ground-borne vibration versus distance prediction algorithms for each plant item, determine the level of ground-borne vibration at each building location. For highly sensitive building occupancies, such as recording studios, the assessment may need to incorporate the vibration properties of the building space and the structural response of the building. This is to be determined by a qualified acoustic consultant, should ground-borne vibration be a potential issue.
- Include the effect of all relevant standard mitigation measures as part of the construction scenario.

Calculate the vibration levels from the proposed construction activities at each receiver and compare these to the ground-borne vibration criteria.

3.6. Vibration and Overpressure from Blasting

Vibration and overpressure as a result of construction activities is usually associated with tunnelling projects where blasting is required. If this construction is implemented then vibration and overpressure may be an issue during the construction of Sydney Metro projects.

If vibration and overpressure impacts are anticipated as a result of construction blasting, a DNVIS report, specifically in relation to the assessment of construction blasting would be undertaken regardless of the projects planning approval pathway.

In undertaking a DNVIS report for blasting vibration and overpressure the following steps are to be taken:

- Determine the location of blast charge in relation to each receiver.
- On the basis of vibration / overpressure versus distance prediction algorithms for blasting determine the level of vibration / overpressure at each receiver (building) location.
- Include the effect of all relevant standard mitigation measures as part of the construction scenario.

Calculate the vibration and overpressure levels from the proposed blasting activities at each receiver and compare these to the blasting criteria.

4. STANDARD NOISE AND VIBRATION MITIGATION MEASURES

4.1. Minimum Requirements

This section sets out the standard construction noise and vibration mitigation measures to be implemented on all Sydney Metro projects and delivered via relevant procedures, systems, environmental assessment, construction environmental management and all relevant contract documentation.

For all Sydney Metro construction projects, the standard mitigation measures in **Table 11** shall be applied by default where feasible and reasonable in order to minimise the potential noise and vibration impacts at the surrounding Noise Sensitive Receivers. The effect of applying standard mitigation measures may be considered in noise and vibration assessments to achieve NML's.

4.1.1. Management Strategies during Construction

- Construction hours would be in accordance with the ICNG, project approvals and the EPL if required, except where otherwise specified in an approved noise management plan.
- When working adjacent to schools, medical facilities and childcare centres, particularly noisy activities would be scheduled outside normal working hours, where feasible and reasonable.
- When working adjacent to churches and places of worship particularly noisy activities would be scheduled outside services, where feasible and reasonable.
- Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers will result in reduced noise emissions.
- Where feasible and reasonable, the offset distance between noisy plant items and nearby noise sensitive receivers would be as great as possible.
- Regular compliance checks on the noise emissions of all plant and machinery used for the project would indicate whether noise emissions from plant items were higher than predicted. This also identifies defective silencing equipment on the items of plant.
- Ongoing noise monitoring during construction at sensitive receivers during critical periods (i.e. times when noise emissions are expected to be at their highest - e.g. piling and hammering) to identify and assist in managing high risk noise events.
- Where feasible and reasonable heavy vehicle movements would be limited to daytime hours.
- The implementation of procedures to maximise the night-time onsite spoil storage capacity where spoil is produced between the hours of 10.00 pm and 7.00 am.
- Where feasible and reasonable, there will be coordination with any required ancillary works (utility relocations etc.) to minimise overall noise impacts and to avoid scheduling such activities during planned respite periods.

4.1.2. Site Induction for all Employees, Contractors and Subcontractors

The site induction would include the following as a minimum:

- All relevant project specific and standard noise and vibration mitigation measures
- Relevant licence and approval conditions
- Permissible hours of work
- Any limitations on high noise generating activities
- Location of nearest sensitive receivers
- Construction employee parking areas
- Designated loading/unloading areas and procedures
- Site opening/closing times (including deliveries)
- Identification of activities likely to cause complaint
- Environmental incident reporting and management procedures

4.1.3. Source Noise Control Strategies

- Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, heavy vehicles, etc. In order to minimise noise emissions, residential grade mufflers would be fitted on all mobile plant utilised on Sydney Metro construction projects.
- The use of damped hammers is recommended such as the 'City' model Rammer hammers. These reduce the 'ringing' of the rock pick, cylinder and excavator arm that is commonly associated with rock breaking works. Approximately 10 dB attenuation can be achieved compared to undamped hammers of the same size.
- Regular maintenance of all plant and machinery used for the project will assist in minimising noise emissions, including the reporting of the results.
- Acoustic enclosure of plant items, if required, as identified during compliance monitoring.
- Use of engine exhaust brakes should be avoided where possible. Air brake silencers would be correctly installed and fully operational for any heavy vehicle that approaches and uses any Sydney Metro construction site.
- Non-tonal reversing alarms would be used for all permanent mobile plant operating on Sydney Metro construction projects. Whilst the use of non-tonal reversing alarms is suggested to ensure noise impacts are minimised, it is noted that OH&S requirements must also be fully satisfied.

4.1.4. Noise Barrier Control Strategies

Temporary noise barriers are recommended between the noise sources and nearby potentially affected noise sensitive receivers, wherever feasible. Typically, 5 dB to 15 dB attenuation can be achieved with a well designed and constructed barrier.

4.1.5. Acoustic Enclosures

Where significant noise impacts are predicted and/or long periods of construction works are planned, acoustic enclosures can be used as an effective mitigation method. Acoustic enclosures act to contain the sources of noise, whilst also providing the benefit of screening the construction site from view. An enclosure with no openings would be expected to provide attenuation the order of 20 dB.

4.1.6. Vibration Control Strategies

Attended vibration measurements are required at the commencement of vibration generating activities to confirm that vibration levels satisfy the criteria for that vibration generating activity. Where there is potential for exceedances of the criteria further vibration site law investigations would be undertaken to determine the site-specific safe working distances for that vibration generating activity. Continuous vibration monitoring with audible and visible alarms would be conducted at the nearest sensitive receivers whenever vibration generating activities need to take place inside the calculated safe-working distances.

4.1.7. Community Consultation

Active community consultation and the maintenance of positive, cooperative relationships with schools, local residents and building owners and occupiers assists in managing impacts from noisier operations and in alleviating concerns and thereby minimising disturbance and complaint. This includes, for example:

- Periodic notification of work activities and progress (e.g. regular letterbox drops, e-consult)
- Specific notification (letter-box drop) prior to especially noisy activities
- Comprehensive website information
- Project information and construction response telephone line
- Email distribution list

4.2. Summary of the Standard Mitigation Measures

The actions set out in **Table 11** must be implemented on all Sydney Metro construction projects.

Table 11: Standard Mitigation Measures to Reduce Construction Noise and Vibration

Action required	Applies to	Details
Management Measures		
Implementation of any project specific mitigation measures required	Airborne noise Ground-borne noise and vibration	In addition to the measures set out in this table, any <i>project specific</i> mitigation measures identified in the environmental assessment documentation (e.g. EA, REF, submissions or representations report) or approval or licence conditions must be implemented.

Action required	Applies to	Details
Implement community consultation measures	Airborne noise Ground-borne noise and vibration	Periodic Notification (monthly letterbox drop) ¹ Website Project information and construction response telephone line Email distribution list Place Managers
Register of Noise Sensitive Receivers	Airborne noise Ground-borne noise and vibration	A register of all noise and vibration sensitive receivers (NSRs) would be kept on site. The register would include the following details for each NSR: <ul style="list-style-type: none"> • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number
Site inductions	Airborne noise Ground-borne noise and vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: <ul style="list-style-type: none"> • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on high noise generating activities • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures
Behavioural practices	Airborne noise	No swearing or unnecessary shouting or loud stereos/radios; on site. No dropping of materials from height; throwing of metal items; and slamming of doors. No excessive revving of plant and vehicle engines Controlled release of compressed air.
Monitoring	Airborne noise Ground-borne noise and vibration	A noise monitoring program is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.

¹ Detailing all upcoming construction activities at least 14 days prior to commencement of relevant works

Action required	Applies to	Details
Attended vibration measurements	Ground-borne vibration	Attended vibration measurements are required at the commencement of vibration generating activities to confirm that vibration levels satisfy the criteria for that vibration generating activity. Where there is potential for exceedances of the criteria further vibration site law investigations would be undertaken to determine the site-specific safe working distances for that vibration generating activity. Continuous vibration monitoring with audible and visible alarms would be conducted at the nearest sensitive receivers whenever vibration generating activities need to take place inside the applicable safe-working distances.
Source Controls		
Construction hours and scheduling	Airborne noise Ground-borne noise and vibration	Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels would be scheduled during less sensitive time periods.
Construction respite period	Ground-borne noise and vibration Airborne noise	High noise and vibration generating activities ² may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block ³ .
Equipment selection	Airborne noise Ground-borne noise and vibration	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits.
Maximum noise levels	Airborne-noise	The noise levels of plant and equipment must have operating Sound Power Levels compliant with the criteria in Table 13 .
Rental plant and equipment	Airborne-noise	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table 13 .
Plan worksites and activities to minimise noise and vibration	Airborne noise Ground-borne vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Airborne noise	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.

² Includes jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling.

³ "Continuous" includes any period during which there is less than a 60 minutes respite between ceasing and recommencing any of the work.

Action required	Applies to	Details
Minimise disturbance arising from delivery of goods to construction sites	Airborne noise	<p>Loading and unloading of materials/deliveries is to occur as far as possible from NSRs</p> <p>Select site access points and roads as far as possible away from NSRs</p> <p>Dedicated loading/unloading areas to be shielded if close to NSRs</p> <p>Delivery vehicles to be fitted with straps rather than chains for unloading, wherever feasible and reasonable</p>
Path Controls		
Shield stationary noise sources such as pumps, compressors, fans etc	Airborne noise	<p>Stationary noise sources would be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.</p> <p>Appendix F of AS 2436: 1981 lists materials suitable for shielding.</p>
Shield sensitive receivers from noisy activities	Airborne noise	<p>Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when siting plant.</p>

Table 12: Minimum Requirements for Construction Methods

Method	Minimum Requirements
Excavator	Ensure that the Sound Power Levels given in Table 13 have been met.
Truck	Ensure that the Sound Power Levels given in Table 13 have been met.
Rock breakers and jackhammers	<p>Ensure that the Sound Power Levels given in Error! Reference source not found. have been met.</p> <p>Noise and vibration monitoring would be conducted at the nearest identified NSR where exceedances of the criteria have been predicted.</p>
PCF	<p>Where it has been predicted that vibration / regenerated noise is likely to be in excess of the nominated goals, specific notification would be given to all NSRs a minimum of 2 weeks prior to a shot being fired.</p> <p>Vibration and overpressure monitoring would be conducted at the nearest identified NSR.</p>
Blasting	<p>Where it has been predicted that vibration / overpressure is likely to be in excess of the nominated goals, specific notification would be given to all NSRs a minimum of 2 weeks prior to a shot being fired.</p> <p>Vibration and overpressure monitoring would be conducted at the nearest identified NSR.</p>
TBM	Noise and vibration monitoring would be conducted at the nearest identified NSR where levels are expected to exceed the relevant noise and vibration goals.
Road headers	Noise and vibration monitoring would be conducted at the nearest identified NSR where levels are expected to exceed the relevant noise and vibration goals.

4.3. Maximum Allowable Plant Sound Power Levels

Plant or equipment operating on Sydney Metro project construction sites shall have an operating sound power level (SWL) which is no higher than the corresponding SWL presented in **Table 13** unless justified. The SWLs presented in **Table 13** have been compiled from a selection of field measurements conducted between 2004 and 2008 of plant and equipment operating on large construction projects throughout NSW and are therefore considered to be representative of plant and equipment SWLs which are readily achieved by current plant and equipment normally used in the construction industry.

Table 13: Maximum Allowable Sound Power Levels for Construction Equipment

Equipment	Maximum Allowable Sound Power Level (dB) L _{Amax}	Maximum Allowable Sound Pressure Level (dB) L _{Amax} at 7 m
Excavator Hammer	118	93
Excavator (approx. 3 tonne)	90	65
Excavator (approx. 6 tonne)	95	70
Excavator (approx. 10 tonne)	100	75
Excavator (approx. 20 tonne)	105	80
Excavator (approx. 30 tonne)	110	85
Excavator (approx. 40 tonne)	115	90
Skidsteer Loaders (approx. 1/2 tonne)	107	82
Skidsteer Loaders (approx. 1 tonne)	110	85
Dozer (tracking) - equiv. CAT D8	118	93
Dozer (tracking) - equiv. CAT D9	120	95
Dozer (tracking) - equiv. CAT D10	121	96
Backhoe/FE Loader	111	86
Dump Truck (approx. 15 tonne)	108	83
Concrete Truck	112	87
Concrete Pump	109	84
Concrete Vibrator	105	80
Bored Piling Rig	110	85
Scraper	110	85
Grader	110	85
Vibratory Roller (approx. 10 tonne)	114	89
Vibratory Pile Driver	121	96
Impact Piling Rig	134	109
Compressor (approx. 600 CFM)	100	75
Compressor (approx. 1500 CFM)	105	80
Concrete Saw	118	93
Jackhammer	113	88
Generator	104	79
Lighting Tower	80	55
Flood Lights	90	65

Equipment	Maximum Allowable Sound Power Level (dB) L _{Amax}	Maximum Allowable Sound Pressure Level (dB) L _{Amax} at 7 m
Cherry Picker	102	77
Mobile Crane	110	85

Where an item of construction equipment is not listed in **Table 13**, generic sound power levels presented in **Table 14** may be adopted.

Table 14: Generic Equipment or System Sound Power Level Limit¹

Equipment	Maximum Allowable Sound Power Level (dB) L _{Amax}	Maximum Allowable Sound Pressure Level (dB) L _{Amax} at 7 m
Motorised (<25kW)	90	65
Motorised (<50kW)	95	70
Motorised (<100kW)	100	75
Motorised (<200kW)	105	80
Motorised (>200kW)	110	85
All other Auxiliary Equipment or Systems	90	65

Note 1: Sound Power Levels in dBA relative to 10 pW.

4.4. Auditing and Monitoring

All significant noise generating items of plant would have noise audits conducted upon arrival at a Sydney Metro construction site and at 6 month intervals thereafter. The purpose of these audits is to validate that individual items of plant and equipment fall within the Sound Power Level ranges identified in **Table 13**.

Where it has been identified within this strategy that noise and/or vibration monitoring is required at the nearest sensitive receiver; however, the nearest sensitive receiver has refused monitoring at their property, monitoring would be undertaken at the near point to that receiver within the site boundary or at another suitable location determined by an acoustic consultant.

5. ADDITIONAL NOISE AND VIBRATION MITIGATION MEASURES

The implementation of the standard management measures, compliance with maximum sound power levels for plant and equipment, construction hour management and standard community consultation measures in this Strategy should significantly reduce the noise and vibration impacts on nearby sensitive receivers.

Nevertheless, due to the highly variable nature of construction activities and the likelihood of work outside the standard construction hours on Sydney Metro projects, some exceedances of the construction noise and vibration management levels are likely to be unavoidable.

Where there is a potential exceedance of the construction noise and vibration management levels, a number of additional measures to mitigate such exceedances – primarily aimed at pro-active engagement with affected sensitive receivers – would be explored and have been included in this Strategy. The additional mitigation measures to be applied are outlined in **Table 15**.

Table 15: Additional Management Measures

Measure	Description	Abbreviation
Alternative accommodation	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts over an extended period of time. Alternative accommodation will be determined on a case-by-case basis.	AA
Monitoring	Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals, noise or vibration monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the noise or vibration goal has been exceeded so that additional management measures may be implemented.	M
Individual briefings	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.	IB
Letter box drops	For each Sydney Metro project, a newsletter is produced and distributed to the local community via letterbox drop and the project mailing list. These newsletters provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage and inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on the community. Content and newsletter length is determined on a project-by-project basis. Most projects distribute notifications on a monthly basis. Each newsletter is graphically designed within a branded template.	LB
Project specific respite offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact.	RO

Measure	Description	Abbreviation
Phone calls and emails	Phone calls and/or emails detailing relevant information would be made to identified/affected stakeholders within 7 days of proposed work. Phone calls and/or emails provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs etc.	PC
Specific notifications	Specific notifications would be letterbox dropped or hand distributed to identified stakeholders no later than 7 days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications, or to advertise unscheduled works.	SN

5.1. Applying Additional Mitigation Measures

In circumstances where following application of the standard mitigation measures, the $L_{Aeq}(15\text{minute})$ construction noise and vibration levels are still predicted to exceed the Noise Management Level, the relevant Additional Mitigation Measures (AMM) are considered to determine any offset strategies for these impacts (**Table 16**).

The following steps need to be carried out to determine the Additional Mitigation Measures to be implemented:

- Determine the duration (time period) when the work is to be undertaken.
- Determine the level of exceedance above the NML.
- From the AMM table, identify the additional mitigation measures to be implemented (abbreviation codes are explained in **Table 15**).

Table 16: Additional Mitigation Measures – Airborne Construction Noise

Time Period		Mitigation Measures			
		Predicted L_{Aeq} (15minute) noise level Above NML			
		0 to 10 dB	10 to 20 dB	20 to 30 dB	> 30 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	-	LB	LB, M, SN	LB, M, SN
	Sat (8.00 am - 1.00 pm)				
	Sun/Pub Hol (Nil)				
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M	LB, M, SN, RO	LB, M, SN, IB, PC, RO
	Sat (1.00 pm - 10.00 pm)				
	Sun/Pub Hol (8.00 am - 6.00 pm)				
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB	LB, M, SN, RO	LB, M, SN, IB, PC, RO, AA	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)				
	Sun/Pub Hol (6.00 pm - 7.00 am)				

Table 17: Additional Mitigation Measures – Ground Borne Construction Noise

Time Period		Mitigation Measures		
		Predicted LAeq (15minute) noise level Above NML		
		0 to 10 dB	10 to 20 dB	> 20 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	No NML for GBN during standard hours, refer to Table 18		
	Sat (8.00 am - 1.00 pm)			
	Sun/Pub Hol (Nil)			
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB	LB, M, SN	LB, M, SN, IB, PC, RO
	Sat (1.00 pm - 10.00 pm)			
	Sun/Pub Hol (8.00 am - 6.00 pm)			
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB, M, SN	LB, M, SN, IB, PC, RO, AA	LB, M, SN, IB, PC, RO, AA
	Sat (10.00 pm - 8.00 am)			
	Sun/Pub Hol (6.00 pm - 7.00 am)			

Table 18: Additional Mitigation Measures - Ground-borne Vibration

Time Period		Mitigation Measures
		Predicted Vibration Levels Exceed Maximum Levels
Standard	Mon-Fri (7.00 am - 6.00 pm)	LB, M, RO
	Sat (8.00 am - 1.00 pm)	
	Sun/Pub Hol (Nil)	
OOHW (Evening)	Mon-Fri (6.00 pm - 10.00 pm)	LB, M, IB, PC, RO, SN
	Sat (1.00 pm - 10.00 pm)	
	Sun/Pub Hol (8.00 am - 6.00 pm)	
OOHW (Night)	Mon-Fri (10.00 pm - 7.00 am)	LB, M, IB, PC, RO, SN, AA
	Sat (10.00 pm - 8.00 am)	
	Sun/Pub Hol (6.00 pm - 7.00 am)	

6. MONITORING, AUDITING AND REPORTING

6.1. Plant Noise Auditing, Compliance Evaluation and Reporting

In order to compare the noise levels of plant and equipment with the values in **Section 4.3**, the following guidelines are recommended:

- Measurements of Sound Pressure Level (SPL) at 7 m (with plant or equipment stationary) shall be undertaken using procedures that are consistent with the requirements of Australian Standard AS2012–1990 Acoustics – Measurement of Airborne Noise Emitted by Earthmoving Machinery and Agricultural Tractors – Stationary Test Condition Part 1: Determination of Compliance with Limits for Exterior Noise.
- Measurements of Sound Power Level (SWL) shall be determined using procedures that are consistent with the requirements of International Standard ISO 9614-2 1996 Acoustics – Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning.
- If measuring the SPL at 7 m of moving plant, compliance measurements would be guided by the requirements of Australian Standard AS2012–1977 Method for Measurement of Airborne Noise from Agricultural Tractors and Earthmoving Machinery.

For all measurements, the plant or equipment under test would be measured while operating under typical operating conditions. If this is not practical, it may be appropriate to conduct a stationary test at high idle.

In the case of an exceedance in Sound Power Levels the item of plant would either be replaced, or the advice of an acoustic consultant would be sought to provide suitable mitigation measures, which may include:

- ensuring all bolts are tightened and no parts are loose
- cleaning and/or lubricating moving parts
- replacing old or worn parts
- implementing additional or upgrading existing muffling devices
- building enclosures around items of stationary plant (e.g. pumps or generators).

A register of measured sound power levels for each item of plant would be kept for reference where future noise audits are conducted. The register would be reviewed annually in conjunction with this strategy and corresponding revisions made to the Sound Power Levels presented in **Section 4.3** to represent contemporary plant noise emission levels.

6.2. Noise Monitoring

Where a DNVIS or GNVIS has been prepared for a Sydney Metro construction site and it has been predicted that noise levels may be in excess of the nominated construction noise goals at a noise sensitive receiver, noise monitoring would be conducted at:

- the affected receiver; or
- if more than one affected receiver has been identified, at the nearest affected receiver; or

- where the nearest affected receiver refuses noise monitoring on their property, at the near point to that receiver within the site boundary.
- If it can be demonstrated that direct measurement of noise from the construction site is impractical, alternative means of determining construction noise levels may be adopted in accordance with Chapter 7 of the Noise Policy for Industry.

All noise monitoring results would be assessed against the nominated noise goals and compiled into a report to be forwarded to the construction contractor and project manager. Reporting would be submitted to the construction contractor and project manager within one week of being undertaken or at weekly intervals for continuous monitoring. All noise monitoring reports would also be made available to the public through a publically accessible website.

6.3. Vibration Monitoring

Where it is anticipated that an item of plant will exceed the cosmetic damage criteria given in **Section 2.3.3**, vibration monitoring would be required at the nearest affected receiver. Where it is anticipated that an item of plant will exceed the human response / ground borne noise criteria and concerns have been raised regarding vibration, vibration monitoring would also be required at the receiver(s) under question.

All vibration monitoring results would be assessed against the nominated vibration goals and compiled into a report to be forwarded to the construction contractor and project manager. Reporting would be submitted to the construction contractor and project manager within one week of being undertaken or at weekly intervals for continuous monitoring. All vibration monitoring reports would also be made available to the public through the publically accessible website.

6.4. Blast Monitoring

As specified in the minimum requirements presented in **Section 3.6**, vibration and overpressure monitoring would be conducted for all PCF and blasting activities which take place on Sydney Metro construction sites.

Monitoring would be conducted as a minimum at the sensitive receiver(s) likely to receive the maximum vibration and/or overpressure emissions from the blast as identified by an acoustic consultant.

All blast monitoring results would be assessed against the nominated goals and compiled into a report to be forwarded to the construction contractor and project manager. All blast monitoring reports would also be made available to the public through the Sydney Metro website.

As the effect of vibration and overpressure from blasting have the potential to cause structural damage to buildings and services, accurate records of all blasts are required to be maintained. Such records would describe the location of the blast and all the blast holes, the design of the blast in terms of type of explosives, mass of explosives, initiating system used, ground vibration and overpressure measurement data.

Records of every blast would be kept for a minimum of seven years. A longer period of retention of the records may be warranted if a construction project is blasted over an extended or disrupted period.

For any section of tunnel construction where blasting is proposed, a series of initial trials at reduced scale shall be conducted prior to production blasting to determine site-specific blast response characteristics and to define allowable blast sizes to meet the airblast overpressure and ground vibration limits.

6.5. Dilapidation Surveys

If construction activities have the potential to cause damage through vibration to nearby public utilities, structures, buildings and their contents, an Existing Condition Inspection of these items is required to be undertaken in accordance with AS 4349.1 *“Inspection of Buildings”* except where a planning approval specifies an alternate process.

Prior to conducting the Existing Condition Inspections, the property owners will be advised of the inspection scope and methodology and the process for making a property damage claim. At the same time, maintain a register of all properties inspected and of any properties where owners refused the inspection offer.

The findings of all dilapidation surveys conducted for each Sydney Metro construction site would be compiled into a report to be forwarded to the construction contractor and project manager. Follow-up Condition Inspections would be required at the completion of certain major works (e.g. completion of shaft bulk excavation works).

7. COMPLAINT HANDLING

All complaints handling would be in accordance with the Sydney Metro Construction Complaints Management System.

8. COMMUNITY CONSULTATION AND LIAISON

All community consultation would be in accordance with relevant project communications plans.

9. DOCUMENTATION REQUIREMENTS

Any acoustic assessment, CNVIS or CNVMP undertaken for the Sydney Metro project must document the following as a minimum (where applicable):

- Acoustic Terminology / Glossary
- Overview of the Project / Works
- Secretary's Environmental Assessment Requirements
- EPL conditions (if applicable)
- Site Plan and Sensitive Receivers
- Ambient Noise Monitoring: methodology, locations, analysis and results
- Construction Noise and Vibration Criteria
 - Construction Airborne Noise Criteria
 - Construction Tunnelling Ground-borne Noise Criteria (if applicable)
 - Construction Ground-borne Noise Criteria
 - Construction Vibration Criteria
- Construction Noise and Vibration Assessment
 - Construction Airborne Noise Methodology / Predictions
 - Construction Tunnelling Ground-borne Noise Methodology / Predictions (if applicable)
 - Construction Ground-borne Noise Methodology / Predictions
 - Construction Vibration Methodology / Predictions
- Summary of Noise and Vibration Impacts
- Summary of all Standard and Additional Mitigation Measures
- References

All noise and vibration predictions are to be presented (as a minimum) as facade noise maps for a distance of at least 300 m in all directions from each work site / project area under assessment.

10. REFERENCES

Related Documents and References

- ANZEC, 1990, Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration. Australian and New Zealand Environment Council.
- APTA, 1981, Guidelines for Design of Rapid Transit Systems. American Public Transit Association.
- AS 2107, 2000, Acoustics - Recommended design sound levels and reverberation times for building interiors. Standards Australia.
- AS 2012 Part 1, 1990, Acoustics - Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors - Stationary test condition - Determination of compliance with limits for exterior noise. Standards Australia.
- AS 2187, Part 2, 2006, Explosives - Storage and Use - Part 2: Use of Explosives. Standards Australia.
- AS 2436, 2010, Guide to Noise Control on Construction, Demolition and Maintenance Sites. Standards Australia.
- AS 4349, 2007, Inspection of buildings - General requirements. Standards Australia.
- BS 6472, 1992, Evaluation of Human Exposure Vibration in Buildings. The British Standards Institution.
- BS 7385 Part 2, 1993, Evaluation and Measurement for Vibration in Buildings Part 2. The British Standards Institution.
- Colin G. Gordon, 1999, Generic Vibration Criteria for Vibration-Sensitive Equipment. International Society for Optical Engineering.
- The Association of Australian Acoustical Consultants (AAAC) Technical Guideline on Child Care Centre Noise Assessments
- DECC, 1999, Environmental Criteria for Road Traffic Noise. NSW Environment Protection Authority.
- DEC, 2006, Assessing Vibration: a technical guideline. NSW Environment Protection Authority.
- DECC, 2009, Interim Construction Noise Guideline. NSW Environment Protection Authority.
- EN ISO 9641, Part 2, 1996, Acoustics - Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning. International Organization for Standardization.
- EPA, 2017, NSW Noise Policy for Industry. NSW Environment Protection Authority.
- RTA, 2001, Environmental noise management manual, NSW Roads and Traffic Authority.
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Appendix E KNOWnoise Information Flyer

KNOWnoise™

Noise impact self-assessment tool

KNOWnoise™

KNOWnoise™ quickly and simply provides your team with the tools to plan, assess and manage project noise impacts. Achieve cost and time savings by minimising the need for external consultants while getting immediate and accurate answers on construction noise impacts.

KNOWnoise™ is a project-specific self-assessment tool that fits into your management plan framework, providing great value as part of any out-of-hours work procedure.

Almost any combination of construction equipment and location can be assessed by the tool for results at all receivers. Work can be programmed to minimise impacts on surrounding sensitive receivers while maximising efficiency of the construction process and program.

Applications include:

- Out of hours works
- Rail possessions
- ROL constraints
- Unexpected tasks not included in the CNVMP

Benefits	KNOWnoise™	Consultant
Expertise / resources	✓	✓
Reduced cost to project	✓	
Timely results	✓	
Flexibility	✓	

KNOWnoise

Home > Demonstrate > AS01 Administrator >

AS01: Assessment 1

Assessment 1

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In progress [Submit](#)

[Activities](#) [History](#)

[+ Create](#)

▼ 1: NDD (Enabled)

15/01/2019 05:57PM - 16/01/2019 05:57PM [Enabled](#) [Edit](#) [Copy](#) [Delete](#)

ITS crossing

Equipment type	Quantity	Usage	Reduction	SWL
Suction Truck	1	100%	0	112

Activity Sound Power Level: 112

▼ 2: Excavate (Enabled)

13/02/2019 12:01PM - 14/02/2019 12:01PM [Enabled](#) [Edit](#) [Copy](#) [Delete](#)

Digging

Equipment type	Quantity	Usage	Reduction	SWL
Excavator (30 tonne)	1	40%	0	106

Activity Sound Power Level: 106

Activity input application

Value-adding features

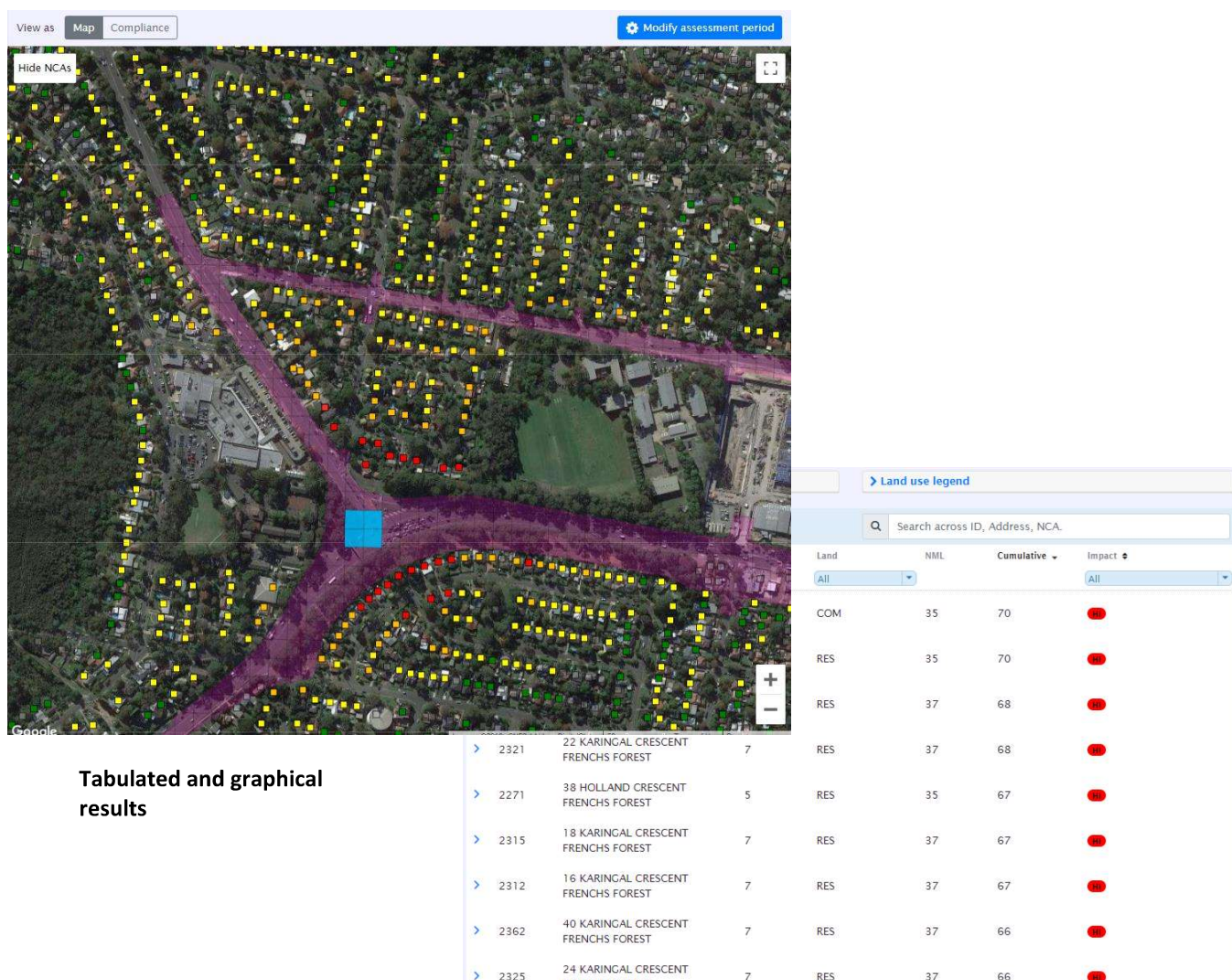
More than just a predicted noise level, KNOWnoise gives the project team:

- Web-based, accessible for almost all devices.
- A built in equipment list, that can be modified or augmented.
- Detailed prediction results for all affected receivers, identifying exceedances, cumulative impacts and colour-coded risk profiles. This can also include ancillary facilities (compounds).
- 'Impact maps' showing colour coded noise predictions and risk profiles.
- A detailed printable report for approval and records.
- Quality control records including submission and approval dates and personnel.

Working together

Hutchison Weller works closely with the project team to tailor KNOWnoise™ features to your needs including:

- user input that allows flexible and detailed activity input, to replicate construction locations and equipment.
- location maps based on Google maps to readily identify where works are planned – almost any configuration of work areas is possible.
- Predictions and analysis tools that match your compliance obligations.
- Custom reporting for approval or auditing needs.



Flexibility in planning

The benefits of using KNOWnoise extend beyond knowing the likely noise impacts:

- Flexible planning around the table or on-site.
- Prioritise impact management where it is needed most.
- Identify specific receivers that may require notification or alternative accommodation.
- Inform the community with a detailed understanding of the potential impacts.

More information?

Contact us for further detail or a demonstration.

<p>John [REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]@hutchisonweller.com</p>	<p>Cameron [REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]@hutchisonweller.com</p>
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Appendix F MCoA A6 Consultation Evidence

Sydney Metro West, Power Enabling Works

Memorandum

3869-SMW-MEMO-005

Revision 00

20 May 2021

DOCUMENT CONTROL & APPROVAL			PROJECT NO.		3869
ISSUE	DATE	ISSUE DETAILS / REMARKS	AUTHOR	CHECKED	APPROVED
00	20/05/2021	Revision 00 sent for Endorsement			

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Condition of Approval A6 Evidence – Construction Noise and Vibration Management Sub-Plan and Noise and Vibration Monitoring Program

To the Secretary of the Department of Planning, Industry and Environment,

Please find attached supporting evidence to demonstrate compliance with Condition of Approval (CoA) A6 in the development of the Construction Noise and Vibration Management Sub-Plan (prepared in accordance with CoA C5 (a)) and the Noise and Vibration Monitoring Program (prepared in accordance with CoA C14 (a))

CoA A6 Evidence	
Where the terms of this approval require a document or monitoring program to be prepared or a review to be undertaken in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Secretary with the document. The evidence must include:	
(a) documentation of the engagement with the party(s) identified in the condition of approval that has occurred prior to submitting the document for approval	This memo
(b) log of the points of engagement or attempted engagement with the identified party(s) and a summary of the issues raised by them	Table 1 and Appendix A
(c) documentation of the follow-up with the identified party(s) where feedback has not been provided to confirm that they have none or have failed to provide feedback after repeated requests	Appendix A
(d) outline of the issues raised by the identified party(s) and how they have been addressed	Appendix B
(e) a description of the outstanding issues raised by the identified party(s) and the reasons why they have not been addressed	Appendix B

The Construction Noise and Vibration Management Sub-Plan and Noise and Vibration Monitoring Program was provided to the following required agencies and stakeholders for consultation:

Table 1 Consultation log

Consultee	Date received	Date comments returned
Acoustic Advisor	5 May 2021	12 May 2021
Environmental Representative	5 May 2021	12 May 2021
Inner West Council	11 May 2021	12 May 2021
Sydney Metro West Noise Advisor	11 May 2021	14 May 2021
Place Management NSW	11 May 2021	11 May 2021
EPA	11 May 2021	17 May 2021

Kind Regards,

Erran [REDACTED]

[REDACTED] Quickway

Appendix A Detailed Consultation log

EPA

John [REDACTED]

From: Anna [REDACTED] <Anna.[REDACTED]@epa.nsw.gov.au>
Sent: Wednesday, 26 May 2021 6:44 PM
To: John [REDACTED]
Subject: RE: Sydney Metro West - SSI 10038 - Post Approval C14(a) - Noise monitoring programme

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Hi John

Please note that the EPA's role is to advise on the monitoring plan, however, it is not to approve it. The EPA was consulted on the preparation of the monitoring plan as per the conditions, and provided detailed comments in our letter addressed to Todd [REDACTED] dated 17 May 2021 (ref DOC21/390012). The EPA will provide no further comment.

Kind regards

Anna [REDACTED]
[REDACTED]



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From: John Ieroklis <John.[REDACTED]@transport.nsw.gov.au>
Sent: Wednesday, 26 May 2021 8:01 AM
To: Anna Timbrell <Anna.[REDACTED]@epa.nsw.gov.au>
Subject: RE: Sydney Metro West - SSI 10038 - Post Approval C14(a) - Noise monitoring programme

Hello Anna,

Thank you for providing comments on the Sydney Metro West Power Enabling Works Noise and Vibration Monitoring Program. The program, now upto Revision D has been amended by the contractor who was provided your initial comments.

I have included a clean pdf copy, a tracked changes .docx copy and a table showing how the Contractor implemented your comments. We would be grateful if you could confirm back to us via return email if you are happy with the amendments or if you do not believe your comments were addressed satisfactorily. Please respond before close of business Friday 4 June.

As a further assistance, Sydney Metro West would also like to offer NSW EPA a walk-through of the reasoning and strategy used to develop the Noise and Vibration Management Plan and Monitoring Program. If you are interested I would appreciate it if you could come back to me with some dates that work for you and we can organise it from there. We would need no more than 45 minutes of your time.

Thanks and kind regards,

John [REDACTED]

[REDACTED]
Sydney Metro

[REDACTED] | [john.\[REDACTED\]@transport.nsw.gov.au](mailto:john.[REDACTED]@transport.nsw.gov.au)

sydneymetro.info
[REDACTED]



I acknowledge the traditional owners of the land on which I work and pay my respects to their Elders, past and present.

From: Anna [REDACTED] [[mailto:Anna.\[REDACTED\]@epa.nsw.gov.au](mailto:Anna.[REDACTED]@epa.nsw.gov.au)]

Sent: Monday, 17 May 2021 1:36 PM

To: John [REDACTED] [John.\[REDACTED\]@transport.nsw.gov.au](mailto:John.[REDACTED]@transport.nsw.gov.au)

Cc: Matthew [REDACTED] <[Matthew.\[REDACTED\]@planning.nsw.gov.au](mailto:Matthew.[REDACTED]@planning.nsw.gov.au)>; Erin [REDACTED] [Erin.\[REDACTED\]@epa.nsw.gov.au](mailto:Erin.[REDACTED]@epa.nsw.gov.au)

Subject: Sydney Metro West - SSI 10038 - Post Approval C14(a) - Noise monitoring programme

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Hi John

Please see attached EPA's comments regarding the Construction Noise Monitoring programme for the Power Enabling Works.

Please note our letter does not have any comment with regard to the OOHV Protocol.

Kind regards

Anna [REDACTED]
[REDACTED]



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John [REDACTED]

From: John [REDACTED]
Sent: Monday, 10 May 2021 3:30 PM
To: jacinta [REDACTED]@epa.nsw.gov.au
Cc: Elizabeth [REDACTED]
Subject: FW: Sydney Metro West comments - SSI 10038 Noise & Vibration Monitoring Program - feedback please by 16 April 2021
Attachments: Quickway NVMP Rev B.PDF; SSI 10038 Request for Consultation ASP1 - EPA.PDF

Afternoon Jacinta,

Thanks for taking my call earlier today. Please see below for the original email to Anna Timbrell on 6 April 2021 requesting consultation mandated by our SSI approval on our contractor's Noise and Vibration Management Plan, OOHV Protocol and N&V Monitoring Program. Please note the scope of works here is the trenching and installation of 33kV underground power from the Rozelle zone sub-station to The Bays Metro West site at White Bay. Figure below:



Figure 9-35: The Bays Station – power supply route

For accuracy, the original NVMP that was emailed has since been evolved into Revision B (which contains an improved Out-of-Hours-Work Protocol). It is this revision that I have attached. I have also attached The original consultation letter for your information.

Could you please arrange for the relevant person in your team to review the NVMP (as you described) and provide me EPA's feedback or position so that we may capture this as evidence of consultation? Importantly, given we are now nearing the end of our consultation process and are closing plans out we require your letter before COB Thursday 13 May in order to get it endorsed by our ER and submit this plan to DPIE on Friday 14 May.

Please contact me directly if you need help with these documents and thanks for your assistance.

Much appreciated,

John [REDACTED]

Sydney Metro

[REDACTED] | [john.\[REDACTED\]@transport.nsw.gov.au](mailto:john.[REDACTED]@transport.nsw.gov.au)

sydnymetro.info



I acknowledge the traditional owners of the land on which I work and pay my respects to their Elders, past and present.

From: SydneyMetroWest

Sent: Tuesday, 6 April 2021 11:40 AM

To: anna.[REDACTED]@epa.nsw.gov.au

Cc: smwsdds.transport <smwsdds.transport@transport.nsw.gov.au>; John [REDACTED]
<John.[REDACTED]@transport.nsw.gov.au>

Subject: Sydney Metro West comments - SSI 10038 Noise & Vibration Monitoring Program - feedback please by 16 April 2021

Hello Anna

Sydney Metro awarded the contract for construction of the Power Enabling Works to Quickway Constructions. These works are due to commence in May 2021 and completion of the work is expected to occur in March 2022.

Attached is the consultation package for Quickway's Noise and Vibration Monitoring Program for NSW EPA.

Please find attached:

- Pdf copy of the NVMP
- Word doc copy of the NVMP
- Consultation letter signed by Todd [REDACTED] as pdf – note date of workshop in this letter changed to 14 April and feedback deadline changed to 16 April

Please note, the EPA are only required to be consulted on the **Noise and Vibration Monitoring Program** which is in Appendix B of the Noise and Vibration Management Plan.

To achieve timely approvals, we would welcome your feedback on the attached plans by **16 April 2021**.
Sydney Metro will hold a Stakeholders Workshop on 14 April 2021.
An invitation to this workshop will be sent to you shortly.

Kind regards

Project Communications Team
Sydney Metro West



sydneymetro.info



Use public transport... plan your trip at transportnsw.info
Get on board with Opal at opal.com.au

John [REDACTED]

From: Anna [REDACTED] <Anna.[REDACTED]@epa.nsw.gov.au>
Sent: Monday, 17 May 2021 1:36 PM
To: John [REDACTED]
Cc: Matthew [REDACTED]; Erin [REDACTED]
Subject: Sydney Metro West - SSI 10038 - Post Approval C14(a) - Noise monitoring programme
Attachments: 21.05.17 Letter to TfNSW_EPA comment on Post Approval_(C14a)_CNVMP_Sydney Metro West_SSI 10038.pdf

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Hi John

Please see attached EPA's comments regarding the Construction Noise Monitoring programme for the Power Enabling Works.

Please note our letter does not have any comment with regard to the OOHV Protocol.

Kind regards

Anna [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

E [anna.\[REDACTED\]@epa.nsw.gov.au](mailto:anna.[REDACTED]@epa.nsw.gov.au)



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DOC21/390012

17 May 2021

Mr Todd [REDACTED]
[REDACTED]

Dear Mr [REDACTED]

Sydney Metro West (SSI 10038)
Comment on draft Noise and Vibration Monitoring Programme –
Power Enabling Works at The Bays and Eastern Creek (Condition C14(a))

I am writing to you in reply to your request to the Environment Protection Authority (EPA) to comment on the draft document *Construction Noise and Vibration Management Plan* (CNVMP), Revisions Draft B, dated 4 May 2021, prepared by Quickway that has been prepared for the power enabling works package for the above project.

The EPA understands the works will involve site clearance, construction of ancillary facilities and access, temporary pedestrian and cycling diversion as required, trenching and installation of conduits and cables, excavation of joint bays and backfilling of excavated areas. The works will be at two locations:

1. The Bays – along a distance of approximately 2 kilometres between the Manning Street substation in Rozelle and Robert Street, Rozelle adjacent to White Bay; and
2. Eastern Creek Pre-Cast Yards – for approximately 200 metres along Lenore Drive, Eastern Creek.

The EPA notes that the CNVMP is not clear about what the overall duration of the works will be at each location.

Included within the CNVMP are the *Noise Monitoring Program* at Appendix B submitted to the EPA for consultation in accordance with condition C14(a), and the *Out of Hours Works Protocol* (OOHWP) at Appendix C also submitted to the EPA for consultation in accordance with condition D38. Regarding the OOHWP, the EPA notes the requirements for variation to work hours under condition D37 and has **no comment on the OOHWP**. Therefore, the EPA limits its comments to this *Noise Monitoring Program* (Appendix B) which has been prepared to address the requirements of conditions C14 to C16.

In summary, the EPA considers that there are a number of areas where either conditions of approval have not been satisfied, or it is unclear in the programme how a condition has been satisfied. Further, the programme should not consider comparison of measured noise levels with predicted noise levels by itself as evidence of achieving the outcome of best-achievable noise levels implementing all reasonable and feasible mitigation measures. Noise level measurements are only one component of evidence that the desired outcome has been achieved. This should be made clearer in the programme. Detailed comments follow:

[REDACTED]

Requirements of Condition C15

Condition C15 of the Project Approval requires each monitoring program to include:

- (a) details of baseline data available including the period of baseline monitoring;*
- (b) details of baseline data to be obtained and when;*
- (c) details of all monitoring of the project to be undertaken;*
- (d) the parameters of the project to be monitored;*
- (e) the frequency of monitoring to be undertaken;*
- (f) the location of monitoring;*
- (g) the reporting of monitoring results and analysis results against relevant criteria;*
- (h) details of the methods that will be used to analyse the monitoring data;*
- (i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts;*
- (j) a consideration of SMART principles; and*
- (k) any consultation to be undertaken in relation to the monitoring programs; and*
- (l) any specific requirements as required by **Conditions C16 to C17** of this schedule.*

Section B.1.6 of the programme states that these requirements are addressed in sections B.2, 4.3, B.3, B.4, B.7 and B.1.5. However, it is not clear that these requirements have been adequately addressed as detailed below.

Section B.2 states that Quickway identified that baseline monitoring data provided in the Environmental Impact Statement (EIS) could be improved, however does not provide the details required by Condition C15(a) and C15(b). The potential issues with the existing baseline monitoring data are not provided – e.g. which Noise Catchment Areas require additional monitoring.

In order to comply with Condition C15(a) and C15(b) the EPA recommends that the issues identified within the EIS are outlined, and details of the additional monitoring are included in this plan and not deferred to subsequent documents.

Section B.3 sets out a method for attended and unattended noise measurements. However, it does not appear that it currently satisfies the requirements of C15(h) C15(i) and C16(a). Condition 16(a) states:

*noise and vibration monitoring determined in consultation with the **AA** to confirm the best achievable construction noise and vibration levels with consideration of all reasonable and feasible mitigation and management measures that will be implemented;*

The first bullet point of B.3.1 states that the monitoring will be carried out “*to confirm that actual noise and vibration levels are consistent with noise and vibration predictions...*” and the sixth bullet point states monitoring is to be undertaken “*Following the implementation of mitigation measures or noise attenuation due to exceedance of predicted noise levels.*”

In order to verify a prediction, a like-for-like comparison needs to be made. That is, measurements need to be taken under the same conditions and during the same activities as the modelling. There is no detail in the plan which explains how this will be done. It is also not clear which predicted levels are being referred to. There are multiple occasions of noise level predictions for this construction activity from the EIS to the CNVIS. However, the level of detail and certainty of assumptions has a significant effect on whether the predicted levels are useful for assisting in determining if all reasonable and feasible measures have been implemented.

The purpose of the noise monitoring should be to determine that the best achievable noise levels using all reasonable and feasible mitigation measures are being achieved. This outcome should not be wholly dependent on noise level predictions which may not represent best achievable noise levels or consider mitigation measures which cannot be easily quantified. Section 8.2 of the CNVMP states that Quickway will likely use a “self-assessment” tool called KNOWnoise. The EPA does not have detailed knowledge of this product; however it appears to allow some sort of prediction of

construction noise and integrate it with GIS mapping. The EPA considers it important to note that comparison of measured noise levels against predicted noise levels does not itself ensure the outcomes of the *Interim Construction Noise Guideline* (DECC, 2009) are achieved and would not likely be acceptable by itself as evidence of compliance with construction noise outcomes.

Furthermore, the programme does not provide any detail on what data will be used to satisfy C15(h). The EPA considers that data from attended measurements includes measured noise levels, estimated or calculated contribution noise levels, measurement notes and observations on noise sources, mitigation measures and environmental conditions in addition to analysis on the mitigation measures actually applied on site and whether they represent all reasonable and feasible measures.

The EPA recommends that the noise monitoring programme provide clarification on the intended outcome of the monitoring programme and how monitoring will support assessment of performance against the intended outcome. This includes providing appropriate information to demonstrate that Conditions C15(h) and C15(i) have been satisfied and amending the Plan in consideration of the above.

It does not appear that there is sufficient evidence in the programme which demonstrates how Conditions C15(i) and C15(j) have been satisfied. **The EPA recommends that the appropriate information to demonstrate that Conditions C15(i) and C15(j) have been satisfied is included in the Plan.**

Noise measurements

Under section B.3.1:

- On page 71 of 81, the list of factors for consideration of noise monitoring locations should also include the mitigation measures applied to the premises, activity or receiver.
- On page 72 of 81, the list of minimum parameters for real time noise monitoring should also include LA10.
- On page 72 of 81, the list of information included for each monitoring event must also include the meteorological conditions at the time of measurement. A method of recording meteorological conditions can be found in Australian Standard AS 1055.
- Page 70 of 81 references the “maximum noise level goals for construction equipment.” No reference has been provided for these goals. The reference for these goals should be included in the programme.

The EPA recommends that the programme is amended in consideration of the above.

Ground-Borne Noise

Under section B.3.2:

- Where access to the room of interest cannot be gained, an alternative room may be used provided it is representative of the impacts in the room of interest. Evidence and justification must be provided that any alternative room used is representative and any differences should be accounted for.
- There appears to be conflicting requirements for the measurement location on page 73 of 81 regarding ground-borne noise measurements indoors, particularly the distance from reflecting surfaces other than the floor.
- The list of information recorded for each monitoring event should include the mitigation measures implemented at the premises, for the activity or at the receiver.

The EPA recommends that the programme is amended in consideration of the above.

Should you require clarification of any of the above please contact Anna [REDACTED] or email [anna.f\[REDACTED\]@epa.nsw.gov.au](mailto:anna.f[REDACTED]@epa.nsw.gov.au)

Yours sincerely

[REDACTED]

ERIN [REDACTED]
[REDACTED]

cc Matthew [REDACTED]
[REDACTED]
Department of Planning, Infrastructure and Environment

Appendix B Consultation Comments

Construction Noise and Vibration Sub-plan and Noise and Vibration Monitoring Program

Report No: 04.076

User: Deml

Run Date: 21-05-21 04:10 PM
Page: 1

[illegible]

Comment No.	Date	Commented By:	Replied By:	Comment	Comment Category	Public	Comment Type	Closed	Attachment
34	16-05-21	Jaspreet Singh	Arun Kumar (Environment Protection Authority)	The EPA notes that the CNMWP is not clear about what the overall duration of the works will be at each location. Included within the CNMWP are the Noise Monitoring Program at Appendix C submitted to the EPA for consultation in accordance with condition C10.4, the EPA notes the requirements for validation to work hours under condition C21 and the time to complete the CNMWP. Therefore, the EPA finds it is comments to this Noise Monitoring Program Appendix B, which has been prepared to address the requirements of conditions C14, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100, C101, C102, C103, C104, C105, C106, C107, C108, C109, C110, C111, C112, C113, C114, C115, C116, C117, C118, C119, C120, C121, C122, C123, C124, C125, C126, C127, C128, C129, C130, C131, C132, C133, C134, C135, C136, C137, C138, C139, C140, C141, C142, C143, C144, C145, C146, C147, C148, C149, C150, C151, C152, C153, C154, C155, C156, C157, C158, C159, C160, C161, C162, C163, C164, C165, C166, C167, C168, C169, 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95	13-05-21	Joseph ■■■■ NDO	Archi ■■■■ (Environment Protection Authority)	<p>Requirements of Condition C15</p> <p>Condition C15 of the Project Approval requires each monitoring program to include:</p> <ul style="list-style-type: none"> (a) details of baseline data available including the period of baseline monitoring; (b) details of baseline data to be obtained and when; (c) details of all monitoring of the project to be undertaken; (d) the frequency of monitoring to be undertaken; (e) the frequency of monitoring to be undertaken; (f) the location of monitoring; (g) the reporting of monitoring results and analysis results against relevant criteria; (h) details of the methods that will be used to analyse the monitoring data; (i) procedures to identify and implement additional mitigation measures where the results of monitoring indicate that such measures are required; (j) a consideration of SMART principles; and (k) any consideration to be undertaken in relation to the monitoring program; and (l) any specific requirements as required by Conditions C15 to C17 of this schedule. <p>Section B: 1.6 of the programme states that noise requirements are addressed in sections B: 2, 4.3, 5.3, 5.4, 5.7 and 5.13. However, it is not clear that noise requirements have been adequately addressed in the program.</p> <p>Section B: 2 states that Outcome identified that baseline monitoring data provided in the Environmental Impact Statement (EIS) could be improved; however does not provide the details required by Condition C15(a) and C15(b). The general issues with the existing baseline monitoring data are not provided – e.g. which Noise Character Areas require additional monitoring.</p>	Observation	Yes	During Review	Yes	
96	13-05-21	Joseph ■■■■ SUD	Archi ■■■■ (Environment Protection Authority)	<p>Section B: 2 outlines the existing baseline data that was prepared as part of the EIS for this project. The EIS data described has been included to meet condition (a).</p> <p>The Monitoring Program is silent on presenting any additional background monitoring (i.e. Item (b)), which is an approach originally discussed with the AA and EIR and determined as appropriate. Should further monitoring be undertaken for background data, this information will be provided in the DNVS following AA acceptance of such data. Note that any changes to background data would not result in any changes to the proposed methodology and implementation of the Monitoring Program.</p> <p>The AA will review and endorse the DNVS prior to use.</p>	Observation	Yes	From Document Register		
97	13-05-21	Joseph ■■■■ SUD	Archi ■■■■ (Environment Protection Authority)	<p>In order to comply with Condition C15(a) and C15(b) the EPA recommends that the issues identified within the EIS are outlined, and details of the additional monitoring are included in the plan and not deferred to subsequent documents. Section B: 2 sets out a method for attended and unattended noise measurements. However, it does not specify how the data will be collected, stored, analysed and reported. The EPA considers that the monitoring will be carried out by the contractor. To confirm that actual noise and vibration levels are consistent with noise and vibration predictions, and the sixth bullet point table monitoring is to be undertaken. Following the implementation of mitigation measures or noise attenuation due to exceedance of predicted noise levels. In order to verify a predictive, like-for-like comparison needs to be made. That is, measurements need to be taken under the same conditions and during the same activities as the modelling. There is no detail in the plan which explains how this will be done. It also is not clear which predicted levels are being referred to. There are multiple occasions of noise level predictions or like-for-like comparisons being used. The level of detail and clarity of assumptions is a significant effect on whether the predicted levels are useful for assessing if determining if all reasonable and feasible measures have been implemented. The purpose of the noise monitoring should be to determine that the best achievable noise level using all reasonable and feasible mitigation measures are being achieved. The outcome should not be widely dependent on noise level predictions which may not represent best achievable noise level or consider mitigation measures which cannot be easily quantified. Section 2 of the CNMWP states that Outcome will fully use a like-for-like comparison tool called KNOWnoise. The EPA does not have detailed knowledge of the product however it appears to allow some sort of prediction of a construction noise and fatigue level GIS outcomes of the Noise Character Area (NCA) (DNVS, 2019) are achieved and would not likely be acceptable by itself as evidence of compliance with condition noise outcomes. Furthermore, the programme does not provide any detail on what data will be used to verify C15(a). The EPA considers that data from attended measurements indicates measured noise levels, estimated or calculated contribution noise levels, measurement notes and observations on noise sources, mitigation measures and environmental conditions in addition to analysis of the mitigation measures actually applied on site and whether they represent all reasonable and feasible measures.</p>	Observation	Yes	During Review	Yes	
98	13-05-21	Joseph ■■■■ SUD	Archi ■■■■ (Environment Protection Authority)	<p>The first section of this comment is an extension of the above comment. Please refer to response above.</p> <p>EPA references C16(a). The condition is met through the review and endorsement of the monitoring program by the AA.</p>	Observation	Yes	From Document Register		
99	13-05-21	Joseph ■■■■ SUD	Archi ■■■■ (Environment Protection Authority)	<p>This EPA references C15(a) and states: In order to verify a predictive, like-for-like comparison needs to be made. That is, measurements need to be taken under the same conditions and during the same activities as the modelling. In the CNMWP (e.g. response, notification, AA, etc). The monitoring is then undertaken to validate the noise model against the actual results. As such, the like-for-like will be achieved.</p> <p>The document is clear in that it will compare predicted levels not from the EIS, but from the DNVS and/or KNOWnoise model to allow for site and activity specific controls to be incorporated into the model, which may not have been appropriately included in the EIS. Additional wording has been included in B7 to further clarify this.</p> <p>As mentioned in comment response above, the Monitoring Program and the process of undertaking monitoring is not intended to be the process for confirming that all reasonable and feasible mitigation measures have been implemented. Mitigation measures are iterative, those outlined in the CNMWP are based on outcomes of the EIS, however the modelling identifies additional mitigation measures that may be implemented where the DNVS directs this to be necessary. The model is merely a predictive tool to help inform the measures and controls required for an activity. It is important that the model is validated and updated as required, via the outcomes of the monitoring.</p> <p>Please refer to the CNMWP for details on the full suite of proposed mitigation measures and how the appropriate, reasonable and feasible mitigation measures will be determined, implemented and confirmed (i.e. site inspections).</p> <p>It is understood that EPA does not have detailed knowledge of the modelling tool; this tool has been discussed, demonstrated and accepted by Sydney Metro, the EIR and the AA.</p>	Observation	Yes	During Review	Yes	

97.171	2046-21	Issue 6	Landmark (Quakekey)	<p>The Monitoring Program has been updated to address multiple reviewer comments, including the EG and AA, since the version reviewed by EPA. Quakekey are confident the document addresses how the monitoring outcomes will be used to validate the predictive tool, which is used to identify appropriate additional mitigation measures (i.e. respite, notification, AA) on top of the standard mitigation measures detailed in the CNMP. The process of validating the predictive tool is highly important and fundamental to ensuring correct additional mitigation measures are implemented.</p> <p>C15(h) refer to content above.</p> <p>C15(i) addresses procedures to identify and implement additional mitigation measures where the results of the monitoring indicated unacceptable project impacts. Section B7 specifically addresses actions to be undertaken should monitoring demonstrate unacceptable impacts.</p> <p>C16(j) addresses the consideration of SMART principles</p> <p>An additional section (G.7.1) has been added to fulfil C16(i).</p> <ul style="list-style-type: none"> With regards to specific hot points raised regarding section B.3.1: On page 71 of 81, the list of factors for consideration of noise monitoring locations should also include the mitigation measures applied to the premises, actively or receiver. This has now been added On page 72 of 81, the list of minimum parameters for real time noise monitoring should also include LA10. <p>LA10 is included on Page 73</p> <ul style="list-style-type: none"> On page 72 of 81, the list of information included for each monitoring event must also include the meteorological conditions at the time of measurement. A method of recording meteorological conditions can be found in Australian Standard AS 1055. This has now been added Page 70 of 81 references the "maximum noise level goals for construction equipment." No reference has been provided for these goals. The reference for these goals should be included in the program <p>This is referring to the CNVS plant SWL's, a new section has been added regarding this (B.3.1.3).</p> <p>With regards to specific hot points raised regarding section B.3.2:</p> <ul style="list-style-type: none"> Where access to the room of interest cannot be gained, an alternative room may be used provided it is representative of the impacts in the room of interest. Evidence and justification must be provided that any alternative room used is representative and any differences should be accounted for. It's noted in Section B.3.2.2 that if access to the preferred room is not granted it will be noted in the monitoring form. There appears to be conflicting requirements for the measurement location on page 73 of 81 regarding ground-borne noise measurements indoors, particularly the distance from reflecting surfaces other than the floor. Document states, where possible, noise monitoring is to be carried out at least 3.0 m from any reflective surface (other than the ground) with the preferred microphone/measurement height at 1.2-1.5 m above the ground while using a tripod. The list of information recorded for each monitoring event should include the mitigation measures implemented at the premises, for the activity or at the receiver. <p>This has been included to the list.</p>	Observation	Yes	From Document Register	
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Appendix G Indicative Vibration Impact Mapping

Vibration Safe Working Distances - Heavy Hammer (Typically 20-30t excavator)

Legend

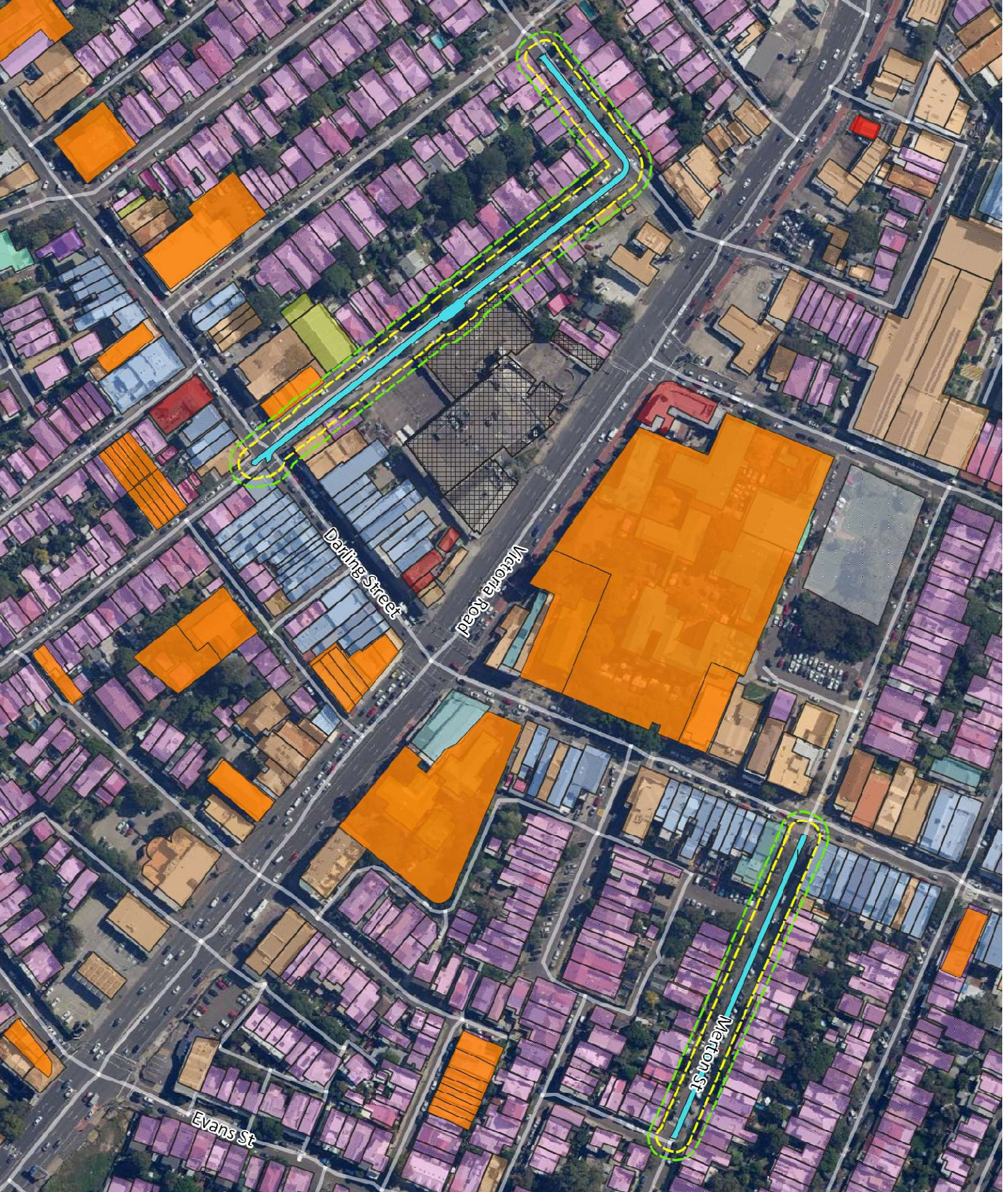
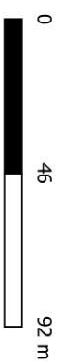
- Work Area
- Cosmetic damage buffer (6m)
- Heritage criteria buffer (10m)

Receiver Type

- Chilcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Community/Residential
- Education
- Garage
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Place of Worship
- Recreational Passive
- Diapidated/Vacant

Heritage Items

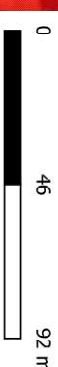
- Local Heritage - General
- Section 170
- State Heritage



Vibration Safe Working Distances- Heavy Hammer (Typically 20-30t excavator)

Legend

- Work Area
- Cosmetic damage buffer (6m)
- Heritage criteria buffer (10m)
- Receiver Type
- Childcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Community/Residential
- Education
- Garage
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Place of Worship
- Recreational Passive
- Disapidated/Vacant
- Heritage Items
- Local Heritage - General
- Section 170
- State Heritage

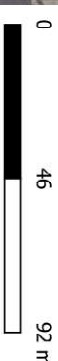


Vibration Safe Working Distances- Heavy Hammer (Typically 20-30t excavator)

Legend

- Work Area
- Cosmetic damage buffer (6m)
- Heritage criteria buffer (10m)
- Receiver Type

- Childcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Community/Residential
- Education
- Garage
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Pace of Worship
- Recreational/Passive
- Dilapidated/Vacant
- Heritage Items
- Local Heritage - General
- Section .170
- State Heritage



Vibration Safe Working
Distances- Medium
Hammer (typically 12-15t
excavator)

Legend

- Work Area
- Cosmetic damage buffer (4m)
- Heritage criteria buffer (7m)

Receiver Type

- Childcare
- Commercial/Business
- Commercial/Residential
- Community Use
- Community/Residential
- Education
- Garage
- Hotel
- Industrial/Utilities
- Recreational/Open Space
- Residential
- Medical
- Place of Worship
- Recreational/Passive
- Dilapidated/Vacant






















Heritage Items

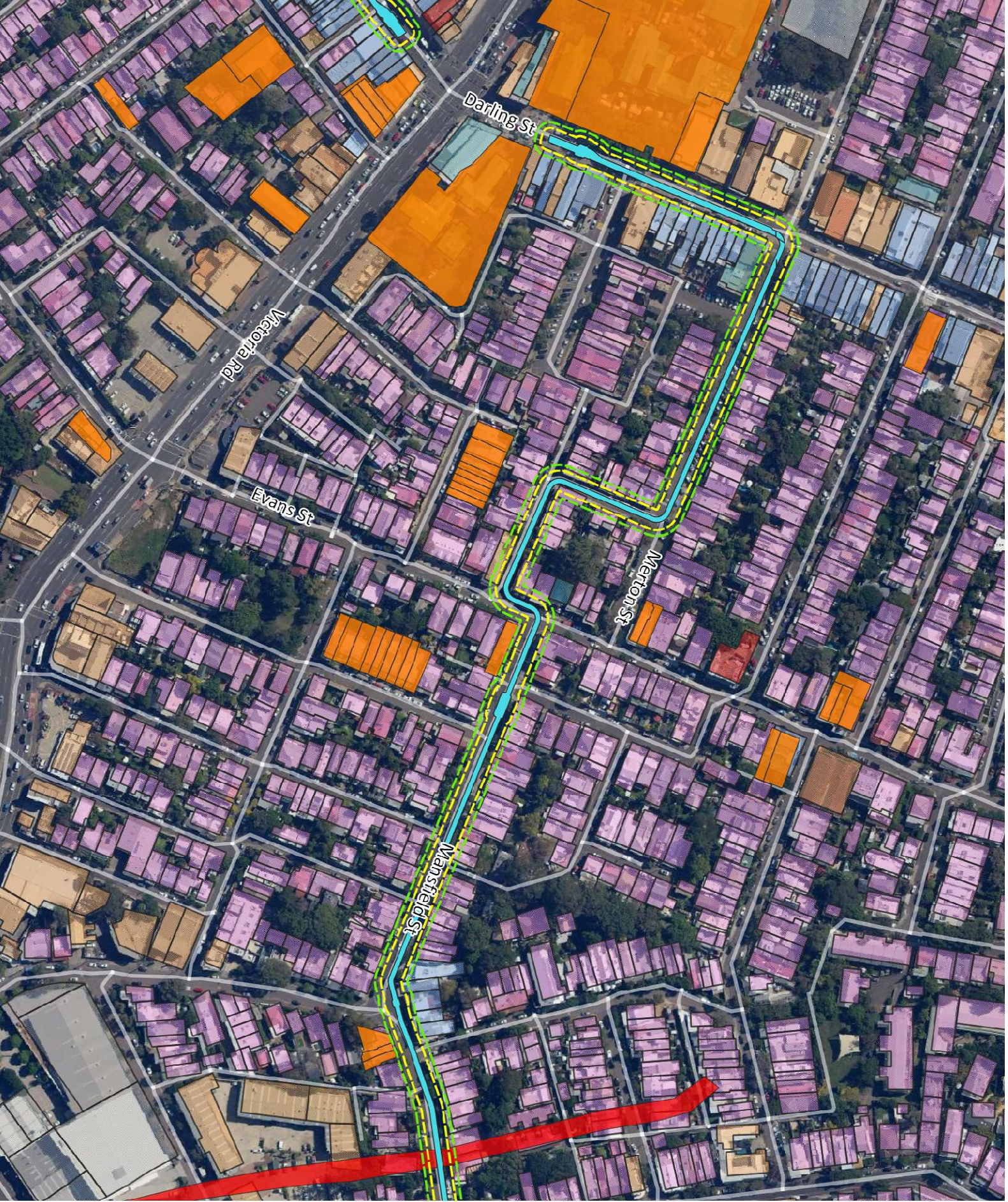
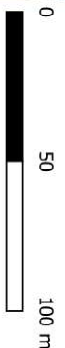
- Local Heritage - General
- Section 170
- State Heritage



Vibration Safe Working
Distances - Medium
Hammer (typically 12-15t
excavator)

Legend

-  Work Area
-  Cosmetic damage buffer (4m)
-  Heritage criteria buffer (7m)
- Receiver Type
 -  Childcare
 -  Commercial/Business
 -  Commercial/Residential
 -  Community Use
 -  Community/Residential
 -  Education
 -  Garage
 -  Hotel
 -  Industrial/Utilities
 -  Recreational/Open Space
 -  Residential
 -  Medical
 -  Place of Worship
 -  Recreational/Passive
 -  Dilapidated/Vacant
- Heritage Items
 -  Local Heritage - General
 -  Section 170
 -  State Heritage



Vibration Safe Working Distances- Medium Hammer (typically 12-15t excavator)

Legend

Work Area

Cosmetic damage buffer (4m)

Heritage criteria buffer (7m)

Receiver Type

Childcare

Commercial/Business

Commercial/Residential

Community Use

Community/Residential

Education

Garage

Hotel

Industrial/Utilities

Recreation/Open Space

Residential

Medical

Place of Worship

Recreation Passive

Dilapidated/Vacant

Heritage Items

Local Heritage - General

Section 170

State Heritage

