



## Hunter Power Project

### Construction Noise and Vibration Management Plan

| Approved Version 8

29 November 2024



## Hunter Power Project

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The initial management plan was prepared by Jacobs and Snowy Hydro and approved by the Department for the Hunter Power Project. Details of the review process are detailed in the document history table above. Subsequent versions of the approved management plan have been updated by Snowy Hydro in consultation with the Department's endorsed Environmental Representative as required and the reasons for the management plan updates are detailed in the table below.

### Approved management plan version history

Approved version	Date	Description of changes	Author	Date endorsed by ER
1	15 February 2022	Previously referred to as Amended Final v3 and endorsed by the Department and the ER	S Brennan	25 February 2022
2	23 August 2022	Document updated in response to a Noise Impact Assessment memo completed for an Out of Hours Work (OOHW) Application as it was identified that additional time was required for the construction hours to complete works due to months of above average rainfall. Changes made to the Construction Noise and Vibration Management Plan relate to the revised construction hours and the inclusion of additional mitigation measures provided by the Department as part of the OOHW Approval issued on the 16 May 2022.	I Strachan	NA

Approved version	Date	Description of changes	Author	Date endorsed by ER
3 Draft	27 September 2022	Document updated in response to a second OOHW Application as it was identified that additional time was required for the construction hours to complete works. Changes made to the Construction Noise and Vibration Management Plan relate to the extension of time associated with the revised construction hours and the approval requirements provided by the Department as part of the OOHW Approval issued on the 14 September 2022. The document was issued for the ER to review.	R Vazey	NA
3 Final	4 October 2022	Document updated in response to ER comments on approved version 3.	R Vazey	5 October 2022
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5	10 May 2023	Document updated in response to the approval of Modification1 on 1 March 2023. Details of OOHW Application for concrete pours was removed from the document as it has lapsed.	A van der Kroft	29 May 2023
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## Glossary of terms

Term	Definition
Decibel (dB)	A measure of sound level. The decibel is a logarithmic way of describing a ratio. The ratio may be power, sound pressure, voltage, intensity or other parameters. In the case of sound pressure, it is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure squared to a reference sound pressure squared
Department	Same meaning as Department under the EP&A Act
EPA Regulation	Environmental Planning and Assessment Regulation 2000
Feasible and reasonable	Consideration of best practice considering the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, considering mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements
Mitigation	Action to reduce the severity of an impact
The Project	The Hunter Power Project; formerly referred to as the Kurri Kurri Power Station Project
Project Site	The area of land that is directly impacted on by a development, including access roads, and areas used to store construction material
Proponent	Snowy Hydro Limited
Rating Background Level (RBL)	The overall, single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level)
Receiver	The noise-sensitive land use at which noise from a development can be heard
Secretary	Planning Secretary under the EP&A Act, or nominee
Secretary's Approval	A written approval from the Planning Secretary and/or delegate
Sensitive receptor	A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area (EPA 2016)
Significant	Greater than 20% concentration value difference between impact site and reference site



## Abbreviations

Abbreviation	Definition
CEMS	Construction Environmental Management Strategy
CNVG	Construction Noise and Vibration Guideline (Roads and Maritime Service, 2016)
CNVIS	Construction Noise and Vibration Impact Statement
CRM	Community Relationship Manager
dB(A)	Decibels using the A-weighted scale measured according to the frequency of the human ear
DECC	Department of Environment and Climate Change
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ICNG	NSW Interim Construction Noise Guideline
L <sub>A90</sub>	The sound pressure level that is exceeded for 90% of the given measurement period
L <sub>Aeq (15min)</sub>	The A-weighted equivalent continuous (energy average) sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as from industry, road, rail and the community
L <sub>Aeq (9hour)</sub>	The A-weighted equivalent continuous (energy average) sound pressure level of the construction works under consideration over a 9-hour period and excludes other noise sources such as from industry, road, rail and the community
L <sub>Amax</sub>	the A-weighted maximum noise level only from the construction works under consideration, measured using the fast time weighting on a sound level meter
LEP	Local Environmental Plan
NCA	Noise catchment area
NHVR	National Heavy Vehicle Regulator
NML	Noise Management Level
NPI	Noise Policy for Industry
NVMP	(Construction) Noise and Vibration Management Plan (this Plan)
OOHW	Out of Hours Work
OSOM	Oversize over mass
RBL	Rating Background Level
SWL	Sound Power Level
TWAF	Temporary Worker Accommodation Facility
VDV	Vibration dose values

# 1. Introduction

## 1.1 Context

This Construction Noise and Vibration Management Plan (NVMP) was developed to address Infrastructure Approval Condition C1(e)(ii) issued for the Hunter Power Project ('Project') by the Planning Secretary (Secretary) of the Department. All relevant conditions are outlined in Table 1-1 below.

**Table 1-1 Infrastructure Approval conditions**

Condition	Requirement	NVMP Reference
C1	<p>Prior to commencing construction, the Proponent must prepare an Environmental Management Strategy for the development to the satisfaction of the Secretary. This Strategy must:</p> <p>(e) include:</p> <p>(i) the following sub-plans:</p> <ul style="list-style-type: none"> <li>▪ Construction noise management plan prepared in consultation with the EPA.</li> </ul>	Sections 4.3, 6.2 and 7.2
B21*	Operational noise generated at the premises must not exceed the noise limits at the times and locations in Table 5 below (or alternative limits as permitted by the applicable EPL).	Sections 1.2.3, 4.3.1, 5.2.2.2, 6.1
B26	<p>Prior to installation of the gas turbines, unless otherwise agreed by the Secretary, the Proponent must ensure there is a suitable meteorological weather station operating located on the premises or at a location approved by the EPA that:</p> <p>(a) complies with the Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (EPA 2016 or latest version);</p> <p>(b) is capable of continuous real-time measurement of wind speed, wind direction, sigma theta, air temperature, rainfall and relative humidity; and</p> <p>(c) is capable of measuring meteorological conditions in accordance with the Noise Policy for Industry (EPA 2017 or latest version).</p>	Section 7.2.3
B30	<p>Hours of Construction</p> <p>All construction work at the premises must be conducted between 7 am and 6 pm Monday to Friday and between 8 am and 1 pm Saturdays and at no time on Sundays and public holidays.</p>	Section 1.2.3 and 4.2
B31	<p>Exceptions to Construction Hours</p> <p>The following activities may be carried out outside the recommended construction hours:</p> <p>(a) construction that causes LAeq(15minute) noise levels that are:</p> <ul style="list-style-type: none"> <li>(i) no more than 5 dB above Rating Background Level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009); and</li> <li>(ii) no more than the Noise Management Levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses; or</li> </ul> <p>(b) for the delivery of materials required by the police or other authorities for safety reasons; or</p>	Section 1.2.3 and 4.2

Condition	Requirement	NVMP Reference
	(c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or (d) as approved through the process outlined in condition B32 of this approval.	
B32	Variation of Construction Hours The hours of construction activities specified under condition B30 of this approval may be varied with the prior written approval of the Secretary. Any request to alter the hours of construction shall be: (a) considered on a case-by-case or activity-specific basis; (b) accompanied by details of the nature and justification for activities to be conducted during the varied construction hours; (c) accompanied by written evidence that appropriate consultation with potentially affected sensitive receivers and notification of relevant Council(s) (and other relevant agencies) has been and will be undertaken; (d) all feasible and reasonable noise mitigation measures have been put in place; and (e) accompanied by a noise impact assessment consistent with the requirements of the Interim Construction Noise Guideline (DECCW, 2009), or latest version.	Section 1.2.3, 4.2 and 6.6

\* This Condition was added as part of Approved version 8 and applies to hot commissioning activities only

**1.1.1 Purpose**

The purpose of this NVMP is to provide details on the framework of mitigation and management measures proposed to address potential noise and vibration impact resulting from the construction of the Project. Approved version 8 of the NVMP has been updated to include cold and hot commissioning activities.

**1.1.2 Scope**

This NVMP has been developed to address Infrastructure Approval conditions provided by the Department during construction of the Project. These conditions were subsequently modified by the Department on 1 March 2023 to include Precinct 3B and again on 16 November 2023 to allow construction and operation of a Temporary Worker Accommodation Facility (TWAF) as shown in Figure 1-2.

Cold and hot commission activities have been added to this NVMP as they are an integral part of construction and the responsibility of the Principal Contractor and equipment supplier, rather than Snowy Hydro who will be responsible for the operational phase of the project which will be managed by means of an Operational Environmental Management Strategy and associated sub plans.

**1.1.3 Objectives**

The NVMP has been prepared to ensure that all conditions, management and mitigation measures detailed in the Environmental Impact Statement (EIS) and Response to Submissions reports and all other licence and permit requirements have been adequately described, assigned and scheduled. The documents with requirements that have been addressed include:

- The EIS prepared for the Hunter Power Project (Jacobs, 2021a)
- The Response to Submissions Report prepared for the Hunter Power Project (Jacobs, 2021b) and the Revised Noise and Vibration Assessment included as an appendix to the report
- The Project’s Infrastructure Approval conditions, as modified on 1 March 2023

- Environment Protection Licence (EPL) number 21627.

#### **1.1.4 Goals and targets**

The following goals and targets have been established to guide the management of noise and vibration impacts from the construction of the project:

- Compliance with all conditions, EPL requirements and all other regulatory requirements
- Consideration of all mitigation measures detailed in the EIS and Response to Submissions reports
- Ensure training and inductions pertaining to noise and vibration management are provided to all staff working on site prior to starting work
- Assure all noise and vibration impacts are adopted in an efficient manner
- Produce no exceedances of relevant noise limits.

#### **1.1.5 Project location**

The Project Site address is 1 Hart Rd, Loxford. Access to the property is via Hart Road and the property is approximately 1.0 kilometre (km) from the M15 Hunter Expressway as shown in Figure 1-1 and Figure 1-2. The Project Site is shown in Figure 1-3.

The Project Site will be part of an Industrial Estate development. The planning proposal, currently under consideration by Cessnock City Council and the Department, would rezone the Project Site as Heavy Industrial. The Project Site and its surrounds are currently zoned RU2 Rural Landscape under the Cessnock Local Environmental Plan 2011 (Cessnock LEP), with small pockets of surrounding land zoned E2 Environmental Conservation.

#### **1.1.6 Access**

The Project Site is accessed off Hart Road, which is adequate for construction and operation activities. During construction and operation, all vehicular access to the Project Site, including heavy vehicles would be via the Hunter Expressway and Hart Road. Parking for staff will be provided on-site.

Refer to Sections 4.2 to 4.4 of the Traffic Management Plan for further detail on construction access and workforce parking.

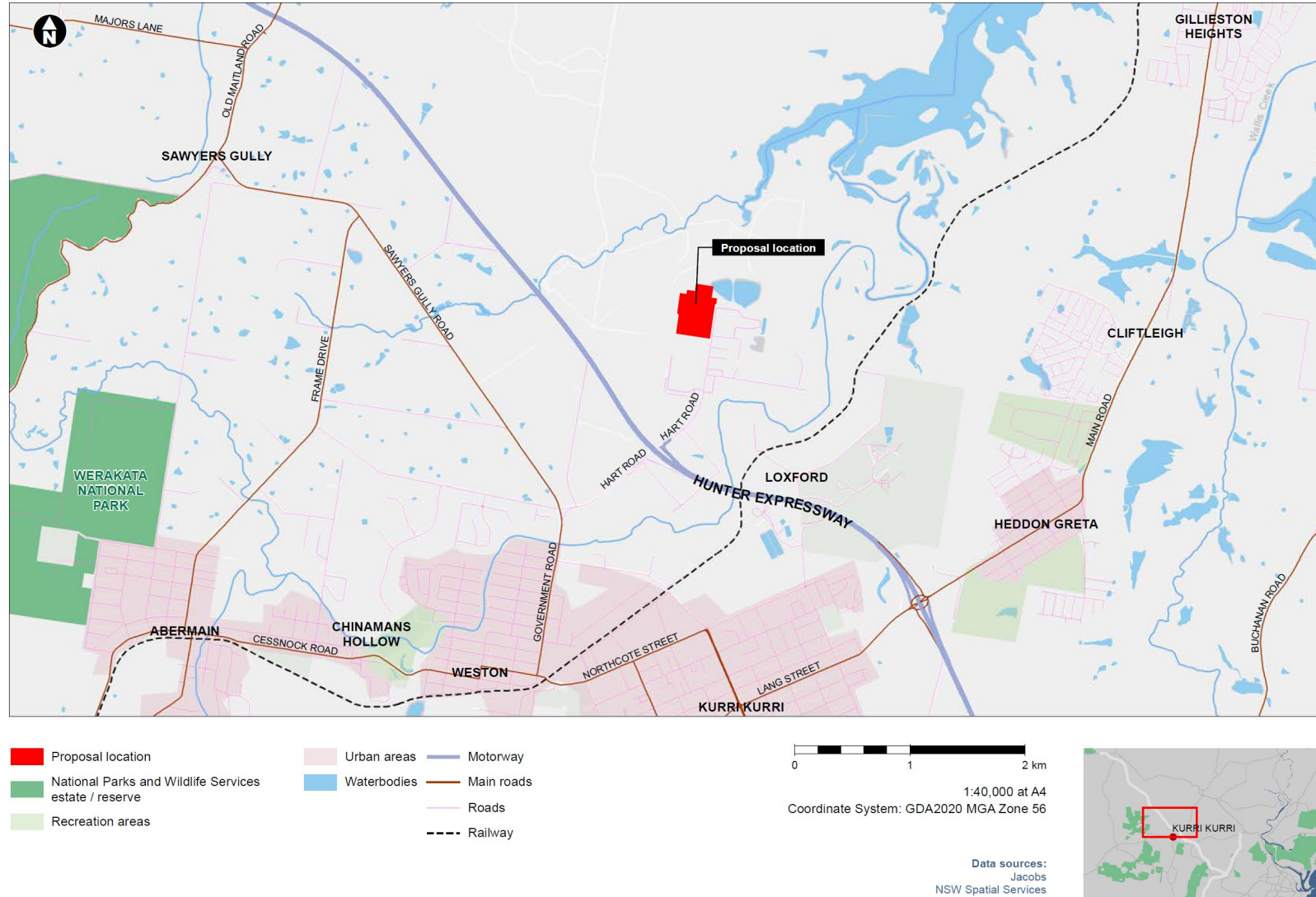


Figure 1-1 Project location (regional)

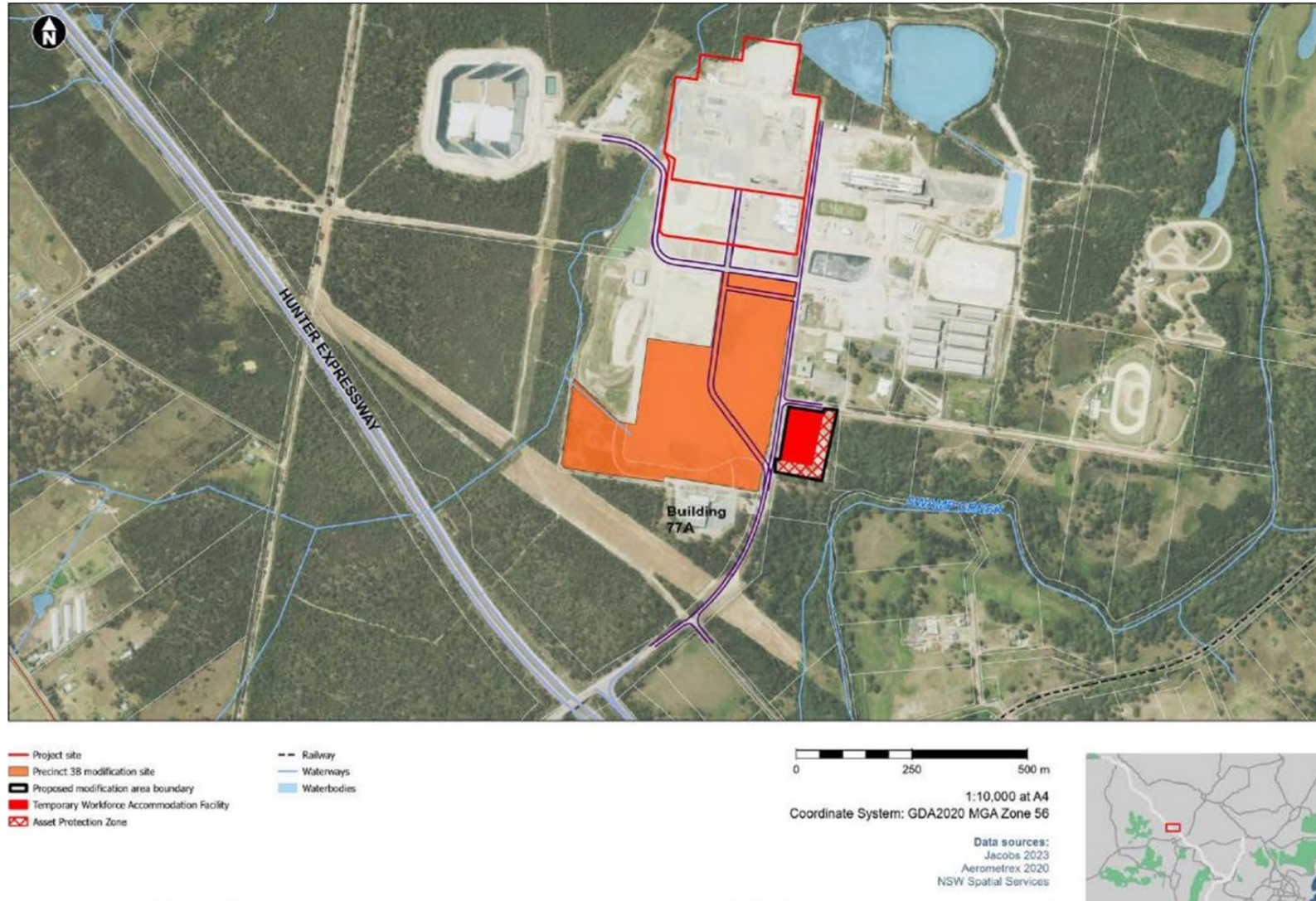


Figure 1-2 Project location (local)

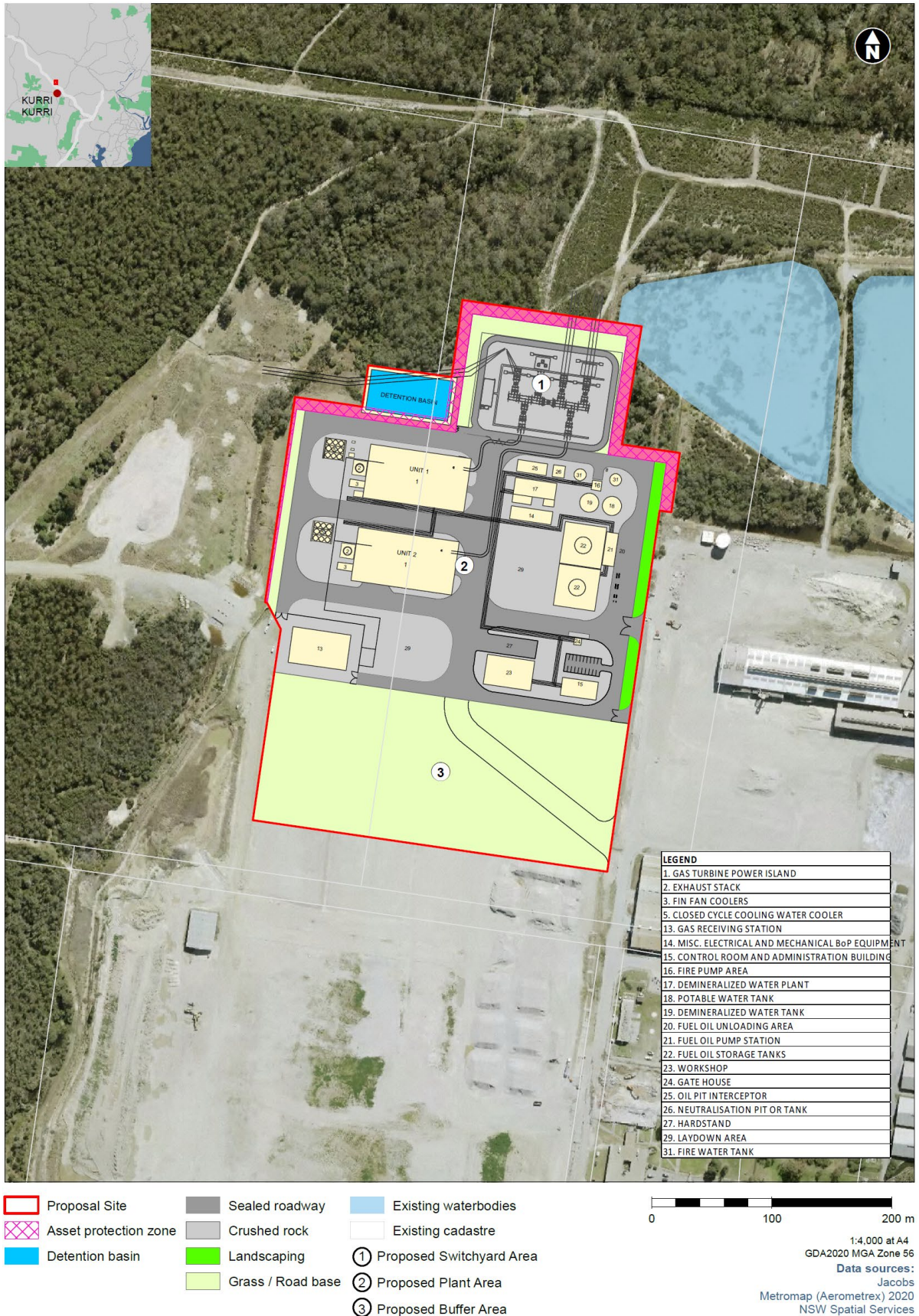


Figure 1-3 Site layout

## 1.2 Project construction

### 1.2.1 Works within construction scope

The key construction activities for the Project are summarised in Table 1-2 and are covered under the Construction Environmental Management Strategy (CEMS) unless noted otherwise. Preliminary work and pre-construction activities that are not considered as construction activities include road dilapidation surveys, installation of fencing, geotechnical drilling and/or surveying activities.

**Table 1-2 Construction activity summary**

Construction stage	Construction activity per program	Activity details
Pre-construction/ site establishment	Site access, civil works, and road construction to establish site	<ul style="list-style-type: none"> <li>▪ Installation of environmental controls, which may include temporary sheds, amenities, fencing, erosion and sediment controls, laydown/stockpiling areas, site surveys and, initial internal road building</li> <li>▪ Construction of reinforced concrete pavement to support heavy vehicles (up to B-double size)</li> <li>▪ Internal road layout design to account for turning paths of large vehicles, cranes, and articulated vehicles, so that movements in and out can be made in a forward direction</li> <li>▪ Roadworks and hardstand areas to be constructed for car parking, delivery/laydown areas</li> <li>▪ Where required, bunded areas for delivery, handling, and storage of fuel and other hazardous material would be constructed</li> </ul>
Construction	Switchyard site preparation	<ul style="list-style-type: none"> <li>▪ Clearing of vegetation</li> </ul>
Site establishment and construction	Earthworks to prepare the Project Site and construction areas	<ul style="list-style-type: none"> <li>▪ Initial site clearing and grading works. Earthworks may involve small amounts of cut and fill to achieve the necessary design levels across the site</li> <li>▪ Trenching for underground utilities and services would be installed such as stormwater, water and sewer reticulation, electrical cables, and (internal) gas pipes between the gas receiving station and the gas turbine locations</li> <li>▪ Preparation and construction of foundations. Deep piling is expected to support the heaviest infrastructure such as the gas turbines, generator and the main step-up transformers while shallower piling or pad type foundations would underpin the foundations where the proposed surface loads are less (e.g. site office/administration buildings, car park). Final numbers and depth of foundation piles will be subject to detailed design, as is the piling method (i.e. bored; driven; vibration piling)</li> <li>▪ Reinforced concrete slabs would be constructed in certain pavement areas, with other areas being surfaced with crushed rock or other suitable materials</li> </ul>
Construction	Balance of plant, switchyard construction, & turbine installation	<ul style="list-style-type: none"> <li>▪ Installation of major plant items associated with the gas turbines including all above ground civil, mechanical, electrical plant equipment</li> <li>▪ Installation of electrical switchyard</li> </ul>



Construction stage	Construction activity per program	Activity details
		<ul style="list-style-type: none"> <li>▪ Use of car parking, site access roads, fabrication and laydown areas within Precinct 3B</li> <li>▪ Construction and occupation of 200 bed Temporary Workforce Accommodation Facility</li> </ul>
Commissioning	Commissioning and testing (excluded from construction scope)	<ul style="list-style-type: none"> <li>▪ Program of testing and certification of all Project components, systems, and processes to demonstrate the Project can operate to the required standards before commencing operation</li> <li>▪ Commissioning, comprised of two phases:               <ul style="list-style-type: none"> <li>○ Cold commissioning – has noise activities similar to construction</li> <li>○ Hot commissioning – has noise activities associated with setting up the operational plant and testing it according to various scenarios with noise more similar to operation</li> </ul> </li> </ul>
Post-construction/demobilisation	Demobilisation	<ul style="list-style-type: none"> <li>▪ Removal of construction equipment, site fencing and construction compounds</li> <li>▪ Installation and establishment of landscaping</li> <li>▪ Demobilisation of Temporary Workforce Accommodation Facility and relinquishment of area to landowner</li> </ul>

### 1.2.2 Construction and commissioning

The initial phase of construction to prepare the site and install environmental controls commenced in early 2022 and follows the general activities outlined in Table 5-1. Towards the end of construction, each turbine and all ancillary equipment in turn will be commissioned cold which is considered as a continuation of construction activities. Following this, will be hot commissioning of each turbine on diesel as well as on natural gas.

### 1.2.3 Construction hours and workforce

All construction work will be undertaken during standard construction hours, which are defined as:

- 7:00am to 6:00pm Monday to Friday, inclusive
- 8:00am to 1:00pm on Saturday
- At no time on Sunday or Public Holidays.

Exceptions to conducting construction activities outside of these hours may occur for the following activities in accordance with the Infrastructure Approval Condition B31:

- Activities that cause noise levels LAeq(15min) no more than 5 decibels (dB) above Rating Background Level at any residence in accordance with the *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change (DECC, 2009), and no more than the Noise Management Levels (NMLs) specified in Table 3 of the ICNG at other sensitive land uses
- For the delivery of material required by the police or other authorities for safety reasons
- Where it is required in an emergency to avoid the loss of lives, property, and/or to prevent environmental harm
- As approved with prior written approval of the Secretary, outlined in Condition B32.

Should construction hours be varied in accordance with Condition B32, details will be included in section 6.6 of this document.

Cold commissioning activities are expected to take place during standard construction hours, or under an exemption. However, if cold commissioning activities are required outside of these hours they would be subject to, or included in, a variation of construction hours in accordance with Condition B32.

Hot commissioning would also generally take place during standard construction hours but would also take place during the evening and night. As the activity is more akin to operations, it will be undertaken in accordance with the Noise Limit Conditions in Condition B21 (and EPL Condition L4.1) with commissioning activities possible during the day, evening and night periods.

## 2. Existing environment

The Project Site is located entirely within a former industrial area, on land formerly occupied by the Kurri Kurri aluminium smelter, which closed permanently in 2014 and is still undergoing demolition and remediation works.

Land use surrounding the Project Site is described as follows:

- To the west is Sawyers Gully, a suburb predominately comprised of farmland and sparsely distributed receivers. The suburb is adjacent to the Hunter Expressway, with a number of receivers in close proximity to the carriageway.
- To the southeast of the Project Site is Loxford
  - The western extent of Loxford, directly south of the Project Site comprises of sparsely distributed residential receivers with some industry, notably a pipe and manifold manufacturing facility. The Noise Catchment Area (NCA) is adjacent to both the Hunter Expressway and the Kurri Kurri Wastewater Treatment Works. Under the proposed rezoning, the northern and eastern sections of the NCA will be rezoned to General Industry while the southern section would be rezoned to Low Density Residential.
  - The eastern side of Loxford (to the southeast of the Project Site), comprises of sparsely distributed residential receivers with the nearby Kurri Kurri TAFE. Under the proposed zoning, the residential areas of this section of Loxford would be rezoned as Low Density Residential.
- Further east of Loxford is the township of Cliftleigh, which predominately features residential and commercial properties. The township also features a number of new and proposed residential developments.
- Northeast of the Project Site, the area of Gillieston North comprises isolated farmhouses and pasture
- Approximately 2 km south of the Project Site is an existing industrial area, and slightly further south is the township of Kurri Kurri which is predominately residential and commercial.

The surrounding land uses and noise sensitive receivers are detailed in Figure 2-1.

A summary of background noise levels is shown below in Table 2-1 which refers to the Noise Catchment Areas (NCA) shown in Figure 2-2. Revised background noise monitoring was performed during a period of 14 days between the 29 June and 13 July 2021. This monitoring was performed in response to commentary from the Environment Protection Authority (EPA) and in addition to the background noise monitoring performed in December 2020 and January 2021. A monitoring location was selected to represent each of the NCAs. Monitoring was undertaken during the winter period in order to limit insect and other environmental noise to the greatest extent possible. It was noted that the evening period was louder than the day period at most noise monitoring locations, as a result of the noise controlling nature of traffic along the Hunter Expressway at NCA 1 and to a lesser extent NCA 2, as well as a result of frogs and other wildlife becoming more active (pertaining especially to NCAs 3, 4 and 5). In those cases, the criterion derived from these noise levels were adjusted to prevent the more sensitive time period from having a less noise sensitive criterion.

**Table 2-1 Background noise levels**

Monitor ID	NCA	Monitoring Location	Monitoring Duration	Measurement	Measured Noise Level – dB(A)		
					Day (7:00 am to 6:00 pm)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
NM1	NCA 1	103 Bishops Bridge Rd, Sawyers Gully	29 June 2021 – 13 July 2021	L <sub>Aeq</sub> (equivalent noise level)	55	57	53
				RBL (Background L <sub>A90</sub> )	45	45	36
NM2	NCA 2	10 Dawes Ave, Loxford	29 June 2021 – 13 July 2021	L <sub>Aeq</sub> (equivalent noise level)	48	47	46
				RBL (Background L <sub>A90</sub> )	40	43	38
NM3	NCA 3	20 Bowditch Ave, Loxford	29 June 2021 – 13 July 2021	L <sub>Aeq</sub> (equivalent noise level)	47	44	44
				RBL (Background L <sub>A90</sub> )	38	39	37
NM4	NCA 4	464 Cessnock Rd, Gillieston Heights	29 June 2021 – 13 July 2021	L <sub>Aeq</sub> (equivalent noise level)	43*	38*	38*
				RBL (Background L <sub>A90</sub> )	29*	33*	30*
NM5	NCA 5	60 Metcalfe Lane, Sawyers Gully	29 June 2021 – 13 July 2021	L <sub>Aeq</sub> (equivalent noise level)	45	46	42

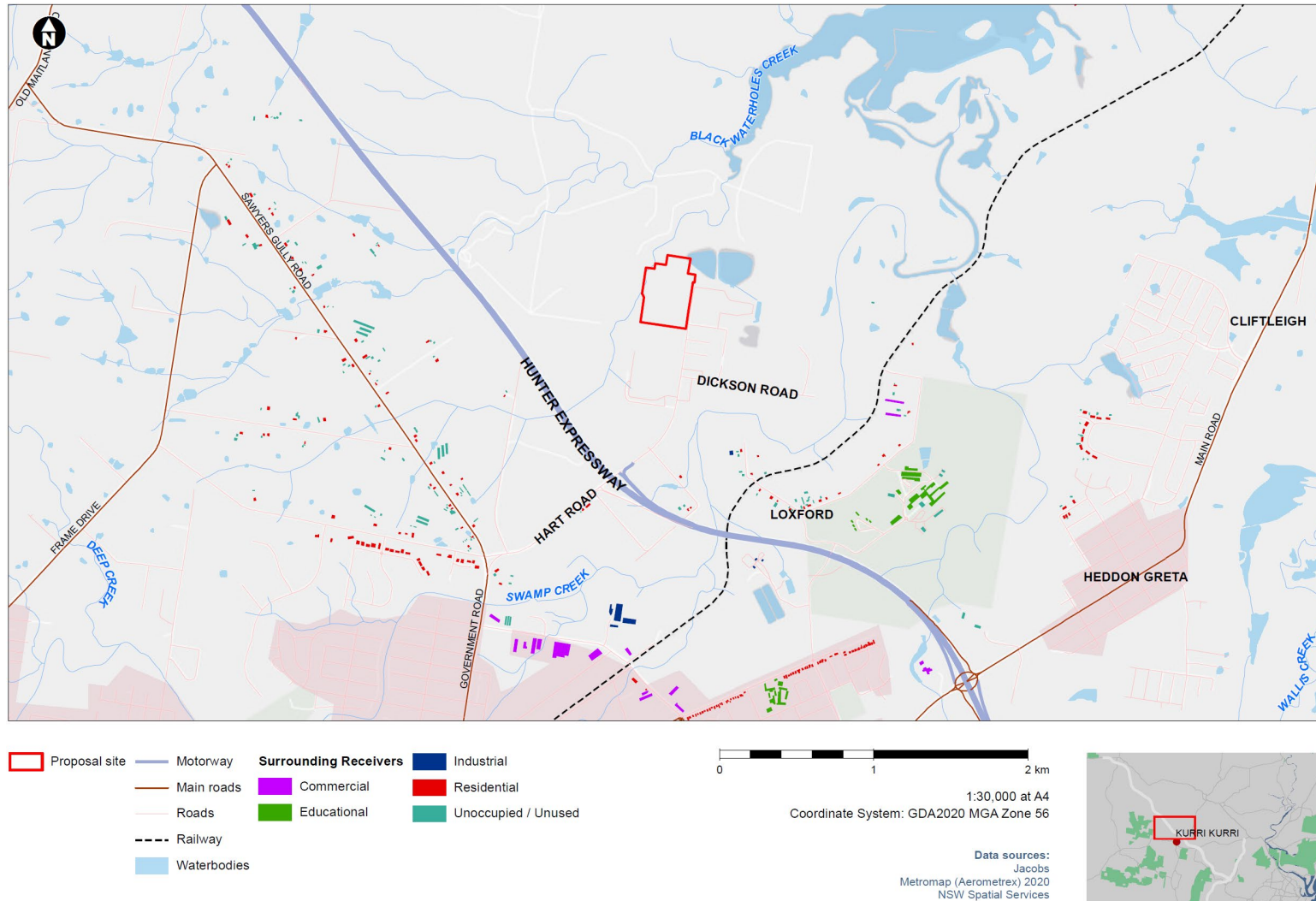


Figure 2-1 Noise sensitive receivers around the Project Site

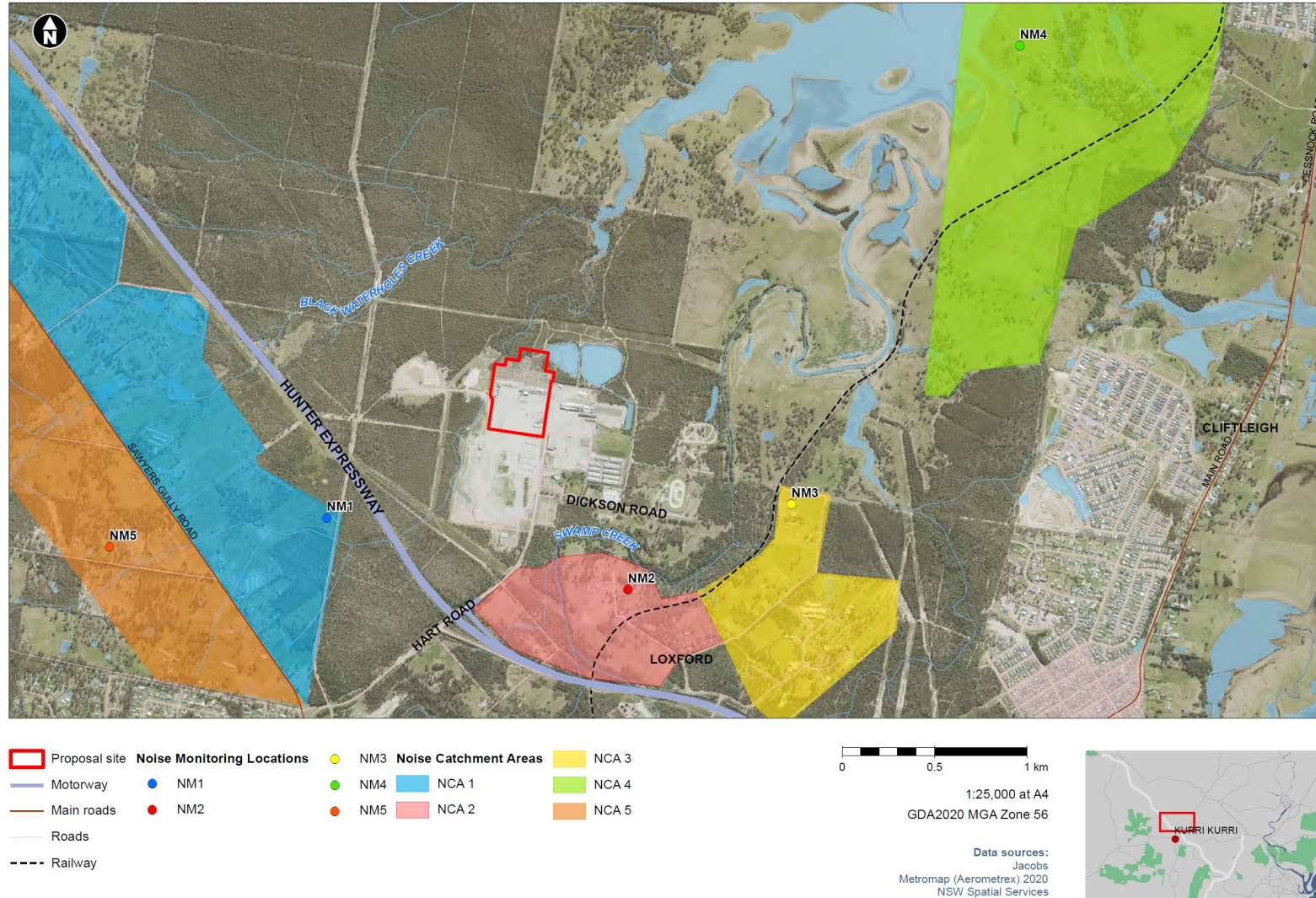


Figure 2-2 Noise Catchment Areas

### 3. Legislative context

#### 3.1 Relevant legislation

All legislation relevant to the NVMP is included in the CEMS.

#### 3.2 Relevant guidelines

The main guidelines, standards and policies relevant to this NVMP include:

- ICNG (DECC, 2009)
- *NSW Road Noise Policy* (DECC, 2011)
- *NSW EPA Noise Policy for Industry 2017*
- *Assessing Vibration: a technical guideline* (Department of Environment and Conservation, 2006)
- *British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration*
- *British Standard BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting*
- *German Standard DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures*

#### 3.3 Infrastructure Approval conditions

The applicable Infrastructure Approval conditions relevant to the NVMP are listed in Table 1-1.

#### 3.4 Environment Protection Licence (EPL)

EPL 21627 contains the conditions administered by the NSW EPA for the Scheduled Development Work for the project and operational conditions. Variations to the EPL licence following a request for OOHV is discussed in Section 4.2.

#### 3.5 EIS commitment

Other environmental requirements established for construction noise in the EIS (Jacobs 2021a) have been detailed in Table 3-1.

**Table 3-1 EIS commitment**

EIS Mitigation Measure	Mitigation measure	Document Reference
NV1	A Construction Noise and Vibration Management Plan (NVMP) will be developed to manage noise during construction. This will include consideration of plant selection, construction hours, plant maintenance, construction traffic and transport, staff awareness, construction staging and monitoring.	This Document

#### 3.6 Consultation

Infrastructure Approval Condition C1(e)(i) requires this management plan to be prepared in consultation with the EPA. The EPA was invited to comment on the draft air quality and water management plans on 12 November 2021, however, has declined this opportunity. A summary of this consultation outcome is provided in Table 3-2. The EPA was further

consulted on the 15 February 2022 regarding this Construction Noise Management Plan and similarly declined to comment. Evidence of the consultation has been provided to the Department.

**Table 3-2 Consultation feedback and response**

Agency	Feedback	Response & section reference
NSW EPA	EPA responded they “encourage the development of [management plans] to ensure that proponents and licensees have determined how they will meet their statutory obligations and designed environmental objectives. Being a regulatory authority, the EPA’s role is to administer and regulate the statues for environmental management and protection. As such the EPA does not directly get involved in the development of strategies to achieve those objectives and does not review or comment on such plans.”	Noted



## 4. Noise and vibration objectives

### 4.1 Summary of objectives

The relevant policies and standards used to determine construction noise and vibration mitigation and management objectives have been detailed in Table 4-1.

**Table 4-1 Summary of noise and vibration objectives**

Impact/ issue	Relevant policy, standard and/or guideline used to establish noise and vibration management levels
Work hours	Infrastructure Approval conditions EPL
Airborne noise	Infrastructure Approval conditions Interim Construction Noise Guideline NSW EPA Noise Policy for Industry
Human comfort vibration impact	<i>Assessing Vibration: A technical guideline</i>
Cosmetic building damage vibration impact	<i>BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration</i> <i>AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives</i>
Heritage structure damage vibration impact	<i>DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures</i>
Buried services damage vibration impact	<i>DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures</i>

### 4.2 Construction hours

Construction working will be undertaken in accordance with conditions B30 and B31, as well as those specified in EPL 21627. The working hours approved under these conditions are detailed in Table 4-2 below. As per the table, wherever possible, works should be undertaken during the standard construction hours of 7am – 6pm Monday to Friday and 8am – 1pm Saturday, however certain works can be undertaken outside of those times, refer to Table 4-2.

For all other work or activities outside standard hours (those that don't meet the exceptions provided in Condition B31), work/activities will not be undertaken, or an assessment of OOHW will be undertaken in accordance with the protocol detailed in Section 6.5 and the EPL conditions.

**Table 4-2 Summary of Construction Working Hours for the Project**

Condition	Requirement	Working Hours		
		Monday - Friday	Saturday	Sunday & Public Holidays
B30	All construction work at the premises must be conducted between 7am and 6pm Monday to Friday and between 8am and 1pm Saturdays and at no time on Sundays and public holidays.	7am to 6pm	8am to 1pm	No Work

Condition	Requirement	Working Hours		
		Monday - Friday	Saturday	Sunday & Public Holidays
B31	<p>The following activities may be carried out outside the recommended construction hours:</p> <p>a) construction that causes <math>L_{Aeq(15min)}</math> noise levels that are:</p> <ol style="list-style-type: none"> <li>i. no more than 5 dB above Rating Background Level at any residence in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009); and</li> <li>ii. no more than the Noise Management Levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (DECC, 2009) at other sensitive land uses; or</li> </ol> <p>b) for the delivery of materials required by the police or other authorities for safety reasons; or</p> <p>c) where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm; or</p> <p>d) as approved through the process outlined in condition B32 of this approval.</p>	6pm to 7am	1pm to 8am	Any Time
B32	<p>The hours of construction activities specified under condition B30 of this approval may be varied with the prior written approval of the Secretary. Any request to alter the hours of construction will be:</p> <ul style="list-style-type: none"> <li>• considered on a case-by-case or activity-specific basis;</li> <li>• accompanied by details of the nature and justification for activities to be conducted during the varied construction hours;</li> <li>• accompanied by written evidence that appropriate consultation with potentially affected sensitive receivers and notification of relevant Council(s) (and other relevant agencies) has been and will be undertaken;</li> <li>• all feasible and reasonable noise mitigation measures have been put in place; and</li> <li>• accompanied by a noise impact assessment consistent with the requirements of the <i>Interim Construction Noise Guideline</i> (DECCW, 2009), or latest version.</li> </ul>	6pm to 7am	1pm to 8am	Any Time

The above is also applicable to cold commissioning activities. As hot commissioning is more akin to operations, it will be undertaken in accordance with Noise Limit Conditions in Condition B21 (and EPL Condition L4.1) with commissioning activities possible during the day, evening and night periods.

### 4.3 Construction noise objectives

#### 4.3.1 Noise management levels

The ICNG provides guidance for assessing noise from construction activities in NSW. It establishes NMLs for recommended standard construction hours and for outside of the recommended standard hours. Construction is considered to have the potential to cause a noise impact if the predicted noise exceeds the applicable noise management level. Table 4-3 lists ICNG guidance for establishing construction NMLs at residential receivers.

**Table 4-3 ICNG guidance for establishing construction NMLs at residential receivers**

Time of day	Management level $L_{Aeq(15min)}$	How to apply
Recommended standard hours (SH): Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected: Rating Background Level (RBL) + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15 min)}$ is greater than the noise affected level, Snowy Hydro (Proponent) should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected: 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 relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours (OOH) - All other times including public holidays	Noise affected: RBL + 5 dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Considering the adopted Rating Background Levels (RBLs) presented in the Revised Noise Impact Assessment in Appendix G of the *Hunter Power Project Response to Submissions Report* (Jacobs, 2021b), and reproduced in Section 2, the Noise Management Levels (NMLs) for the identified surrounding residential receivers grouped into NCAs are presented in Table 4-4 and these are the same as the construction noise limits identified in condition L4.11 of the EPL. These NMLs would apply for the cold commissioning activities. Noise management levels for hot commissioning are described in section 4.5.

**Table 4-4 Construction noise management levels (residential receivers)**

NCA	NML $L_{eq 15 min}$ dB(A)			
	Day (during standard hours) 7:00 am – 6:00 pm Weekdays, 8:00 am – 1:00 pm Saturdays	Day (outside standard hours) 7:00 am – 6:00 pm Outside of Standard Hours	Evening 6:00pm-10:00pm	Night 10:00pm-7:00am
NCA 1	55	50	50	41
NCA 2	50	45	45*	43

NCA	NML $L_{eq, 15 \text{ min}}$ dB(A)			
	Day (during standard hours) 7:00 am – 6:00 pm Weekdays, 8:00 am – 1:00 pm Saturdays	Day (outside standard hours) 7:00 am – 6:00 pm Outside of Standard Hours	Evening 6:00pm-10:00pm	Night 10:00pm-7:00am
NCA 3	48	43	43*	42
NCA 4	45**	40**	35**	35**
NCA 5	47	42	42*	40

Criteria reduced so Evening criteria is not higher than Day OoH criteria.

\*\* Criteria derived from the NPI's minimum assumed RBLs (Table 2.1 of NPI).

The ICNG also provides construction NMLs for non-residential land uses. These are presented in Table 4-5.

**Table 4-5 ICNG NMLs for non-residential receivers**

Non-residential receiver type	Noise management level, $L_{Aeq(15min)}$ (applies when properties are being used)
Commercial	External Noise Level – 70 dB(A)
Industrial	External Noise Level – 75 dB(A)
Educational facilities	Internal Noise Level – 45 dB(A)
Hospital / Medical	Internal Noise Level – 45 dB(A)
Place of Worship	Internal Noise Level – 45 dB(A)
Passive Recreation	External Noise Level – 60 dB(A)
Active Recreation	External Noise Level – 65 dB(A)

It should be noted that the NSW Environmental Protection Authority (NSW EPA) is developing a new construction noise guideline, the *Construction Noise Guideline*, which is currently in-draft. When released, the *Construction Noise Guideline* will replace the ICNG.

#### 4.3.2 Sleep disturbance

For projects where night construction (and operations) occur, the potential for noise levels to lead to sleep disturbance should be considered. Section 4.3 of the ICNG discusses the method for assessing and managing sleep disturbance. This guidance references further information in the Road Noise Policy that discusses criteria for the assessment of sleep disturbance.

Refer to Section 6.5 which outlines the Out of Hours Work Protocol for assessing noise impacts, and may be required if night works are required.

Where noise levels from a construction (or industrial) source at a residential receptor at night exceeds the following, a maximum noise level event assessment should be undertaken:

- $L_{Aeq,15min}$  40 dB(A) or the RBL + 5 dB(A), whichever is greater, and/or
- $L_{AMax}$  52 dB(A) or the RBL +15 dB(A), whichever is greater.

Based on this guidance, Table 4-6 and Table 4-7 present the sleep disturbance screening criterion for the noise catchment areas surrounding the Project.

**Table 4-6  $L_{Aeq,15min}$  Sleep disturbance criterion**

Noise Catchment Area	Night RBL ( $L_{A90}$ dB(A))	RBL + 5 dB(A)	Indicative $L_{Aeq,15min}$ Sleep disturbance criterion	Selected $L_{Aeq,15min}$ Sleep disturbance criterion
NCA 1	36	41	40	41
NCA 2	38	43		43
NCA 3	37	42		42
NCA 4	30	35		40
NCA 5	35	40		40

**Table 4-7  $L_{AMax}$  Sleep disturbance criterion**

Noise Catchment Area	Night RBL ( $L_{A90}$ dB(A))	RBL + 15 dB(A)	Indicative $L_{AMax}$ Sleep disturbance criterion	Selected $L_{AMax}$ Sleep disturbance criterion
NCA 1	36	51	52	52
NCA 2	38	53		53
NCA 3	37	52		52
NCA 4	30	45		52
NCA 5	35	50		52

**4.3.3 Annoying noise characteristics**

Equipment that has the potential to produce a tonal noise, an impulsive noise or any other type of noise defined by the ICNG as ‘particularly annoying’, the noise level for that particular equipment will receive a + 5 dB(A) penalty.

As per guidance from the Noise Policy for Industry (NPI), the penalty for intermittent noise (e.g. the hammers, packers and compactors) would only be applied during night periods. The penalty for tonal noise (e.g. concrete saws and grinders) will apply for all periods.

**4.3.4 Construction traffic noise**

Road traffic noise impacts due to the construction (and operation) of the Project were assessed against the following guidance from the application notes of the Road Noise Policy:

*‘...for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.’*

In reference to the day or night assessment criterion above, the assessment refers to the following criterion provided in the Road Noise Policy (refer to Table 4-8).

**Table 4-8 Relevant Road Noise Policy assessment criteria**

Road Category	Type of project/land use	Assessment Criteria – dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)

Freeway/ arterial/sub- arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L <sub>Aeq, (15 hour)</sub> 60 dB(A)	L <sub>Aeq, (9 hour)</sub> 55 dB(A)
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#### 4.4 Construction vibration criteria

##### 4.4.1 Human comfort

With respect to human comfort, vibration arising from construction activities must comply with criteria presented in Assessing Vibration: a technical guideline and British Standard 6472-1. DECC, 2006 identifies three different forms of vibration associated with construction activities:

- Continuous: uninterrupted vibration occurring over a defined period
- Impulsive: short-term (typically less than two seconds) bursts of vibration which occurs up to three times over an assessment period
- Intermittent: interrupted periods of continuous or repeated impulsive vibration, or continuous vibration that varies significantly in magnitude.

Continuous vibration may result from steady road traffic or steady use of construction equipment (e.g. generator). Impulsive vibration may arise during the loading or unloading of heavy equipment or materials or infrequent use of hammering equipment. Intermittent vibration may arise from the varied use of construction equipment (i.e. a dump truck moving around a site, idling while being loaded with materials, and then dumping the materials) or repeated high-noise activities such as hammering, piling or cutting.

Preferred and maximum values of human exposure for continuous and impulsive vibrations are listed in Table 4-9 (DECC, 2006), for relevant receivers to this Project. As per DECC, daytime is between 7 am and 10 pm, and night is between 10 pm and 7 am.

**Table 4-9 Preferred and maximum weighted Root Mean Square (RMS) values for continuous and impulsive vibration acceleration (m/s<sup>2</sup>) 1-80 Hertz (Hz)**

Location	Assessment period <sup>1</sup>	Preferred values		Maximum values	
		z-axis <sup>2</sup>	x and y axis <sup>2</sup>	z-axis	x and y axis
Continuous vibration					
Residences	Day	0.010	0.0071	0.020	0.014
	Night	0.007	0.005	0.014	0.010
Impulsive vibration					
Residences	Day	0.30	0.21	0.60	0.42
	Night	0.10	0.071	0.20	0.14

<sup>1</sup> Daytime is 7am to 10pm. Night-time is 10 pm to 7 am

<sup>2</sup> z-axis refers to vertical vibration, while the x and y axes refer to horizontal vibration.

Intermittent vibration is assessed differently using vibration dose values (VDV). Preferred and maximum VDV for different types of receivers have been reproduced in Table 4-10 for relative receivers in this assessment.

**Table 4-10 Preferred and maximum VDV for intermittent vibration (m/s<sup>-1.75</sup>), (DECC, 2006)**

Location	Day time (7 am to 10 pm)		Night-time (10 pm to 7 am)	
	Preferred VDV	Maximum VDV	Preferred VDV	Maximum VDV

Residences	0.20	0.40	0.13	0.26
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#### 4.4.2 Cosmetic building damage

Section J4.4.3 of *Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives* provides frequency-dependent guide levels for cosmetic damage to structures arising from vibration. These levels are adopted from *British Standard BS7385: 1990 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration* [BS7385-2:1993] and are presented in Table 4-11.

**Table 4-11 Transient vibration guideline values for cosmetic damage**

Type of building	Peak particle velocity (ppv) mm/s		
	4 to 15 Hz	15 to 40 Hz	40 Hz and above
Reinforced or framed structures industrial and heavy commercial buildings	50		
Un-reinforced or light-framed structures residential or light commercial type buildings	15 to 20	20 to 50	50

#### 4.4.3 Heritage item impact

Guidance for more sensitive structures is presented in the German standard, *DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures* (DIN 4150-3: 2016). Vibration velocities not exceeding 3 mm/s at 1 to 10 Hz are recommended in this standard.

#### 4.4.4 Buried services

DIN 4150-3:2016 also provides guidance for evaluating the effects of short-term vibration on buried services. This guidance has been reproduced below (refer to Table 4-12).

**Table 4-12 DIN 4150-3: 2016 guidance for evaluating effects of short-term vibration on buried services**

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

## 4.5 Commissioning noise management levels

Hot commissioning noise management levels are as per Condition B21 (and EPL Condition L4.1) as shown in Table 4-13

**Table 4-13 Hot commissioning noise management levels**

Location	Day LAeq (15 min) dB	Evening LAeq (15 min) dB	Night LAeq (15 min) dB	Night LAFmax dB
103 Bishops Bridge Road, Sawyers Gully	50	48	41	52
10 Dawes Ave, Loxford	45	45	43	53
20 Bowditch Ave, Loxford	43	43	38	52

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464 Cessnock Road, Gillieston Heights	40	35	35	52
59 Sawyers Gully Road, Sawyers Gully	42	42	38	52



## 5. Construction noise and vibration impacts

### 5.1 Summary of construction noise and vibration impacts

#### 5.1.1 Construction activities

Multiple noise and vibration producing activities will be undertaken during the construction of the project. These activities can be found in Section 1.2.1.

#### 5.1.2 Influencing factors

Factors that may influence the potential noise and vibration impacts from the above activities have been detailed above include:

- The equipment in use, including the numbers of equipment in use and equipment in use simultaneously
- Other works occurring concurrently with the construction of the project
- Topography and screening
- Distances to sensitive receivers
- Background noise
- Hours of construction.

### 5.2 Impact assessment

#### 5.2.1 Context

As further described in Section 6 of the Revised Noise Impact Assessment in Appendix G of the *Hunter Power Project Response to Submissions Report* (Jacobs, 2021b), noise impacts resulting from the construction of the project have been assessed using noise modelling, while vibration impacts have been assessed through the use of vibration setback distances consistent with guidance from the CNVG.

The following subsections detail the assessment of impacts through these methods. It should be noted that the construction scheduling and equipment usage was based on what was accurate during the EIS stage and may be superseded by the time construction activities have been finalised.

#### 5.2.2 Construction staging and plant

##### 5.2.2.1 Noise

Sound power levels were estimated for certain main phases of construction for the Project as outlined in the EIS. These sound power levels can apply to the cold commissioning phase these activities are consistent with normal construction activities. Sound power levels for each construction phase were determined by developing an inventory of noise producing equipment and the estimated numbers of equipment based on the works taking place and estimating the sound power levels of each piece of equipment using sound power levels presented in national and international standards and guidelines, as well as from a Jacobs measurement database.

The indicative construction phases from the EIS for the Project works are linked to the construction stages within the CEMS, and presented in Table 5-1.

**Table 5-1 Construction phase sound power levels**

EIS Phase Reference	Construction Stage	Construction Activity	Location	Equipment	Number of Equipment	Individual Equipment SWL	Phase SWL
1	Pre-construction and site establishment	Site earthworks	Whole Site	Excavator 5-20t	1	99	117
				Dozer	1	116	
	Grader			1	108		
	Delivery Truck			1	100		
	Generator			1	101		
	Roller			1	104		
	Water Cart			1	95		
	Cars			1	95		
2	Site establishment	Pile foundations	Power islands	Franna	1	99	117
				Piling Rig (Driven)*	1	116	
	Hand Tools			1	94		
	Construction			Concrete Truck	1	109	
	Delivery Truck			1	100		
	Generator			1	101		
	Cars			1	95		
3	Site establishment	Under-ground services	From power islands to gas receiving station, demineralised water plant, fuel oil storage tanks, stormwater basin	Excavator 5-20t	1	99	119
				Concrete Saw**	1	118	
	Construction			Roller	1	104	
	Vacuum Truck			1	109		
	Hand Tools			1	94		

EIS Phase Reference	Construction Stage	Construction Activity	Location	Equipment	Number of Equipment	Individual Equipment SWL	Phase SWL
			and control building	Delivery Truck	1	100	
				Generator	1	101	
				Cars	1	95	
				TWA Generators	2	105	
4	Construction	Balance of plant (BoP)	Closed Cycle heat exchangers, Demineralised Water Tanks, Potable Water Tanks, Fuel Oil Storage Tanks, Buildings	Franna	1	99	111
				Excavator 5-20t	1	99	
				Hand Tools	1	94	
				Concrete Truck	1	109	
				Delivery Truck	1	100	
				Generator	1	101	
				Cars	1	95	
				TWA Generators	2	105	
5	Construction	Switchyard – Electrical	Switchyard	Power Hand Tools	1	96	106
				Welder	1	97	
				Generator	1	101	
				Franna	1	99	
				Delivery Truck	1	100	
				Cars	1	95	
				TWA Generators	2	105	
6	Construction	Primary installation of gas	Power Islands	Power Hand Tools	1	96	106
				Welder	1	97	

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EIS Phase Reference	Construction Stage	Construction Activity	Location	Equipment	Number of Equipment	Individual Equipment SWL	Phase SWL
		turbine and generator		Generator	1	101	
				Franna	1	99	
				Delivery Truck	1	100	
				Cars	1	95	
				TWA Generators	2	105	
7	Construction	HV electrical installation	GT Transformers	Power Hand Tools	1	96	108
				Excavator 5-20t	1	99	
				Generator	1	101	
				Roller	1	104	
				Delivery Truck	1	100	
				Cars	1	95	
				TWA Generators	2	105	
8	Construction	Site Surfacing	Whole Site	Paving Machine	1	104	119
	Post construction/ demobilisation			TWA Generators	2	105	
				Concrete Truck	1	109	
				Roller	1	104	
				Excavator 5-20t	1	99	
				Generator	1	101	
				Grader	1	108	
				Concrete Saw**	1	118	
				Delivery Truck	1	100	

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EIS Phase Reference	Construction Stage	Construction Activity	Location	Equipment	Number of Equipment	Individual Equipment SWL	Phase SWL
				Cars	1	95	

\* - Receives a 5 dB(A) penalty for intermittent noise when works take place during night periods. As the works will not take place at night, no penalty was applied.

\*\* - Receives a 5 dB(A) penalty for tonal noise. The time correction applied to the saw and grinder (typically 5 minutes out of a 15-minute period) and the penalty have both been considered when calculating the equipment noise level.

SWL is the Sound Power Level, the total sound energy emitted by the noise source, measured in dB(A).

### 5.2.2.2 Vibration

Vibration producing equipment have been identified from the construction staging. The vibration producing equipment along with the associated setback distances have been detailed in Table 5-2. Other equipment that may also be used are also displayed.

**Table 5-2 Construction phase vibration setbacks**

EIS Reference Phase	Equipment	Cosmetic damage (Ref: BS7385-2: 1993)	Human response (Ref: DECC, 2006)	Heritage Structure Impact (Ref: DIN 4150-3, 2016)
1, 7, 8	Roller	25m	100m	45m
2	Piling Rig (Driven)	15m	50m	27m
Potential Usage	Hydraulic Hammer	22m	73m	40m
Potential Usage	Piling Rig (Bored)	2m	4m	3.75m
Potential Usage	Jackhammer	1m	2m	1.75m

### 5.2.3 Commissioning

The commissioning activities will comprise of:

- Cold commissioning – consists of general construction activities and has not been modelled as a discrete phase in the Noise Assessment completed for the EIS. Activities that may be used during cold commissioning are detailed in Table 5-1
- Hot commissioning – consists of activities for the Power Islands (refer to Table 5-2), Water Tank Pumps, Liquid Fuel (diesel) Pump Station and Demineralisation Plant (refer to Table 5-3) and testing it according to a range of scenarios which will generally result in less than the identified sound power level for normal operational activity. **However, there may be certain short isolated instances of high sound power levels in the early stage of hot commissioning.** In addition, only one unit will be commissioned at a time, and hence the sound power levels will be less than those shown in Table 5-3 which are for 100% load for two units operating simultaneously as modelled as part of the EIS process (Jacobs, 2021b).

**Table 5-3 Power Island sound power levels**

Noise source	Unattenuated sound power level (dB(A))	Attenuation applied (dB)	Attenuated sound power level (dB(A))
Exhaust Stack/Opening	109	12	97
Exhaust Diffuser	112	14	98
Gas Turbine Housing	104	6	98
Gas Turbine Air Inlet	107	12	95
Gas Turbine Generator Enclosure	102	5	97
Generator Step-up Transformers <sup>1</sup>	104	5	99

Generator Fin Fan Cooler	100	3	97
Hydraulic Skid	96	Nil	96
Liquid Fuel Module	96	Nil	96
Fuel Gas Systems	96	Nil	96

Notes:

<sup>1</sup>Transformers were indicated as a candidate for the tonality noise level correction as per Fact Sheet C of the NPI. However, suppliers have indicated that the transformers will be attenuated for tonal noise, hence the attenuated transformers were predicted to not pose a tonal noise risk and the tonality correction was not applied.

**Table 5-4 Balance of Plant sound power levels**

Noise source	Overall sound power level (dB(A))
Water Tank Pumps	93
Liquid Fuel (diesel) Pump Station	85
Demineralisation Plant	85

#### 5.2.4 Predicted construction noise impact

Estimated noise levels at the nearest receivers were predicted from the anticipated noise levels generated during each construction phase of the Project. Table 5-3 presents the predicted noise impact at each representative residential receiver during each construction phase, while Table 5-4 presents the predicted noise impact at each non-residential receiver during each construction phase. The modelling data in these tables accounts for the for the predicted 0-1 dB(A) increase in originally predicted noise levels during the evening and night periods at the closest sensitive receptor within NCA2, but also in some instances within NCA3 should the generators at the TWAF be run without noise mitigation.

Given the requirement for out of hours work (OOHW) to occur during the course of the Project, the protocol for varying hours is set out in Section 6.5, condition of approval B32, and the Environment Protection Licence for the project.

When unloading of OSOM deliveries occur outside the standard construction hours or the exceptions listed in Condition B31, of the Infrastructure Approval, the OOHW protocol in Section 6.5 will be followed. If scheduling and site constraints permit, the deliveries might occur on one night with unloading the following day and return OSOM movement on a following night. In this instance the need to follow the OOHW protocol is not required. Determining this is dependent upon the logistics of the main equipment suppliers and the Principal Contractor responsible for managing the site. It is noted that the movement of OSOM vehicles on public roads will be directed by the National Heavy Vehicle Regulator (NHVR).

The assessment assumed all plant and equipment for each activity was operated concurrently while positioned at the location closest to each individual receiver. This was a conservative approach and while this may provide for the determination of conservative noise levels, actual construction noise levels should be lower than predicted in this assessment.

As Table 5-6 shows, during phase 1, noise levels were predicted to be above the standard hours NML of the NCA 2's nearest receiver by 1 dB(A), as well as the out of hours day NMLs at NCA 2's and NCA 3's nearest receivers by up to 6 dB(A) and 2 dB(A), respectively. Construction noise levels were also predicted to be above the NMLs at NCA 2's nearest receiver during phases 3 and 8.

The construction phases which were predicted to result in the highest noise levels at the nearest sensitive receiver are the initial site earthworks and surfacing works (i.e. Phases 1 and 8). These works would result in noise levels of 51 dB(A) and 49 dB(A) at the nearest residential receiver, respectively.

As listed in Table 5-7, noise levels were not predicted to be above NMLs at any non-residential receivers in each of the NCAs.

The current Project schedule means that the Project will be constructed and commissioned prior to the occupation of any of the adjacent industrial lots. Hence, impacts at these lots have not been considered during the assessment. However, if the construction of the Project is delayed, these lots may be occupied, and hence impacts may occur. As such, the potential noise impacts at the boundary of the Project Site have been assessed in the following subsections.

During construction, the highest predicted noise along the Project Site boundary is equal to but not above the Noise Management Level for industrial receivers. Additionally, several construction phases nearly reach the NML. Phases one



and three reach the NML, while phases four and eight are within 1-2 dB(A) of the NML. The noise levels in comparison to the criteria during each construction phase are detailed in .

**Table 5-5 Construction predicted noise impacts at the Project Site boundary**

EIS Reference Phase	Industrial Lot	
	Highest Predicted Noise Level at the Boundary (dB(A))	Compliant with Noise Criteria?
		Industrial – 75 dB(A)
1	75	Yes
2	66	Yes
3	75	Yes
4	74	Yes
5	70	Yes
6	54	Yes
7	57	Yes
8	73	Yes

**5.2.5 Predicted hot commissioning noise impact**

An assessment of noise impacts during the hot commissioning activities is based on the results of the noise assessment completed for the operational phase activities. The predicted noise impacts on residential receivers during commissioning works are detailed in **Table 5-8**, while impacts on non-residential receivers during commissioning works are detailed in **Table 5-9**. The ‘standard’ and ‘noise-enhancing’ meteorological conditions were adopted for the assessment.

The noise model predicted that noise levels during operation would be compliant at all receivers at all times. Therefore, it follows that during commissioning (when only one turbine would typically be operating) the noise impacts would not exceed the noise management levels.

The receiver predicted to have the highest noise impact was the nearest sensitive receiver in NCA 2. Under standard conditions noise levels were predicted to be 39 dB(A), while noise levels under noise-enhancing conditions were predicted to be 43 dB(A). Generally, noise-enhancing conditions increase noise levels at receivers by approximately 5 dB(A).

The noise model results also show that noise emissions would be closest to the noise criterion during the night period. Commissioning at night is unlikely to occur, and any night time commissioning would likely be of shorter duration. Therefore, the risk of the commissioning activities approaching or exceeding the night time noise criterion is minimised, through the reduced likelihood and shorter duration of night time operations, compared with the likely frequency and duration of daytime or evening operations.

**Table 5-6 Predicted noise impacts from construction works at residential receivers**

EIS Ref Phase	NCA 1			NCA 2			NCA 3			NCA 4			NCA 5		
	Highest Predicted Noise Level at NCA 1 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 2 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 3 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 4 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 5 Representative Residential Receiver (dB(A))	Noise Level Below NML?	
		Standard Hours – 55 dB(A)	Out of Hours, Day – 50 dB(A)		Standard Hours – 50 dB(A)	Out of Hours, Day – 45 dB(A)		Standard Hours – 48 dB(A)	Out of Hours, Day – 43 dB(A)		Standard Hours – 45 dB(A)	Out of Hours, Day – 40 dB(A)		Standard Hours – 47 dB(A)	Out of Hours, Day – 42 dB(A)
1	47	Yes	Yes	51	No, by 1 dB(A)	No, by 6 dB(A)	45	Yes	No, by 2 dB(A)	32	Yes	Yes	41	Yes	Yes
2	42	Yes	Yes	45	Yes	Yes	40	Yes	Yes	<30	Yes	Yes	36	Yes	Yes
3	45	Yes	Yes	48	Yes	No, by 3 dB(A)	43	Yes	Yes	31	Yes	Yes	39	Yes	Yes
4	36	Yes	Yes	40	Yes	Yes	35	Yes	Yes	<30	Yes	Yes	30	Yes	Yes
5	30	Yes	Yes	34	Yes	Yes	30	Yes	Yes	<30	Yes	Yes	<30	Yes	Yes
6	31	Yes	Yes	35	Yes	Yes	<30	Yes	Yes	<30	Yes	Yes	<30	Yes	Yes
7	33	Yes	Yes	36	Yes	Yes	31	Yes	Yes	<30	Yes	Yes	<30	Yes	Yes
8	45	Yes	Yes	49	Yes	No, by 4 dB(A)	43	Yes	Yes	30	Yes	Yes	39	Yes	Yes

**Table 5-7 Predicted noise impacts from construction works at non-residential receivers**

EIS Reference Phase	NCA 2*		NCA 3*			
	Highest Predicted Noise Level at NCA 2 Industrial Receiver (dB(A))	Noise Level Below NML?	Highest Predicted Noise Level at NCA 3 Commercial Receiver (dB(A))	Noise Level Below NML?	Highest Predicted Noise Level at NCA 3 Educational Receiver (dB(A))	Noise Level Below NML?
		Industrial – 75 dB(A)		Commercial – 70 dB(A)		Educational – 55 dB(A)
1	51	Yes	45	Yes	42	Yes
2	45	Yes	40	Yes	38	Yes
3	48	Yes	43	Yes	40	Yes
4	40	Yes	35	Yes	32	Yes
5	34	Yes	30	Yes	27	Yes
6	34	Yes	29	Yes	26	Yes
7	36	Yes	31	Yes	29	Yes
8	49	Yes	43	Yes	40	Yes

\* There were no non-residential receivers identified in NCA 1, NCA 4 and NCA 5

**Table 5-8 Predicted noise impacts from hot commissioning works at residential receivers (based on normal plant operation, ie two turbines at 100% load)**

Noise level at nearest residential receiver in Noise Catchment Area	Highest predicted noise level at residential receiver		Noise criteria	Compliant with noise criteria?	
	Standard conditions	Noise-enhancing conditions		Standard conditions	Noise-enhancing conditions
NCA 1 Representative residential receiver	36 dB(A) <sup>1</sup>	41 dB(A) <sup>1</sup>	Day – 52 dB(A)	Yes	Yes
			Evening – 48 dB(A)	Yes	Yes
			Night – 43 dB(A)	Yes	Yes
			Sleep disturbance – 54 dB(A)	Yes	Yes
NCA 2 Representative residential receiver	39 dB(A) <sup>1</sup>	43 dB(A) <sup>1</sup>	Day – 58 dB(A)	Yes	Yes
			Evening – 48 dB(A)	Yes	Yes
			Night – 43 dB(A)	Yes	Yes
			Sleep disturbance – 58 dB(A)	Yes	Yes
NCA 3 Representative residential receiver	34 dB(A)	39 dB(A)	Day – 57 dB(A)	Yes	Yes
			Evening – 48 dB(A)	Yes	Yes
			Night – 43 dB(A)	Yes	Yes
			Sleep disturbance – 56 dB(A)	Yes	Yes
NCA 4 Representative residential receiver	<30 dB(A)	<30 dB(A)	Day – 53 dB(A)	Yes	Yes
			Evening – 48 dB(A)	Yes	Yes
			Night – 43 dB(A)	Yes	Yes
			Sleep disturbance – 55 dB(A)	Yes	Yes
NCA 5 Representative residential receiver	<30 dB(A)	<30 dB(A)	Day – 42 dB(A)	Yes	Yes
			Evening – 42 dB(A)	Yes	Yes
			Night – 38 dB(A)	Yes	Yes
			Sleep disturbance – 52 dB(A)	Yes	Yes

Note:

<sup>1</sup>A 2 dB positive adjustment for low frequency noise applies to the predicted noise levels as required under the NSW NPI (2017).

**Table 5-9 Predicted noise impacts from hot commissioning works at non-residential receivers (based on normal plant operation, ie two turbines at 100% load)**

Non-residential receiver	Highest predicted noise level at non-residential receiver		Noise criteria	Compliant with noise criteria?	
	Standard conditions	Noise-enhancing conditions		Standard conditions	Noise-enhancing conditions
NCA 2 Industrial receiver	39 dB(A)	44 dB(A)	Industrial criteria – 68 dB(A)	Yes	Yes
NCA 3 Commercial receiver	34 dB(A)	39 dB(A)	Commercial criteria – 63 dB(A)	Yes	Yes
NCA 4 Educational receiver	32 dB(A)	37 dB(A)	Educational criteria – 43 dB(A)	Yes	Yes

The current schedule for the Project means that the Project will be commissioned prior to the occupation of any of the adjacent industrial lots. Hence, commissioning noise impacts at these lots have not been considered during the assessment. However, the operational noise modelling showed that the Project would be compliant and therefore it follows that commissioning noise impacts with generally only one turbine operating would be compliant.



**5.2.6 Predicted construction traffic noise impact**

During construction of the Project, the estimated peak vehicle movements per day at the peak of construction is expected to be 460 light vehicle movements, along with 120 heavy vehicle movements during standard hours daily, along with two oversize over mass movements during the night (one inbound trip and one outbound trip).

Considering the estimate of construction vehicle movements per day using the Construction Noise Estimator (RMS, 2016) it was determined that noise from the existing road traffic plus the additional construction noise traffic would be 63 dB(A) during the day and 61.2 dB(A) during the night. While these levels are above the day and night traffic noise criteria, the

additional construction noise traffic associated with the Project would only contribute 0.2 dB(A) to the overall traffic noise level during the day and would contribute less than 0.1 dB(A) to the traffic noise level during the night. Therefore, the 2 dB(A) traffic noise increase criterion would not be exceeded, and it was concluded that the noise generated from the additional traffic during construction of the Project would not present a noise impact issue. Further to this, the additional 60 light vehicles travelling to and from site on a daily basis associated with the TWAf are not anticipated to generate additional traffic noise over and above that predicted as part of the 3B Modification.

With regards to OSOM deliveries at night, the condition of approval B31(b) provides for the, "delivery of materials required by the police or other authorities for safety reasons." It is very likely the NHVR will require OSOM deliveries to be conducted at night in order to manage the safety of the public road network and road users. As a matter of good practice, a Construction and Noise Vibration Impact Statement (CNVIS) will be prepared for OSOM transport. Refer to Section 5.2.3 above regarding OSOM deliveries, unloading, and how the Out of Hours Work protocol will be addressed.

#### **5.2.7 Predicted sleep disturbance impact**

Construction and commissioning are not predicted to take place during the night, and as such construction and commissioning activities associated with the Project would not result in sleep disturbance impacts.

#### **5.2.8 Predicted cumulative noise impact**

Remediation of the former Kurri Kurri aluminium smelter land adjacent the Project Site is estimated to be ongoing to late 2023 and therefore concurrent with the construction of the Project. Details of the adjacent works is described in more detail in Section 6.8.3 of the Revised Noise Impact Assessment in Appendix G of the *Hunter Power Project Response to Submissions Report* (Jacobs, 2021b).

The predicted cumulative impacts associated with the works undertaken during Phase 1 along with the concurrent Hydro Aluminium Demolition and Remediation activities has been detailed in Table 5-10 for residential receivers, and Table 5-11 for non-residential receivers. As shown in the table, cumulative impacts may result in an increase in construction noise levels at the nearest receivers. Construction noise levels at the nearest receivers at NCA 3 and NCA 4 (the receivers nearest to the demolition works) increase by approximately 6 dB(A), resulting in noise levels above the standard hours NML at NCA 3. The cumulative works also increase construction noise levels at NCA 2's nearest receiver by 3 dB(A), and at NCA 1 and NCA 5 by 1 dB(A) each. Cumulative noise has not been predicted to be above the NMLs of any non-residential receivers.

**Table 5-10 Predicted cumulative construction noise impact on residential receivers**

EIS Reference Phase	NCA 1			NCA 2			NCA 3			NCA 4			NCA 5		
	Highest Predicted Noise Level at NCA 1 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 2 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 3 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 4 Representative Residential Receiver (dB(A))	Noise Level Below NML?		Highest Predicted Noise Level at NCA 5 Representative Residential Receiver (dB(A))	Noise Level Below NML?	
		Standard Hours – 55 dB(A)	Out of Hours, Day – 50 dB(A)		Standard Hours – 50 dB(A)	Out of Hours, Day – 45 dB(A)		Standard Hours – 48 dB(A)	Out of Hours, Day – 43 dB(A)		Standard Hours – 45 dB(A)	Out of Hours, Day – 40 dB(A)		Standard Hours – 47 dB(A)	Out of Hours, Day – 42 dB(A)
Phase 1	47	Yes	Yes	51	No, by 1 dB(A)	No, by 6 dB(A)	45	Yes	No, by 2 dB(A)	32	Yes	Yes	41	Yes	Yes
Phase 1 with Hydro Aluminium Works	48	Yes	Yes	54	No, by 4 dB(A)	No, by 9 dB(A)	51	No, by 3 dB(A)	No, by 8 dB(A)	37	Yes	Yes	42	Yes	Yes

**Table 5-11 Predicted cumulative construction noise impact on non-residential receivers**

EIS Reference Phase	NCA 2 <sup>1</sup>		NCA 3*			
	Highest Predicted Noise Level at NCA 2 Industrial Receiver (dB(A))	Noise Level Below NML?	Highest Predicted Noise Level at NCA 3 Commercial Receiver (dB(A))	Noise Level Below NML?	Highest Predicted Noise Level at NCA 3 Educational Receiver (dB(A))	Noise Level Below NML?
		Industrial – 75 dB(A)		Commercial – 70 dB(A)		Educational – 55 dB(A)
Phase 1	51	Yes	45	Yes	42	Yes
Phase 1 with Hydro Aluminium Works	54	Yes	51	Yes	47	Yes



**5.2.9 Predicted construction vibration impact**

As identified in Section 5.2.2, vibratory rollers and piling rigs, which are a vibration-generating plant, would be used during construction. The equipment, setback distances and nearest impacted receivers are displayed in Table 5-12.

**Table 5-12 Predicted vibration impact**

Equipment	Setback Distance (m)			Nearest Affected Receiver (m)			Vibration Impact?
	Human Comfort	Cosmetic Building Damage	Heritage Structure Impact	Residency	Occupancy	Heritage Item	
Vibratory Roller	100m	25m	45m	1.15km	1.15km	1.3km	No
Air Track Drill	50m	15m	27m				No

As displayed in the table, no vibration impacts at nearest receivers have been predicted as a result of the construction of the Project. Additionally, as the nearest medical facility is 3.3 km away from the Project Site, no impacts to medical facilities due to construction vibration have been predicted.

## 6. Mitigation and management measures

Mitigation measures to address predicted noise and vibration impacts that were identified as part of the EIS and Submissions Report completed for the project will be implemented to address the impacts predicted in Section 5. The specific mitigation measures to address the relevant Infrastructure Approval conditions (refer to **Table 1-1**) for noise, vibration and cumulative impacts are detailed in Sections 6.1, 6.2 and 6.3 respectively.

### 6.1 Standard noise mitigation measures

To reduce construction and commissioning noise levels to below the respective NMLs, standard mitigation measures from Section 7 of the Revised Noise Impact Assessment in Appendix G of the *Hunter Power Project Response to Submissions Report* (Jacobs, 2021b) will be implemented. These have been derived from the standard mitigation measures contained within the ICNG (DECC, 2009) and *Construction Noise and Vibration Guidelines* (RMS, 2016). These are displayed in Table 6-1.

**Table 6-1 Standard noise mitigation measures during construction and commissioning**

Mitigation measure	Details	Timing	Responsibility
NVIA1	Wherever possible and safe, limit works to standard hours of construction.	During construction	Principal Contractor
NVIA2	Select low-noise plant and equipment. Ensure equipment mufflers operate in a proper and efficient manner. All plant and equipment used on site, or in connection with the development, is operated in a proper and efficient manner	Prior to and during construction and commissioning	Principal Contractor
NVIA3	Where possible, use quieter and less vibration emitting construction methods.	During construction	Principal Contractor
NVIA4	Only have necessary equipment on-site and turn off when not in use.	During construction and commissioning	Principal Contractor
NVIA5	Where possible, concentrate noisy activities at one location and move to another as quickly as possible.	During construction	Principal Contractor
NVIA6	Vehicle movements, including deliveries outside standard hours, should be minimised and avoided where possible.	During construction and commissioning	Principal Contractor
NVIA7	All plant and equipment is to be well maintained and where possible, fitted with silencing devices.	Prior to and during construction and commissioning	Principal Contractor
NVIA8	Use only the necessary size and powered equipment for tasks.	During construction and commissioning	Principal Contractor
NVIA9	Implement training to induct staff on noise sensitivities	Prior to and during construction and commissioning	Principal Contractor

Mitigation measure	Details	Timing	Responsibility
NVIA10	Where possible, consider the application of less intrusive alternatives to reverse beepers such as ‘squawker’ or ‘broadband’ alarms.	During construction and commissioning	Principal Contractor
NVIA11	Consider the installation of temporary construction noise barriers or earth mounds for concentrated, noise-intensive activities.	During construction	Principal Contractor
NVIA12	Where practicable, install enclosures around noisy mobile and stationary equipment as necessary.	During construction and commissioning	Principal Contractor
NVIA13	Where possible, avoid simultaneous operation of two or more noisy plant close to receivers. The offset distance between noisy plant and sensitive receivers should be maximised.	During construction and commissioning	Principal Contractor
NVIA14	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements.	Prior to and during construction and commissioning	Principal Contractor
NVIA15	Complete routine monitoring to evaluate construction noise levels and evaluate whether the mitigation measures in place are adequate or require revision.	During construction	Principal Contractor
NVIA 16	Prior to the commencement of the installation of the gas turbines, unless otherwise agreed by the Secretary, the Proponent must ensure there is a suitable meteorological weather station operating located on the premises or at a location approved by the EPA. The weather station will be capable of monitoring in accordance with the Environment Protection Licence requirements. The monitoring capability is in accordance with the EPL, which accounts for the Noise Policy for Industry, and is summarised in the Construction Monitoring Program required by condition C1 and appended to the CEMS.	Prior to the commencement of operations (agreed by the Secretary on 22/12/2022)	Principal Contractor
NVIA 17	The siting of the weather station will be such that the measurements are representative of the conditions at the power station and surrounding area, and that nearby infrastructure does not affect those measurements.	Prior to the commencement of operations (agreed by the Secretary on 22/12/2022)	Snowy Hydro

## 6.2 Standard vibration mitigation measures

As detailed in the Revised Noise and Vibration Assessment prepared for the Submissions Report, *Assessing Vibration: a technical guideline*, (DECC, 2006) provides general guidance for limiting vibration impacts during construction. These have again been reviewed and the relevant recommendations have been summarised in Table 6-2 below. If vibration is a concern during the construction of the project, these measures should be implemented.

**Table 6-2 Standard vibration management control measures from DECC, 2006**

Control measure	Details	Timing	Responsibility
Controlling vibration levels from the source	Choosing alternative, lower-impact equipment or methods wherever possible	During construction	Principal Contractor
	Scheduling the use of vibration-causing equipment at the least sensitive times of the day (wherever possible)	Prior to and during construction	Principal Contractor
	Locating high vibration sources as far away from sensitive receiver areas as possible	During construction	Principal Contractor
	Sequencing operations so that vibration-causing activities do not occur simultaneously.	During construction	Principal Contractor
	Keeping equipment well maintained	During construction	Principal Contractor
	Do not conduct vibration intensive works within the recommended safe setback distances.	During construction	Principal Contractor
Consultation	Informing nearby receivers about the nature of construction phases and the vibration-generating activities.	During construction	Principal Contractor, Snowy Hydro Environmental Advisor

### 6.3 Cumulative impacts

Noise from construction works may occur concurrently with the remediation of the Kurri Kurri Aluminium Smelter, which may result in a cumulative noise impact. Measures in Table 6-3 have been provided to address the potential for cumulative noise impacts.

**Table 6-3 Cumulative noise management measures**

Control measure	Details	Timing	Responsibility
Scheduling Works	Where possible, scheduling works to occur at different times of the day to prevent multiple noisy activities from taking place at the same time	During construction	Principal Contractor
	Where possible, scheduling works to take place at different locations on site to prevent noisy activities from taking place near one another which will limit the amplification of the noise.	Prior to and during construction	Principal Contractor
Consultation	Discuss works schedules and timings with the proponents of other works in the industrial estate to gain an understanding of when noisy work surrounding the Project will take place. Should respectively project schedules and work priorities change, proponents should commit to regular meetings to ensure all proponents are aware of the changes.	During construction and commissioning	Principal Contractor Snowy Hydro

## 6.4 Construction Noise and Vibration Impact Statements

As detailed in Section 5.2.1, there is a possibility that the works program to be undertaken deviates from the works detailed in the EIS, Response to Submissions and NVMP. Where works are expected to result in a greater noise impact than those in the predicted in the NVMP, a Construction Noise and Vibration Impact Statement (CNVIS) should be undertaken.

The Principal Contractor will be responsible for advising of the works program that do not align with the EIS, and developing CNVIS as identified here for each stage of the work. Each CNVIS will be reviewed by the Environment Representative for the project.

CNVISs will be employed to inform and direct noise and vibration management for the works undertaken as part of the project. The CNVIS will be progressively produced to inform all noise and vibration risks associated with each work stage and provide applicable management measures to be undertaken. Any works which a CNVIS identifies as producing noise and/or vibration impacts above the limits in Section 4 must be managed in accordance with the NVMP.

Each CNVIS should:

- Detail the scope of works covered by the CNVIS
- Detail the nearest noise and vibration sensitive receivers
- Provide justification for any Out of Hours Work (OOHW), if required
- Provide the noise and vibration objectives and criteria
- Detail the predicted noise and vibration impacts
- Provide appropriate noise and vibration management measures and monitoring requirements.

## 6.5 Out of Hours Work (OOHW) protocol

For all works to be undertaken outside the standard construction hours or those listed in condition B31, an OOHW Protocol will apply. The details of the protocol are detailed below.

Any request to alter the hours of construction will be considered on a case-by-case or activity-specific basis.

### 6.5.1 Justification for OOHW

All proposed OOHW, outside of those listed in condition B31, require a full justification as why the works are required to be undertaken outside standard construction hours. There are several reasons why works can only be undertaken out of hours and these include, but are not limited to:

- Ensuring the safety of construction personnel
- Ensuring public safety
- Minimising disruption to road network users/ pedestrian during deliveries.

### 6.5.2 Construction Noise and Vibration Impact Statements

Prior to the undertaking of any works during OOHW periods, outside of those covered in condition B31, a CNVIS will be developed for to determine the potential noise and vibration impacts posed by those works. As part of the noise and vibration assessment process, the following outcomes must be developed:

- The identification of any noise and vibration impacts on nearby sensitive receivers as a result of those out of hours works
- The predicted noise and vibration levels at the impacted receivers, including the amount by which the noise and vibration levels are above the appropriate noise management level or vibration limit
- The identification of feasible and reasonable mitigation and management measures to address the predicted noise and vibration impacts

- The identification of appropriate noise and vibration monitoring locations to aid in managing the noise and vibration impacts while the works are being undertaken.

### 6.5.3 OOHW documentation

Prior to undertaking OOHW activities, an OOHW Application Form will be developed for submission to the NSW EPA, requesting the required hours for works to be undertaken. Alongside the OOHW Application Form, the above CNVIS will also be provided to detail the activities undertaken and impacts predicted. Variations to construction hours will also require the prior written approval of the Secretary.

### 6.5.4 OOHW community notifications

Notification to relevant impacted receivers will be provided at least 2 days prior to OOHW taking place.

Additional community notification will be undertaken where directed by the NSW EPA including:

- Letterbox drop and/ or email
- Phone calls
- Individual briefings.

Written evidence will be provided in an OOHW application showing consultation with potentially affected sensitive receivers. In the management and preparation of an application it is important to consider the timeframe for notification of potentially impacted receivers.

It is also a requirement to consult with the appropriate Council and other relevant agencies.

### 6.5.5 NSW EPA and the Department's review of OOHW

The OOHW Application will be reviewed and approved by the NSW EPA as required by EPL 21627 and by the Department as required by Infrastructure Approval conditions B31 and B32. Where the OOHW Application has been reviewed and approved, any specific conditions that relate to the OOHW are to be:

- Actioned for implementation (such as any additional notification to the community)
- Tool-boxed to relevant workforce and site personnel before each shift to introduce / reinforce works restrictions, management measures and expected workforce behaviour
- Implemented during works with accountability for the implementation of any conditions to be taken by the Principal Contractor.
- Variations to construction hours will also require the prior written approval of the Secretary.

### 6.5.6 OOHW monitoring

Attended noise and vibration monitoring is to be undertaken, at representative stages of the activity or work, to verify that noise levels resulting from OOHW are in accordance with the outcomes of the OOHW CNVIS. Noise and vibration monitoring should follow the procedures outlined in this NVMP.

## 6.6 OOHW approval and mitigation measures

Out of Hours Work applications were submitted to the Department and EPA to allow construction works to occur on any day of the week at any time of the day in order to minimise further slippage in the construction program. The Department approved this request to vary construction hours on 16 August 2023 subject to the requirements shown in Table 6-4. The EPA was consulted on this requirement and changes to the Project EPL were made.

### Table 6-4 OOHW approval mitigation measures

Control measure	Details	Timing	Responsibility
OOHW1	<p>Written notice must be provided to surrounding potentially affected residential receivers consulted when preparing the request, prior to work occurring outside the normal construction hours. The written notice must:</p> <ul style="list-style-type: none"> <li>a) identify the location, duration, and activities to occur outside normal construction hours;</li> <li>b) provide a telephone contact number of the construction site manager during the extended construction hours.</li> </ul>	Prior to any OOHW	Principal Contractor
OOHW2	Monthly attended monitoring during out of hours work to be undertaken to validate model predictions.	During OOHW	Principal Contractor
OOHW3	If any complaint is received, appropriate mitigation measures are to be identified, and the Department and the complainant are to be informed of the measures that will be implemented to address the complaint. Should any further complaints be received regarding works in the extended construction hours, this approval to extend the works hours may be revoked by the Department.	During OOHW	Snowy Hydro
OOHW4	Where a complaint is received, attended monitoring should be undertaken to investigate the noise and reduce noisy activities as soon as feasibly actionable.	During OOHW	Principal Contractor
OOHW5	A record of any complaints made, or non-compliances identified during monitoring, regarding works undertaken during extended construction hours must be provided to the Department within 24 hours of the complaint/non-compliance.	During OOHW	Snowy Hydro
OOHW6	All work is to be undertaken in accordance with the requirements of Condition B32 of Schedule 2 and all additional noise mitigation measures proposed in the Noise Impact Assessment memo must be adopted and implemented.	During OOHW	Principal Contractor

It is noted that the additional noise mitigation measures outlined in the Noise Impact Assessment memo are already included as standard mitigation measures outlined in Table 6-1 above and comprise measures NVIA1 to NVIA15.

## 7. Compliance management

### 7.1 Training

All staff and contractors working on the construction and commissioning of the Project will undergo education and training regarding noise and vibration impacts and management. Training would include:

- Toolbox talks
- Work inductions
- Meetings between contractors and environmental staff
- Posters and Educational Items.

Training should detail:

- The contents of this NVMP
- Legislation pertaining to noise and vibration impact and management
- Construction hours
- Nearby noise sensitive locations
- Complaint and Enquiry reporting
- Management measures listed in this NVMP
- Specific responsibilities regarding the mitigation measures.

### 7.2 Monitoring

Noise and vibration monitoring will be undertaken. The results of monitoring will be compared against the predicted noise impacts. Where monitoring has found noise and vibration impacts to be above the relevant criteria, the following actions would be undertaken:

- Stoppage of work that has been identified as the cause of the criteria exceedance
- Determine if any non-project noise sources may be causing the criteria exceedance
- Determine if a particular piece of equipment is the cause of the criteria exceedance, and if any options exist to mitigate or replace the equipment
- Adopt any other mitigation or management measures where feasible and reasonable to reduce noise
- Review the work practices undertaken against the NVMP
- Adopt any lessons learnt into future modelling, mitigation actions and training.

#### 7.2.1 Noise monitoring during construction

Both attended and unattended noise monitoring may be undertaken during the construction of the Project. Whether attended or unattended monitoring is required will be determined on a case-by-case basis. This will depend on the nature of the activity and level of verification required by the monitoring. For example, unattended monitoring might be considered appropriate to verify a noise level from a change in construction activity occurring over multiple days, whereas attended noise monitoring might be considered appropriate to verify a complaint or noise level in a particular circumstance where the time of the noise occurring is known.

Noise monitoring will be undertaken in the following situations:

- At the commencement of activities where it has been identified that verification monitoring is required, such as confirming that noise levels are consistent with those predicted and to confirm the effectiveness of mitigation



- In response to a complaint received regarding construction noise (where determined appropriate)
- Where there is a change in methodology that may result in an increase in noise levels
- As directed by the NSW EPA
- In accordance with EPL 21627
- As required by a CNVIS
- As required by an OOHW Protocol
- Ongoing, case-by-case spot checks for noise intensive plant and equipment will be undertaken throughout construction to ensure compliance with the noise levels.

Locations for noise monitoring will be determined on a case-by-case basis, in response to complaints and/or the locations of predicted noise impacts. Likewise, the duration and amount of noise monitoring will ultimately be dependent on the scale of the construction activities and extent of expected noise impacts. Noise monitoring will cover a representative period of the construction activity, wherein the plant and equipment operating is consistent with the full range of plant and equipment modelled in the noise assessment (i.e. the monitoring will not be undertaken when key noise producing equipment is not in operation). Where possible, monitoring will be undertaken at the most affected noise sensitive receiver. Noise monitoring locations factors include:

- Proximity of the receiver to the works
- Noise sensitivity of the receiver
- Location of previous monitoring
- Expected duration of the impact
- Background noise levels
- Safety of personnel undertaking the measurements.

Noise monitoring results will be made publicly available on the Snowy Hydro Internet site.

- For attended noise monitoring, results will be published 10 business days after the noise monitoring has been conducted and the results verified as valid with respect to background noise interference to construction noise contributions at the monitoring location.
- For monitoring that is conducted using data logging, results will be published 10 business days after the logging results have been downloaded and the results verified as valid with respect to background noise interference to construction noise contributions at the monitoring location.

### **7.2.2 Out of Hours Protocol Noise Monitoring**

As per the OOHW Protocol detailed in Section 6.5 and the CNVIS requirement in Section 6.4, noise monitoring must be performed where required by the OOHW CNVIS and/or OOHW permit provided by the NSW EPA in order to validate the predicted OOHW noise levels. As per the OOHW protocol, noise monitoring will be required where noise at a receiver is predicted to receive noise levels greater than 5 dB(A) over the NMLs during the night.

Refer to section 2.4 of the Construction Monitoring Program for further detail on noise monitoring.

The OOHW Application will be reviewed and approved by the NSW EPA as required by EPL 21627 and by the Department as required by Infrastructure Approval conditions B31 and B32.

### **7.2.3 Noise verification monitoring after commissioning activities**

No specific noise monitoring is proposed during commissioning unless required by one of the triggers contained in section 7.2.1.

Following all commissioning of the Project, noise verification monitoring will be performed to confirm that operational noise levels comply with the noise criterion. Noise verification monitoring will be undertaken in accordance with Conditions B21 to B29 and EPL requirements L4.1 to L4.10 as well as M8.1.

#### 7.2.4 Noise monitoring parameters

All noise measurements will be undertaken to the following parameters:

- Sample Period: 15 minutes
- Frequency Weighting: A-Weighting
- Time Constant: Fast (125 milliseconds).

Attended noise monitoring will be undertaken in 15-minute sampling intervals, and continued if logging or repeated if attended, until representative noise data showing the noise contribution being targeted is obtained in accordance with the NSW Noise Policy for Industry or until it is demonstrated that the noise contribution being targeted cannot be shown from prevailing background noise.

Unattended noise monitoring will be performed to record at 15-minute sampling intervals.

As a minimum,  $L_{Aeq}$ ,  $L_{AMax}$ , and  $L_{A90}$  A-weighted noise levels should be recorded.

#### 7.2.5 Quality assurance

All monitoring will be undertaken by suitably trained and competent personnel, who are experienced in undertaking noise measurements.

Noise monitoring equipment used will be at least Type 2 instruments and calibrated in accordance with manufacturer specifications and/or relevant Australian Standards. Records of equipment laboratory calibration will be maintained by Snowy Hydro Limited (Snowy Hydro) and the Principal Contractor throughout the delivery of the Project. The calibration of the monitoring equipment will be checked in the field before and after the noise measurement period.

Noise measures while winds are greater than 5 m/s or while rainfall is present should be discarded, in line with the monitoring requirements of the *Noise Policy for Industry* (EPA, 2017).

Noise monitoring will be undertaken and recorded in accordance with the relevant noise measurement requirements in the reference standards and documents in Section 3.1. All monitoring records will be retained throughout the delivery of the Project by Snowy Hydro. Noise monitoring records will be completed to record:

- Name of person undertaking the measurement,
- Date and time of measurement, length of measurement and any measurement time intervals,
- Type and model number of monitoring instrumentation,
- Results of field calibration checks,
- Measurement location details and number of measurements at each location,
- Weather conditions during measurements,
- Operation and activities of the noise sources under investigation,
- Estimated contribution of the Project's activities, and
- Noise due to other extraneous and environmental sources (e.g. traffic, aircraft, trains, dogs barking, insects).

### 7.3 Incidents and complaints

Complaints and enquiries will be managed in accordance with the process outlined in Section 6.3 of the CEMS. Incidents will be reported in accordance with the process outlined in Section 7.4 of the CEMS.

Audits will be undertaken to assess the effectiveness of environmental management measures and compliance with the NVMP and all regulatory requirements. The auditing procedure are be detailed in the CEMS.

#### **7.4 Incident notification**

The Principal Contractor will notify Snowy Hydro upon becoming aware of an incident, and Snowy Hydro will then notify the Secretary in writing via the Major Projects website immediately.

The key aspects the notification will address are:

- (a) the development and application number (12590060);
- (b) details of the incident (date, time, location, a brief description of what occurred and why it is classified as an incident);
- (c) how the incident was detected;
- (d) when the Proponent became aware of the incident;
- (e) any actual or potential non-compliance with conditions of approval;
- (f) what immediate steps were taken in relation to the incident;
- (g) further action(s) that will be taken in relation to the incident; and
- (h) a development contact for further communication regarding the incident. Unless otherwise stated in the incident notification, this is the Snowy Hydro Approvals Manager on 0409 840 165.

#### **7.5 Non-compliance notification**

In the instance of a non-compliance, the Secretary will be notified in writing via the Major Projects website within seven days after the Proponent becomes aware of any non-compliance. Snowy Hydro will lodge the notification.

The Principal Contractor must notify Snowy Hydro whenever it is aware of a non-compliance.

The key aspects a non-compliance notification will address are:

- (a) the development and application number (12590060);
- (b) the condition of approval that the development is non-compliant with;
- (c) the way in which the development does not comply;
- (d) the reasons for the non-compliance (if known); and
- (e) the corrective and preventative actions undertaken to address the non-compliance.

For clarity, a non-compliance which has already been notified as an incident does not need to also be notified as a noncompliance to the Major Projects website.

#### **7.6 Complaints and enquiry management**

An enquiry is defined as a question or request for information.

A complaint is defined as a statement that describes Project related activities as unsatisfactory or unacceptable. Complaints may also be accompanied by threats to contact the media, local MP, or some other authority.

Complaints and enquiries may be received by any method. The Communications and Stakeholder Engagement Manager (CSEM) will acknowledge and respond to enquiries and complaints about the Project, as per the process and timeframes shown in Table 7-1 below. Where the complaint rises to the level of a dispute it shall be managed in accordance with the steps outlined in section 6.3 in the Construction Environmental Management Strategy.

**Table 7-1 Complaints and enquiries management**

<b>Complaints and enquiries management</b>	
Responding to complaints received during standard work hours	<ul style="list-style-type: none"> <li>• Investigate and determine source of complaint immediately</li> <li>• Provide an oral response acknowledging receipt of complaint to complainant as soon as possible. Every effort will be made to respond within 24 hours for emails, or one week for letters</li> <li>• Investigate the potential environmental impacts and consequences of the complaint</li> <li>• Record details of complaint received, how it was managed and the actions required to close out the complaint</li> <li>• Provide an update of the complaints register to the ER for any complaints received on the day they are received.</li> </ul>
Responding to enquiries received during standard work hours	<ul style="list-style-type: none"> <li>• Record details of enquiry received</li> <li>• Provide a response to enquirer on the next business day.</li> </ul>
Responding to enquiries and complaints out of hours	<ul style="list-style-type: none"> <li>• Stakeholders will be provided with the Project phone number for specific complaints and enquiries related to works out of hours. This number will be monitored by the CRM on a 24-hour basis</li> <li>• The CRM will triage complaints and enquiries and liaise directly with the Principal Contractor to respond. Non-urgent enquiries and complaints will be dealt with on the next business day</li> <li>• All details of the enquiry or complaint will be recorded in the Project consultation complaint register by the CRM.</li> <li>• Provide an update of the complaints register to the ER for any complaints received on the day they are received.</li> </ul>

## 8. Review and improvement

### 8.1 Continuous improvement

Continuous improvement of the NVMP will be carried out through the continued evaluation of mitigation and management measures against environmental policies, objectives and targets and identifying where opportunities exist for improvement.

The continuous improvement process will include:

- Identifying opportunities to improve environmental management measures and performance
- Identify the causes of any non-compliances with the relevant criteria
- Develop an effective plan to address any identified non-compliances
- Determine the effectiveness of applied mitigation measures
- Document any changes to work procedures undertaken to control non-compliances and/or improve efficiencies
- Compare work process results with the relevant objectives and targets.

### 8.2 Staging and Review of Management Plans

The Department's approval for the staging of management plans into construction and operation phases was provided on the 22 of December 2021.

Regular reviews of management documentation will also occur and after certain events. The triggers for further review of this Management Plan include:

- (a) the submission of an incident report under condition C6;
- (b) the submission of an audit report under conditions C15 to C19;
- (c) the approval of any modification to the conditions of this approval;
- (d) a direction of the Secretary (Department of Planning Industry and Environment) under condition A2 of Schedule 2;
- (e) as initiated by the Principal Contractor or Snowy Hydro; or
- (f) upon the advice of the Environmental Representative.

Where revisions are made, then within 4 weeks of the review the revised document will be submitted to the Secretary for approval, unless otherwise agreed with the Secretary, or within the scope of the Environmental Representative role as set out in condition A23.

### 8.3 Update and amendment

Where necessary, the NVMP will be required to be updated. Document and records management for the Project is described in Section 7.7 of the CEMS.

## 9. References

- British Standards Group, (1993). *British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration*. British Standards. London, UK
- British Standards Group, (2008). *British Standard BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting*. British Standards. London, UK
- Department of Environment and Conservation 2006, *Assessing Vibration: a technical guideline*, NSW Department of Environment and Conservation, Sydney, NSW.
- Department of Environment and Climate Change 2009, *Interim Construction Noise Guideline*, NSW Department of Environment and Climate Change, Sydney South, NSW.
- Department of Environment and Climate Change 2011, *NSW Road Noise Policy*, NSW Department of Environment and Climate Change, Sydney, NSW.
- Deutsches Institut für Normung, (2016). *German Standard DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures*. DIN, Berlin, Germany.
- Jacobs 2021a, *Hunter Power Project Environmental Impact Statement (Rev 0 – Final)*, Jacobs Group (Australia), 22 April 2021.
- Jacobs 2021b, *Hunter Power Project Response to Submissions – Submissions Report (Rev 1)*, Jacobs Group (Australia), 30 July 2021.
- NSW Environment Protection Authority 2017, *Noise Policy for Industry*, October 2017. EPA, Sydney, NSW.
- Roads and Maritime Services 2016, *Construction Noise and Vibration Guidelines*, Roads and Maritime Services, North Sydney, NSW.

