

Hunter Power Project

Construction noise monitoring

Prepared for Snowy Hydro

November 2023

Hunter Power Project

Construction noise monitoring

Snowy Hydro

E230987 RP3

November 2023

Version	Date	Prepared by	Reviewed by	Comments
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8 November 2023

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1 Introduction

1.1 Background

EMM Consulting Pty Ltd (EMM) was engaged by Snowy Hydro to conduct a monthly survey of construction noise at the Hunter Power Project (HPP, the site) located near Loxford, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was done during the evening and night periods of 2 November 2023 at five monitoring locations.

1.2 Attended monitoring locations

Attended monitoring locations are detailed in Table 1.1 and shown on Figure 1.1.

Table 1.1 Attended monitoring locations

Location ID	Address	Coordinates (MGA56)	
		Easting	Northing
NM1	103 Bishops Bridge Rd, Loxford NSW 2326	356579	6370464
NM2	10 Dawes Ave, Loxford NSW 2326	358109	6370268
NM3	22 Bowditch Ave, Loxford NSW 2326	359228	6370812
NM4	464 Cessnock Rd, Gillieston Heights NSW 2321	361930	6372907
NM5	59 Sawyers Gully Rd, Sawyers Gully NSW 2326	356117	6370129

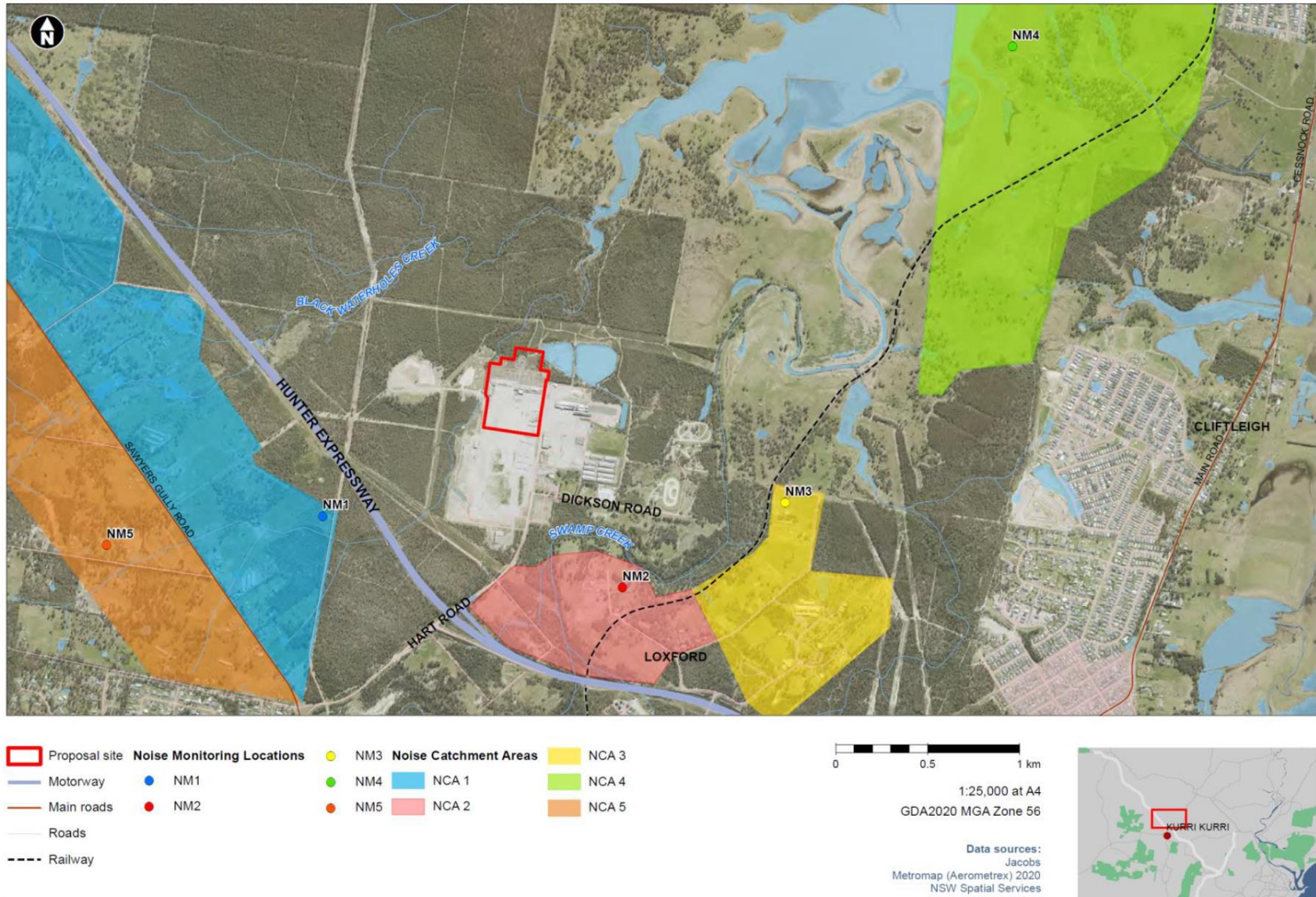


Figure 1.1 Attended noise monitoring locations

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The “A” weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1% of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10% of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50% of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90% of the time, also referred to as the “background” noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The “C” weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Project approval

The current project approval for HPP is 12590060 (MOD 1, February 2023). Relevant sections of the project approval are reproduced in Appendix B.1.

2.2 Environment protection licence

HPP holds Environment Protection Licence (EPL) No. 21627 issued by the Environment Protection Authority (EPA) on 25 August 2023. Relevant sections of the EPL are reproduced in Appendix B.2.

2.3 Construction noise management plan

The current Construction Noise and Vibration Management Plan (CNVMP) is version 4, approved on 10 May 2023. Relevant sections of the CNVMP are reproduced in Appendix B.3.

2.4 Noise limits

Construction noise limits based on the project approval, licence and CNVMP are provided in Table 2.1.

Table 2.1 Construction noise limits, dB

Location	Day (standard hours) ¹ L _{Aeq,15minute}	Day (outside standard hours) ¹ L _{Aeq,15minute}	Evening ¹ L _{Aeq,15minute}	Night ¹ L _{Aeq,15minute}	Night L _{Amax}
NM1	55	50	50	41	52
NM2	50	45	45	43	53
NM3	48	43	43	42	52
NM4	45	40	35	35	52
NM5	47	42	42	40	52

Notes: 1. Day (Inside Standard Hours) means the period from 7:00 am–6:00 pm Monday to Friday, the period from 8:00 am–1:00 pm Saturday, and does not include any period on Sunday or public holidays. Day (Outside Standard Hours) means any period from 7:00 am–6:00 pm that are not included in inside standard hours. Evening means the period from 6:00 pm–10:00 pm. Night means the period from 10:00 pm–7:00 am.

2.5 Additional requirements

Monitoring and reporting have been done in accordance with the NSW EPA 'Noise Policy for Industry' (NPfI) issued in October 2017 and the 'Approved methods for the measurement and analysis of environmental noise in NSW' (Approved Methods) issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW requirements.

Meteorological data was obtained from the HPP automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured site noise levels.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted during the evening and night periods at each location. The duration of each measurement was 15 minutes. Atmospheric conditions were measured at each monitoring location.

Measured sound levels from various sources were noted during each measurement and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15\text{minute}}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

3.3 Meteorological data

Meteorological data was obtained from the HPP automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured noise levels. This data was obtained in 5-minute intervals. Atmospheric parameters include wind speed, wind direction and rainfall. When meteorological data is provided in less than 15-minute intervals, analysis must be conducted to determine the meteorological conditions present for most of each measurement period.

3.4 Instrumentation

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Measurement equipment

Item	Serial number	Calibration due date	Relevant standard
Rion NA-28 sound level meter	00370304	31/10/2024	IEC 61672-1:2002
Svantek SV36 calibrator	138017	01/08/2025	IEC 60942:2017

4 Results

4.1 Total measured noise levels and atmospheric conditions

Total noise levels measured during each 15-minute attended measurement are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB –November 2023 ¹

Location	Start date and time	L _{Amax}	L _{A1}	L _{A10}	L _{Aeq}	L _{A50}	L _{A90}	L _{Amin}
NM1	2/11/2023 19:21	62	57	54	51	50	47	41
NM2	2/11/2023 20:32	51	45	41	39	38	36	33
NM3	2/11/2023 20:09	53	42	38	36	35	33	32
NM4	2/11/2023 21:03	75	68	64	60	56	47	41
NM5	2/11/2023 19:42	80	66	51	56	46	44	43
NM1	2/11/2023 23:41	58	53	48	44	41	38	35
NM2	2/11/2023 22:53	59	47	41	39	38	35	32
NM3	2/11/2023 22:30	40	37	36	34	34	32	30
NM4	2/11/2023 22:00	70	64	60	55	48	40	31
NM5	2/11/2023 23:19	55	49	46	44	43	39	36

Notes: 1. Levels in this table are not necessarily the result of activity at HPP.

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.2 Measured atmospheric conditions –November 2023

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction ° magnetic north ¹	Cloud cover 1/8s
NM1	2/11/2023 19:21	19	<0.5	-	1
NM2	2/11/2023 20:32	17	<0.5	-	0
NM3	2/11/2023 20:09	17	<0.5	-	0
NM4	2/11/2023 21:03	17	<0.5	-	1
NM5	2/11/2023 19:42	18	0.5	30	1
NM1	2/11/2023 23:41	13	<0.5	-	1
NM2	2/11/2023 22:53	15	<0.5	-	1
NM3	2/11/2023 22:30	15	0.5	60	1
NM4	2/11/2023 22:00	16	<0.5	-	2
NM5	2/11/2023 23:19	14	0.5	100	1

Notes: 1. “-” indicates calm conditions at monitoring location.

4.2 Site only noise levels

4.2.1 Monitoring results

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS.

Table 4.3 Site noise levels and limits, dB –November 2023

Location	Start date and time	Wind		Limits		Site levels		Exceedances	
		Speed m/s	Direction ¹	L _{Aeq,15minute}	L _{Amax}	L _{Aeq,15minute}	L _{Amax}	L _{Aeq,15minute}	L _{Amax}
NM1	2/11/2023 19:21	2.3	75	50	NA	<25	<25	Nil	NA
NM2	2/11/2023 20:32	0.4	90	45	NA	<20	<20	Nil	NA
NM3	2/11/2023 20:09	1.0	90	43	NA	IA	IA	Nil	NA
NM4	2/11/2023 21:03	0.1	360	35	NA	IA	IA	Nil	NA
NM5	2/11/2023 19:42	1.7	90	42	NA	<20	<20	Nil	NA
NM1	2/11/2023 23:41	0.0	-	41	52	31	35	Nil	Nil
NM2	2/11/2023 22:53	0.0	-	43	53	IA	IA	Nil	Nil
NM3	2/11/2023 22:30	0.0	-	42	52	IA	IA	Nil	Nil
NM4	2/11/2023 22:00	0.0	-	35	52	IA	IA	Nil	Nil
NM5	2/11/2023 23:19	0.0	-	40	52	<30	<30	Nil	Nil

Notes: 1. Degrees magnetic north, “-” indicates calm conditions.
2. “NA” denotes noise limit not applicable during this period.

5 Summary

EMM was engaged by Snowy Hydro to conduct a monthly survey of construction noise at HPP. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was done during the evening and night periods of 2 November 2023 at five monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the November 2023 survey.

Appendix A

Noise perception and examples

A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
Up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

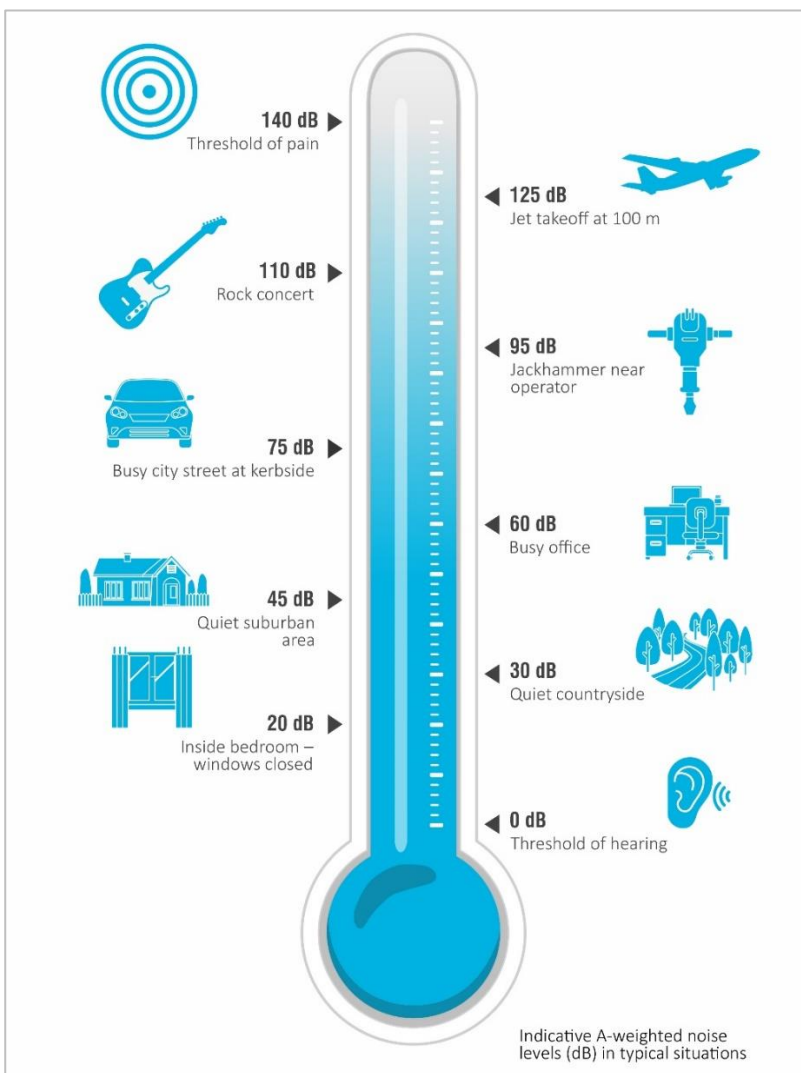


Figure A.1 Common noise levels

Appendix B

Regulator documents

B.1 Project approval

Hours of Construction

B30. 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.

Exceptions to Construction Hours

B31. The following activities may be carried out outside the recommended construction hours:

- (a) construction that causes $L_{Aeq(15\text{minute})}$ noise levels that are:
 - (i) no more than 5 dB above Rating Background Level at any residence in accordance with the *Interim Construction Noise Guideline* (DECC, 2009); and
 - (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
- (b) for the delivery of materials required by the police or other authorities for safety reasons; or
- (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.

Variation of Construction Hours

B32. 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.

B.2 Environmental protection licence

L4.11 Construction noise generated at the premises must not exceed the noise limits (expressed in dB) at the times and locations in the table below.

Location	Day (Inside Standard Hours) LAeq (15min)	Day (Outside Standard Hours) LAeq (15min)	Evening LAeq (15min)	Night LAeq (15min)
103 Bishops Bridge Rd, Sawyers Gully	55	50	50	41
10 Dawes Ave, Loxford	50	45	45	43
20 Bowditch Ave, Loxford	48	43	43	42
464 Cessnock Rd, Gillieston Heights	45	40	35	35
59 Sawyers Gully Rd, Sawyers Gully	47	42	42	40

L4.12 For the purpose of Condition L4.11:

- Day (Inside Standard Hours) means the period from 7:00 am - 6:00 pm Monday to Friday, the period from 8:00 am - 1:00 pm Saturday, and does not include any period on Sunday or public holidays;
- Day (Outside Standard Hours) means any period from 7:00 am - 6:00 pm that are not included in part a;
- Evening means the period from 6:00 pm - 10:00 pm; and
- Night means the period from 10:00 pm - 7:00 am.

B.3 Construction noise and vibration management plan

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.

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

NCA	NML Leq 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 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.

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

Appendix C

Calibration certificates

C.1 Calibration certificates



Octave Band Filter
IEC 61260-3:2016
Calibration Certificate

Calibration Number C22699A

Client Details	EMM Consulting Level 3/175 Scott Street Newcastle NSW 2300
-----------------------	--

Filter Model Number :	Rion NA-28
Filter Serial Number :	N/A
Instrument Serial Number :	00370304
Microphone Serial Number :	10421
Pre-amplifier Serial Number :	60313
Firmware Version :	2.0

Atmospheric Conditions	
Ambient Temperature :	23.8°C
Relative Humidity :	47.8%
Barometric Pressure :	98.77kPa

Calibration Technician :	Lucky Jaiswal	Secondary Check:	Dhanush Bonu
Calibration Date :	31 Oct 2022	Report Issue Date :	31 Oct 2022

Approved Signatory :  Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
Midband Relative Attenuation (Clause 10)	Pass	Operating Range Lower Limit (Clause 12)	Pass
Linearity, Range and Overload (Clause 11)	Pass	Relative Attenuation (Clause 13)	Pass

The filter submitted for testing successfully completed the periodic tests of IEC 61260-3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the filter to the full specifications of IEC 61260-1:2014 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of filter fully conformed to the class 1 specifications in IEC 61260-1:2014 and (b) because the periodic tests of IEC 61260-3 cover only a limited subset of the specifications in IEC 61260-1:2014.

Uncertainties of Measurement -			
Electrical Tests	-5dB < ΔA(f) ≤ 40dB	±0.12dB	Environmental Conditions
	40dB < ΔA(f) ≤ 120dB	±0.2dB	
			Temperature
			Relative Humidity
			Barometric Pressure

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.



Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172. Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C36956

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek

Type No: SV36 Serial No: 138017

Owner: EMM Consulting
Suite 01, 20 Chandos St
St Leonards NSW 2065

Tests Performed: Measured Output Pressure level, Frequency & Distortion

Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	93.90 dB	999.98 Hz	0.56 %
Level2:	NA	N	114.00 dB	1000.00 Hz	0.16 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.i.) k=2					


CONDITION OF TEST:

Ambient Pressure 1012 hPa ±1 hPa Date of Receipt : 28/07/2023
Temperature 23 °C ±1° C Date of Calibration : 01/08/2023
Relative Humidity 39 % ±5% Date of Issue : 01/08/2023

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY: 

AUTHORISED SIGNATURE: 

Hsin Sui

Accredited for compliance with ISO/IEC 17025 - Calibration

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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