

NARRABRI MINE NOISE MONITORING

**Quarter Ending March 2023
Summary Noise Report**

Prepared for:

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Narrabri Coal Operations Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.18063-R20-Narrabri-v1.0	28 April 2023	Sean O'Shea	Adam Sirianni	Martin Davenport

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1 Introduction

Narrabri Coal Operations Pty Ltd has commissioned SLR Consulting Australia Pty Ltd (SLR) to conduct operational noise monitoring for the Narrabri Mine located near Narrabri, New South Wales (NSW) in accordance with the approved Noise Management Plan (NMP) dated June 2018, the Narrabri Mine Project Approval (PA) 08_0144 and the Environment Protection Licence 12789 (EPL 12789).

The objectives of the noise monitoring programme for this operating period were as follows:

- Conduct operator attended noise surveys at 8 locations (as listed in **Section 3.3**) surrounding the mine during the day, evening and night-time periods.
- Quantify all sources of noise within each of the attended noise surveys, including their measured and/or estimated contribution and maximum level of individual noise sources.
- Assess the noise emissions of Narrabri Mine and determine compliance with respect to the limits contained in Section 2 of the NMP and the relevant approvals.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 PERFORMANCE ASSESSMENT AND DISCUSSION

The following provides a summary of the attended noise measurements undertaken at each monitoring location. Further details are provided for each location in **Section 5** of this report.

Table 1 Performance Assessment – Operations

EPL ID	Location	Date	Narrabri Mine Contribution dBA				Noise Criteria ¹	Measurement Periods	Standard Weather			Compliant
			LAeq 15 min Day	LAeq 15 min Evening	LAeq 15 min Night	LA1 (1 min) Night			Day	Evening	Night	
N5	Oakleigh ²	27/3/2023 ³	32 ⁴	26	28	34	Day, Evening and Night – LAeq(15minute) 35 dBA Night LA1(1minute) – 45 dBA	Day - 1.5 hrs Evening - 0.5 hrs Night – 1hrs	Y	Y	Y	Y
		28/3/2023 ³	N/M	I/A	I/A	I/A			Y	Y	Y	Y
		29/3/2023Y ³	I/A	35	33	39			Y	Y	Y	Y
N6	Newhaven	27/3/2023	I/A	I/A	27	30			Y	Y	Y	Y
		28/3/2023	I/A	25	N/M	N/M			Y	Y	Y	Y
		29/3/2023	N/M	30	33	40			Y	Y	Y	Y
N8	Haylin View ²	28/3/2023	39 ⁴	32	27	30			Y	N	Y	Y
		29/3/2023	33	32	33	38			N	Y	Y	Y
		30/3/2023	I/A	I/A	I/A	I/A			N	N	N	Y
N9	High Range ²	28/3/2023	I/A	32	I/A	I/A			Y	Y	Y	Y
		29/3/2023	I/A	34	29	34			Y	Y	Y	Y
		30/3/2023	26	25	I/A	I/A			Y	N	Y	Y
-	Bow Hills ¹	27/3/2023 ³	I/A	I/A	I/A	I/A		Day 15 min Evening 15 min Night 15 min	N	Y	Y	Y
-	Ardmona	30/3/2023	27	N/M	25	29			Y	N	N	Y
-	Merriman ²	30/3/2023	30	29	33	41			Y	N	N	Y
-	Matilda ²	27/3/2023	25	25	I/A	I/A			Y	Y	Y	Y

I/A = Inaudible, N/M = Not Measurable

Note 1: A private agreement between NCOPL and the residents of N1 Bow Hills of 50 dBA LAeq(15minute) is in place. This new level of 50 dBA LAeq(15minute) replaces the levels identified in Conditions 1-3, Schedule 4 of PA 08_0144 Mod 2 and the identical limits contained in condition L3 of Environment Protection Licence No 12789

Note 2: Property is owned by Narrabri Coal Operations. Noise limits contained in Conditions 1-3, Schedule 4 of PA 08_0144 Mod 2 and the identical limits contained in condition L3 of Environment Protection Licence No 12789 are not applicable.

Note 3: Evening and Night monitoring conducted on this date, Day monitoring conducted during the following day period.

Note 4: Noise levels dominated by a-typical construction activities occurring onsite.

3 Noise Criteria

3.1 Project Approval, EPL and NMP

Noise monitoring at the Narrabri Mine was conducted in accordance with EPL 12789, the PA requirements and the NMP. The site specific EPL and PA noise limits are summarised in Section 2 of the NMP and are reproduced in **Table 2**. These criteria do not apply where the mine has an agreement with the relevant owner/s of the residence to generate higher noise levels, or where the property is mine owned.

Table 2 Project Approval and EPL Noise Criteria

Location	Day	Emergency Day	Night	
	LAeq(15minute)	LAeq(15minute)	LAeq(15minute)	LA1(1minute)
All Privately owned Residences	35	35	35	45

3.2 Non-compliances & Exemptions

In accordance with Section 11.1.3 of the NSW Industrial Noise Policy (INP) a development is deemed to be in non-compliance with a noise consent or licence condition if the monitored noise level is more than 2 dB above the statutory noise limit specified in the consent or licence. This may occur for two reasons:

- The noise from the Narrabri Mine is excessive, in which case Narrabri Mine will be not complying with its consent or licence condition.
- The noise was increased by extreme, non-standard weather effects—in which case the Narrabri Mine is not considered to be in noncompliance with its consent or licence condition.

In this latter case, further monitoring at a later date is required to determine compliance under “normal” meteorological conditions.

The INP states in Section 9.2 that *“it is not practicable to meet the noise limit under all inversion events; hence exceedances under extreme temperature inversions are not considered to be a non-compliance with consent or licence conditions.”*

Non-standard weather effects include:

- Wind speeds greater than 3 m/s at 10m above ground level; or
- Stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level; or
- Stability category G temperature inversion conditions

As stated in EPL 12789 *“Data recorded by the meteorological station identified as EPA Identification Point(s) W1 must be used to determine meteorological conditions and temperature inversion conditions (stability category) are to be determined by direct measurement over a minimum 50m height interval as referred to in Part E2 of Appendix E of the “New South Wales Industrial Noise Policy” dated January 2000 ISBN 0 7313 2715 2.”*

Weather and Temperature inversion monitoring is undertaken continuously in accordance with EPL 12789 with monitoring locations displayed in **Figure 1**. Monitoring Location W1 records wind speed and direction at 10m above ground level. Temperature inversion monitoring is undertaken continuously by directly measuring temperature at two elevations 50m apart (10m & 60m from ground level) at monitoring location W2. All weather data reported in **Table 5** to **Table 20** have been recorded at these monitoring locations.

3.3 Attended Monitoring

Attended Noise monitoring is to be undertaken on a quarterly basis at residential areas. The attended monitoring will take place at the following locations:

EPL Monitoring Locations

- N5 Oakleigh – 16293 Kamilaroi Highway Baan Baa
- N6 Newhaven – 184 Greylands Road Turrawan
- N8 Haylin View – 791 Mayfield Road, Baan Baa
- N9 High Range – 92 Davis Road Turrawan

It is noted that the Narrabri Mine own the properties Oakleigh (N5), Haylin View (N8) and High Range (N9).

NMP Monitoring Locations

- N1 Bow Hills – 16652 Kamilaroi Highway Baan Baa
- N3 Ardmona – 16462 Kamilaroi Highway Baan Baa
- N7 Merriman – 16896 Kamilaroi Highway Baan Baa
- N8_(NMP) Matilda – 773 Mayfield Road Baan Baa

It is noted that the Narrabri Mine owns the properties Merriman (N7) and Matilda (N8_(NMP)) and has a private agreement with the landholder of Bow Hills (N1) for increased noise limits.

The following details the requirements of the monitoring:

EPL Monitoring Requirements

- At each one of the monitoring locations N5, N6, N8 and N9;
- Occur quarterly in a reporting period;
- Occur during each day, evening and night period as defined in the NSW Industrial Noise Policy for a minimum of:
 - i) 1.5 hours during the day;
 - ii) 30 minutes during the evening; and
 - iii) 1 hour during the night.
- Occur for three consecutive operating days.

NMP Monitoring Requirements

- At each one of the monitoring locations N1, N3, N7 and N8_(NMP)
- Occur quarterly in a reporting period; and
- Occur during a day, evening and night period as defined in the NSW Industrial Noise Policy for a minimum 15 minutes.

4 Operational Noise Monitoring Methodology

4.1 General Requirements

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672.1 – 2019 *Electroacoustics—Sound level meters*, AS IEC 60942 2017 *Electroacoustics – Sound calibrators* and carried current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ± 0.5 dBA. Calibration certificates for all instruments employed during the monitoring campaign are presented in **Appendix B**.

4.2 Methodology - Operator Attended Noise Monitoring

Operator attended noise measurements were conducted during the day, evening and night-time periods for a minimum of 1.5 hours during the day; 30 minutes during the evening and 1 hour during the night at the three EPL nominated noise monitoring locations and for 15 minutes during the day, evening and night at each of the NMP nominated noise monitoring location representing the most affected receiver locations, listed in **Table 3** and shown in **Figure 1**. During the operator attended noise measurements, the character and relative contribution of ambient noise sources and mine contributions were determined.

Table 3 Noise Monitoring Locations

Monitoring Location	Monitoring Requirements	Receiver Type	Address	Monitoring Location - MGA Zone 55	
				Easting (m)	Northing (m)
N5 ^{1,2}	EPL	Residence	Oakleigh – 16293 Kamilaroi Highway Baan Baa	779526	6617751
N6 ^{1,2}	EPL	Residence	Newhaven – 184 Greylands Road Turrawan	776564	6624643
N8 ¹	EPL	Residence	Haylin View – 791 Mayfield Road Baan Baa	777428	6617316
N9 ¹	EPL	Residence	High Range – 92 Davis Road Turrawan	775879	6625895
N1	NMP	Residence	Bow Hills – 16652 Kamilaroi Highway Baan Baa	780114	6620641
N3 ²	NMP	Residence	Ardmona – 16462 Kamilaroi Highway Baan Baa	780233	6618836
N7 ²	NMP	Residence	Merriman – 16896 Kamilaroi Highway Baan Baa	779290	6623143
N8 _(NMP) ²	NMP	Residence	Matilda – 773 Mayfield Road Baan Baa	777815	6617045

Note: 1. EPL monitoring locations
 2. NMP monitoring locations

The objective of the operator attended noise monitoring was to measure the $LA_{1(1\text{minute})}$ and the $LA_{eq(15\text{minute})}$ noise level contribution from the Narrabri Mine at the nearest potentially affected receptors in order to determine the noise contribution of operational activities associated with Narrabri Mine over each 15 minute measurement period. In addition, the operator quantifies and characterises the overall levels of ambient noise in the area (i.e. LA_{max} , LA_1 , LA_{10} , LA_{90} , and LA_{eq}) over the 15 minute measurement interval.

Operator attended noise measurements were conducted using one-third octave integrating Brüel & Kjær Type 2270 and 2250L sound level meters (s/n 3029485 and s/n 3004635). Attended noise measurements were undertaken by SLR staff Sean O'Shea and Adam Sirianni.

Figure 1 Attended Noise Monitoring Locations

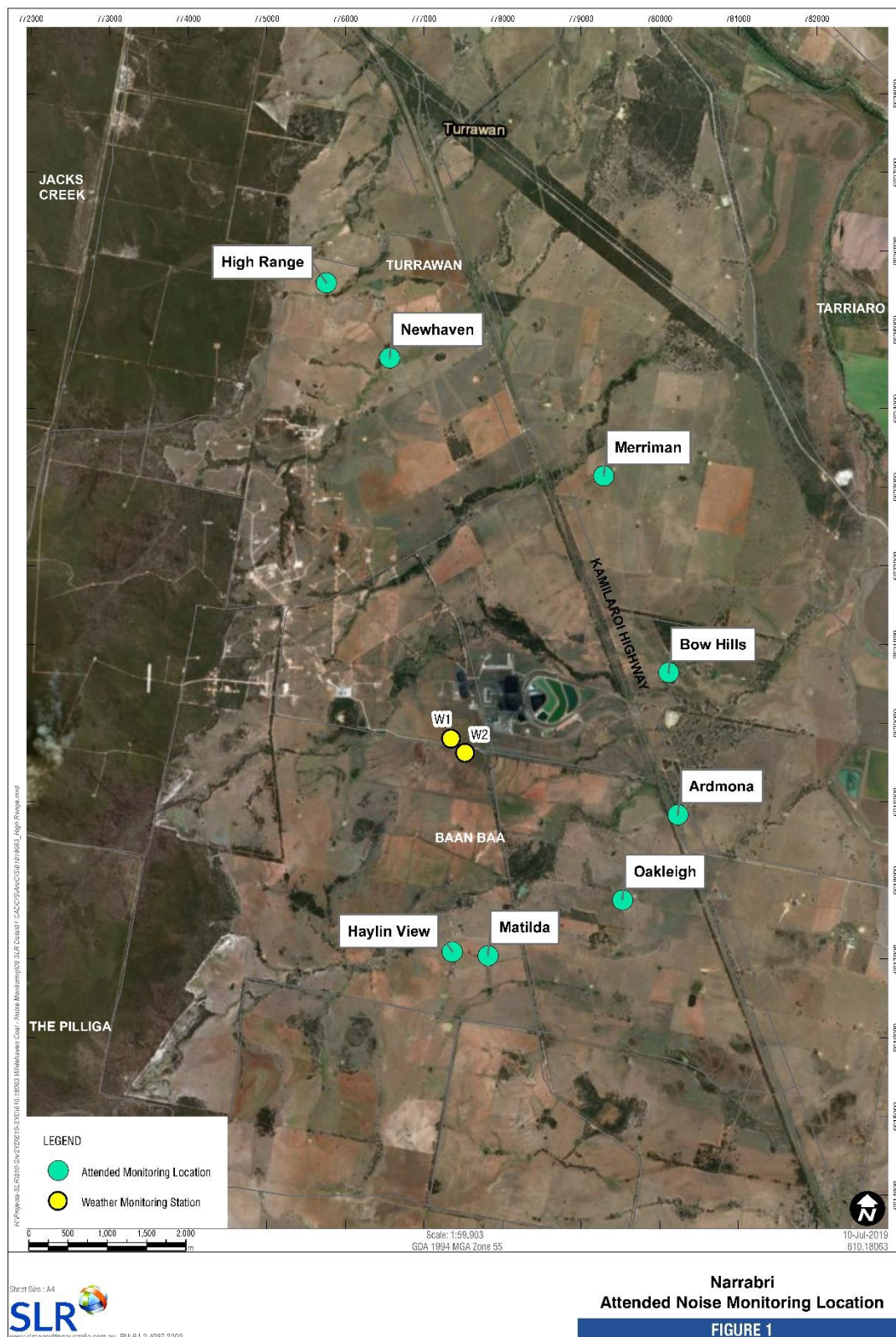


Table 4 presents a summary of which days of the week the quarterly monitoring was conducted, in accordance with condition M7.4 of EPL 12789 and Section 5 of the NMP.

Table 4 Days of the Week Quarterly EPL Monitoring was Conducted – Q1 2023

Period	Day of the Week (Excluding Weekends and Public Holidays)				
	Monday	Tuesday	Wednesday	Thursday	Friday
EPL Monitoring Locations					
Day	27 March 2023	28 March 2023	29 March 2023	30 March 2023	
Evening	27 March 2023	28 March 2023	29 March 2023	30 March 2023	
Night ¹	27 March 2023	28 March 2023	29 March 2023	30 March 2023	
NMP Monitoring Locations					
Day	27 March 2023	28 March 2023		30 March 2023	
Evening	27 March 2023			30 March 2023	
Night ¹	27 March 2023			30 March 2023	

Note 1: Taken to mean the night-time period from 10:00 pm on the stated day to 7:00 am the following day.

5 Results and Discussion

5.1 Results of Operator Attended Monitoring

Results of the operator attended noise surveys at N5, N6, N9, N1, N3, N7 and N8_(NMP) are provided **Table 5** to **Table 20**.

Ambient noise levels presented include all noise sources such as transport (roads, rail and aircraft), fauna (insects, frogs, birds and bats), the natural environment (wind in trees), domestic noises, other industrial operations as well as Narrabri Mine noise emissions.

Weather data during the monitoring period has been obtained from the weather station located on the Narrabri Mine site and observed conditions.

The tables also provide the following information:

- Date and start time, operator and equipment details.
- Monitoring location.
- Wind velocity (m/s) and temperature (°C) at weather station W1, as detailed in **Section 3.2**.
- Typical maximum (L_{Amax}) and contributed L_{Aeq}(15minute) noise levels.

5.1.1 Operator Attended Noise Survey Results – EPL Monitoring Location N5

Results of the operator attended noise surveys at N5 are provided in **Table 5**, **Table 6** and **Table 7**. Monitoring location N5 represents residential receptors located to the southeast of the site in Oakleigh.

Table 5 Operator Attended EPL Noise Survey Results – N5 – Oakleigh (Day 1)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 1 28/3/2023 09:19 2.5 – 4.2 m/s SE 22°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	52	43	41	37	39	34	32 L _{Aeq} ²	Site Related Noise Events: Dozer operations 30-32 Onsite construction activity 30-40 Other Noise Events: Traffic 40-49 Birds 46-62 Plane 38-55 Train 42-57
		2	F	55	49	41	35	39	32	31 L _{Aeq} ²	
		3	E	50	46	42	35	39	32	27 L _{Aeq} ²	
		4	E	51	47	41	33	38	30	26 L _{Aeq} ²	
		5	E	63	50	41	34	40	30	27 L _{Aeq} ²	
		6	E	62	51	42	34	41	30	26 L _{Aeq} ²	
Evening 1 27/03/2023 20:40 0 – 0.8 m/s WSW 24°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	47	44	41	36	39	33	23 L _{Aeq}	Site Related Noise Events: Dozer operations 23-35 Other Noise Events: Traffic 35-48 Insects 38-45
		2	F	48	42	39	36	38	34	26 L _{Aeq}	
Night 1 27/3/2023 22:27 3 – 3.3 m/s SE 22-23°C 3029485	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	E	57	49	39	29	37	27	28 L _{Aeq} 34 L _{A1}	Site Related Noise Events: Dozer operations 28-34 General surface activity 21-26 Onsite engine revs 20-25 Other Noise Events: Insects 28-36 Traffic 31-47 Plane 47-53
		2	E	47	40	34	26	31	25	25 L _{Aeq} 28 L _{A1}	
		3	E	50	44	33	28	32	26	<25 L _{Aeq} 25 L _{A1}	
		4	E	47	40	32	27	31	25	I/A	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

Note 2: Noise levels dominated by a-typical construction activities occurring onsite.

Table 6 Operator Attended EPL Noise Survey Results – N5 – Oakleigh (Day 2)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 2 29/3/2023 09:08 2.7 – 6 m/s NW 20-23°C 3029485	35 dBA L _{Aeq} (15minute)	1	E	49	44	40	34	38	30	N/M	Site Related Noise Events: Dozer operations faintly audible Other Noise Events: Birds 45-65 Traffic 37-46 Plane 45-51 Wind 38-50
		2	E	56	49	41	34	39	31	I/A	
		3	E	65	49	42	35	40	32	I/A	
		4	D	58	47	43	37	41	34	I/A	
		5	D	52	48	45	35	42	33	I/A	
		6	D	55	53	50	41	47	37	I/A	
Evening 2 28/3/2023 20:34 3.4 – 4.2 m/s ENE 21°C 3029485	35 dBA L _{Aeq} (15minute)	1	E	58	53	48	35	44	32	I/A	Site Related Noise Events: Inaudible Other Noise Events: Traffic 40-52 Wind 40-47 Train 50-58
		2	E	49	46	43	32	39	27	I/A	
Night 2 28/3/2023 23:25 2.2 – 3.4 m/s SE 20-21°C 3029485	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	E	51	45	33	26	33	24	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 26-31 Traffic 40-51 Plane 41-44
		2	E	50	44	37	27	34	24	I/A	
		3	E	49	39	31	23	29	21	I/A	
		4	E	55	34	30	26	29	24	I/A	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

Table 7 Operator Attended EPL Noise Survey Results – N5 – Oakleigh (Day 3)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 3 30/3/2023 07:01 0.7 – 2.4 m/s SW 15-17°C 3029485	35 dBA L _{Aeq} (15minute)	1	G	51	46	42	34	39	30	I/A	Site Related Noise Events: Inaudible Other Noise Events: Traffic 38-47 Birds 45-66 Train 41-44
		2	G	66	58	44	34	44	28	I/A	
		3	G	62	54	44	36	43	33	I/A	
		4	G	55	46	41	35	39	31	I/A	
		5	G	55	47	40	32	38	28	I/A	
		6	F	61	50	42	30	39	26	I/A	
Evening 3 29/3/2023 20:35 0 – 1.8 m/s SSE 19-20°C 3029485	35 dBA L _{Aeq} (15minute)	1	E	57	39	37	34	36	31	35 L _{Aeq}	Site Related Noise Events: Dozer operations 30-39 Onsite impact 51 Other Noise Events: Traffic 36-43 Insects 35-40 Animals 51-57
		2	E	54	38	35	32	34	30	30 L _{Aeq}	
Night 3 29/3/2023 22:00 1 – 2.3 m/s WSW 19-20°C 3029485	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	G	47	44	39	32	36	30	30 L _{Aeq} 33 L _{A1}	Site Related Noise Events: Dozer operations 28-40 Other Noise Events: Traffic 40-53 Insects 32-34 Plane 38-44 Bats 41-44
		2	G	53	48	40	29	37	28	29 L _{Aeq} 32 L _{A1}	
		3	F	44	39	34	30	32	28	30 L _{Aeq} 32 L _{A1}	
		4	F	48	40	36	31	34	29	33 L _{Aeq} 39 L _{A1}	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

5.1.2 Operator Attended Noise Survey Results – EPL Monitoring Location N6

Results of the operator attended noise surveys at N6 are provided in **Table 8**, **Table 9** and **Table 10**. Monitoring location N6 represents residential receptors located to the northwest of the site in Newhaven.

Table 8 Operator Attended EPL Noise Survey Results – N6 – Newhaven (Day 1)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 1 27/3/2023 14:25 3– 4.9 m/s WNW 28-29°C 3029485	35 dBA L _{Aeq} (15minute)	1	A	52	45	37	30	35	27	I/A	Site Related Noise Events: Inaudible Other Noise Events: Birds 44-53 Animals 41-58 Traffic 37-49 Plane 40-47
		2	A	51	44	38	29	35	26	I/A	
		3	B	53	46	41	31	38	28	I/A	
		4	A	58	46	41	30	38	27	I/A	
		5	A	58	42	37	28	34	26	I/A	
		6	B	49	43	39	27	36	24	I/A	
Evening 1 27/3/2023 19:48 1.3 m/s W 25°C 3029485	35 dBA L _{Aeq} (15minute)	1	E	50	44	40	35	38	34	I/A	Site Related Noise Events: Inaudible Other Noise Events: Traffic 40-50 Insects 35-38 Train 42-56
		2	E	56	51	44	35	41	33	I/A	
Night 1 27/3/2023 23:49 2.6 – 3 m/s SE 22°C 3029485	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	E	50	44	37	29	34	28	25 L _{Aeq} 30 L _{A1}	Site Related Noise Events: Main exhaust vent Fan 20-30 Dozer operations 24-29 Other Noise Events: Insects 30-34 Traffic 33-48 Animals 38-61 Train 46-53
		2	E	43	37	33	28	31	27	26 L _{Aeq} 29 L _{A1}	
		3	E	51	45	39	30	36	28	25 L _{Aeq} 29 L _{A1}	
		4	E	61	51	45	29	40	27	27 L _{Aeq} 30 L _{A1}	

Note: N/M = Not Measurable, I/A = Inaudible

Table 9 Operator Attended EPL Noise Survey Results – N6 – Newhaven (Day 2)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 2 28/3/2023 07:01 1.3 – 1.7 m/s SE 20-21°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	55	51	46	32	43	27	I/A	Site Related Noise Events: Inaudible Other Noise Events: Traffic 40-57 Birds 47-66 Plane 46-48 Roadworks 30-36
		2	F	56	50	45	34	42	30	I/A	
		3	F	58	49	44	34	41	28	I/A	
		4	E	60	49	44	34	41	29	I/A	
		5	E	54	50	44	33	41	28	I/A	
		6	E	66	53	48	36	44	30	I/A	
Evening 2 28/3/2023 19:41 2.7 – 3 m/s NE 21°C 3029485	35 dBA L _{Aeq} (15minute)	1	E	50	47	44	37	41	34	N/M	Site Related Noise Events: Dozer operations 20-25 Main exhaust vent fan 25-33 Other Noise Events: Traffic 40-50 Insects 36-40 Plane 41-47
		2	E	50	45	42	36	39	34	25 L _{Aeq}	
Night 2 28/3/2023 22:00 1.4 – 2.3 m/s SE 21-22°C 3029485	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	E	49	44	39	34	37	32	I/A	Site Related Noise Events: Dozer operations faintly audible Other Noise Events: Traffic 40-55 Insects 33-37 Plane 35-41 Animals 46-60
		2	E	60	47	41	33	38	31	I/A	
		3	E	54	48	44	32	40	30	N/M	
		4	E	48	41	36	32	34	30	N/M	

Note: N/M = Not Measurable, I/A = Inaudible

Table 10 Operator Attended EPL Noise Survey Results – N6 – Newhaven (Day 3)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 3 29/3/2023 07:08 0 – 1.2 m/s SSW 18-20°C 3029485	35 dBA L _{Aeq} (15minute)	1	D	52	48	45	36	41	33	I/A	Site Related Noise Events: Dozer operations faintly audible Other Noise Events: Train 47-50 Traffic 40-53 Birds 31-60 Animals 44-52
		2	D	58	49	44	35	41	32	I/A	
		3	E	52	46	41	33	38	30	N/M	
		4	E	55	47	40	34	38	31	I/A	
		5	D	60	49	42	33	39	30	I/A	
		6	E	53	48	44	34	40	30	I/A	
Evening 3 29/3/2023 19:43 2.1 – 2.4 m/s NW 19-20°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	50	43	41	39	40	38	30 L _{Aeq}	Site Related Noise Events: Main exhaust vent fan 28-40 Other Noise Events: Plane 40-45 Traffic 42-51 Insects 40-44 Birds 45-50 Dog 44-50 Train 46-53
		2	E	53	49	42	39	41	37	N/M	
Night 3 29/3/2023 23:25 0 – 2 m/s S 18-19°C 3029485	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	F	49	44	40	36	38	34	33 L _{Aeq} 38 L _{A1}	Site Related Noise Events: Main exhaust vent fan 27-38 Dozer operations 27-34 Onsite impact 40 Other Noise Events: Insects 36-39 Traffic 37-49 Impact 47 Bat 45-52
		2	F	43	38	37	35	36	34	29 L _{Aeq} 40 L _{A1}	
		3	G	43	40	38	35	36	33	29 L _{Aeq} 32 L _{A1}	
		4	G	52	38	37	35	36	33	29 L _{Aeq} 35 L _{A1}	

Note: N/M = Not Measurable, I/A = Inaudible

5.1.3 Operator Attended Noise Survey Results – EPL Monitoring Location N8

Results of the operator attended noise surveys at N8 are provided in **Table 11**, **Table 12** and **Table 13**. Monitoring location N8 represents residential receptors located to the southeast of the site in Haylin View.

Table 11 Operator Attended EPL Noise Survey Results – N8 – Haylin View (Day 1)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 1 28/3/2023 09:07 2.8 – 4.2 m/s SE 21-22°C 3004635	35 dBA L _{Aeq} (15minute)	1	D	52	46	44	39	41	36	39 L _{Aeq} ²	Site Related Noise Events: Dozer operations 30-42 Onsite construction activity 36-45 Other Noise Events: Traffic 43-64 Insects 44-52 Birds 42-67
		2	D	62	51	44	39	43	37	38 L _{Aeq} ²	
		3	D	54	43	40	36	39	34	35 L _{Aeq} ²	
		4	D	65	58	44	36	45	33	35 L _{Aeq} ²	
		5	D	68	48	40	35	41	31	N/M	
		6	D	52	46	41	36	39	33	N/M	
Evening 1 28/3/2023 20:46 3.4 – 4.2 m/s ENE 21°C 3004635	35 dBA L _{Aeq} (15minute)	1	E	50	46	45	36	42	33	I/A	Site Related Noise Events: Dozer operations 38-40 Other Noise Events: Traffic 36-50 Insects 40-43
		2	E	46	45	44	37	42	31	32 L _{Aeq}	
Night 1 28/3/2023 22:01 1.4 – 2.3 m/s SE 21-22°C 3004635	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	E	47	44	43	40	42	36	27 L _{Aeq} 30 L _{A1}	Site Related Noise Events: Dozer operations 25-30 Other Noise Events: Insects 32-62 Plane 43-44 Truck 32-43
		2	E	43	39	39	33	37	31	I/A	
		3	E	42	40	39	35	38	32	I/A	
		4	E	62	39	37	24	35	22	I/A	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable

Note 2: Noise levels dominated by a-typical construction activities occurring onsite.

Table 12 Operator Attended EPL Noise Survey Results – N8 – Haylin View (Day 2)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 2 29/3/2023 09:13 3.4 – 6 m/s NW 21-24°C 3004635	35 dBA L _{Aeq} (15minute)	1	E	61	50	39	34	39	32	33 L _{Aeq}	Site Related Noise Events: Onsite reversing alarm 37 Dozer operations 36-39 Other Noise Events: Traffic 30-49 Birds 37-61 Wind 36-40 Plane 49-51
		2	E	50	42	39	35	37	32	N/M	
		3	D	58	51	43	34	41	30	32 L _{Aeq}	
		4	D	56	46	42	32	38	30	N/M	
		5	D	61	51	45	35	42	32	N/M	
		6	C	59	48	44	35	41	32	I/A	
Evening 2 29/3/2023 20:45 0 m/s Calm 19.6°C 3004635	35 dBA L _{Aeq} (15minute)	1	E	52	41	37	33	35	31	32 L _{Aeq}	Site Related Noise Events: Dozer operations 34-43 Onsite impact 52 Other Noise Events: Insects 32-52 Birds 32-38
		2	F	52	42	37	34	36	31	28 L _{Aeq}	
Night 2 29/3/2023 22:00 1 – 2.3 m/s WSW 19-20°C 3004635	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	G	43	38	37	34	35	32	31 L _{Aeq} 36 L _{A1}	Site Related Noise Events: Dozer operations 30-38 Other Noise Events: Plane 36-42 Insects 30-48 Birds 40-42 Traffic 43-47 Cow 30-32
		2	G	47	41	36	33	35	30	32 L _{Aeq} 36 L _{A1}	
		3	F	45	40	34	30	32	28	30 L _{Aeq} 34 L _{A1}	
		4	F	48	49	37	30	35	27	33 L _{Aeq} 38 L _{A1}	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

Table 13 Operator Attended EPL Noise Survey Results – N8 – Haylin View (Day 3)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 3 30/3/2023 10:46 3.3 – 4.1 m/s SW 20-21°C 3004635	35 dBA L _{Aeq} (15minute)	1	A	66	49	41	30	40	27	I/A	Site Related Noise Events: Inaudible Other Noise Events: Birds 40-65 Wind 38-57 Insects 35-51 Traffic 30-44 Plane 54-56
		2	B	58	44	40	31	37	27	I/A	
		3	A	52	45	40	31	37	27	I/A	
		4	C	56	50	42	31	39	28	I/A	
		5	B	53	44	39	30	36	26	I/A	
		6	A	57	50	44	32	40	28	I/A	
Evening 3 30/3/2023 20:34 2.6 – 2.7 m/s SW 18°C 3004635	35 dBA L _{Aeq} (15minute)	1	F	56	33	28	24	28	23	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 28-53 Traffic 26-39 Impact 54-56
		2	F	39	32	31	27	30	24	I/A	
Night 3 30/3/2023 22:00 2.5 – 2.9 m/s SSW 17-18°C 3004635	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	F	42	36	32	27	30	24	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 27-32 Birds 34-42 Plane 51-53
		2	F	53	48	36	27	35	24	I/A	
		3	F	51	46	32	26	33	22	I/A	
		4	F	40	30	28	25	27	21	I/A	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

5.1.4 Operator Attended Noise Survey Results – EPL Monitoring Location N9

Results of the operator attended noise surveys at N9 are provided in **Table 14**, **Table 15** and **Table 16**. Monitoring location N9 represents residential receptors located to the northwest of the site in High Range.

Table 14 Operator Attended EPL Noise Survey Results – N9 – High Range (Day 1)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 1 28/3/2023 07:04 1.3 – 1.7 m/s SSE 20-21°C 3004635	35 dBA L _{Aeq} (15minute)	1	F	75	57	49	34	49	26	I/A	Site Related Noise Events: Inaudible Other Noise Events: Birds 45-75 Dogs 44-58 Traffic 38-50
		2	F	69	63	49	37	49	31	I/A	
		3	F	58	52	48	37	44	33	I/A	
		4	E	62	53	44	34	43	29	I/A	
		5	E	60	49	44	34	40	30	I/A	
		6	E	68	52	45	36	43	31	I/A	
Evening 1 28/3/2023 19:38 2.1 – 2.7 m/s ENE 21-22°C 3004635	35 dBA L _{Aeq} (15minute)	1	D	51	43	39	32	41	34	I/A	Site Related Noise Events: Dozer operations 30-36 Other Noise Events: Traffic 30-42 Plane 38-43 Insects 44-52 Sheep 35-38
		2	E	52	41	38	31	45	33	32 L _{Aeq}	
Night 1 28/3/2023 23:35 2.2 – 3.4 m/s SE 20-21°C 3004635	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	E	49	42	37	28	34	26	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 26-52 Dogs 49 Traffic 32-52
		2	E	53	37	32	29	31	27	I/A	
		3	E	45	47	32	29	31	27	I/A	
		4	E	53	53	43	30	39	27	I/A	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

Table 15 Operator Attended EPL Noise Survey Results – N9 – High Range (Day 2)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 2 29/3/2023 07:12 0 – 1.2 m/s SSW 19-20°C 3004635	35 dBA L _{Aeq} (15minute)	1	D	88	53	47	35	55	31	I/A	Site Related Noise Events: Inaudible Other Noise Events: Birds 40-88 Insect 34-57 Traffic 30-53 Sheep 35-39
		2	D	70	58	43	33	46	29	I/A	
		3	E	67	54	44	32	42	30	I/A	
		4	E	66	53	43	30	42	28	I/A	
		5	D	62	47	38	31	39	28	I/A	
		6	E	59	46	41	30	38	27	I/A	
Evening 2 29/3/2023 19:42 2.1 – 2.4 m/s NW 19-20°C 3004635	35 dBA L _{Aeq} (15minute)	1	F	59	50	49	37	44	32	34 L _{Aeq}	Site Related Noise Events: Main exhaust vent fan 30-36 Other Noise Events: Insects 40-55 Traffic 40-49 Sheep 45-47 Bird 47-49
		2	E	56	47	44	38	42	34	31 L _{Aeq}	
Night 2 29/3/2023 23:22 0 – 1.9 m/s SW 18-19°C 3004635	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	F	56	49	38	32	37	28	29 L _{Aeq} 34 L _{A1}	Site Related Noise Events: Dozer operations 33-38 Other Noise Events: Insects 32-56 Birds 38-42 Traffic 30-47 Plane 36-40
		2	F	52	49	40	31	38	28	N/M	
		3	G	52	50	47	31	41	29	N/M	
		4	G	48	47	44	30	38	28	I/A	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

Table 16 Operator Attended EPL Noise Survey Results – N9 – High Range (Day 3)

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 3 30/3/2023 08:54 2.2 – 3.2 m/s SW 19-20°C 3004635	35 dBA L _{Aeq} (15minute)	1	E	70	59	39	26	45	23	26 L _{Aeq}	Site Related Noise Events: Main exhaust vent fan 25-30 Other Noise Events: Traffic 27-38 Birds 40-77 Insects 30-46 Wind 30-32 Plane 70-73
		2	D	77	46	36	25	48	22	N/M	
		3	D	54	44	35	29	34	26	I/A	
		4	D	67	47	34	28	37	26	I/A	
		5	D	56	44	35	27	34	23	I/A	
		6	A	73	57	43	26	45	23	I/A	
Evening 3 30/3/2023 07:40 2.2 – 2.4 m/s SW 18-19°C 3004635	35 dBA L _{Aeq} (15minute)	1	F	47	45	44	28	40	24	25 L _{Aeq}	Site Related Noise Events: Main exhaust vent fan 25-30 Other Noise Events: Insects 38-46 Traffic 33-44 Sheep 38-40 Plane 42-44 Birds 46-47
		2	F	47	45	43	26	37	24	N/M	
Night 3 30/3/2023 23:24 1.7 – 3.8 m/s S 16-17°C 3004635	35 dBA L _{Aeq} (15minute) 45 dBA L _{A1} (1minute)	1	F	52	51	47	26	41	23	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 38-54 Traffic 30-51 Dogs 43-52 Sheep 30-34
		2	F	53	52	47	27	42	26	I/A	
		3	F	53	52	51	26	44	24	I/A	
		4	F	54	51	49	24	42	22	I/A	

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable.

5.1.5 Operator Attended Noise Survey Results – NMP Monitoring Location N1 (Bow Hills)

Results of the operator attended noise surveys at N1 are provided in **Table 17**. Monitoring location N1 represents residential receptors located to the east of the site in Bow Hills.

Table 17 Operator Attended NMP Noise Survey Results – N1 – Bow Hills

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 28/3/2023 08:50 3.2 m/s SE 22°C 3029485	35 dBA L _{Aeq} (15minute)	1	E	57	53	49	40	46	34	I/A	Site Related Noise Events: Inaudible Other Noise Events: Roadworks 40-48 Traffic 50-57 Birds 53-56
Evening 27/3/2023 21:30 1.1 m/s SE 24°C 3004635	35 dBA L _{Aeq} (15minute)	1	F	62	51	45	32	41	28	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 40-62 Traffic 46-54
Night 27/3/2023 22:03 2.2 m/s SE 23.5°C 3004635	35 dBA L _{Aeq} (15minute)	1	E	56	49	44	34	40	27	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 38-44 Traffic 45-56 Plane 50-55

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: A private agreement between NCOPL and the residents of N1 Bow Hills of 50 dBA L_{Aeq}(15minute) is in place. This new level of 50 dBA L_{Aeq}(15minute) replaces the levels identified in Conditions 1-3, Schedule 4 of PA 08_0144 Mod 2 and the identical limits contained in condition L3 of Environment Protection Licence No 1278

5.1.6 Operator Attended Noise Survey Results – NMP Monitoring Location N3 (Ardmona)

Results of the operator attended noise surveys at N3 are provided in **Table 18**. Monitoring location N3 represents residential receptors located to the southeast of the site in Ardmona.

Table 18 Operator Attended NMP Noise Survey Results – N3 – Ardmona

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 30/3/2023 09:26 2.9 m/s SW 19.5°C 3029485	35 dBA L _{Aeq} (15minute)	1	D	86	80	70	37	67	30	27 L _{Aeq}	Site Related Noise Events: Dozer operations 27-29 Other Noise Events: Traffic 79-86 Birds 61 Train 74 Road Works 55-60
Evening 30/3/2023 20:07 2.2 m/s SW 18.4°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	93	83	67	38	69	33	N/M	Site Related Noise Events: Dozer operations faintly audible Other Noise Events: Traffic 77-90 Insects 33-36
Night 30/3/2023 23:02 3.0 m/s S 17.5°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	87	74	54	29	62	27	25 L _{Aeq} 29 L _{A1}	Site Related Noise Events: Dozer operations 21-29 Other Noise Events: Insects 30-33 Traffic 80-87

Note: N/M = Not Measurable, I/A = Inaudible

5.1.7 Operator Attended Noise Survey Results – NMP Monitoring Location N7 (Merriman)

Results of the operator attended noise surveys at N7 are provided in **Table 19**. Monitoring location N7 represents residential receptors located to the northeast of the site in Merriman.

Table 19 Operator Attended NMP Noise Survey Results – N7 – Merriman

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 30/3/2023 08:57 2.2 m/s SW 19°C 3029485	35 dBA L _{Aeq} (15minute)	1	D	65	47	41	34	40	31	30 L _{Aeq}	Site Related Noise Events: Dozer operations 27-35 Other Noise Events: Traffic 39-44 Birds 60-65 Dog 40-45
Evening 30/3/2023 19:41 2.4 m/s SW 18.8°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	66	57	51	37	47	33	29 L _{Aeq}	Site Related Noise Events: Dozer operations 28-32 Other Noise Events: Traffic 50-59 Insects 35-38 Resident Car 47-50 Dog 50-66
Night 30/3/2023 23:38 2.7 m/s S 16.8°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	65	54	45	35	43	32	33 L _{Aeq} 41 L _{A1}	Site Related Noise Events: Dozer operations 30-41 Other Noise Events: Traffic 51-55 Bats 51 Dog 60-65

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable

5.1.8 Operator Attended Noise Survey Results – NMP Monitoring Location N8_(NMP) (Matilda)

Results of the operator attended noise surveys at N8_(NMP) are provided in **Table 20**. Monitoring location N8_(NMP) represents residential receptors located to the south of the site in Matilda.

Table 20 Operator Attended NMP Noise Survey Results – N8 – Matilda

Period Date/Start Time Weather SLM Details	Criteria ¹	Measurement Number	Stability Category	Primary Noise Descriptor						Narrabri Mine Contribution, (dB)	Description
				L _{Amax} (dB)	L _{A1} (dB)	L _{A10} (dB)	L _{A90} (dB)	L _{Aeq} (dB)	L _{Amin} (dB)		
Day 27/3/2023 16:24 2.4 m/s WSW 29.5°C 3029485	35 dBA L _{Aeq} (15minute)	1	B	54	42	35	29	33	27	25 L _{Aeq}	Site Related Noise Events: Dozer operations 25-27 Other Noise Events: Wind 35-40 Birds 41 Farming 40-43 Ute 50-54
Evening 27/3/2023 21:23 1.1 m/s SE 23.8°C 3029485	35 dBA L _{Aeq} (15minute)	1	F	45	45	44	40	42	30	25 L _{Aeq}	Site Related Noise Events: Dozer operations 25-27 Other Noise Events: Traffic 38-42 Insects 40-43 Plane 40-44 Animals 43-45
Night 27/3/2023 22:01 2.2 m/s SE 23.5°C 3029485	35 dBA L _{Aeq} (15minute)	1	E	54	48	45	38	43	35	I/A	Site Related Noise Events: Inaudible Other Noise Events: Insects 40-45 Traffic 38-41 Animals 40-49 Plane 47-54

Note: N/M = Not Measurable, I/A = Inaudible

Note 1: Mine owned receiver – criteria not applicable

6 Conclusion

SLR was engaged by Narrabri Coal Operations Pty Ltd to conduct attended noise monitoring for the Narrabri Mine in accordance with the Narrabri Mines' Noise Management Plan, Environment Protection Licence and Project Approval.

Operator attended noise monitoring was conducted at eight locations in order to determine the noise performance of the Narrabri Mine, with compliance achieved at all privately owned receiver locations.

APPENDIX A

Acoustic Terminology

Sound Level or Noise Level

The terms “sound” and “noise” are almost interchangeable, except that in common usage “noise” is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 “A” Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an “A-weighting” filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	Loud
80	Kerbside of busy street	
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as “linear”, and the units are expressed as dB(lin) or dB.

3 Sound Power Level

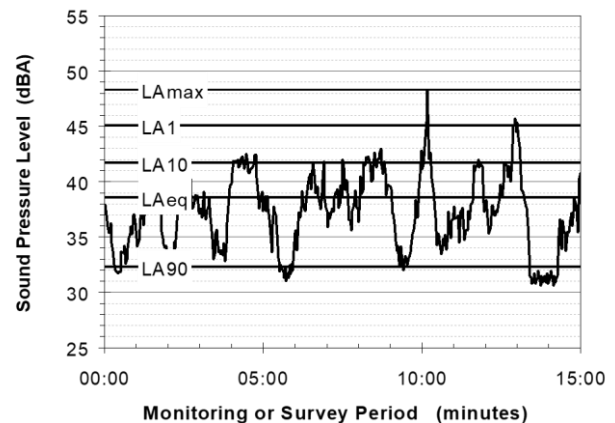
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

- LA1 The noise level exceeded for 1% of the 15 minute interval.
- LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.
- LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.
- LAeq The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the “repeatable minimum” LA90 noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or “average” levels representative of the other descriptors (LAeq, LA10, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than “broad band” noise. 7. Impulsiveness

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

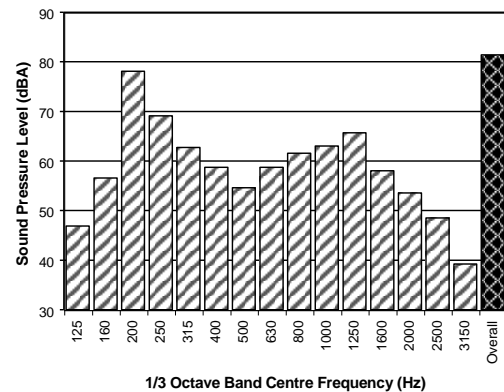
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



APPENDIX B

Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE No: SLM31777

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: B&K

Type No: 2270

Serial No: 3029485

Mic. Type: 4189

Serial No: 3260622

Pre-Amp. Type: ZC0032

Serial No: 30123

Filter Type: 1/3 Octave

Test No: F031778

Owner: SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Ambient Pressure 1007 hPa ± 1 hPa

Date of Receipt: 15/02/2022


Temperature 25 $^{\circ}\text{C} \pm 1^{\circ}\text{C}$


Date of Calibration: 16/02/2022

Relative Humidity 55 % $\pm 5\%$

Date of Issue: 16/02/2022

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: 

AUTHORISED SIGNATURE: 

John Doe

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.

This report applies only to the item identified in the report and may not be reproduced in part.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



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The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	Clause	Result
<i>Absolute Calibration</i>	10	Pass
<i>Acoustical Frequency Weighting</i>	12	Pass
<i>Self-Generated Noise</i>	11.1	Observed
<i>Electrical Noise</i>	11.2	Observed
<i>Long Term Stability</i>	15	Pass
<i>Electrical Frequency Weightings</i>	13	Pass
<i>Frequency and Time Weightings</i>	14	Pass
<i>Reference Level Linearity</i>	16	Pass
<i>Range Level Linearity</i>	17	Not Applicable
<i>Toneburst</i>	18	Pass
<i>Peak C Sound Level</i>	19	Pass
<i>Overload Indicator</i>	20	Pass
<i>High Level Stability</i>	21	Pass

Statement of Compliance: The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:-2013, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:-2013 because evidence was not publically available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:-2013 and because the periodic tests of IEC 61672-3:-2013 cover only a limited subset of the specifications in IEC 61672-1:-2013.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:

Tests performed	Clause	Result
<i>Test of relative attenuation at filter midband frequency</i>	10	N/A
<i>Linear operating range including range control if fitted</i>	11	Pass
<i>Test of lower limit of linear operating range</i>	12	Pass
<i>Measurement of relative attenuation (filter shape)</i>	13	Pass

The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

A full technical report is available on request.

CERTIFICATE OF CALIBRATION

Certificate No: CAU2200657

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CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	No: 3004635
Microphone:	Brüel & Kjær	4950	No: 3177885
Preamplifier:	Brüel & Kjær	ZC-0032	No: 20462
Supplied Calibrator:	None	None	No: N/A
Software version:	BZ7133 Version 4.7.5	Pattern Approval:	PTB
Instruction manual:	BE1853-11	Identification:	N/A

CUSTOMER:

SLR Consulting Australia Pty Ltd
202 Submarine School, Sub Base Platypus
North Sydney NSW 2060

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 °C
Environment conditions: see actual values in **Environmental conditions** sections

SPECIFICATIONS:

The Sound Level Meter has been calibrated in accordance with the requirements as specified in IEC61672-1:2013 class 1. Procedures from IEC 61672-3:2013 were used to perform the periodic tests.
The measurements included in this document are traceable to Australian/National standards.

PROCEDURE:

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System B&K 3630 with application software type 7763 (version 8.3 - DB: 8.30) and test procedure 2250-L-4950.

RESULTS:

	Initial calibration		Calibration prior to repair/adjustment
X	Calibration without repair/adjustment		Calibration after repair/adjustment

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of Calibration: 28/09/2022

Certificate issued: 04/10/2022



Sajeeb Tharayil
Calibration Technician



Craig Robert Patrick
Approved signatory

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Summary

Preliminary inspection	<u>Passed</u>
Environmental conditions, Prior to calibration	<u>Passed</u>
Reference information	<u>Passed</u>
Indication at the calibration check frequency	<u>Passed</u>
Acoustical signal tests of a frequency weighting, C weighting	<u>Passed</u>
Self-generated noise, Microphone installed	<u>Passed</u>
Self-generated noise, Electrical	<u>Passed</u>
Electrical signal tests of frequency weightings, A weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, C weighting	<u>Passed</u>
Electrical signal tests of frequency weightings, Z weighting	<u>Passed</u>
Frequency and time weightings at 1 kHz	<u>Passed</u>
Long-term stability, Reference	<u>Passed</u>
Level linearity on the reference level range, Upper	<u>Passed</u>
Level linearity on the reference level range, Lower	<u>Passed</u>
Toneburst response, Time-weighting Fast	<u>Passed</u>
Toneburst response, Time-weighting Slow	<u>Passed</u>
Toneburst response, LAE	<u>Passed</u>
C-weighted peak sound level, 8 kHz	<u>Passed</u>
C-weighted peak sound level, 500 Hz	<u>Passed</u>
Overload indication	<u>Passed</u>
Long-term stability, 1. relative	<u>Passed</u>
High-level stability	<u>Passed</u>
Long-term stability, 2. relative	<u>Passed</u>
Environmental conditions, Following calibration	<u>Passed</u>

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Conformance to a performance specification is demonstrated when the following criteria are both satisfied: (a) a measured deviation from a design goal does not exceed the applicable acceptance limit and (b) the corresponding uncertainty of measurement does not exceed the corresponding maximum-permitted uncertainty of measurement given in IEC 61672-1:2013 for the same coverage probability of 95 %.

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