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Holcim (Australia) Pty Ltd

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Report

Date
May 2024

Lynwood Quarry Quarterly Noise Monitoring Assessment

Quarter 1 2024

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Lynwood Quarry Quarterly Noise Monitoring Assessment

Quarter 1 2024

Project name	**NSW Environmental Monitoring 2023-2024**
Project no.	**318001799**
Recipient	**Wayne Beattie**
Document type	**Report**
Version	**1**
Date	**06/05/2024**
Prepared by	**Jake Bourke, Matilda Englert**
Checked by	**Arnold Cho**
Approved by	**Belinda Sinclair**
Description	**Data collected on 22 and 23 of January and 6 March 2024 for the quarterly period ending March 2024 at Marulan, NSW, as part of the noise monitoring program**

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Contents

Appendices

Abbreviations and Definitions

Ambient Noise	The all-encompassing noise within a given environment. It is the composite of sounds from many sources, both near and far.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor (see below).
dB	Abbreviation for decibel, a measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm of a given sound power to a reference power.
dB(A)	A measure of A-weighted sound levels. A Weighting is an adjustment made to the sound level measurement to approximate the response of the human ear.
Extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods. Normal daily traffic is not extraneous noise.
LA1	The noise level, measured in dB(A), which is exceeded for 1 per cent of the measurement period.
LA1(1min)	The noise level, measured in dB(A), which is exceeded for 1 per cent of the time over a 1-minute measurement period, i.e., is exceeded for 0.6 seconds. This measure can approximate to the maximum noise level but may be less if there is more than 1 noise event during this 0.6 second period.
LA10	The noise level, measured in dB(A), which is exceeded for 10 per cent of the time.
LA90	The noise level, measured in dB(A), which is exceeded for 90 per cent of the time, referred to as the background noise level. This is considered to represent the background noise (see above).
LAeq	The level of noise equivalent to the energy average of noise levels occurring over a defined measurement period.
LAeq (period)	The average equivalent noise level, measured in dB(A), during a measurement period (e.g., 15-minute, day, evening, or night).
LAmax	The A-weighted sound pressure level that represents the maximum noise level measured over the time that a given sound is measured.
NMA	Noise Monitoring Assessment
NMP	Noise Management Plan
SPL	The Sound Pressure Level. Sound pressure is the fluctuation in air pressure, from the steady atmospheric pressure, created by sound. The sound pressure level is the sound pressure expressed on a decibel scale.

Source: Noise Guide for Local Government (NSW EPA, 2023)

1. Overview

1.1 Project Driver

Ramboll Australia Pty Ltd (Ramboll) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry ("the quarry") at Marulan, NSW.

This NMA was done in accordance with the following documents:

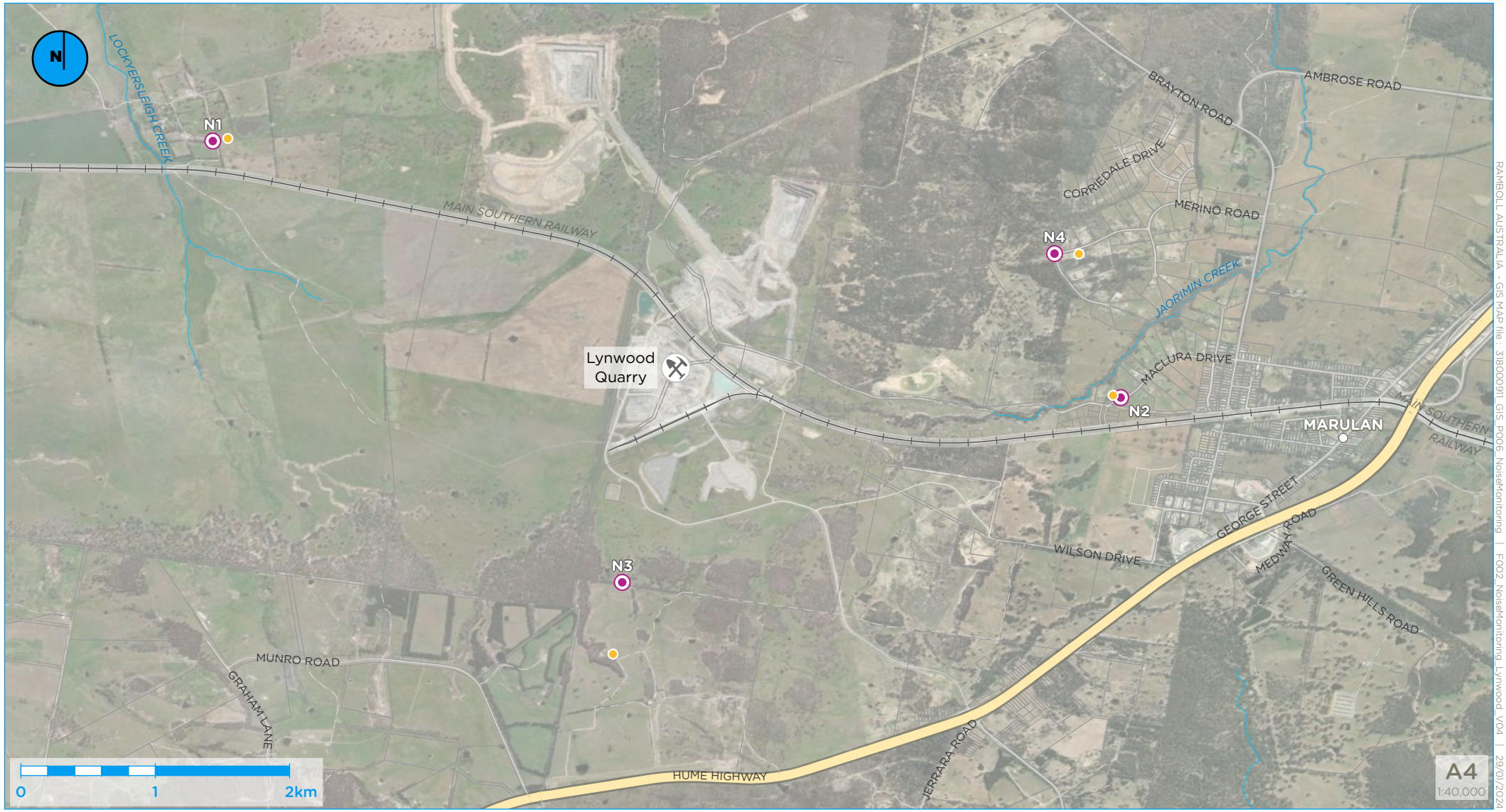
- Noise Policy for Industry (NPfI) (NSW EPA, 2017).
- Lynwood Quarry Noise Management Plan (NMP) (Holcim Australia, 2019).
- Environment Protection Licence (EPL) number 12939 (NSW EPA, 2021).
- Development Consent DA 128-5-2005 (Minister for Planning, 2017).
- Australian Standard AS 1055:2018 Acoustics — Description and measurement of environmental noise (Standards Australia, 2018).
- IEC 60942 Ed. 3.0 b:2003 Electroacoustics - Sound calibrators (Standards Australia, 2003).

This NMA has been undertaken for the quarterly period January to March 2024, and forms part of the monitoring program to determine compliance with conditions of the Development Consent.

1.2 Site Location and Sensitive Receptors

The quarry is located at 278 Stoney Creek Road, approximately 4 km to the west of the Marulan railway station and town centre. Sensitive receptors surrounding the quarry are primarily rural and residential (to the west of the site). The Hume Highway is located to the east and south of the quarry. Highway traffic (Hume Highway) is a dominant noise source.

The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1**.



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Legend

- Noise monitoring location
- Residence/noise assessment location

Figure 1 : Noise monitoring locations at Lynwood Quarry

2. Noise Criteria

Table 2-1 includes the applicable noise criteria outlined in the Development Consent and the EPL for the 16 residential receivers surrounding the quarry (L1–L16), and the four monitoring locations adopted from the NMP that are deemed representative and applicable for this NMA (N1–N4). It should be noted that the original location of N3 (on the northern boundary of 16038 Hume Highway, Marulan) continues to be inaccessible and as such N3 has been relocated to a nearby residential receiver approximately 900 m to the west on Munro Road, Marulan (**Figure 1**) where all future monitoring will take place. This revised location is deemed representative and applicable for this NMA.

Table 2-1: Monitoring locations and noise criteria

EPL ID	Receiver Description	Monitoring Locations		Day[1]	Evening[2]	Night[3]	Night[3]
		NMP ID	Address	LAeq (15min)	LAeq (15min)	LAeq (15min)	LA1 (1min)
				dBA			
L1	West of the Granite Pit.	N1	1114 Carrick Road, Marulan	35	35	35	45
L2	Northeast of the site	-	-	35	35	35	45
L3	Northeast of the site	-	-	35	35	35	45
L4	East of the site in Marulan	-	-	35	37	35	46
L5	East of the site in Marulan	-	-	35	35	35	46
L6	East of the site in Marulan	N2	End of Maclura Drive, Marulan	35	37	36	46
L7	East of the site in Marulan	-	-	38	38	35	55
L8	East of the site in Marulan	-	-	39	38	36	55
L9	East of the site in Marulan	-	-	39	39	37	56
L10	Southeast of the site in Old Marulan	-	-	42	42	40	53
L11	South of the site	N3	Off Marulan South Road, near DD8	35	35	36	47
L12	East of the site in Marulan	N4	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47
L13	East of the site in Marulan	-	-	40	38	37	47
L14	South of the site	-	-	35	35	35	47
L15	South of the site	-	-	35	35	35	47
L16	Northeast of the site	-	-	35	35	35	45

[1] 7 am–6 pm Monday to Saturday and 8 am–6 pm Sunday and public holidays

[2] 6 pm–10 pm Monday to Sunday

[3] 10 pm–7 am Monday to Saturday and 10 pm–8 am Sunday and public holidays

3. Methodology

The monitoring program was designed in accordance with the procedures described in Australian Standard AS 1055:2018 and the Approval Documents referenced in Section 1. The measurements were carried out using a RION Sound Level Meter NL-52 on Monday 22 January, Tuesday 23 January and Wednesday 6 March 2024. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672-1:2013/2002 class 1. Calibration of all instrumentation was checked prior to and following measurements using a Pulsar Acoustic Calibrator 105 which carried a current NATA calibration and complies with IEC 60942:2003. Drift in calibration did not exceed ±0.3 dBA.

Attended noise monitoring was conducted for 15-minutes in duration during the day, evening, and night periods over three days. Where possible, throughout each measurement the operator quantified the contribution of each significant noise source.

Where the quarry was not distinctly audible during the attended monitoring, the quarry contribution is estimated to be at least 10 dBA below the ambient noise level, as determined by the LA90.

3.1 Meteorological Conditions

Meterology has an important influence on noise monitoring assessment. Where an onsite meterological station with data recorded at 10m height has not been available, the nearest Bureau of Meteorology data has been adopted to inform this assessment and modelled using The Air Pollution Model (TAPM) to determine the atmospheric stability category as outline in **Table 3-1.**

Table 3-1: Classification of Atmospheric Stability (NSW EPA, 2014)

Stability Classification	Pasquill Stability Category	Ambient temperature change with height (°C/100m)
Extremely unstable	A	$\Delta T \leq -1.9$
Moderately unstable	B	$-1.9 < \Delta T \leq -1.7$
Slightly unstable	C	$-1.7 < \Delta T \leq -1.5$
Neutral	D	$-1.5 < \Delta T \leq -0.5$
Slightly stable	E	$-0.5 < \Delta T \leq 1.5$
Moderately stable	F	$1.5 < \Delta T \leq 4.0$
Extremely stable	G	$\Delta T > 4.0$

As stated in the Development Consent, the noise criteria in **Table 2-1** applies under all meteorological conditions except the following:

- Monitoring locations for the collection of representative noise data
- Wind speeds greater than 3 m/s at 10 metres above ground level
- Stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level
- Stability category G temperature inversion conditions.

Appendix 10 of the Development Consent also specifies that except for wind speed at microphone height, the data to be used for determing meterological conditons must be that recorded by a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.

4. Results and Discussion

4.1 Location N1

Noise monitoring at location N1 was conducted on Monday 22 January, Tuesday 23 January and Wednesday 6 March 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods, with the ambient noise environment dominated by birds, insects, trees/wind, motorway hum, dogs, and horses in surrounding paddocks. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N1 are presented in **Table 4-1**.

Table 4-1: Noise survey results and observations for Location N1

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LA1	LAeq	LA90							
23-01-24	7:00am to 7:15am (Day)	51.5	40.0	29.0	WD: n/a WS: 0 m/s Rain: Nil	WD: 146° WS: 1.3 m/s Rain: nil Stability Category: D[1]	Insects 25-31 Birds 33-56 Quarry inaudible	<19	35	n/a	n/a
22-01-24	6:03pm to 6:18pm (Evening)	52.2	43.6	38.6	WD: 271° WS: 0.5 m/s Rain: Nil	WD: 117° WS: 3.8 m/s Rain: nil Stability Category: D[1]	Wind/trees 35-48 Birds 39-53 Dogs 40-61 Quarry inaudible	<29	35	n/a	n/a
06-03-24	6:23am to 6:42am (Night)	41.9	32.4	28.3	WD: n/a WS: 0 m/s Rain: Nil	WD: 319° WS: 7.2 m/s Rain: nil Stability Category: E[1]	Motorway hum 26 Birds 40-47 Horses galloping 44-45 Quarry inaudible	<18	35	<42	45

[1] Temperature data modelled using TAPM to determine Stability Category.

4.2 Location N2

Noise monitoring at location N2 was conducted on Monday 22 January and Tuesday 23 January 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods, with the ambient noise environment dominated by motorway traffic, birds, and a passing train. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N2 are presented in **Table 4-2**.

Table 4-2 Noise survey results and observations for Location N2

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
23-01-24	8:43am to 8:58am (Day)	47.1	40.2	37.3	WD: n/a WS: 0 m/s Rain: Nil	WD: 143° WS: 1.2 m/s Rain: nil Stability Category: D[1]	Background motorway 34-40 Birds 40-53 Quarry inaudible	<27	35	n/a	n/a
22-01-24	7:06pm to 7:21pm (Evening)	49.0	43.6	40.5	WD: 233 WS: 0.6 m/s Rain: Nil	WD: 93° WS: 1.8 m/s Rain: nil Stability Category: D[1]	Background motorway 37-44 Birds 40-54 Train 49-53 Quarry inaudible	<31	37	n/a	n/a
23-01-24	6:00am to 6:15am (Night)	44.8	39.8	36.9	WD: n/a WS: 0 m/s Rain: Nil	WD: 150° WS: 0.5 m/s Rain: nil Stability Category: E[1]	Background motorway 33-41 Birds 39-55 Quarry inaudible	<27	36	<45	46

[1] Temperature data modelled using TAPM to determine Stability Category.

4.3 Location N3

Noise monitoring at location N3 was conducted on Monday 22 January, Tuesday 23 January and Wednesday 6 March 2024. Noise from the quarry was inaudible during the day and evening monitoring periods. Audible quarry noise was identified during the night period. Site vehicles on the quarry entrance road were observed and measured during the night monitoring period for up to twelve seconds on three occasions, however, noise emission is below the 15min LAeq criteria using sound level exposure calculations also included in **Appendix 1**. The ambient noise environment was dominated by motorway traffic and birds. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N3 are presented in **Table 4-3**.

Table 4-3: Noise survey results and observations for Location N3

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
23-01-24	9:16am to 9:31am (Day)	41.4	36.7	34.2	WD: n/a WS: 0 m/s Rain: Nil	WD: 165° WS: 1.3 m/s Rain: nil Stability Category: D[1]	Motorway hum 32-35 Birds 33-59 Quarry inaudible	<24	35	n/a	n/a
22-01-24	7:35pm to 7:50pm (Evening)	48.0	39.9	35.8	WD: n/a WS: 0 m/s Rain: Nil	WD: 108° WS: 2.1 m/s Rain: nil Stability Category: E[1]	Motorway hum 33-39 Birds 36-61 Quarry inaudible	<26	35	n/a	n/a
06-03-24	5:37am to 5:52am (Night)	48.4	40.4	36.7	WD: n/a WS: 0 m/s Rain: Nil	WD: 343° WS: 4.6 m/s Rain: nil Stability Category: E[1]	Motorway hum 33-38 Birds 40-54 Holcim vehicles on quarry entrance road 37-43 (occurred 3 times for 10-12 seconds each) Quarry audible	<29[2]	<36	<48[3]	47

[1] Temperature data modelled using TAPM to determine Stability Category.

[2] value estimated based on sound exposure level calculation in **Appendix 1**.

[3] Measured LA1 was dominated by background motorway traffic and birds.

4.4 Location N4

Noise monitoring at location N4 was conducted on Monday 22 January and Tuesday 23 January 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods, with the ambient noise environment dominated by motorway traffic, wind, trees, and birds. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at location N4 are presented in **Table 4-4**.

Table 4-4: Noise survey results and observations for Location N4

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
23-01-24	8:27am to 8:42am (Day)	45.3	38.2	33.9	WD: n/a WS: 0 m/s Rain: Nil	WD: 143° WS: 1.2 m/s Rain: nil Stability Category: E[1]	Motorway 31-36 Birds 40-57 Quarry inaudible	<24	37	n/a	n/a
22-01-24	6:40pm to 6:55pm (Evening)	46.3	40.9	37.8	WD: 233 WS: 0.7 m/s Rain: Nil	WD: 107° WS: 2.1 m/s Rain: nil Stability Category: D[1]	Wind/trees/motorway 34-40 Birds 41-44 Quarry inaudible	<28	37	n/a	n/a
23-01-24	6:35am to 6:50am (Night)	43.6	37.8	34.8	WD: n/a WS: 0 m/s Rain: Nil	WD: 163° WS: 0.9 m/s Rain: nil Stability Category: E[1]	Motorway 32-38 Birds 40-55 Quarry inaudible	<25	36	<47	47

[1] Temperature data modelled using TAPM to determine Stability Category.

5. Conclusion

This NMA was completed by Ramboll at the Holcim Lynwood Quarry, Marulan, NSW as a quarterly requirement of the NMP. Monitoring was carried out on Monday 22 January, Tuesday 23 January and Wednesday 6 March 2024 at four locations selected as representative to the sensitive receptors at the surroundings to Lynwood Quarry. No audible noise from quarry operations was recorded at any of the four locations during the day, evening, and night periods. The LA1 quarry contribution also exceeded the LA1(1min) (dBA) criteria for N3 but it was noted that LA1 was dominated by birds and road traffic at this location.

The results presented in this NMA show compliance with the relevant noise criteria at the Holcim Lynwood Quarry, Marulan, NSW, except for the night LA1 contribution at N3.

6. References

Holcim Australia (2019) *Lynwood Quarry, Noise Management Plan*.

Minister for Planning and Infrastructure (2005) 'Development Consent DA 128-5-2005, Lynwood Hard Rock Quarry, and associated infrastructure'.
NSW EPA (2021) Environment Protection Licence number 12939

NSW EPA (2013) *Noise Guide for Local Government*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/20130127nglg.pdf (Accessed: 25 October 2022).

NSW EPA (2014) Discussion Paper. Validation of Inversion Strength Estimation Method.

NSW EPA (2017) *Noise Policy for Industry (NPfI)*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/17p0524-noise-policy-for-industry.pdf (Accessed: 25 October 2022).

Standards Australia (2018) *AS 1055:2018 Acoustics—Description and measurement of environmental noise*. Australian Standard. Available at: https://infostore.saiglobal.com/preview/825367946534.pdf?sku=1131503_SAIG_AS_AS_2626154 (Accessed: 19 January 2023).

Standards Australia (2003) *AS 60942:2003 Electroacoustics - Sound calibrators.* Australian Standard.

Appendix 1
Sound Exposure Level Calculation

Project No: 318001799
Client Name: Holcim Australia Pty Ltd
Project Name: NSW Environmental Monitoring
Project Site: Lynwood Quarry
6/05/2024

Sound Exposure Level Calculation

RAMBOLL

N3 night monitoring period (5:37AM - 5:52AM)

Noise source	Holcim machinery
Meas. Dist from source (m)	-
Meas. Time (s)	12
Meas. LAeq dB	43
Calc Sel dB	**54**
No. Events in 15min	3
Total LAeq (15min)	**29**

Intended for
Holcim (Australia) Pty Ltd

Document type
Report

Date
July 2024

Lynwood Quarry Quarterly Noise Monitoring Assessment

Quarter 2 2024

RAMBOLL Bright ideas. Sustainable change.

Lynwood Quarry Quarterly Noise Monitoring Assessment
Quarter 2 2024

Project name	**NSW Environmental Monitoring 2023-2024**
Project no.	**318001799**
Recipient	**Wayne Beattie**
Document type	**Report**
Version	**1**
Date	**12/07/2024**
Prepared by	**Jake Bourke, Matilda Englert**
Checked by	**Arnold Cho**
Approved by	**Gavan Butterfield**
Description	**Data collected on 3, 4 and 19 June 2024 for the quarterly period ending June 2024 at Marulan, NSW, as part of the noise monitoring program**

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dB(A)	A measure of A-weighted sound levels. A Weighting is an adjustment made to the sound level measurement to approximate the response of the human ear.
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LA10	The noise level, measured in dB(A), which is exceeded for 10 per cent of the time.
LA90	The noise level, measured in dB(A), which is exceeded for 90 per cent of the time, referred to as the background noise level. This is considered to represent the background noise (see above).
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- Australian Standard AS 1055:2018 Acoustics — Description and measurement of environmental noise (Standards Australia, 2018).
- Australian Standard AS/NZS IEC 61672.1:2019 Electroacoustics – Sound level meters, Part 1: Specifications (Standards Australia and Standards New Zealand, 2019)
- IEC 60942:2017 Electroacoustics - Electroacoustics – Sound calibrators (International Standard, 2017).

This NMA has been undertaken for the quarterly period April to June 2024, and forms part of the monitoring program to determine compliance with conditions of the Development Consent.

1.2 Site Location and Sensitive Receptors

The quarry is located at 278 Stoney Creek Road, approximately 4 km to the west of the Marulan railway station and town centre. Sensitive receptors surrounding the quarry are primarily rural and residential (to the west of the site). The Hume Highway is located to the east and south of the quarry. Highway traffic (Hume Highway) is a dominant noise source.

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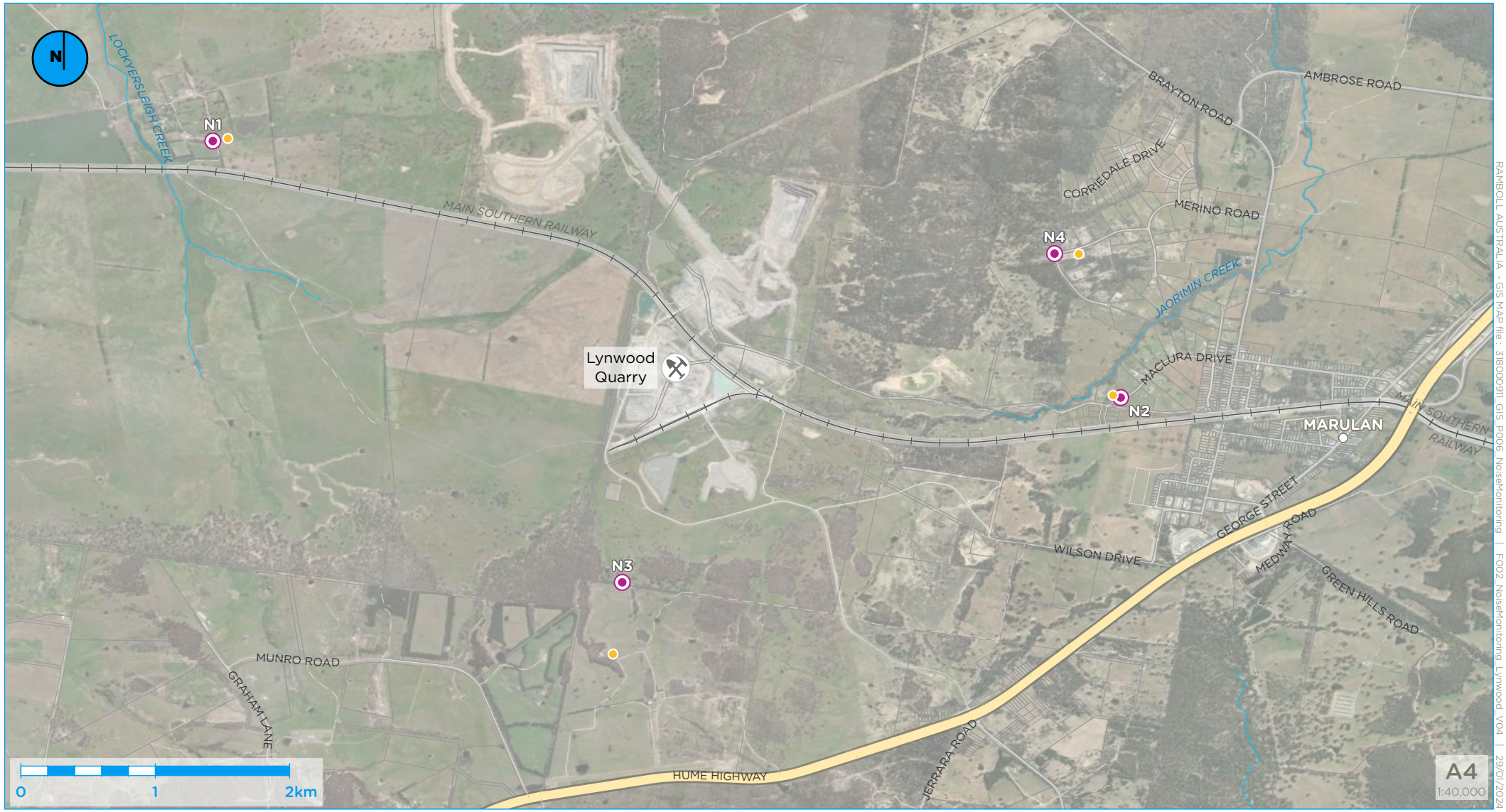

RAMBOLL AUSTRALIA - GIS MAP file: 318000911_GIS_P006_NoiseMonitoring | F002_NoiseMonitoring_Lynwood_V04 | 29/01/2024

Legend

- Noise monitoring location
- Residence/noise assessment location

Figure 1 : Noise monitoring locations at Lynwood Quarry

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Table 2-1: Monitoring locations and noise criteria

EPL ID	Receiver Description	Monitoring Locations		Day[1]	Evening[2]	Night[3]	Night[3]
		NMP ID	Address	LAeq (15min)	LAeq (15min)	LAeq (15min)	LA1 (1min)
				dBA			
L1	West of the Granite Pit.	N1	1114 Carrick Road, Marulan	35	35	35	45
L2	Northeast of the site	-	-	35	35	35	45
L3	Northeast of the site	-	-	35	35	35	45
L4	East of the site in Marulan	-	-	35	37	35	46
L5	East of the site in Marulan	-	-	35	35	35	46
L6	East of the site in Marulan	N2	End of Maclura Drive, Marulan	35	37	36	46
L7	East of the site in Marulan	-	-	38	38	35	55
L8	East of the site in Marulan	-	-	39	38	36	55
L9	East of the site in Marulan	-	-	39	39	37	56
L10	Southeast of the site in Old Marulan	-	-	42	42	40	53
L11	South of the site	N3	Off Marulan South Road, near DD8	35	35	36	47
L12	East of the site in Marulan	N4	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47
L13	East of the site in Marulan	-	-	40	38	37	47
L14	South of the site	-	-	35	35	35	47
L15	South of the site	-	-	35	35	35	47
L16	Northeast of the site	-	-	35	35	35	45

[1] 7 am–6 pm Monday to Saturday and 8 am–6 pm Sunday and public holidays

[2] 6 pm–10 pm Monday to Sunday

[3] 10 pm–7 am Monday to Saturday and 10 pm–8 am Sunday and public holidays

3. Methodology

The monitoring program was designed in accordance with the procedures described in Australian Standard AS 1055:2018 and the Approval Documents referenced in Section 1. The measurements were carried out using a RION Sound Level Meter NL-52 on Monday 3 June 2024, Tuesday 4 June 2024 and Wednesday 19 June 2024. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672-1:2019 class 1. Calibration of all instrumentation was checked prior to and following measurements using a Pulsar Acoustic Calibrator 105 which carried a current NATA calibration and complies with IEC 60942:2017. Drift in calibration did not exceed ±0.3 dBA.

Attended noise monitoring was conducted for 15-minutes in duration during the day, evening, and night periods over three days at each monitoring location. Where possible, throughout each measurement the operator quantified the contribution of each significant noise source.

Where the quarry was not distinctly audible during the attended monitoring, the quarry contribution is estimated to be at least 10 dBA below the ambient noise level, as determined by the LA90.

3.1 Meteorological Conditions

Meterology has an important influence on noise monitoring assessment. Where an onsite meterological station with data recorded at 10m height has not been available, the nearest Bureau of Meteorology data has been adopted to inform this assessment and modelled using The Air Pollution Model (TAPM) to determine the atmospheric stability category as outline in **Table 3-1.**

Table 3-1: Classification of Atmospheric Stability (NSW EPA, 2014)

Stability Classification	Pasquill Stability Category	Ambient temperature change with height (°C/100m)
Extremely unstable	A	$\Delta T \leq -1.9$
Moderately unstable	B	$-1.9 < \Delta T \leq -1.7$
Slightly unstable	C	$-1.7 < \Delta T \leq -1.5$
Neutral	D	$-1.5 < \Delta T \leq -0.5$
Slightly stable	E	$-0.5 < \Delta T \leq 1.5$
Moderately stable	F	$1.5 < \Delta T \leq 4.0$
Extremely stable	G	$\Delta T > 4.0$

As stated in the Development Consent, the noise criteria in **Table 2-1** applies under all meteorological conditions except the following:

- Monitoring locations for the collection of representative noise data
- Wind speeds greater than 3 m/s at 10 metres above ground level
- Stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level
- Stability category G temperature inversion conditions.

Appendix 10 of the Development Consent also specifies that except for wind speed at microphone height, the data to be used for determing meterological conditons must be that recorded by a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.

4. Results and Discussion

4.1 Location N1

Noise monitoring at location N1 was conducted on Monday 3 June 2024, Tuesday 4 June 2024 and Wednesday 19 June 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods. The ambient noise environment was dominated by birds, frogs, trees/wind, and motorway hum. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N1 are presented in **Table 4-1**.

Table 4-1: Noise survey results and observations for Location N1

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-06-24	12:07pm to 12:22pm (Day)	60.9	55.7	50.0	WD: 90° WS: 2.1 m/s Rain: Nil	WD: 101° WS: 5.5 m/s Rain: nil Stability Category: C[1]	Background wind/trees 45-65 Birds 54 Quarry inaudible	<40[2]	35	n/a	n/a
3-06-24	6:16pm to 6:31pm (Evening)	47.1	41.4	39.1	WD: n/a WS: 0 m/s Rain: Nil	WD: 102° WS: 2.2 m/s Rain: nil Stability Category: E[1]	Background trees/insects 36-53 Quarry inaudible	<29	35	n/a	n/a
19-06-24	6:16am to 6:31am (Night)	38.2	26.0	18.9	WD: n/a WS: 0 m/s Rain: Nil	WD: 274° WS: 3.5 m/s Rain: nil Stability Category: E[1]	Background motorway 17-22 Frogs 50 Quarry inaudible	<9	35	<38	45

[1] Modelled using TAPM to determine Stability Category.

[2] Measured LA90 value of 50 was dominated by rustling and fauna noise so unable to estimate contribution for quarry at assessment location.

4.2 Location N2

Noise monitoring at location N2 was conducted on Monday 3 June 2024, Tuesday 4 June 2024 and Wednesday 19 June 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods. The ambient noise environment was dominated by motorway traffic, birds, frogs, and a passing train. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N2 are presented in **Table 4-2**.

Table 4-2 Noise survey results and observations for Location N2

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-06-24	1:30pm to 1:45pm (Day)	57.0	46.6	41.5	WD: 90° WS: 2.1 m/s Rain: Nil	WD: 101° WS: 4.6 m/s Rain: nil Stability Category: D[1]	Background wind/motorway/frog 38-44 Birds 45-46 Train 45-67 Quarry inaudible	<32	35	n/a	n/a
3-06-24	7:19pm to 7:34pm (Evening)	62.5	49.6	38.8	WD: n/a WS: 0 m/s Rain: Nil	WD: 105° WS: 3.1 m/s Rain: nil Stability Category: E[1]	Background wind/motorway 26-64 Train 58-63 Car passing 54-62 Quarry inaudible	<29	37	n/a	n/a
19-06-24	5:16am to 5:32am (Night)	43.2	38.2	34.9	WD: n/a WS: 0 m/s Rain: Nil	WD: 264° WS: 3.9 m/s Rain: nil Stability Category: E[1]	Background motorway 31-41 Frogs 37-38 Quarry inaudible	<25	36	<43	46

[1] Modelled using TAPM to determine Stability Category.

4.3 Location N3

Noise monitoring at location N3 was conducted on Monday 3 June 2024, Tuesday 4 June 2024 and Wednesday 19 June 2024. Noise from the quarry was inaudible during the day and evening monitoring periods. Audible Holcim trucks were observed and measured during the night period for up to ten seconds on two occasions, however, noise emission was below the 15min LAeq criteria using sound level exposure calculations included in **Appendix 1**. The ambient noise environment was dominated by motorway traffic and frogs. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N3 are presented in **Table 4-3**.

Table 4-3: Noise survey results and observations for Location N3

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-06-24	2:59pm to 3:14pm (Day)	48.3	40.9	35.8	WD: 90° WS: 0.8 m/s Rain: Nil	WD: 95° WS: 3.9 m/s Rain: nil Stability Category: D[1]	Background trees/wind/motorway/ frogs 33-50 Quarry inaudible	<26	35	n/a	n/a
3-06-24	7:49pm to 8:04pm (Evening)	45.6	38.9	35.0	WD: n/a WS: 0 m/s Rain: Nil	WD: 105° WS: 3.9 m/s Rain: nil Stability Category: E[1]	Background trees/wind 32-51 Quarry inaudible	<25	35	n/a	n/a
19-06-24	4:46am to 5:01am (Night)	38.9	29.8	26.7	WD: n/a WS: 0 m/s Rain: Nil	WD: 253° WS: 4.0 m/s Rain: nil Stability Category: E[1]	Holcim trucks entering/exiting quarry 30-34 (occurred twice for approx. 7-10 secs) Frogs 27-30 Quarry audible	<17[2]	<36	<39	47

[1] Modelled using TAPM to determine Stability Category.

[2] Value estimated based on sound exposure level calculation in **Appendix 1**.

4.4 Location N4

Noise monitoring at location N4 was conducted on Monday 3 June 2024, Tuesday 4 June 2024 and Wednesday 19 June 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods. The ambient noise environment was dominated by motorway traffic, wind, trees, and a passing car. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at location N4 are presented in **Table 4-4**.

Table 4-4: Noise survey results and observations for Location N4

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-06-24	12:59pm to 1:14pm (Day)	48.7	42.1	38.1	WD: 94° WS: 0.3 m/s Rain: Nil	WD: 95° WS: 5.0 m/s Rain: nil Stability Category: D[1]	Background birds/wind/trees 36-68 Quarry inaudible	<28	37	n/a	n/a
3-06-24	6:51pm to 7:06pm (Evening)	54.9	45.9	37.1	WD: n/a WS: 0 m/s Rain: Nil	WD: 104° WS: 2.8 m/s Rain: nil Stability Category: E[1]	Background trees/wind 34-58 Quarry inaudible	<27	37	n/a	n/a
19-06-24	5:38am to 5:53am (Night)	40.3	32.0	27.4	WD: n/a WS: 0 m/s Rain: Nil	WD: 268° WS: 4.0 m/s Rain: nil Stability Category: E[1]	Background motorway 24-30 Car passing 36-43 Quarry inaudible	<17	36	<40	47

[1] Modelled using TAPM to determine Stability Category.

5. Conclusion

This NMA was completed by Ramboll at the Holcim Lynwood Quarry, Marulan, NSW as a quarterly requirement of the NMP. Monitoring was carried out on Monday 3 June 2024, Tuesday 4 June 2024 and Wednesday 19 June 2024 at four locations selected as representative to the sensitive receptors at the surroundings to Lynwood Quarry.

No audible noise from quarry operations was observed at any of the four locations during the day, evening, and night periods, except for N3 during the evening.

The results presented in this NMA show compliance with the relevant noise criteria at the Holcim Lynwood Quarry, Marulan, NSW.

6. References

Holcim Australia (2019) *Lynwood Quarry, Noise Management Plan*.

International Electrotechnical Commission *IEC 60942:2017 Electroacoustics – Sound calibrators*

Minister for Planning and Infrastructure (2005) 'Development Consent DA 128-5-2005, Lynwood Hard Rock Quarry, and associated infrastructure'.
NSW EPA (2021) Environment Protection Licence number 12939

NSW EPA (2013) *Noise Guide for Local Government*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/20130127nglg.pdf (Accessed: 25 October 2022).

NSW EPA (2014) Discussion Paper. Validation of Inversion Strength Estimation Method.

NSW EPA (2017) *Noise Policy for Industry (NPfI)*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/17p0524-noise-policy-for-industry.pdf (Accessed: 25 October 2022).

Standards Australia (2018) *AS 1055:2018 Acoustics—Description and measurement of environmental noise*. Australian Standard. Available at: https://infostore.saiglobal.com/preview/825367946534.pdf?sku=1131503_SAIG_AS_AS_2626154 (Accessed: 19 January 2023).

Standards Australia and Standards New Zealand (2019) *AS/NZS IEC 61672.1:2019 Electroacoustics—Sound level meters, Part 1: Specifications*. Australian/New Zealand Standard. Available at: https://infostore.saiglobal.com/preview/825343328243.pdf?sku=1142059_SAIG_AS_AS_2705644 (Accessed: 28 September 2022).

Appendix 1

Sound Exposure Level Calculation

Project No: 318001799
Client Name: Holcim Australia Pty Ltd
Project Name: NSW Environmental Monitoring
Project Site: Lynwood Quarry
12/07/2024

Sound Exposure Level Calculation

RAMBOLL

N3 night monitoring period (4:46AM - 5:01AM)

Noise source	Holcim trucks
Meas. Dist from source (m)	-
Meas. Time (s)	10
Meas. LAeq dB	43
Calc Sel dB	**34**
No. Events in 15min	2
Total LAeq (15min)	**7**

Intended for
Holcim (Australia) Pty Ltd

Document type
Report

Date
October 2024

Lynwood Quarry Quarterly Noise Monitoring Assessment

Quarter 3 2024

RAMBOLL Bright ideas. Sustainable change.

Lynwood Quarry Quarterly Noise Monitoring Assessment

Quarter 3 2024

Project name	**NSW Environmental Monitoring 2023-2024**
Project no.	**318001800**
Recipient	**Wayne Beattie**
Document type	**Report**
Version	**1**
Date	**25/10/2024**
Prepared by	**Jake Bourke, Matilda Englert**
Checked by	**Arnold Cho**
Approved by	**Gavan Butterfield**
Description	**Data collected on 4 and 5 September 2024 for the quarterly period ending September 2024 at Marulan, NSW, as part of the noise monitoring program**

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Abbreviations and Definitions

Ambient Noise	The all-encompassing noise within a given environment. It is the composite of sounds from many sources, both near and far.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor (see below).
dB	Abbreviation for decibel, a measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm of a given sound power to a reference power.
dB(A)	A measure of A-weighted sound levels. A Weighting is an adjustment made to the sound level measurement to approximate the response of the human ear.
Extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods. Normal daily traffic is not extraneous noise.
LA1	The noise level, measured in dB(A), which is exceeded for 1 per cent of the measurement period.
LA1(1min)	The noise level, measured in dB(A), which is exceeded for 1 per cent of the time over a 1-minute measurement period, i.e., is exceeded for 0.6 seconds. This measure can approximate to the maximum noise level but may be less if there is more than 1 noise event during this 0.6 second period.
LA10	The noise level, measured in dB(A), which is exceeded for 10 per cent of the time.
LA90	The noise level, measured in dB(A), which is exceeded for 90 per cent of the time, referred to as the background noise level. This is considered to represent the background noise (see above).
LAeq	The level of noise equivalent to the energy average of noise levels occurring over a defined measurement period.
LAeq (period)	The average equivalent noise level, measured in dB(A), during a measurement period (e.g., 15-minute, day, evening, or night).
LAmax	The A-weighted sound pressure level that represents the maximum noise level measured over the time that a given sound is measured.
NMA	Noise Monitoring Assessment
NMP	Noise Management Plan
SPL	The Sound Pressure Level. Sound pressure is the fluctuation in air pressure, from the steady atmospheric pressure, created by sound. The sound pressure level is the sound pressure expressed on a decibel scale.

Source: Noise Guide for Local Government (NSW EPA, 2023)

1. Overview

1.1 Project Driver

Ramboll Australia Pty Ltd (Ramboll) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry ("the quarry") at Marulan, NSW.

This NMA was done in accordance with the following documents:

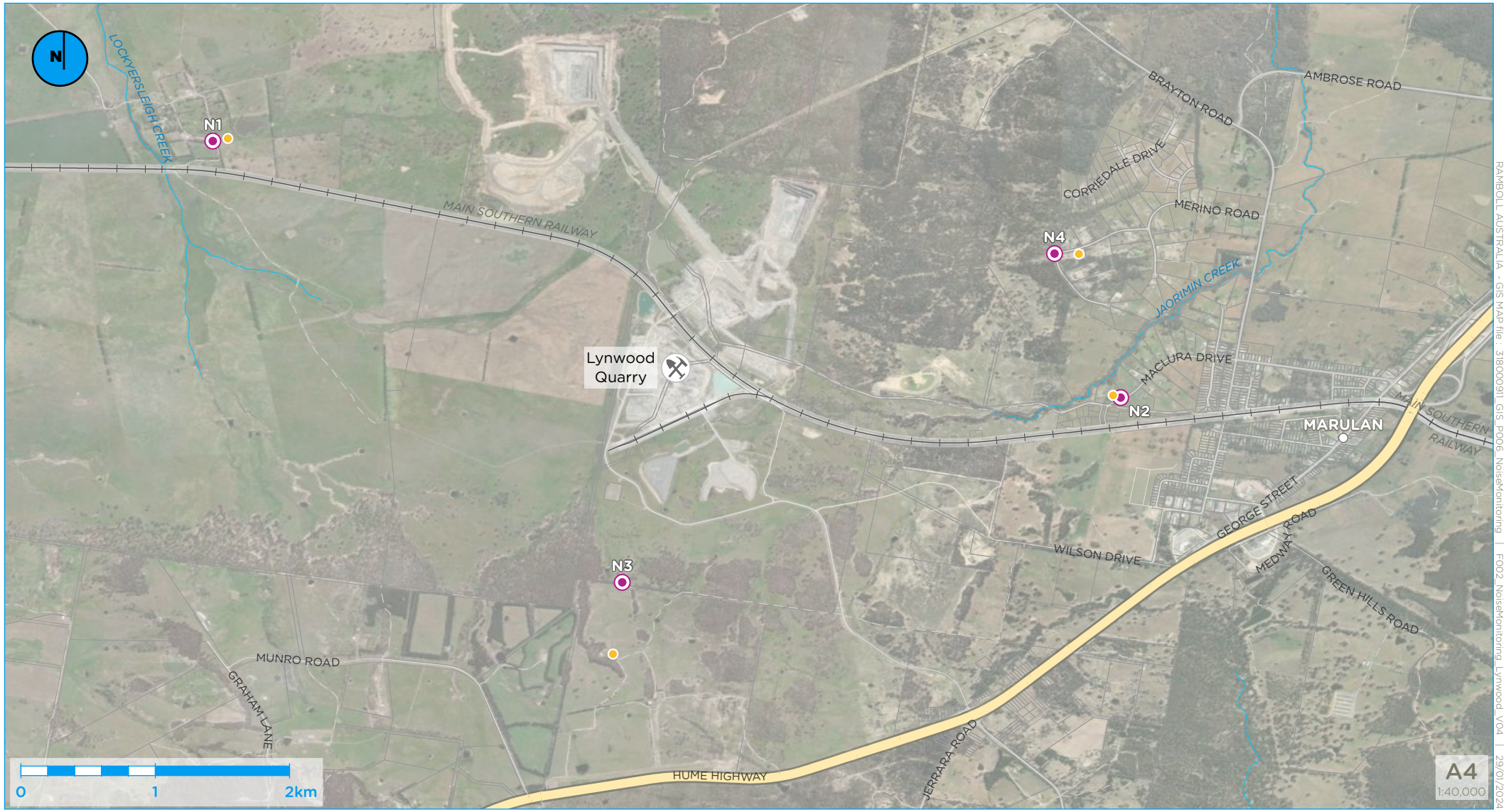
- Noise Policy for Industry (NPfI) (NSW EPA, 2017).
- Lynwood Quarry Noise Management Plan (NMP) (Holcim Australia, 2019).
- Environment Protection Licence (EPL) number 12939 (NSW EPA, 2021).
- Development Consent DA 128-5-2005 (Minister for Planning, 2017).
- Australian Standard AS 1055:2018 Acoustics — Description and measurement of environmental noise (Standards Australia, 2018).
- Australian Standard AS/NZS IEC 61672.1:2019 Electroacoustics – Sound level meters, Part 1: Specifications (Standards Australia and Standards New Zealand, 2019)
- IEC 60942:2017 Electroacoustics - Electroacoustics – Sound calibrators (International Standard, 2017).

This NMA has been undertaken for the quarterly period July to September 2024, and forms part of the monitoring program to determine compliance with conditions of the Development Consent.

1.2 Site Location and Sensitive Receptors

The quarry is located at 278 Stoney Creek Road, approximately 4 km to the west of the Marulan railway station and town centre. Sensitive receptors surrounding the quarry are primarily rural and residential (to the west of the site). The Hume Highway is located to the east and south of the quarry. Highway traffic (Hume Highway) is a dominant noise source.

The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1**.



RAMBOLL AUSTRALIA - GIS MAP file: 318000911_GIS_P006_NoiseMonitoring | F002_NoiseMonitoring_Lynwood_V04 | 29/01/2024

Legend

- Noise monitoring location
- Residence/noise assessment location

Figure 1 : Noise monitoring locations at Lynwood Quarry

2. Noise Criteria

Table 2-1 includes the applicable noise criteria outlined in the Development Consent and the EPL for the 16 residential receivers surrounding the quarry (L1–L16), and the four monitoring locations adopted from the NMP that are deemed representative and applicable for this NMA (N1–N4). It should be noted that the original location of N3 (on the northern boundary of 16038 Hume Highway, Marulan) continues to be inaccessible and as such N3 has been relocated to a nearby residential receiver approximately 900 m to the west on Munro Road, Marulan (**Figure 1**) where all future monitoring will take place. This revised location is deemed representative and applicable for this NMA.

Table 2-1: Monitoring locations and noise criteria

EPL ID	Receiver Description	Monitoring Locations		Day[1]	Evening[2]	Night[3]	Night[3]
		NMP ID	Address	LAeq (15min)	LAeq (15min)	LAeq (15min)	LA1 (1min)
				dBA			
L1	West of the Granite Pit.	N1	1114 Carrick Road, Marulan	35	35	35	45
L2	Northeast of the site	-	-	35	35	35	45
L3	Northeast of the site	-	-	35	35	35	45
L4	East of the site in Marulan	-	-	35	37	35	46
L5	East of the site in Marulan	-	-	35	35	35	46
L6	East of the site in Marulan	N2	End of Maclura Drive, Marulan	35	37	36	46
L7	East of the site in Marulan	-	-	38	38	35	55
L8	East of the site in Marulan	-	-	39	38	36	55
L9	East of the site in Marulan	-	-	39	39	37	56
L10	Southeast of the site in Old Marulan	-	-	42	42	40	53
L11	South of the site	N3	Off Marulan South Road, near DD8	35	35	36	47
L12	East of the site in Marulan	N4	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47
L13	East of the site in Marulan	-	-	40	38	37	47
L14	South of the site	-	-	35	35	35	47
L15	South of the site	-	-	35	35	35	47
L16	Northeast of the site	-	-	35	35	35	45

[1] 7 am–6 pm Monday to Saturday and 8 am–6 pm Sunday and public holidays

[2] 6 pm–10 pm Monday to Sunday

[3] 10 pm–7 am Monday to Saturday and 10 pm–8 am Sunday and public holidays

3. Methodology

The monitoring program was designed in accordance with the procedures described in Australian Standard AS 1055:2018 and the Approval Documents referenced in Section 1. The measurements were carried out using a RION Sound Level Meter NL-52 on Wednesday 4 September 2024 and Thursday 5 September 2024. The acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672-1:2019 class 1. Calibration of all instrumentation was checked prior to and following measurements using a Pulsar Acoustic Calibrator 105 which carried a current NATA calibration and complies with IEC 60942:2017. Drift in calibration did not exceed ±0.3 dBA.

Attended noise monitoring was conducted for 15-minutes in duration during the day, evening, and night periods over three days at each monitoring location. Where possible, throughout each measurement the operator quantified the contribution of each significant noise source.

Where the quarry was not distinctly audible during the attended monitoring, the quarry contribution is estimated to be at least 10 dBA below the ambient noise level, as determined by the LA90.

3.1 Meteorological Conditions

Meterology has an important influence on noise monitoring assessment. Where an onsite meterological station with data recorded at 10m height has not been available, the nearest Bureau of Meteorology data has been adopted to inform this assessment and modelled using The Air Pollution Model (TAPM) to determine the atmospheric stability category as outline in **Table 3-1.**

Table 3-1: Classification of Atmospheric Stability (NSW EPA, 2014)

Stability Classification	Pasquill Stability Category	Ambient temperature change with height (°C/100m)
Extremely unstable	A	$\Delta T \leq -1.9$
Moderately unstable	B	$-1.9 < \Delta T \leq -1.7$
Slightly unstable	C	$-1.7 < \Delta T \leq -1.5$
Neutral	D	$-1.5 < \Delta T \leq -0.5$
Slightly stable	E	$-0.5 < \Delta T \leq 1.5$
Moderately stable	F	$1.5 < \Delta T \leq 4.0$
Extremely stable	G	$\Delta T > 4.0$

As stated in the Development Consent, the noise criteria in **Table 2-1** applies under all meteorological conditions except the following:

- Monitoring locations for the collection of representative noise data
- Wind speeds greater than 3 m/s at 10 metres above ground level
- Stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level
- Stability category G temperature inversion conditions.

Appendix 10 of the Development Consent also specifies that except for wind speed at microphone height, the data to be used for determing meterological conditons must be that recorded by a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.

4. Results and Discussion

4.1 Location N1

Noise monitoring at location N1 was conducted on Wednesday 4 September 2024 and Thursday 5 September 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods. The ambient noise environment was dominated by trees/wind, wildlife, and barking dogs. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N1 are presented in **Table 4-1**.

Table 4-1: Noise survey results and observations for Location N1

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-09-24	3:00pm to 3:15pm (Day)	56.4	47	38	WD: 65° WS: 2.0 m/s Rain: Nil	WD: 290° WS: 5.2 m/s Rain: nil Stability Category: E[1]	Background trees/wind/birds 34-42 Dogs barking 38-49 Quarry inaudible	<28	35	n/a	n/a
4-09-24	8:22pm to 8:37pm (Evening)	60	47	29.6	WD: n/a WS: 0 m/s Rain: Nil	WD: 288° WS: 0.1 m/s Rain: nil Stability Category: F[1]	Background frogs/insects 25-32 Dog barking 32-66 Quarry inaudible	<20	35	n/a	n/a
5-09-24	6:10am to 6:25am (Night)	46.2	34.8	20.6	WD: n/a WS: 0 m/s Rain: Nil	WD: 295° WS: 2.8 m/s Rain: nil Stability Category: E[1]	Background insects/birds 17-52 Quarry inaudible	<11	35	<46[2,3]	45

[1] Modelled using TAPM to determine Stability Category.

[2] Measured LA1 value was dominated by insects and birds so unable to estimate contribution for quarry at assessment location.

[3] Negligible exceedance (NPfI 2017 – Table 4.1 and Table 4.2)

4.2 Location N2

Noise monitoring at location N2 was conducted on Wednesday 4 September 2024 and Thursday 5 September 2024. Noise from the quarry was inaudible during the day, evening, and night monitoring periods. The ambient noise environment was dominated by motorway traffic, birds, frogs, and insects. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N2 are presented in **Table 4-2**.

Table 4-2 Noise survey results and observations for Location N2

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-09-24	4:57pm to 5:12pm (Day)	49.8	41.1	34	WD: 65° WS: 2.0 m/s Rain: Nil	WD: 280° WS: 2.7 m/s Rain: nil Stability Category: E[1]	Background frogs/insects 31-37 Car passing 32-64 Quarry inaudible	<24	35	n/a	n/a
4-09-24	8:20pm to 8:35pm (Evening)	40.7	33.8	30.1	WD: n/a WS: 0 m/s Rain: Nil	WD: 288° WS: 0.1 m/s Rain: nil Stability Category: F[1]	Background frogs/insects 26-34 Horse exhaling 50 Quarry inaudible	<20	37	n/a	n/a
5-09-24	5:13am to 5:28am (Night)	44.3	34.4	27.6	WD: n/a WS: 0 m/s Rain: Nil	WD: 285° WS: 4.8 m/s Rain: nil Stability Category: E[1]	Background motorway/frogs 25-31 Birds 30-60 Quarry inaudible	<18	36	<44	46

[1] Modelled using TAPM to determine Stability Category.

4.3 Location N3

Noise monitoring at location N3 was conducted on Wednesday 4 September 2024. Noise from the quarry was inaudible during the day monitoring period. Audible Holcim alarms were observed and measured during the evening and night periods for up to 10 seconds on numerous occasions however, noise emission was below the 15min LAeq criteria using sound level exposure calculations included in **Appendix 1**. The ambient noise environment was dominated by birds, insects, and frogs. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at Location N3 are presented in **Table 4-3**.

Table 4-3: Noise survey results and observations for Location N3

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-09-24	4:25pm to 4:40pm (Day)	44.2	37.2	33	WD: 65° WS: 2.0 m/s Rain: Nil	WD: 280° WS: 3.2 m/s Rain: nil Stability Category: E[1]	Background wind/trees Birds 32-55 Quarry inaudible	<23	35	n/a	n/a
4-09-24	9:45pm to 10:00pm (Evening)	41.4	34	30.5	WD: n/a WS: 0 m/s Rain: Nil	WD: 308° WS: 0 m/s Rain: nil Stability Category: F[1]	Background insects/frogs 27-32 Holcim alarms 32-35 (occurred every 10-13 secs for 5-10 secs) Quarry audible	<32[2]	35	n/a	n/a
4-09-24	10:05pm to 10:20pm (Night)	41.1	35.9	32.4	WD: n/a WS: 0 m/s Rain: Nil	WD: 315° WS: 0.1 m/s Rain: nil Stability Category: F[1]	Background frogs/insects 29-35, Holcim alarms 32-35 (occurred every 10-20 seconds) Quarry audible	<23[2]	<36	<41	47

[1] Modelled using TAPM to determine Stability Category.

[2] Values estimated based on sound exposure level calculations in **Appendix 1**.

4.4 Location N4

Noise monitoring at location N4 was conducted on Wednesday 4 September 2024 and Thursday 5 September 2024. Noise from the quarry was inaudible during the day and night monitoring periods. Audible noise from a dump truck on site was observed and measured during the evening for a period of 5 minutes however, noise emission was below the 15min LAeq criteria using sound level exposure calculations included in **Appendix 1**. The ambient noise environment was dominated by motorway hum, wind, trees, and a passing car. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring. The results and observations taken during the monitoring events at location N4 are presented in **Table 4-4**.

Table 4-4: Noise survey results and observations for Location N4

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
4-09-24	3:35pm to 3:50pm (Day)	50.2	43	34.5	WD: 65° WS: 2.0 m/s Rain: Nil	WD: 296° WS: 4.9 m/s Rain: nil Stability Category: E[1]	Background wind/trees 32-42 Car passing 59-64 Quarry inaudible	<25	37	n/a	n/a
4-09-24	8:58pm to 9:13pm (Evening)	39.8	31.4	27.8	WD: n/a WS: 0 m/s Rain: Nil	WD: 307° WS: 0.1 m/s Rain: nil Stability Category: F[1]	Holcim dump truck 31-34 (occurred for 5 mins) Quarry audible	<29[2]	37	n/a	n/a
5-09-24	5:35am to 5:50am (Night)	42.9	33.2	22.4	WD: n/a WS: 0 m/s Rain: Nil	WD: 283° WS: 3.2 m/s Rain: nil Stability Category: E[1]	Background motorway hum 19-32 Car passing 35-39 Quarry inaudible	<12	36	<43	47

[1] Modelled using TAPM to determine Stability Category.

[2] Value estimated based on sound exposure level calculation in **Appendix 1**.

5. Conclusion

This NMA was completed by Ramboll at the Holcim Lynwood Quarry, Marulan, NSW as a quarterly requirement of the NMP. Monitoring was carried out on Wednesday 4 September 2024 and Thursday 5 September 2024 at four locations selected as representative to the sensitive receptors at the surroundings to Lynwood Quarry.

No audible noise from quarry operations was observed at any of the four locations during the day, evening, and night periods, except for N3 during the evening and night, and N4 during the evening.

The results presented in this NMA show compliance with the relevant noise criteria at the Holcim Lynwood Quarry, Marulan, NSW.

6. References

Holcim Australia (2019) *Lynwood Quarry, Noise Management Plan*.

International Electrotechnical Commission *IEC 60942:2017 Electroacoustics – Sound calibrators*

Minister for Planning and Infrastructure (2005) 'Development Consent DA 128-5-2005, Lynwood Hard Rock Quarry, and associated infrastructure'.
NSW EPA (2021) Environment Protection Licence number 12939

NSW EPA (2013) *Noise Guide for Local Government*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/20130127nglg.pdf (Accessed: 25 October 2022).

NSW EPA (2014) Discussion Paper. Validation of Inversion Strength Estimation Method.

NSW EPA (2017) *Noise Policy for Industry (NPfI)*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/17p0524-noise-policy-for-industry.pdf (Accessed: 25 October 2022).

Standards Australia (2018) *AS 1055:2018 Acoustics—Description and measurement of environmental noise*. Australian Standard. Available at: https://infostore.saiglobal.com/preview/825367946534.pdf?sku=1131503_SAIG_AS_AS_2626154 (Accessed: 19 January 2023).

Standards Australia and Standards New Zealand (2019) *AS/NZS IEC 61672.1:2019 Electroacoustics—Sound level meters, Part 1: Specifications*. Australian/New Zealand Standard. Available at: https://infostore.saiglobal.com/preview/825343328243.pdf?sku=1142059_SAIG_AS_AS_2705644 (Accessed: 28 September 2022).

Appendix 1
Sound Exposure Level Calculations

Project No: 318001800
Client Name: Holcim Australia Pty Ltd
Project Name: NSW Environmental Monitoring
Project Site: Lynwood Quarry
25/10/2024

Sound Exposure Level Calculations

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N3 evening monitoring period (9:45PM to 10:00PM)

Noise source	Holcim alarms
Meas. Dist from source (m)	-
Meas. Time (s)	10
Meas. LAeq dB	35
Calc Sel dB	45
No. Events in 15min	45
Total LAeq (15min)	**32.0**

N3 night monitoring period (10:05PM to 10:20PM)

Noise source	Holcim alarms
Meas. Dist from source (m)	-
Meas. Time (s)	1
Meas. LAeq dB	35
Calc Sel dB	35
No. Events in 15min	60
Total LAeq (15min)	**23.2**

N4 evening monitoring period (8:58PM to 9:13PM)

Noise source	Holcim dump truck
Meas. Dist from source (m)	-
Meas. Time (s)	300
Meas. LAeq dB	34
Calc Sel dB	59
No. Events in 15min	1
Total LAeq (15min)	**29.2**

Intended for
Holcim (Australia) Pty Ltd

Document type
Report

Date
January 2025

Lynwood Quarry Quarterly Noise Monitoring Assessment

Quarter 4 2024

RAMBOLL

Bright ideas.
Sustainable change.

Lynwood Quarry Quarterly Noise Monitoring Assessment

Quarter 4 2024

Project name	**NSW Environmental Monitoring 2024-2025**
Project no.	**318001800**
Recipient	**Wayne Beattie**
Document type	**Report**
Version	**1**
Date	**31/01/2025**
Prepared by	**Jake Bourke, Brodie Wood**
Checked by	**Arnold Cho**
Approved by	**Gavan Butterfield**
Description	**Data collected on 4 and 6 November 2024 for the quarterly period ending December 2024 at Marulan, NSW, as part of the noise monitoring program**

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Abbreviations and Definitions

	Description
ΔT	Vertical Temperature Difference, i.e. the measured difference in ambient temperature between two elevations on the same tower. It is defined as the upper-level temperature measurement minus the lower-level temperature measurement.
°	Degree
Ambient Noise	The all-encompassing noise within a given environment. It is the composite of sounds from many sources, both near and far.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor (see below).
C	Celcius
CCAM	Conformal Cubic Atmospheric Model
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB	Abbreviation for decibel, a measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm of a given sound power to a reference power.
dB(A)	A measure of A-weighted sound levels. A Weighting is an adjustment made to the sound level measurement to approximate the response of the human ear.
EPA	Environment Protection Authority
EPL	Environment Protection Licence
Extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods. Normal daily traffic is not extraneous noise.
m	Metre
LA1	The noise level, measured in dB(A), which is exceeded for 1 per cent of the measurement period.
LA1(1min)	The noise level, measured in dB(A), which is exceeded for 1 per cent of the time over a 1-minute measurement period, i.e., is exceeded for 0.6 seconds. This measure can approximate to the maximum noise level but may be less if there is more than 1 noise event during this 0.6 second period.
LA10	The noise level, measured in dB(A), which is exceeded for 10 per cent of the time.
LA90	The noise level, measured in dB(A), which is exceeded for 90 per cent of the time, referred to as the background noise level. This is considered to represent the background noise (see above).
LAeq	The level of noise equivalent to the energy average of noise levels occurring over a defined measurement period.
LAeq (period)	The average equivalent noise level, measured in dB(A), during a measurement period (e.g., 15-minute, day, evening, or night).
LAmax	The A-weighted sound pressure level that represents the maximum noise level measured over the time that a given sound is measured.
NATA	National Association of Testing Authorities
NMA	Noise Monitoring Assessment
NMP	Noise Management Plan
NPfI	Noise Policy for Industry 2017

	Description
NSW	New South Wales
s	Second
SPL	The Sound Pressure Level. Sound pressure is the fluctuation in air pressure, from the steady atmospheric pressure, created by sound. The sound pressure level is the sound pressure expressed on a decibel scale.
TAPM	The Air Pollution Model

Source: Noise Guide for Local Government (NSW EPA, 2023).

1. Overview

1.1 Project Driver

Ramboll Australia Pty Ltd (Ramboll) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for Lynwood Quarry ("the quarry") at Marulan, NSW.

This NMA was done in accordance with the following documents:

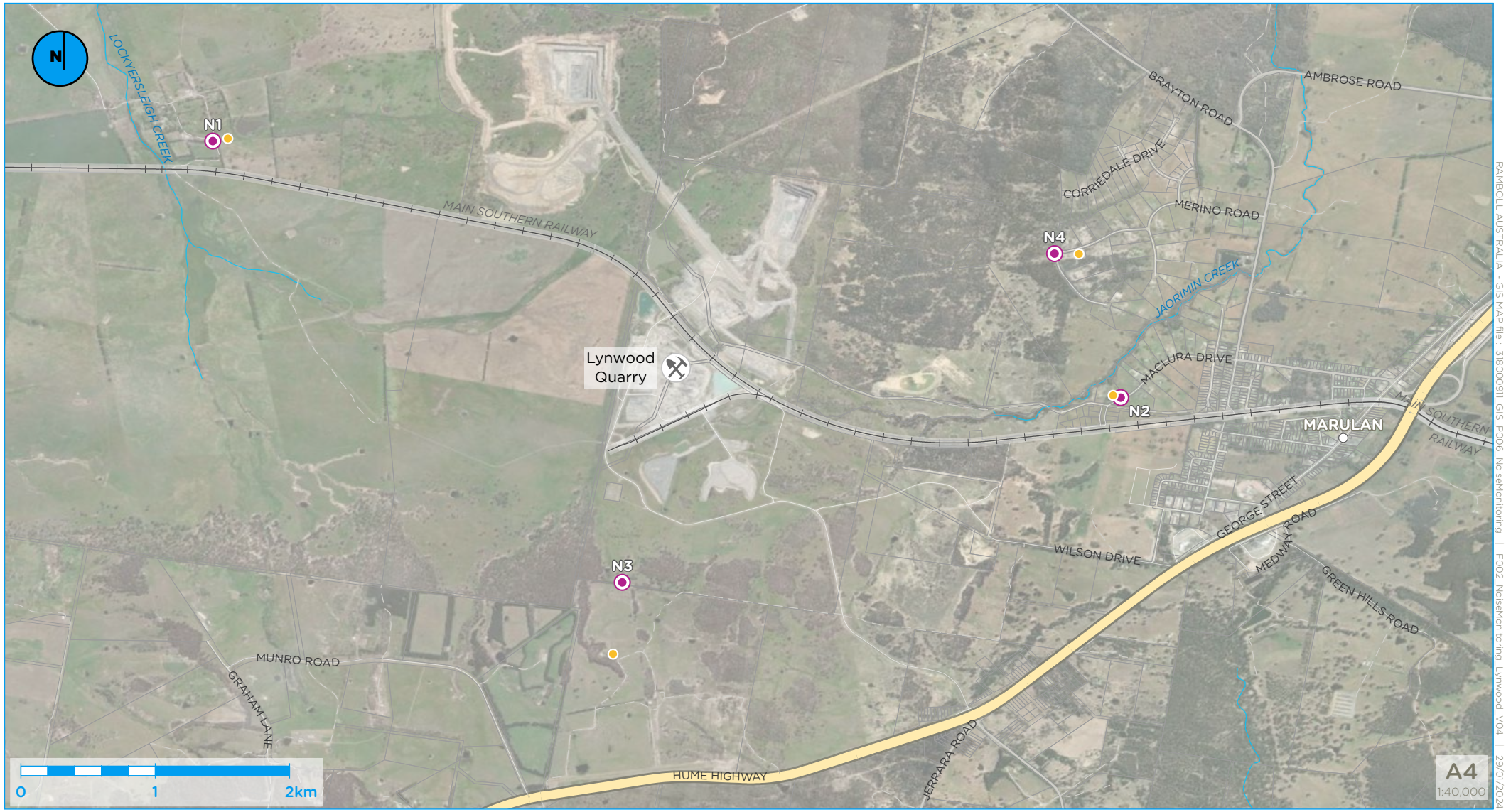
- Noise Policy for Industry (NPfI) (NSW EPA, 2017)
- Lynwood Quarry Noise Management Plan (NMP) (Holcim Australia, 2019)
- Environment Protection Licence (EPL) number 12939 (NSW EPA, 2021)
- Development Consent DA 128-5-2005 (Minister for Planning, 2017)
- Australian Standard AS 1055:2018 Acoustics — Description and measurement of environmental noise (Standards Australia, 2018)
- Australian Standard AS/NZS IEC 61672.1:2019 Electroacoustics – Sound level meters, Part 1: Specifications (Standards Australia and Standards New Zealand, 2019)
- IEC 60942:2017 Electroacoustics - Electroacoustics – Sound calibrators (International Standard, 2017).

This NMA has been undertaken for the quarterly period October to December 2024, and forms part of the monitoring program to determine compliance with conditions of the Development Consent.

1.2 Site Location and Sensitive Receptors

The quarry is located at 278 Stoney Creek Road, approximately 4 km to the west of the Marulan railway station and town centre. Sensitive receptors surrounding the quarry are primarily rural and residential (to the west of the site). The Hume Highway is located to the east and south of the quarry. Highway traffic (Hume Highway) is a dominant noise source.

The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan in **Figure 1**.



RAMBOLL AUSTRALIA - GIS MAP file: 318000911_GIS_P006_NoiseMonitoring | F002_NoiseMonitoring_Lynwood_V04 | 29/01/2024

Legend

- Noise monitoring location
- Residence/noise assessment location

Figure 1 : Noise monitoring locations at Lynwood Quarry

2. Noise Criteria

Table 2-1 includes the applicable noise criteria outlined in the Development Consent and the EPL for the 16 residential receivers surrounding the quarry (L1–L16), and the four monitoring locations adopted from the NMP that are deemed representative and applicable for this NMA (N1–N4). It should be noted that the original location of N3 (on the northern boundary of 16038 Hume Highway, Marulan) continues to be inaccessible and as such N3 has been relocated to a nearby residential receiver approximately 900 m to the west on Munro Road, Marulan (**Figure 1**) where all future monitoring will take place. This revised location is deemed representative and applicable for this NMA.

Table 2-1: Monitoring locations and noise criteria

EPL ID	Receiver Description	Monitoring Locations		Day[1]	Evening[2]	Night[3]	Night[3]
		NMP ID	Address	LAeq (15min)	LAeq (15min)	LAeq (15min)	LA1 (1min)
				dBA			
L1	West of the Granite Pit.	N1	1114 Carrick Road, Marulan	35	35	35	45
L2	Northeast of the site	-	-	35	35	35	45
L3	Northeast of the site	-	-	35	35	35	45
L4	East of the site in Marulan	-	-	35	37	35	46
L5	East of the site in Marulan	-	-	35	35	35	46
L6	East of the site in Marulan	N2	End of Maclura Drive, Marulan	35	37	36	46
L7	East of the site in Marulan	-	-	38	38	35	55
L8	East of the site in Marulan	-	-	39	38	36	55
L9	East of the site in Marulan	-	-	39	39	37	56
L10	Southeast of the site in Old Marulan	-	-	42	42	40	53
L11	South of the site	N3	Off Marulan South Road, near DD8	35	35	36	47
L12	East of the site in Marulan	N4	Corner of Dorsett and Suffolk Road, Marulan	37	37	36	47
L13	East of the site in Marulan	-	-	40	38	37	47
L14	South of the site	-	-	35	35	35	47
L15	South of the site	-	-	35	35	35	47
L16	Northeast of the site	-	-	35	35	35	45

[1] 7 am–6 pm Monday to Saturday and 8 am–6 pm Sunday and public holidays

[2] 6 pm–10 pm Monday to Sunday

[3] 10 pm–7 am Monday to Saturday and 10 pm–8 am Sunday and public holidays

3. Methodology

The monitoring program was designed in accordance with the procedures described in Australian Standard AS 1055:2018 and the Approval Documents referenced in Section 0. The measurements were carried out using a RION Sound Level Meter NL-52 on Monday 4 November 2024 and Wednesday 6 November 2024. The acoustic instrumentation used carries current National Association of Testing Authorities (NATA) calibration and complies with AS/NZS IEC 61672-1:2019 class 1. Calibration of all instrumentation was checked prior to and following measurements using a Pulsar Acoustic Calibrator 105 which carried a current NATA calibration and complies with IEC 60942:2017. Drift in calibration did not exceed ±0.3 dBA.

Attended noise monitoring was conducted for 15-minutes in duration during the day, evening, and night periods over three days at each monitoring location. Where possible, throughout each measurement the operator quantified the contribution of each significant noise source. Where the quarry was not distinctly audible during the attended monitoring, the quarry contribution is estimated to be at least 10 dBA below the ambient noise level, as determined by the LA90.

3.1 Meteorological Conditions

Meterology has an important influence on noise monitoring assessment. An onsite meterological station with data recorded at 10m height has been used to adopt wind direction, wind speed and rain data to inform this assessment. Temperature data has been adopted from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Conformal Cubic Atmospheric Model (CCAM) and modelled using The Air Pollution Model (TAPM) to determine the atmospheric category as outline in **Table 3-1.**

Table 3-1: Classification of Atmospheric Stability (NSW EPA, 2014)

Stability Classification	Pasquill Stability Category	Ambient temperature change with height (°C/100m)
Extremely unstable	A	$\Delta T \leq -1.9$
Moderately unstable	B	$-1.9 < \Delta T \leq -1.7$
Slightly unstable	C	$-1.7 < \Delta T \leq -1.5$
Neutral	D	$-1.5 < \Delta T \leq -0.5$
Slightly stable	E	$-0.5 < \Delta T \leq 1.5$
Moderately stable	F	$1.5 < \Delta T \leq 4.0$
Extremely stable	G	$\Delta T > 4.0$

As stated in the Development Consent, the noise criteria in **Table 2-1** applies under all meteorological conditions except the following:

- Monitoring locations for the collection of representative noise data
- Wind speeds greater than 3 m/s at 10 metres above ground level
- Stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 metres above ground level
- Stability category G temperature inversion conditions.

Appendix 10 of the Development Consent also specifies that except for wind speed at microphone height, the data to be used for determing meterological conditons must be that recorded by a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.

4. Results and Discussion

4.1 Location N1

Noise monitoring at location N1 was conducted on Monday 4 November 2024 and Friday 6 November 2024 with results presented in **Table 4-1**. Noise from the quarry was inaudible at N1 during the day, evening, and night monitoring periods. The ambient noise environment was dominated by trees/wind, and birds. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring.

Table 4-1: Noise survey results and observations for Location N1

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1(1min) Criteria (dBA)
		LA1	LAeq	LA90							
6-11-24	7:02am to 7:17am (Day)	54.5	41.9	29.7	WD: n/a WS: 0 m/s Rain: Nil	WD:340° WS: 0.6 m/s Rain: nil Stability Category: E[1]	Background birds 26-61 Quarry inaudible	<20	35	n/a	n/a
4-11-24	6:15pm to 6:30pm (Evening)	53.8	47.1	42.9	WD: n/a WS: 0 m/s Rain: Nil	WD: n/a WS: 0 m/s Rain: Nil Stability Category: E[1]	Background wind/trees/birds 40-56 Quarry inaudible	<33	35	n/a	n/a
6-11-24	6:35am to 6:50am (Night)	50.6	39.5	29.2	WD: n/a WS: 0 m/s Rain: Nil	WD: 331° WS: 0.7 m/s Rain: nil Stability Category: E[1]	Background birds 25-59 Quarry inaudible	<19	35	n/a[2]	45

[1] Temperature data sourced from CSIRO CCAM and modelled using TAPM to determine Stability Category.

[2] Measured LA1 value of 50.6 was dominated by birds so unable to estimate contribution for quarry at assessment location.

4.2 Location N2

Noise monitoring at location N2 was conducted on Monday 4 November 2024 and Wednesday 6 November 2024 with results presented in **Table 4-2**. Noise from the quarry was inaudible at N2 during the day, evening, and night monitoring periods. The ambient noise environment was dominated by motorway traffic, wind, birds, frogs, and insects. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring.

Table 4-2 Noise survey results and observations for Location N2

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
6-11-24	9:19am to 9:34am (Day)	42.5	34.4	31	WD: n/a WS: 0 m/s Rain: Nil	WD: 302° WS: 0.5 m/s Rain: nil Stability Category: E[1]	Background motorway hum/birds 28-35 Quarry inaudible	<21	35	n/a	n/a
4-11-24	9:15pm to 9:30pm (Evening)	48.8	44	39.8	WD: n/a WS: 0 m/s Rain: Nil	WD: 109° WS: 2.3 m/s Rain: nil Stability Category: E[1]	Background motorway traffic/wind/frogs 36-53 Quarry inaudible	<30	37	n/a	n/a
6-11-24	5:34am to 5:49am (Night)	57.4	43.8	31.4	WD: n/a WS: 0 m/s Rain: Nil	WD: 339° WS: 0.6 m/s Rain: nil Stability Category: F[1]	Background motorway 25-31 Birds 34-40 Train 44-61 Quarry inaudible	<21	36	n/a[2]	46

[1] Temperature data sourced from CSIRO CCAM and modelled using TAPM to determine Stability Category.

[2] Measured LA1 value of 57.4 was dominated by a train so unable to estimate contribution for quarry at assessment location.

4.3 Location N3

Noise monitoring at location N3 was conducted on Monday 4 November 2024 and Wednesday 6 November 2024 with results presented in **Table 4-3**. Noise from the quarry was inaudible at N3 during the evening and night monitoring period. The site was audible at N3 during the day monitoring period, with an industrial hum, however, was below the LAeq(15min) criteria using sound level exposure calculations included in **Appendix 1**. The ambient noise environment was dominated by birds, motorway traffic and frogs. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring.

Table 4-3: Noise survey results and observations for Location N3

Date	Time	Descriptor (dBA)			Meteorology (handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
6-11-24	10:17am to 10:31am (Day)	46.6	37	30.9	WD: n/a WS: 0 m/s Rain: Nil	WD: 267° WS: 1.5 m/s Rain: nil Stability Category: E[1]	Background birds/industrial hum (Holcim) 27-35 Birds 54 Quarry audible	<35[2]	35	n/a	n/a
4-11-24	9:45pm to 10:00pm (Evening)	43.1	39.7	37.5	WD: n/a WS: 0 m/s Rain: Nil	WD: 105° WS: 1.7 m/s Rain: nil Stability Category: E[1]	Background motorway/frogs 3-45 Quarry inaudible	<28	35	n/a	n/a
4-11-24	10:00pm to 10:15pm (Night)	43.2	39.8	37.5	WD: n/a WS: 0 m/s Rain: Nil	WD: 102° WS: 1.9 m/s Rain: nil Stability Category: E[1]	Background motorway/frogs 34-48 Quarry inaudible	<28	<36	<43	47

[1] Temperature data sourced from CSIRO CCAM and modelled using TAPM to determine Stability Category.

[2] Values estimated based on sound exposure level calculations in **Appendix 1**. Noise sources that contributed to LAeq value included industrial hum from Holcim as well as birds.

4.4 Location N4

Noise monitoring at location N3 was conducted on Monday 4 November 2024 and Wednesday 6 November 2024 with results presented in **Table 4-4**. Noise from the quarry was inaudible during the day, evening night monitoring periods. The ambient noise environment was dominated by insects, birds, trees, motorway traffic and a passing car. The results meet the established noise criteria and indicate that noise emissions from Lynwood Quarry did not contribute to noise nuisance at the time of the monitoring.

Table 4-4: Noise survey results and observations for Location N4

Date	Time	Descriptor (dBA)			Meteorology (Handheld at microphone height)	Onsite Met Station (10m height)	Apparent Noise Source, Description and SPL (dBA)	Lynwood Quarry LAeq (15min) Contribution (dBA)	LAeq (15min) Criteria (dBA)	Lynwood Quarry LA1(1min) Contribution (dBA)	LA1 (1min) Criteria (dBA)
		LA1	LAeq	LA90							
6-11-24	8:43am to 8:58am (Day)	48.5	42.1	37.6	WD: n/a WS: 0 m/s Rain: Nil	WD: 329° WS: 0.9 m/s Rain: nil Stability Category: E[1]	Background insects/birds 35-44 Passing car 40-60 Quarry inaudible	<28	37	n/a	n/a
4-11-24	8:53pm to 9:08pm (Evening)	44.1	37.9	34.5	WD: n/a WS: 0 m/s Rain: Nil	WD: 105° WS: 3.0 m/s Rain: nil Stability Category: F[1]	Background wind/trees 32-49 Quarry inaudible	<25	37	n/a	n/a
6-11-24	5:56am to 6:11am (Night)	52.0	40.3	33.2	WD: n/a WS: 0 m/s Rain: Nil	WD: 333° WS: 0.7 m/s Rain: nil Stability Category: E[1]	Background motorway/birds 42 Passing car 40-59 Quarry inaudible	<23	36	n/a[2]	47

[1] Temperature data sourced from CSIRO CCAM and modelled using TAPM to determine Stability Category.

[2] Measured LA1 value of 52.0 was dominated by a train so unable to estimate contribution for quarry at assessment location.

5. Conclusion

This NMA was completed by Ramboll at the Holcim Lynwood Quarry, Marulan, NSW as a quarterly requirement of the NMP. Monitoring was carried out on Monday 4 November 2024 and Wednesday 6 November 2024 at four locations selected as representative to the sensitive receptors at the surroundings to Lynwood Quarry.

No audible noise from quarry operations was observed at any of the four locations during the day, evening, and night periods, except at N3 during the day, where the quarry was audible with an industrial hum. The results presented in this NMA show compliance with the relevant noise criteria at the Holcim Lynwood Quarry, Marulan, NSW.

6. References

Holcim Australia (2019) *Lynwood Quarry, Noise Management Plan*.

International Electrotechnical Commission *IEC 60942:2017 Electroacoustics – Sound calibrators*

Minister for Planning and Infrastructure (2005) 'Development Consent DA 128-5-2005, Lynwood Hard Rock Quarry, and associated infrastructure'.
NSW EPA (2021) Environment Protection Licence number 12939

NSW EPA (2013) *Noise Guide for Local Government*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/20130127nglg.pdf (Accessed: 25 October 2022).

NSW EPA (2014) Discussion Paper. Validation of Inversion Strength Estimation Method.

NSW EPA (2017) *Noise Policy for Industry (NPfI)*. Sydney NSW: NSW Environment Protection Authority. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/noise/17p0524-noise-policy-for-industry.pdf (Accessed: 25 October 2022).

Standards Australia (2018) *AS 1055:2018 Acoustics—Description and measurement of environmental noise*. Australian Standard. Available at: https://infostore.saiglobal.com/preview/825367946534.pdf?sku=1131503_SAIG_AS_AS_2626154 (Accessed: 19 January 2023).

Standards Australia and Standards New Zealand (2019) *AS/NZS IEC 61672.1:2019 Electroacoustics—Sound level meters, Part 1: Specifications*. Australian/New Zealand Standard. Available at: https://infostore.saiglobal.com/preview/825343328243.pdf?sku=1142059_SAIG_AS_AS_2705644 (Accessed: 28 September 2022).

Appendix 1
Sound Exposure Level Calculations

Project No: 318001800
Client Name: Holcim Australia Pty Ltd
Project Name: NSW Environmental Monitoring
Project Site: Lynwood Quarry
31/01/2025

Sound Exposure Level Calculations

RAMBOLL

N3 Day monitoring period (10:17AM to 10:31AM)

Noise source	Holcim exhaust fans
Measured distance from source (m)	-
Measured time (s)	900
Measured SPL (dBA)	35
Calculated Sel (dB)	65
Number of events in 15min	1
Total LAeq (15min)	**35.0**