Noise Monitoring Assessment

Teven Quarry, Teven, NSW
Quarter 1 Ending March 2022

Prepared for: Holcim (Australia) Pty Ltd
February 2022
MAC180611-06RP15

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Teven Quarry, Teven, NSW

Quarter 1 Ending March 2022

Prepared for: Holcim (Australia) Pty Ltd

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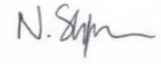
MAC180611-06RP15	Final	9 February 2022	Nicholas Shipman		Rod Linnett	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for the quarterly period ending March 2022 for Teven Quarry (the 'quarry'), Teven, NSW.

The monitoring has been conducted in accordance with the Teven Noise Management Plan (NMP) and in general accordance with relevant conditions outlined in the Development Consent (ref: SSD 6422) at five representative monitoring locations. This assessment has been undertaken during Quarter 1, ending March 2022 and forms part of the noise monitoring program for the quarry.

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- NSW Environment Protection Authority (EPA), Environmental Protection Licence (EPL 3293);
- NSW Department of Planning and Environment, Development Consent (SSD 6422), 2015;
- Teven Quarry Noise Management Plan Revision 1, 4 May 2016 (EMM); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

Schedule 3 of the Teven Quarry Development Consent (2015), outlines the applicable noise criteria for residential receivers surrounding the quarry site.

Table 1 reproduces relevant criteria for each of the receivers as outlined in the quarry's Development Consent.

Table 1 Noise Criteria

Location[1]	Quarry Operations	
	Period: Day	Period: Evening
	7am – 6pm	6pm – 10pm
	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$
R3, R4, R13, R15, R16, R17, R18, R20	38	35
All other receivers	37	35

Note 1: Receiver locations are shown in Figure 1.

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3 Methodology

3.1 Locality

The quarry is located in Teven, NSW approximately 7km west of Ballina, NSW. Receivers in the locality surrounding the quarry are primarily rural residential. The surroundings of the quarry are primarily rural. The monitoring locations with respect to the quarry are presented in the locality plan shown in **Figure 1.**

3.2 Noise Monitoring Locations

Five monitoring locations have been selected as part of the NMA in accordance with the NMP. The selected monitoring locations are presented in **Table 2** along with the noise sensitive receivers they represent.

Table 2 Monitoring Locations (MGA56 Coordinates)

Location	Nearest Receiver	Easting, m	Northing, m
NM1	R7	546737	6809918
NM2	R3/R4	548892	6810285
NM3	R2	547781	6808991
NM4	R10	547576	6810379
NM5	R14	548100	6810792

3.3 Assessment Methodology

Attended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise and the NPI. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 1 February 2022 and Wednesday 2 February 2022. Acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

As per the Noise Management Plan, two daytime measurements were conducted at each monitoring location. It is noted that the quarry was not operating during the evening period, however two measurements were conducted at each monitoring location as per the requirements of the EPL.

Measurements were of 15 minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ noise contribution for comparison against the relevant criteria. Where the quarry was inaudible, the contribution is estimated to be at least 10dB below the ambient noise level.

FIGURE 1

Site Locality

MAC180611-06

Holcim Teven Quarry

KEY

Noise Monitoring Locations

0 100 200 300 400 500 m

N

MAC
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4 Results

4.1 Assessment Results - Location NM1

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM1 are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location NM1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
02/02/2022	07:08 (Day)	74	53	42	WD: SW WS: 0.1m/s Rain: Nil	Birds 40-74 Insects 40-42 Traffic 40-67 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
02/02/2022	07:23 (Day)	78	54	40	WD: SW WS: 0.1m/s Rain: Nil	Birds 37-71 Insects 37-41 Traffic 37-78 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
01/02/2022	18:05 (Evening)	72	57	42	WD: N WS: 0.6m/s Rain: Nil	Insects 39-72 Wind in trees 39-46 Aircraft 39-54 Birds <44 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
01/02/2022	18:20 (Evening)	72	59	40	WD: N WS: 0.6m/s Rain: Nil	Insects 36-72 Birds 36-41 Wind in trees 36-44 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Assessment Results - Location NM2

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM2 are presented in **Table 4**.

Table 4 Operator-Attended Noise Survey Results – Location NM2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
02/02/2022	07:51 (Day)	90	67	42	WD: SW WS: 0.1m/s Rain: Nil	Insects 39-52 Birds 39-62 Traffic 39-90 Aircraft 42-67 Creek flow <39 Local residential noise 48-56 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
02/02/2022	08:06 (Day)	88	67	47	WD: SW WS: 0.1m/s Rain: Nil	Insects 44-48 Birds 48-56 Traffic 44-88 Aircraft 44-49 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
01/02/2022	18:47 (Evening)	87	62	36	WD: N WS: 0.3m/s Rain: Nil	Birds 35-48 Insects 35-41 Traffic 35-87 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
01/02/2022	19:02 (Evening)	83	54	35	WD: N WS: 0.3m/s Rain: Nil	Birds 36-49 Insects 34-39 Traffic 34-83 Dog bark 34-46 Local residential noise 34-45 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3 Assessment Results - Location NM3

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM3 are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location NM3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
02/02/2022	08:28 (Day)	64	60	59	WD: SW WS: 0.1m/s Rain: Nil	Insects 57-64 Birds <57 Traffic <57 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
02/02/2022	08:43 (Day)	62	60	56	WD: SW WS: 0.1m/s Rain: Nil	Insects 53-62 Birds 53-59 Traffic <53 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
01/02/2022	19:23 (Evening)	66	58	49	WD: N WS: 0.2m/s Rain: Nil	Aircraft 47-52 Insects 47-66 Birds 49-52 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
01/02/2022	19:38 (Evening)	66	61	52	WD: N WS: 0.2m/s Rain: Nil	Insects 49-66 Birds 49-54 Traffic <49 Aircraft 49-64 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Assessment Results - Location NM4

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM4 are presented in **Table 6**.

Table 6 Operator-Attended Noise Survey Results – Location NM4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
02/02/2022	09:04 (Day)	85	65	54	WD: SW WS: 0.1m/s Rain: Nil	Insects 41-68 Birds 41-58 Traffic 47-85 Quarry processing 44-53
Teven Quarry $L_{Aeq(15min)}$ Contribution						47
02/02/2022	09:19 (Day)	85	64	52	WD: SW WS: 0.2m/s Rain: Nil	Insects 48-62 Birds 48-54 Traffic 48-85 Quarry processing 44-54
Teven Quarry $L_{Aeq(15min)}$ Contribution						47
01/02/2022	19:59 (Evening)	67	65	58	WD: N WS: 0.1m/s Rain: Nil	Aircraft 50-54 Insects 50-67 Birds 50-56 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
01/02/2022	20:14 (Evening)	61	54	44	WD: N WS: 0.1m/s Rain: Nil	Insects 42-58 Birds 42-61 Traffic <42 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 1: Contribution calculated at 108 Stockers Lane.

4.5 Assessment Results - Location NM5

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM5 are presented in **Table 7**.

Table 7 Operator-Attended Noise Survey Results – Location NM5

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
02/02/2022	09:38 (Day)	81	57	39	WD: SW WS: 0.1m/s Rain: Nil	Traffic 38-81 Insects 38-41 Birds 40-52 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
02/02/2022	09:53 (Day)	82	58	40	WD: SW WS: 0.2m/s Rain: Nil	Insects 39-42 Birds 40-51 Traffic 39-82 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
01/02/2022	20:32 (Evening)	58	50	48	WD: N WS: 0.1m/s Rain: Nil	Insects 45-52 Aircraft 45-58 Traffic <45 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
01/02/2022	20:47 (Evening)	53	50	48	WD: N WS: 0.1m/s Rain: Nil	Insects 44-49 Traffic 44-53 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

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5 Discussion

5.1 Discussion of Results - Location NM1

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 2 February 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Non quarry noise sources observed during the measurements included birds, insects, traffic, aircraft and wind in trees.

5.2 Discussion of Results - Location NM2

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 2 February 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Quarry noise sources observed during the measurements included the processing plant. Non quarry noise sources observed during the measurements included insects, birds, traffic, aircraft, creek flow, dog bark and local residential noise.

5.3 Discussion of Results - Location NM3

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 2 February 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Non quarry noise sources observed during the measurements included insects, birds, traffic and aircraft.

5.4 Discussion of Results - Location NM4

Quarry noise emissions were audible during the daytime noise measurements conducted on Wednesday 2 February 2022. Quarry noise contributions were estimated at 47dBA for both measurements and therefore are above the daytime noise limits.

It was observed that the stockpiles to the north of the processing area were significantly reduced compared to previous surveys where compliance was achieved. The stockpiles reduce line of site between the plant and receiver NM4 and as a result provide a significant amount of noise attenuation for the project site. Due to a recent high demand the stockpile has been significantly reduced. Typically, it takes three to four weeks to replenish the stockpile to full capacity. The plant manager was notified of the exceedance and will investigate other potential factors such as the integrity of plant enclosures and whether access doors are being closed. Over the next quarterly period, stockpile levels will be monitored more frequently, and potential permanent solutions will be investigated.

The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Quarry noise sources observed during the measurements included the processing plant. Non quarry noise sources included insects, birds, traffic and aircraft.

5.5 Discussion of Results - Location NM5

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 2 February 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

It is noted that due to excessive rainfall access to receiver NM5 was not available. An intermediate location on Stokers Lane closer to the quarry was assessed.

Non quarry noise sources observed during the measurements included traffic, birds and insects.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Teven Quarry, Teven, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Development Consent for the relevant surrounding residential receivers during Quarter 1, ending March 2022.

Attended noise measurements were undertaken on Tuesday 1 February 2022 and Wednesday 2 February 2022 at five representative monitoring locations with quarry noise contributions compared against the relevant criteria.

The assessment has identified that noise emissions generated by Teven Quarry exceeded relevant noise criteria specified in the Development Consent at receiver NM4 during the day period. Section 5.4 of the discussion outlines recommendations to help reduce noise emissions as demonstrated in historical assessments. At all other receiver locations, quarry noise was inaudible and therefore complied with relevant criteria.

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Appendix A - Glossary of Terms

Table A1 provides a number of technical terms have been used in this report.

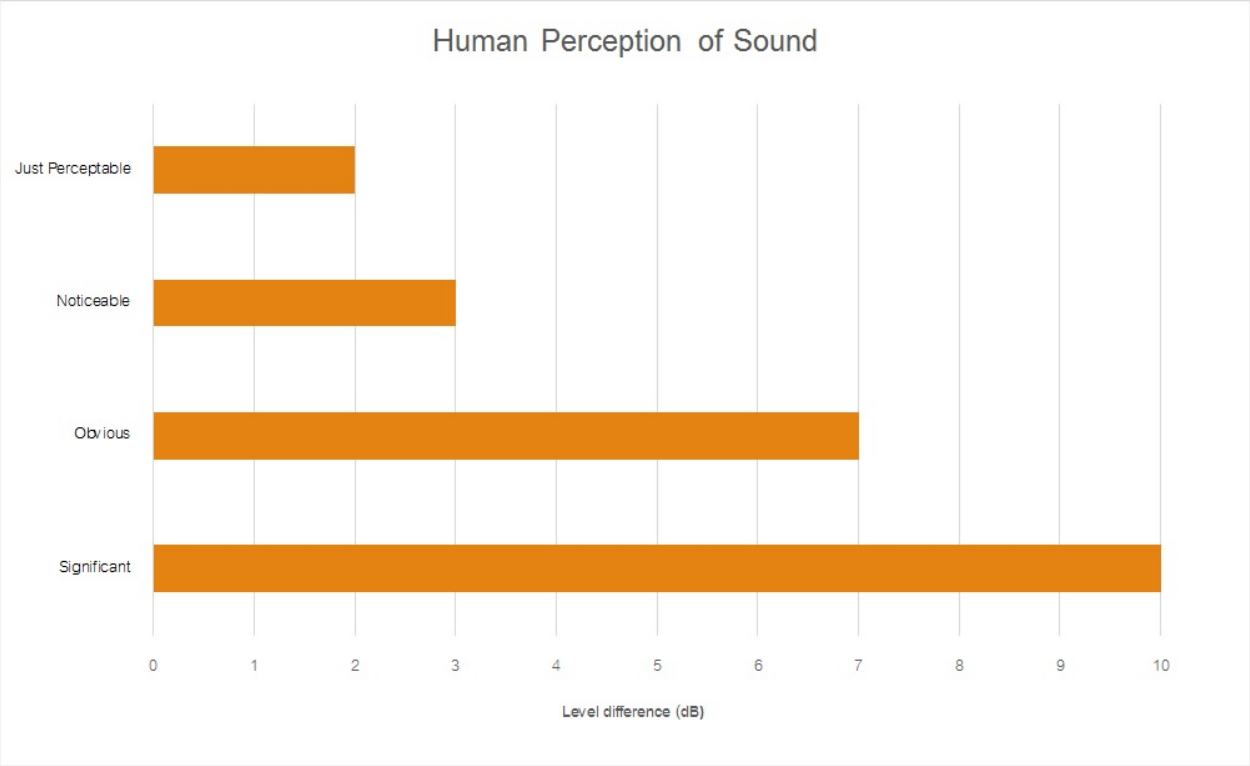
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Noise Monitoring Assessment

Teven Quarry, Teven, NSW
Quarter 2 Ending June 2022

Prepared for: Holcim (Australia) Pty Ltd
May 2022
MAC180611-06RP16

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Teven Quarry, Teven, NSW

Quarter 2 Ending June 2022

Prepared for: Holcim (Australia) Pty Ltd

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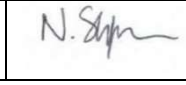
Document ID	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-06RP16	30 May 2022	Nicholas Shipman		Rod Linnett	

CONTENTS

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The monitoring has been conducted in accordance with the Teven Noise Management Plan (NMP) and in general accordance with relevant conditions outlined in the Development Consent (ref: SSD 6422) at five representative monitoring locations. This assessment has been undertaken during Quarter 2, ending June 2022 and forms part of the noise monitoring program for the quarry.

The assessment has been conducted in accordance with the following documents:

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Table 1 reproduces relevant criteria for each of the receivers as outlined in the quarry's Development Consent.

Table 1 Noise Criteria

Location[1]	Quarry Operations	
	Period: Day	Period: Evening
	7am – 6pm	6pm – 10pm
	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$
R3, R4, R13, R15, R16, R17, R18, R20	38	35
All other receivers	37	35

Note 1: Receiver locations are shown in Figure 1.

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3 Methodology

3.1 Locality

The quarry is located in Teven, NSW approximately 7km west of Ballina, NSW. Receivers in the locality surrounding the quarry are primarily rural residential. The surroundings of the quarry are primarily rural. The monitoring locations with respect to the quarry are presented in the locality plan shown in **Figure 1**.

3.2 Noise Monitoring Locations

Five monitoring locations have been selected as part of the NMA in accordance with the NMP. The selected monitoring locations are presented in **Table 2** along with the noise sensitive receivers they represent.

Table 2 Monitoring Locations (MGA56 Coordinates)

Location	Nearest Receiver	Easting, m	Northing, m
NM1	R7	546737	6809918
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NM3	R2	547781	6808991
NM4	R10	547576	6810379
NM5	R14	548100	6810792

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As per the Noise Management Plan, two daytime measurements were conducted at each monitoring location. It is noted that the quarry was not operating during the evening period, however two measurements were conducted at each monitoring location as per the requirements of the EPL.

Measurements were of 15 minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ noise contribution for comparison against the relevant criteria. Where the quarry was inaudible, the contribution is estimated to be at least 10dB below the ambient noise level.

FIGURE 1

Site Locality

MAC180611-06

Holcim Teven Quarry

KEY

Noise Monitoring Locations

0 100 200 300 400 500 m

N

MAC
Muller Acoustic Consulting

4 Results

4.1 Assessment Results - Location NM1

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM1 are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location NM1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/05/2022	09:09 (Day)	76	55	40	WD: N WS: 0.4m/s Rain: Nil	Insects <38 Birds 38-49 Traffic 37-72 Wind in trees 38-46 Aircraft 46-76 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
19/05/2022	09:24 (Day)	70	48	39	WD: N WS: 0.4m/s Rain: Nil	Insects <37 Birds 37-56 Traffic 38-70 Aircraft 39-44 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<29
18/05/2022	18:25 (Evening)	58	41	39	WD: N WS: 0.8m/s Rain: Nil	Insects 37-48 Traffic 38-44 Aircraft 41-43 Wind in trees 38-41 MAC operator 52-58 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
18/05/2022	18:40 (Evening)	62	41	36	WD: N WS: 1m/s Rain: Nil	Insects 36-44 Traffic 35-62 Wind in trees 36-42 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Assessment Results - Location NM2

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM2 are presented in **Table 4**.

Table 4 Operator-Attended Noise Survey Results – Location NM2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/05/2022	09:51 (Day)	97	69	42	WD: N WS: 0.4m/s Rain: Nil	Birds 41-72 Traffic 41-97 Insects <40 Local residential noise 39-46 Quarry alarms barely audible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<32
19/05/2022	10:06 (Day)	84	64	41	WD: N WS: 0.4m/s Rain: Nil	Birds 40-51 Traffic 39-84 Insects <40 Dog bark 46-51 Local residential noise 40-60 Quarry processing <37 Quarry alarms barely audible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<37
18/05/2022	19:10 (Evening)	86	56	36	WD: N WS: 0.2m/s Rain: Nil	Insects 36-42 Traffic 35-86 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
18/05/2022	19:25 (Evening)	85	59	36	WD: N WS: 0.2m/s Rain: Nil	Insects 37-42 Traffic 36-85 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3 Assessment Results - Location NM3

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM3 are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location NM3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/05/2022	10:27 (Day)	65	45	39	WD: N WS: 0.4m/s Rain: Nil	Birds 37-65 Insects <40 Traffic 37-45 Aircraft 39-56 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<29
19/05/2022	10:42 (Day)	87	58	38	WD: N WS: 0.3m/s Rain: Nil	Birds 41-46 Insects <38 Traffic 38-87 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
18/05/2022	19:45 (Evening)	46	41	39	WD: N WS: 0.2m/s Rain: Nil	Insects 37-43 Traffic 37-46 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
18/05/2022	20:00 (Evening)	46	41	39	WD: N WS: 0.2m/s Rain: Nil	Insects 37-41 Traffic 40-46 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Assessment Results - Location NM4

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM4 are presented in **Table 6**.

Table 6 Operator-Attended Noise Survey Results – Location NM4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/05/2022	11:04 (Day)	83	63	45	WD: N WS: 0.3m/s Rain: Nil	Traffic 43-83 Birds 44-52 Quarry processing 35-40
Teven Quarry $L_{Aeq(15min)}$ Contribution						37
19/05/2022	11:19 (Day)	87	64	43	WD: N WS: 0.2m/s Rain: Nil	Traffic 41-87 Birds 40-47 Insects <42 Quarry processing 34-39
Teven Quarry $L_{Aeq(15min)}$ Contribution						36
18/05/2022	20:22 (Evening)	75	46	36	WD: N WS: 0.3m/s Rain: Nil	Insects 36-41 Traffic 40-46 Aircraft 36-44 Birds 34-75 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
18/05/2022	20:37 (Evening)	50	38	35	WD: N WS: 0.2m/s Rain: Nil	Insects 34-40 Aircraft 39-50 Traffic 36-41 Birds 38-46 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 1: Contribution calculated at 108 Stockers Lane.

4.5 Assessment Results - Location NM5

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM5 are presented in **Table 7**.

Table 7 Operator-Attended Noise Survey Results – Location NM5

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
19/05/2022	11:37 (Day)	83	62	38	WD: N WS: 0.3m/s Rain: Nil	Traffic 36-83 Insects <35 Birds 36-54 Quarry alarms <34 Quarry processing 34-36 (5 minutes)
Teven Quarry $L_{Aeq(15min)}$ Contribution						30
19/05/2022	11:52 (Day)	81	63	38	WD: N WS: 0.3m/s Rain: Nil	Traffic 37-81 Insects <35 Aircraft 42-53 Quarry alarms <35 Quarry processing 34-36
Teven Quarry $L_{Aeq(15min)}$ Contribution						35
18/05/2022	20:56 (Evening)	68	52	34	WD: N WS: 0.3m/s Rain: Nil	Insects 34-39 Birds 36-54 Aircraft 38-68 Traffic 38-56 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
18/05/2022	21:11 (Evening)	45	37	34	WD: N WS: 0.3m/s Rain: Nil	Insects 32-40 Traffic 35-45 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

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5 Discussion

5.1 Discussion of Results - Location NM1

Quarry noise emissions were inaudible during the daytime measurements conducted on Thursday 19 May 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Non quarry noise sources observed during the measurements included insects, birds, traffic, wind in trees, operator noise and aircraft.

5.2 Discussion of Results - Location NM2

Quarry noise emissions were audible during the daytime measurements conducted on Thursday 19 May 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Quarry noise sources observed during the measurements included the processing activities. Non quarry noise sources observed during the measurements included birds, traffic, insects, local residential noise and dog bark.

5.3 Discussion of Results - Location NM3

Quarry noise emissions were inaudible during the daytime measurements conducted on Thursday 19 May 2022 Quarry noise contributions were estimated to be less than 35dBA for both measurements and satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Non quarry noise sources observed during the measurements included insects, birds, traffic and aircraft.

5.4 Discussion of Results - Location NM4

Quarry noise emissions were audible during the daytime noise measurements conducted on Thursday 19 May 2022. Quarry noise contributions were estimated between 36dBA and 37dBA for both measurements and therefore satisfied the daytime noise limits.

It was observed that the stockpiles to the north of the processing area were significantly higher compared to the previous survey where compliance was not achieved.

The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Quarry noise sources observed during the measurements included processing activities. Non quarry noise sources included traffic, birds, insects and aircraft.

5.5 Discussion of Results - Location NM5

Quarry noise emissions were audible during the daytime measurements conducted on Thursday 19 May 2022. Quarry noise contributions were estimated to be less than 35dBA for both measurements and satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

It is noted that due to excessive rainfall access to receiver NM5 was not available. An intermediate location on Stokers Lane closer to the quarry was used to complete the assessment.

Non quarry noise sources observed during the measurements included traffic, aircraft, birds and insects.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Teven Quarry, Teven, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Development Consent for the relevant surrounding residential receivers during Quarter 2, ending June 2022.

Attended noise measurements were undertaken on Wednesday 18 May 2022 and Thursday 19 May 2022 at five representative monitoring locations with quarry noise contributions compared against the relevant criteria.

The assessment has identified that noise emissions generated by Teven Quarry were audible on several occasions although complied with relevant criteria.

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Appendix A - Glossary of Terms

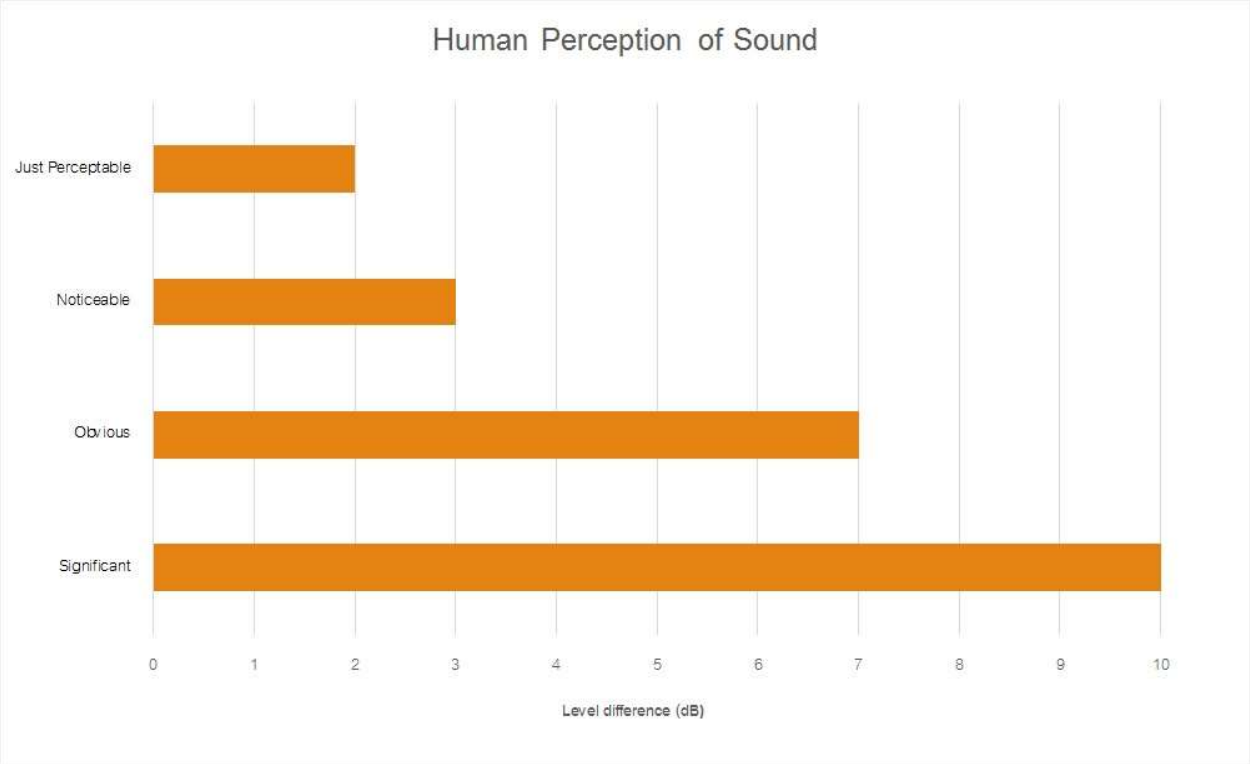
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Muller Acoustic Consulting

Noise Monitoring Assessment

Teven Quarry, Teven, NSW
Quarter 3 Ending September 2022

Prepared for: Holcim (Australia) Pty Ltd
September 2022
MAC180611-06RP17

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Teven Quarry, Teven, NSW

Quarter 3 Ending September 2022

Prepared for: Holcim (Australia) Pty Ltd

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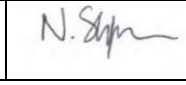
MAC180611-06RP17	7 September 2022	Nicholas Shipman		Rod Linnett	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for the quarterly period ending September 2022 for Teven Quarry (the 'quarry'), Teven, NSW.

The monitoring has been conducted in accordance with the Teven Noise Management Plan (NMP) and in general accordance with relevant conditions outlined in the Development Consent (ref: SSD 6422) at five representative monitoring locations. This assessment has been undertaken during Quarter 3, ending September 2022 and forms part of the noise monitoring program for the quarry.

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- NSW Environment Protection Authority (EPA), Environmental Protection Licence (EPL 3293);
- NSW Department of Planning and Environment, Development Consent (SSD 6422), 2015;
- Teven Quarry Noise Management Plan Revision 1, 4 May 2016 (EMM); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

Schedule 3 of the Teven Quarry Development Consent (2015) outlines the applicable noise criteria for residential receivers surrounding the quarry site.

Table 1 reproduces relevant criteria for each of the receivers as outlined in the quarry's Development Consent.

Table 1 Noise Criteria

Location[1]	Quarry Operations	
	Period: Day	Period: Evening
	7am – 6pm	6pm – 10pm
	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$
R3, R4, R13, R15, R16, R17, R18, R20	38	35
All other receivers	37	35

Note 1: Receiver locations are shown in Figure 1.

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3 Methodology

3.1 Locality

The quarry is located in Teven, NSW approximately 7km west of Ballina, NSW. Receivers in the locality surrounding the quarry are primarily rural residential. The surroundings of the quarry are primarily rural. The monitoring locations with respect to the quarry are presented in the locality plan shown in **Figure 1**.

3.2 Noise Monitoring Locations

Five monitoring locations have been selected as part of the NMA in accordance with the NMP. The selected monitoring locations are presented in **Table 2** along with the noise sensitive receivers they represent.

Table 2 Monitoring Locations (MGA56 Coordinates)

Location	Nearest Receiver	Easting, m	Northing, m
NM1	R7	546737	6809918
NM2	R3/R4	548892	6810285
NM3	R2	547781	6808991
NM4	R10	547576	6810379
NM5	R14	548100	6810792

3.3 Assessment Methodology

Attended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise and the NPI. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 30 August 2022 and Wednesday 31 August 2022. Acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

As per the Noise Management Plan, two daytime measurements were conducted at each monitoring location. It is noted that the quarry was not operating during the evening period, however two measurements were conducted at each monitoring location as per the requirements of the EPL.

Measurements were of 15 minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ noise contribution for comparison against the relevant criteria. Where the quarry was inaudible, the contribution is estimated to be at least 10dB below the ambient noise level.

FIGURE 1

Site Locality

MAC180611-06

Holcim Teven Quarry

KEY

Noise Monitoring Locations

0 100 200 300 400 500 m

N

MAC
Muller Acoustic Consulting

4 Results

4.1 Assessment Results - Location NM1

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM1 are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location NM1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
31/08/2022	08:39 (Day)	72	47	34	WD: NW WS: 1.6m/s Rain: Nil	Wind in trees 32-46 Birds 38-53 Traffic 34-72 Holcim mobile plant 30-34
Teven Quarry $L_{Aeq(15min)}$ Contribution						32
31/08/2022	08:54 (Day)	67	44	30	WD: NW WS: 1.2m/s Rain: Nil	Wind in trees 29-41 Birds 32-59 Traffic 34-67 Insects 29-34 Aircraft 31-42 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
30/08/2022	18:09 (Evening)	65	47	45	WD: N WS: 0.1m/s Rain: Nil	Insects 44-47 Birds 44-49 Traffic 46-65 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
30/08/2022	18:24 (Evening)	57	45	44	WD: N WS: 0.1m/s Rain: Nil	Insects 44-48 Traffic 44-57 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.2 Assessment Results - Location NM2

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM2 are presented in **Table 4**.

Table 4 Operator-Attended Noise Survey Results – Location NM2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
31/08/2022	09:24 (Day)	84	63	45	WD: NW WS: 0.3m/s Rain: Nil	Birds 41-56 Traffic 37-84 Aircraft 41-66 Construction noise 36-64 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
31/08/2022	09:39 (Day)	81	64	52	WD: NW WS: 0.2m/s Rain: Nil	Birds 46-52 Traffic 46-81 Construction noise 48-67 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<38
30/08/2022	18:52 (Evening)	85	58	42	WD: N WS: 0.1m/s Rain: Nil	Traffic 39-85 Insects 39-44 Aircraft 41-54 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
30/08/2022	19:07 (Evening)	81	58	40	WD: N WS: 0.1m/s Rain: Nil	Insects 38-44 Traffic 38-81 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3 Assessment Results - Location NM3

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM3 are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location NM3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
31/08/2022	09:59 (Day)	55	36	31	WD: NW WS: 0.2m/s Rain: Nil	Birds 29-48 Insects 29-32 Traffic 32-36 Aircraft 30-55 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
31/08/2022	10:14 (Day)	50	38	33	WD: NW WS: 0.2m/s Rain: Nil	Birds 30-50 Insects 30-32 Traffic 31-34 Aircraft 30-44 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
30/08/2022	19:31 (Evening)	51	38	34	WD: N WS: 0.1m/s Rain: Nil	Insects 34-39 Traffic 38-51 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
30/08/2022	19:46 (Evening)	41	36	34	WD: N WS: 0.1m/s Rain: Nil	Insects 33-37 Traffic 36-41 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Assessment Results - Location NM4

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM4 are presented in **Table 6**.

Table 6 Operator-Attended Noise Survey Results – Location NM4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
31/08/2022	10:35 (Day)	87	62	48	WD: NW WS: 1.6m/s Rain: Nil	Birds 44-54 Wind in trees 45-55 Traffic 45-87 Quarry processing <43
Teven Quarry $L_{Aeq(15min)}$ Contribution						37[1]
31/08/2022	10:50 (Day)	81	57	48	WD: NW WS: 1.5m/s Rain: Nil	Birds 45-56 Wind in trees 45-52 Traffic 45-81 Insects <45 Quarry processing <42
Teven Quarry $L_{Aeq(15min)}$ Contribution						37[1]
30/08/2022	20:12 (Evening)	52	40	36	WD: N WS: 0.1m/s Rain: Nil	Traffic 32-52 Insects 32-46 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
30/08/2022	20:27 (Evening)	55	41	37	WD: N WS: 0.1m/s Rain: Nil	Traffic 32-43 Insects 32-36 Aircraft 37-55 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 1: Contribution calculated at 108 Stockers Lane.

4.5 Assessment Results - Location NM5

The monitored noise level contributions and observed meteorological conditions for each day and evening survey period at Location NM5 are presented in **Table 7**.

Table 7 Operator-Attended Noise Survey Results – Location NM5

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
31/08/2022	11:07 (Day)	79	56	41	WD: NW WS: 2m/s Rain: Nil	Traffic 38-79 Birds 41-64 Wind in trees 39-48 Quarry mobile plant <35
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
31/08/2022	11:22 (Day)	81	60	43	WD: NW WS: 2.2m/s Rain: Nil	Traffic 41-81 Birds 42-59 Wind in trees 41-49 Quarry mobile plant <35
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
30/08/2022	20:45 (Evening)	56	37	34	WD: N WS: 0.1m/s Rain: Nil	Insects 30-36 Traffic 30-56 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
30/08/2022	21:00 (Evening)	77	49	31	WD: N WS: 0.1m/s Rain: Nil	Insects 29-35 Traffic 30-77 Quarry inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

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5 Discussion

5.1 Discussion of Results - Location NM1

Quarry noise emissions were audible during one measurement throughout the measurement period on Tuesday 30 August 2022 and Wednesday 31 August 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Non quarry noise sources observed during the measurements included wind in trees, birds, traffic, insects and aircraft.

5.2 Discussion of Results - Location NM2

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 31 August 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Non quarry noise sources observed during the measurements included birds, traffic, aircraft, construction noise and insects.

5.3 Discussion of Results - Location NM3

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 31 August 2022 Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Non quarry noise sources observed during the measurements included birds, insects, traffic and aircraft.

5.4 Discussion of Results - Location NM4

Quarry noise emissions were audible during the daytime noise measurements conducted on Wednesday 31 August 2022. Quarry noise contributions were estimated to be 37dBA for both measurements and therefore satisfied the daytime noise limits.

It was observed that the stockpiles to the north of the processing area were significantly higher compared to the previous survey where compliance was not achieved.

The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

Quarry noise sources observed during the measurements included processing activities. Non quarry noise sources included birds, wind in trees, traffic, insects and aircraft.

5.5 Discussion of Results - Location NM5

Quarry noise emissions were audible during the daytime measurements conducted on Wednesday 31 August 2022. Quarry noise contributions were estimated to satisfy the daytime noise limits. The quarry was not operational during the evening period which satisfied the relevant evening noise limits however background measurements were completed as per the requirements of the EPL.

It is noted that due to excessive rainfall access to receiver NM5 was not available. An intermediate location on Stokers Lane closer to the quarry was used to complete the assessment.

Non quarry noise sources observed during the measurements included traffic, birds, wind in trees and insects.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Teven Quarry, Teven, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Development Consent for the relevant surrounding residential receivers during Quarter 3, ending September 2022.

Attended noise measurements were undertaken on Tuesday 30 August 2022 and Wednesday 31 August 2022 at five representative monitoring locations with quarry noise contributions compared against the relevant criteria.

The assessment has identified that noise emissions generated by Teven Quarry were audible on several occasions although complied with relevant criteria.

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Appendix A - Glossary of Terms

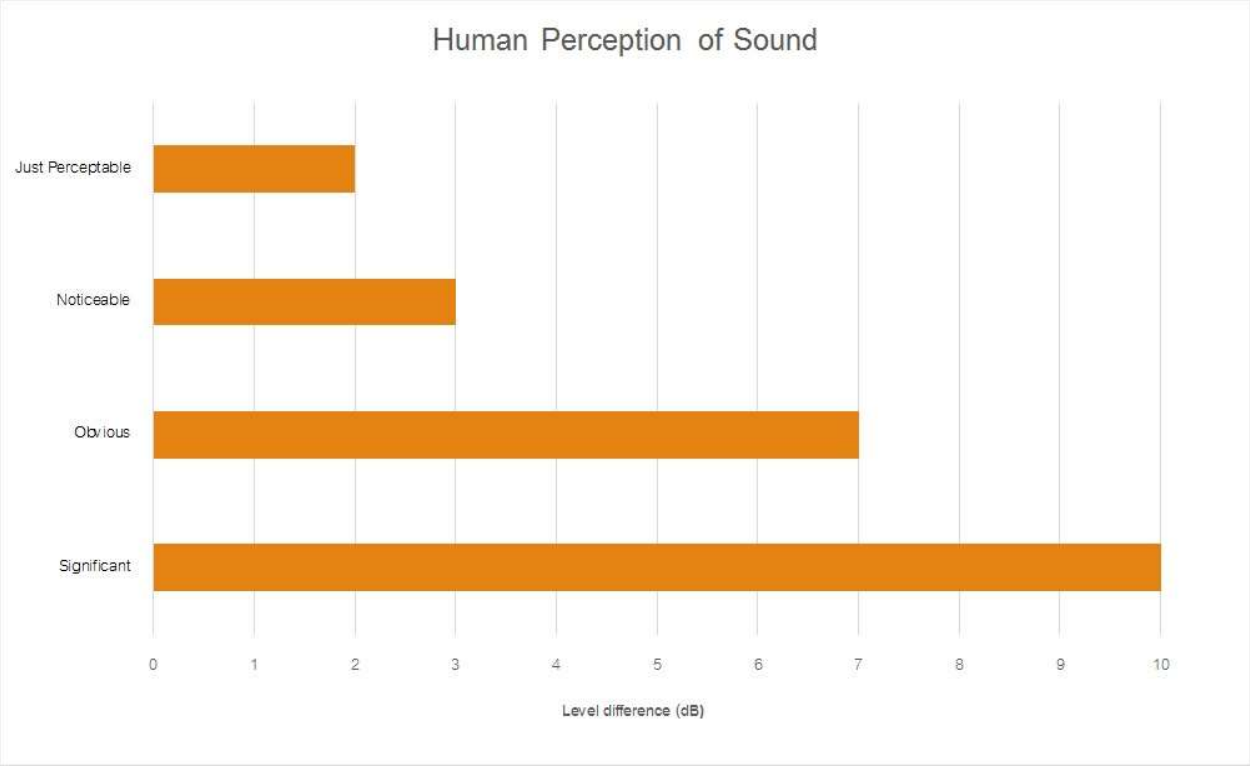
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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QUARTERLY NOISE MONITORING ASSESSMENT – QUARTER 4 2022

TEVEN QUARRY, TEVEN, NSW

RAMBOLL Bright ideas. Sustainable change.

QUARTERLY NOISE MONITORING ASSESSMENT – QUARTER 4 2022
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CONTENTS

Tables

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

Source: Noise Guide for Local Government (NSW EPA, 2013)

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 Teven Quarry ("the quarry") at Teven, NSW.

This NMA was done in accordance with the following documents:

- Noise Policy for Industry (NPI) (NSW EPA, 2017).
- Teven Quarry Noise Management Plan (NMP) (Holcim Australia, 2021).
- Environment Protection Licence (EPL) number 3293 (NSW EPA, 2021).
- Development Consent Application Number SSD_6422 (Minister for Planning and Environment, 2015).
- 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 in accordance with the NMP for the quarterly period October to December 2022, 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 in Teven, NSW, approximately 7 km west of Ballina, NSW.

Sensitive receptors surrounding the quarry are primarily rural and residential properties in coastal bushland with elevated and undulating topography.

Five monitoring locations have been selected as part of the NMA and in accordance with the EPL and Development Consent and are shown in **Table 1-1**.

Table 1-1: Monitoring locations locality and sensitive receptors

Monitoring Locations	Nearest Receiver	Locality and Sensitive Receptors
NM1	R7	West of the quarry situated at a rural residential property at the end of Leadbeatters Lane.
NM2	R3/R4	East of the quarry situated at a rural residential property on Teven Road.
NM3	R2	South of the quarry situated at a rural residential property at the end of Wellers Road.
NM4	R10	North of the quarry situated at a rural residential property adjacent the site off Stokers Lane.
NM5	R14	Northeast of the quarry situated at a rural residential property of Teven Road.

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

Legend

Noise monitoring location

Figure 1 : Noise monitoring locations at Teven Quarry

2. NOISE CRITERIA

Table 2-1 summaries the applicable noise criteria outlined in the NMP and Development Consent for residential receivers (NM1, NM2, NM3, NM4, NM5) surrounding the quarry.

Table 2-1: Monitoring locations and noise criteria

Receivers	Monitoring Locations	Day[1]	Evening[2]
		LAeq (15min)	LAeq (15min)
		Db(A)	
R3, R4, R13, R15, R16, R17, R18, R20	NM2	38	35
All other receivers	NM1, NM3, NM4, NM5	37	35

[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. METHODOLOGY

The monitoring program was created 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 Tuesday 13 December 2022 and Wednesday 14 December 2022. 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 also 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-minute periods at each location over two days. As per the NMP, two measurements were conducted during the day, and two measurements were conducted during the evening, at each monitoring location. It is noted that the quarry was not operational during the evening periods, however, monitoring was conducted as per requirements of the EPL.

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, or estimated to be less than criteria value.

4. RESULTS AND DISCUSSION

4.1 Location NM1

Noise monitoring at location NM1 conducted on Tuesday 13 December 2022 and Wednesday 14 December 2022 resulted in inaudible quarry noise during both the day and evening periods. These results meet the established noise criteria and indicate that noise emissions from Teven Quarry did not contribute to noise nuisance. The results and observations taken during the monitoring event at Location NM1 are presented in Table 4-1.

Extraneous noise sources and the dominant background contribution was from birds and insects.

Table 4-1: Noise survey results and observations for Location NM1

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Teven Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)
		LAmax	LAeq	LA90				
14-12-22	7:00 (Day)	82	46	32	WD: n/a WS: 0 Rain: Nil	Background 35 Birds 40 Quarry inaudible	<37	37
14-12-22	7:15 (Day)	60	35	30	WD: n/a WS: 0 Rain: Nil	Background 35 Birds 40 Quarry inaudible	<37	37
13-12-22	20:53 (Evening)	61	42	40	WD: n/a WS: 0 Rain: Nil	Insects 40-48 Distant Road traffic 40 Aircraft 45 Quarry inaudible	<35	35
13-12-22	21:09 (Evening)	58	40	39	WD: n/a WS: 0 Rain: Nil	Insects 40-45 Distant Road traffic 40 Aircraft 58 Quarry inaudible	<35	35

4.2 Location NM2

Noise monitoring at location NM2 conducted on Tuesday 13 December 2022 and Wednesday 14 December 2022 resulted in inaudible quarry noise during both the day and evening periods. These results meet the established noise criteria and indicate that noise emissions from Teven Quarry did not contribute to noise nuisance. The results and observations taken during the monitoring events at Location NM2 are presented in Table 4-2.

Extraneous noise sources measured included birds, aircraft, a barking dog, and cars and trucks passing on Teven Road.

Table 4-2: Noise survey results and observations for Location NM2

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Teven Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)
		LAmax	LAeq	LA90				
14-12-22	8:53 (Day)	88	66	45	WD: n/a WS: 0 Rain: Nil	Birds Car passing 73 Truck passing 80 Quarry inaudible	<38	38
14-12-22	9:09 (Day)	85	66	41	WD: n/a WS: 0 Rain: Nil	Birds Trucks passing 61-79 Dog barking Quarry inaudible	<38	38
13-12-22	18:57 (Evening)	81	59	35	WD: 270° WS: 0.4 m/s Rain: Nil	Birds 50-63 Cars passing 55-80 Aircraft 57 Dog barking 55-57 Quarry inaudible	<35	35
13-12-22	19:12 (Evening)	83	57	35	WD: 270° WS: 0.3 m/s Rain: Nil	Birds 48-59 Cars passing 52-80 Quarry inaudible	<35	35

4.3 Location NM3

Noise monitoring at location NM3 conducted on Tuesday 13 December 2022 and Wednesday 14 December 2022 resulted in inaudible quarry noise during both the day and evening periods. These results meet the established noise criteria and indicate that noise emissions from Teven Quarry did not contribute to noise nuisance. The results and observations taken during the monitoring events at Location NM3 are presented in Table 4-3.

Noise sources measured included birds, aircrafts, distant road traffic and chirping insects (mostly cicada). Insects were the dominant noise source.

Table 4-3: Noise survey results and observations for Location NM3

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Teven Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)
		LAmax	LAeq	LA90				
14-12-22	9:29 (Day)	73	58	56	WD: n/a WS: 0 Rain: Nil	Aircraft 60 Birds Insects (dominant source) Quarry inaudible	<37	37
14-12-22	9:45 (Day)	82	58	56	WD: n/a WS: 0 Rain: Nil	Birds Insects 54-59 Quarry inaudible	<37	37
13-12-22	18:07 (Evening)	67	41	37	WD: 270° WS: 0.6 m/s Rain: Nil	Bird 47 Insects chirping 37-39 Cicada 43-45 Distant Road traffic 38-47 Quarry inaudible	<35	35
13-12-22	18:38 (Evening)	59	40	37	WD: 270° WS: 1.6 m/s Rain: Nil	Aircraft 59 Bird calls 37-52 Insects chirping 37-39 Distant Road traffic 38-43 Quarry inaudible	<35	35

4.4 Location NM4

Noise monitoring at location NM4 conducted on Tuesday 13 December 2022 and Wednesday 14 December 2022 resulted in inaudible quarry noise during both the day and evening periods. These results meet the established noise criteria and indicate that noise emissions from Teven Quarry did not contribute to noise nuisance. The results and observations taken during the monitoring events at Location NM4 are presented in Table 4-4.

Noise sources measured included birds, traffic to site, reverse beeper, front end loader, aircraft, passing trucks, passing cars and insects (mostly cicada).

Table 4-4: Noise survey results and observations for Location NM4

Date	Time	Descriptor (dBA)			Meteorology	Apparent Noise Source, Description and LAeq (dBA)	Teven Quarry LAeq(15min) Contribution (dBA)	LAeq(15min) Criteria (dBA)
		LAmax	LAeq	LA90				
14-12-22	8:20 (Day)	80	58	41	WD: n/a WS: 0 Rain: Nil	Birds Traffic to site Trucks passing 71-80 Front end loader up incline 52 Quarry inaudible	<37	37
14-12-22	8:35 (Day)	77	56	43	WD: n/a WS: 0 Rain: Nil	Birds Traffic to site Trucks passing 60-75 Reversing beeper 46 Quarry inaudible	<37	37
13-12-22	20:07 (Evening)	79	59	49	WD: n/a WS: 0 Rain: Nil	Insects (mostly cicada) 48-59 Quarry inaudible	<35	35
13-12-22	20:23 (Evening)	89	55	47	WD: n/a WS: 0 Rain: Nil	Insects (mostly cicada) 48-56 Aircraft 53-55 Car passing 65 Sneeze 88 Quarry inaudible	<35	35

4.5 Location NM5

Noise monitoring at location NM5 conducted on Tuesday 13 December 2022 and Wednesday 14 December 2022 resulted in inaudible quarry noise during both the day and evening periods. These results meet the established noise criteria and indicate that noise emissions from Teven Quarry did not contribute to noise nuisance. The results and observations taken during the monitoring events at Location NM5 are presented in Table 4-5.

Noise sources measured included birds, frogs, insects, aircraft, passing trucks and the nearby Boral quarry to the east of the quarry.

Table 4-5: Noise survey results and observations for Location NM5

Date	Time (hrs)	Descriptor (dBA)			Meteorology	Description and SPL, dBA	Teven Quarry LAeq(15min) Contribution	LAeq(15min) Criteria
		LAmax	LAeq	LA90				
14-12-22	7:43 (Day)	75	44	38	WD: n/a WS: 0 Rain: Nil	Insects Birds Frogs Truck pass 40 Boral quarry nearby audible Quarry inaudible	<37	37
14-12-22	7:59 (Day)	73	44	36	WD: n/a WS: 0 Rain: Nil	Insects Birds Frogs Truck pass 40 Boral quarry nearby audible Quarry inaudible	<37	37
13-12-22	19:31 (Evening)	68	41	35	WD: 270° WS: 1.3 m/s Rain: Nil	Birds 39-44 Insects 36-41 Quarry inaudible	<35	35
13-12-22	19:46 (Evening)	59	46	40	WD: 270° WS: 0.5 m/s Rain: Nil	Aircraft 39-45 Birds 40-49 Insects 38-41 Cicada 40-49 Quarry inaudible	<35	35

5. CONCLUSION

Monitoring was carried out on Tuesday 13 December and Wednesday 14 December 2022 at five locations selected as representative to the sensitive receptors at the surroundings to Teven Quarry.

This NMA completed by Ramboll at the Holcim Teven Quarry, Teven, NSW as a quarterly requirement of the NMP showed compliance to the relevant noise criteria.

6. REFERENCES

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