Noise Monitoring Assessment

Teven Quarry, Teven, NSW
Quarter 2 Ending June 2021.

Prepared for: Holcim (Australia) Pty Ltd
May 2021
MAC180611-06RP12

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Teven Quarry, Teven, NSW

Quarter 2 Ending June 2021

Prepared for: Holcim (Australia) Pty Ltd

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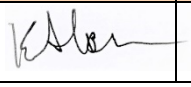
MAC180611-06RP12	Final	31 May 2021	Kristian Allen		Rod Linnett	

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 June 2021 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 2, ending June 2021 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 Wednesday 19 May 2021. 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}		
19/05/2021	11:45 (Day)	53	37	33	WD: SE WS: 1.0m/s Rain: Nil	Traffic 31-35 Birds 28-53 Aircraft 30-48 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
19/05/2021	12:00 (Day)	52	36	32	WD: SE WS: 1.0m/s Rain: Nil	Traffic 30-35 Birds 27-52 Residential Noise 32-39 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
19/05/2021	18:14 (Evening)	63	40	33	WD: SE WS: <0.5m/s Rain: Nil	Traffic 30-63 Insects 32-45 Dogs <32 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
19/05/2021	18:29 (Evening)	52	37	29	WD: SE WS: <0.5m/s Rain: Nil	Traffic 25-39 Insects 28-36 Dogs 25-30 Aircraft 30-52 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}		
19/05/2021	13:05 (Day)	85	65	39	WD: SW WS: 1.0m/s Rain: Nil	Traffic 33-85 Birds 33-46 Aircraft 35-56 Wind 36-40 Quarry - Reverse Alarms <33 (Infrequent 3 second durations)
	Teven Quarry $L_{Aeq(15min)}$ Contribution					<33
19/05/2021	13:20 (Day)	88	65	38	WD: SW WS: 1.0m/s Rain: Nil	Traffic 31-88 Birds 31-54 Wind 34-40 Aircraft 35-40 Quarry Inaudible
	Teven Quarry $L_{Aeq(15min)}$ Contribution					<30
19/05/2021	19:34 (Evening)	88	66	37	WD: S WS: <0.5m/s Rain: Nil	Traffic 32-88 Insects 35-44 Quarry Inaudible
	Teven Quarry $L_{Aeq(15min)}$ Contribution					Quarry not operational
19/05/2021	19:49 (Evening)	85	60	37	WD: S WS: <0.5m/s Rain: Nil	Traffic 31-85 Insects 34-41 People 31-40 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}		
19/05/2021	12:30 (Day)	79	56	31	WD: SE WS: 1.0m/s Rain: Nil	Traffic 29-36 Birds 26-41 Aircraft 30-79 Wind 26-34 Insects 29-41 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
19/05/2021	12:45 (Day)	54	44	32	WD: SE WS: 1.0m/s Rain: Nil	Traffic 30-35 Insects 30-49 Birds 27-54 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
19/05/2021	18:59 (Evening)	60	47	42	WD: SE WS: <0.5m/s Rain: Nil	Insects 37-47 Traffic 34-40 Aircraft 34-60 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
19/05/2021	19:14 (Evening)	52	45	41	WD: S WS: 0.1m/s Rain: Nil	Insects 36-52 Traffic 33-43 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}		
19/05/2021	13:55 (Day)	73	58	45	WD: S WS: 0.5m/s Rain: Nil	Traffic 40-73 Trucks Idling 52-60 Agricultural Noise <39 Quarry FEL <35-47 (6-8 Minute total duration) Quarry Processing <35-44 (10-15 minute duration) Quarry Trucks <35-39 (Infrequent 20 second durations)
Teven Quarry $L_{Aeq(15min)}$ Contribution						37[1]
19/05/2021	14:10 (Day)	74	55	44	WD: S WS: 0.5m/s Rain: Nil	Traffic 38-74 Trucks Idling 52-56 Agricultural Noise <37-40 Quarry FEL <34-45 (6-9 minute total duration) Quarry Processing <34-43 (10-15 minute duration) Quarry Trucks <34-38 (Infrequent 20 second durations)
Teven Quarry $L_{Aeq(15min)}$ Contribution						37[1]
19/05/2021	20:43 (Evening)	47	39	37	WD: S WS: 0.1m/s Rain: Nil	Insects 36-47 Traffic 33-46 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
19/05/2021	20:58 (Evening)	72	46	37	WD: S WS: 0.1m/s Rain: Nil	Insects 31-43 Traffic 34-72 Aircraft 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.

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}		
19/05/2021	14:30 (Day)	52	43	38	WD: S WS: 0.5m/s Rain: Nil	Traffic 30-52 Insects 30-35 Agricultural Noise 35-47 Birds 30-44 Quarry Processing <34-38 (8-12 minute total duration) Quarry FEL <31-39 (2-4 minute total duration)
Teven Quarry $L_{Aeq(15min)}$ Contribution						35
19/05/2021	14:45 (Day)	56	43	37	WD: S WS: 0.5m/s Rain: Nil	Traffic 30-56 Insects 30-35 Agricultural Noise 35-45 Birds 30-40 Quarry Processing <34-37 (8-12 minute total duration) Quarry FEL <31-38 (2-4 minute total duration)
Teven Quarry $L_{Aeq(15min)}$ Contribution						35
19/05/2021	20:09 (Evening)	60	42	37	WD: S WS: 0.1m/s Rain: Nil	Traffic 32-60 Insects 35-44 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
19/05/2021	20:24 (Evening)	42	37	35	WD: S WS: 0.1m/s Rain: Nil	Traffic 30-39 Insects 33-42 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.

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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 19 May 2021. 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, dogs barking, local residential noise and aircraft.

5.2 Discussion of Results - Location NM2

Quarry noise emissions were just audible occasionally during one of the daytime measurements conducted on Wednesday 19 May 2021. Quarry noise contributions were measured at <33dBA and <30dBA and therefore satisfied 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 vehicle reverse alarms. Non quarry noise sources observed during the measurements included traffic, birds, aircraft, wind in trees, insects and people taking.

5.3 Discussion of Results - Location NM3

Quarry noise emissions were inaudible during the daytime noise measurements conducted on Wednesday 19 May 2021 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 aircraft, wind in tress, birds, insects and traffic.

5.4 Discussion of Results - Location NM4

Quarry noise emissions were audible during the daytime noise measurements conducted on Wednesday 19 May 2021. Quarry noise contributions were estimated at 37dBA for both measurements and therefore 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 front end loader, heavy vehicles, and the processing plant. Non quarry noise sources included trucks idling, birds, agricultural noise, aircraft, traffic and insects.

5.5 Discussion of Results - Location NM5

Quarry noise emissions were audible during the daytime measurements conducted on Wednesday 19 May 2021. Quarry noise contributions were estimated at 35dBA for both measurements and therefore 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 front end loader and the processing plant. Non-quarrying sources included insects, agricultural noise, birds, traffic, wind in trees and aircraft.

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 2021.

Attended noise measurements were undertaken on Wednesday 19 May 2021 at representative monitoring locations with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Teven Quarry complied with relevant noise criteria specified in the Development Consent at all assessed residential receivers.

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Appendix A - Glossary of Terms

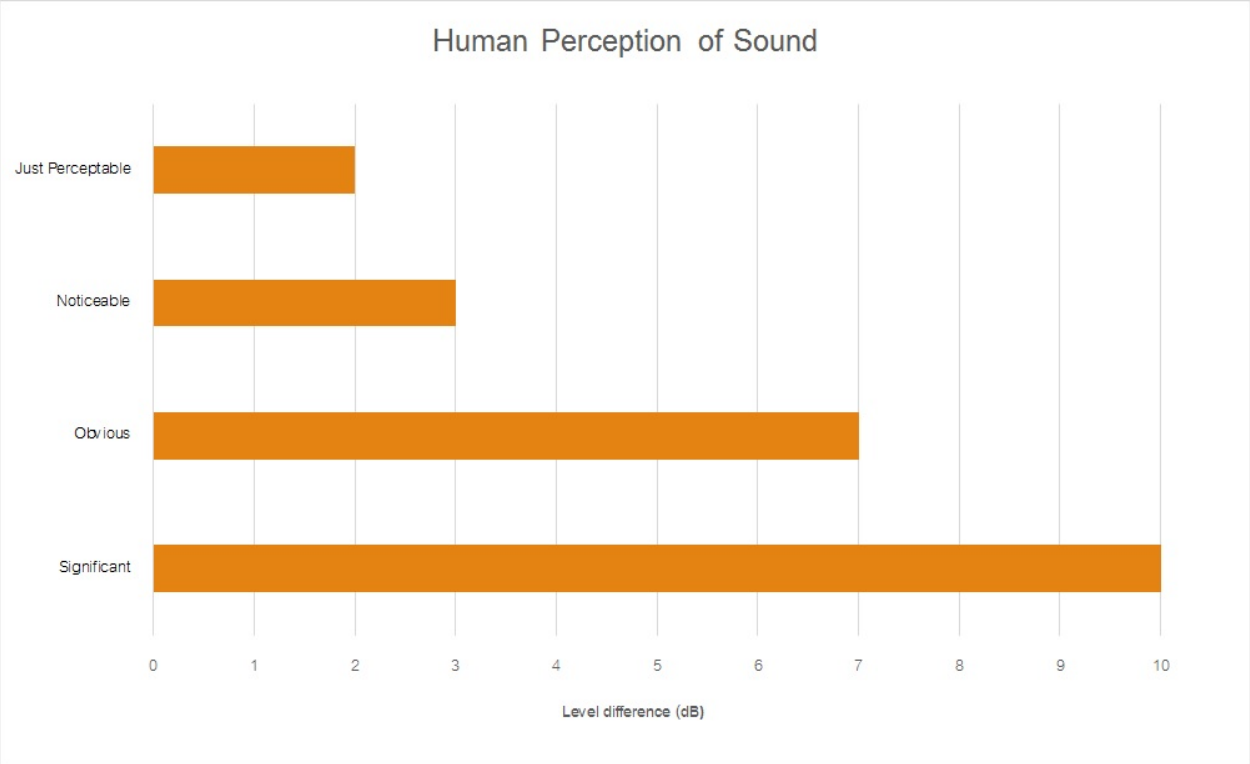
Table A1 provides a number of technical terms have been used in this report.

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 3 Ending September 2021.

Prepared for: Holcim (Australia) Pty Ltd
July 2021
MAC180611-06RP13

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Teven Quarry, Teven, NSW

Quarter 3 Ending September 2021

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MAC180611-06RP13	Final	30 July 2021	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 2021 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 2021 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.

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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 20 July 2021 and Wednesday 21 July 2021. 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}		
21/07/2021	08:28 (Day)	75	49	38	WD: W WS: 0.8m/s Rain: Nil	Birds 34-62 Wind in trees 34-44 Traffic 34-75 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
21/07/2021	08:43 (Day)	76	49	40	WD: W WS: 0.8m/s Rain: Nil	Birds 36-48 Wind in trees 36-52 Traffic 36-76 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
20/07/2021	18:32 (Evening)	64	41	27	WD: W WS: 0.4m/s Rain: Nil	Traffic 26-64 Wind in trees 26-34 Birds 26-40 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
20/07/2021	18:47 (Evening)	61	38	26	WD: W WS: 0.5m/s Rain: Nil	Traffic 26-61 Insects 24-30 Wind in trees 24-32 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}		
21/07/2021	09:10 (Day)	86	65	46	WD: W WS: 2m/s Rain: Nil	Wind in trees 42-48 Dog bark 42-58 Traffic 42-86 Birds 42-68 Aircraft 39-62 Quarry Inaudible
	Teven Quarry $L_{Aeq(15min)}$ Contribution					<30
21/07/2021	09:25 (Day)	85	66	47	WD: W WS: 2.5m/s Rain: Nil	Wind in trees 44-58 Birds 44-72 Traffic 44-85 Quarry Inaudible
	Teven Quarry $L_{Aeq(15min)}$ Contribution					<30
20/07/2021	19:15 (Evening)	88	60	34	WD: W WS: 1.2m/s Rain: Nil	Wind in trees 32-46 Traffic 32-88 Birds 32-38 Quarry Inaudible
	Teven Quarry $L_{Aeq(15min)}$ Contribution					Quarry not operational
20/07/2021	19:30 (Evening)	50	39	33	WD: W WS: 1.2m/s Rain: Nil	Wind in trees 30-50 Insects <30 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}		
21/07/2021	09:47 (Day)	58	41	37	WD: W WS: 1.2m/s Rain: Nil	Wind in trees 36-55 Birds 36-56 Aircraft 36-58 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
21/07/2021	10:02 (Day)	57	41	37	WD: W WS: 1m/s Rain: Nil	Wind in trees 35-46 Birds 35-57 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
20/07/2021	19:51 (Evening)	70	46	28	WD: W WS: 0.4m/s Rain: Nil	Operator 55-57 Traffic 28-48 Aircraft 54-70 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
20/07/2021	20:06 (Evening)	47	28	27	WD: W WS: 0.3m/s Rain: Nil	Traffic 27-47 Insects 26-29 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}		
21/07/2021	10:25 (Day)	83	59	45	WD: W WS: 2m/s Rain: Nil	Wind in trees 44-56 Traffic 44-83 Birds 44-52 Holcim Crushing <37-41 (constant) Holcim FEL 37-41 (20 seconds)
	Teven Quarry $L_{Aeq(15min)}$ Contribution					37[1]
21/07/2021	10:40 (Day)	81	60	46	WD: W WS: 2m/s Rain: Nil	Wind in trees 41-58 Birds 41-55 Traffic 41-81 Holcim Tipping 36-46 (5 seconds) Holcim Crushing <37-41 (constant)
	Teven Quarry $L_{Aeq(15min)}$ Contribution					37[1]
20/07/2021	20:29 (Evening)	41	33	29	WD: W WS: 0.3m/s Rain: Nil	Insects <26 Traffic 26-29 Birds 26-41 Quarry Inaudible
	Teven Quarry $L_{Aeq(15min)}$ Contribution					Quarry not operational
20/07/2021	20:44 (Evening)	43	31	26	WD: W WS: 0.4m/s Rain: Nil	Birds 27-43 Insects <27 Traffic 26-32 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}		
21/07/2021	11:06 (Day)	83	59	45	WD: W WS: 2m/s Rain: Nil	Wind in trees 41-56 Birds 41-57 Traffic 41-83 Aircraft 41-47 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
21/07/2021	11:21 (Day)	86	59	44	WD: W WS: 2m/s Rain: Nil	Wind in trees 41-56 Birds 41-53 Traffic 41-86 Aircraft 41-60 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
20/07/2021	21:04 (Evening)	77	47	29	WD: W WS: 0.4m/s Rain: Nil	Wind in trees 26-42 Insects 26-30 Traffic 26-77 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
20/07/2021	21:19 (Evening)	81	50	26	WD: W WS: 0.4m/s Rain: Nil	Traffic 23-81 Insects 23-26 Wind in trees 23-32 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 21 July 2021. 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, wind in trees, traffic and insects.

5.2 Discussion of Results - Location NM2

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 21 July 2021. 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, dog barking, traffic, birds and aircraft.

5.3 Discussion of Results - Location NM3

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 21 July 2021. 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, aircraft, operator noise and traffic.

5.4 Discussion of Results - Location NM4

Quarry noise emissions were audible during the daytime noise measurements conducted on Wednesday 21 July 2021. Quarry noise contributions were estimated at 37dBA for both measurements and therefore 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 front end loader, heavy vehicles tipping, and the processing plant. Non quarry noise sources included wind in trees, traffic, birds and insects.

5.5 Discussion of Results - Location NM5

Quarry noise emissions were inaudible during the daytime measurements conducted on Wednesday 21 July 2021. 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, aircraft 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 2021.

Attended noise measurements were undertaken on Tuesday 20 July 2021 and Wednesday 21 July 2021 at representative monitoring locations with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Teven Quarry complied with relevant noise criteria specified in the Development Consent at all assessed residential receivers.

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Appendix A - Glossary of Terms

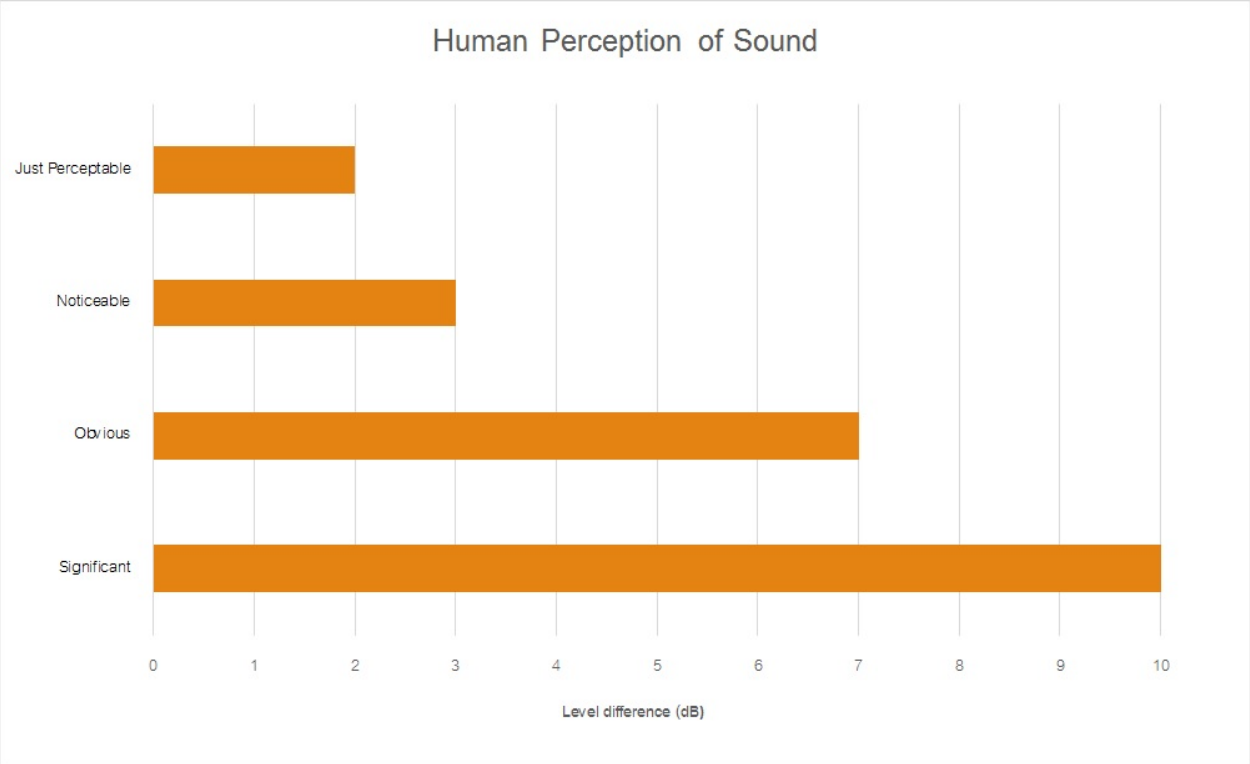
Table A1 provides a number of technical terms have been used in this report.

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 4 Ending December 2021.

Prepared for: Holcim (Australia) Pty Ltd
October 2021
MAC180611-06RP14

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Teven Quarry, Teven, NSW

Quarter 4 Ending December 2021

Prepared for: Holcim (Australia) Pty Ltd

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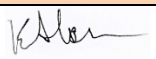
MAC180611-06RP14	Final	29 October 2021	Kristian Allen		Rod Linnett	

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 December 2021 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 4, ending December 2021 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 Wednesday 6 October 2021 and Thursday 7 October 2021. 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}		
07/10/2021	07:20 (Day)	67	45	30	WD: N WS: 0.1m/s Rain: Nil	Birds 28-46 Traffic 28-67 Agricultural Noise 28-44 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
07/10/2021	07:35 (Day)	72	48	31	WD: N WS: 0.3m/s Rain: Nil	Birds 28-52 Traffic 28-72 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
06/10/2021	18:11 (Evening)	59	40	33	WD: E WS: 1.0m/s Rain: Nil	Wind 34-46 Birds 34-59 Traffic <34 Insects <34 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
06/10/2021	18:26 (Evening)	56	37	32	WD: E WS: 1.0m/s Rain: Nil	Insects <31 Wind 31-44 Birds 30-56 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}		
07/10/2021	08:04 (Day)	89	67	39	WD: N WS: 0.3m/s Rain: Nil	Birds 36-52 Traffic 36-89 Wind <37 Holcim Processing <36 (30 seconds)
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
07/10/2021	08:19 (Day)	86	66	38	WD: N WS: 0.4m/s Rain: Nil	Traffic 35-86 Birds 35-51 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
06/10/2021	18:53 (Evening)	81	55	37	WD: E WS: 0.4m/s Rain: Nil	Residential Noise <36 Birds 34-52 Traffic 34-81 Insects <34 Wind <34 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
06/10/2021	19:08 (Evening)	85	60	45	WD: E WS: <0.1m/s Rain: Nil	Traffic 42-85 Insects <42 Birds 42-48 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}		
07/10/2021	08:46 (Day)	60	40	31	WD: N WS: 0.4m/s Rain: Nil	Birds 28-50 Agricultural Noise 28-60 Distant Traffic 28-36 Insects <28 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
07/10/2021	09:01 (Day)	65	46	36	WD: N WS: 0.4m/s Rain: Nil	Birds 30-50 Agricultural Noise 30-65 Distant Traffic 30-34 Insects <30 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
06/10/2021	19:29 (Evening)	65	42	36	WD: E WS: 0.3m/s Rain: Nil	Insects 34-35 Distant Traffic 34-42 Birds 34-65 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
06/10/2021	19:44 (Evening)	50	41	36	WD: E WS: 0.2m/s Rain: Nil	Insects 34-35 Distant Traffic 34-40 Agricultural Noise 42-50 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}		
07/10/2021	09:23 (Day)	80	57	43	WD: N WS: 0.2m/s Rain: Nil	Birds 39-46 Traffic 39-80 Aircraft 39-62 Holcim Processing 39-41 (Constant)
Teven Quarry $L_{Aeq(15min)}$ Contribution						36[1]
07/10/2021	09:38 (Day)	78	56	43	WD: N WS: 0.3m/s Rain: Nil	Birds 39-54 Traffic 39-78 Holcim Processing 39-43 (Constant)
Teven Quarry $L_{Aeq(15min)}$ Contribution						37[1]
06/10/2021	20:06 (Evening)	54	39	36	WD: E WS: 0.1m/s Rain: Nil	Insects <34 Agricultural Nosie 34-54 Distant Traffic 34-44 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
06/10/2021	20:21 (Evening)	47	39	37	WD: E WS: 0.1m/s Rain: Nil	Insects <35 Agricultural Nosie 35-47 Distant Traffic 35-44 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.

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}		
07/10/2021	10:04 (Day)	66	41	30	WD: N WS: 0.2m/s Rain: Nil	Birds 28-66 Distant Traffic 28-38 Agricultural Noise 28-36 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
07/10/2021	10:19 (Day)	65	46	33	WD: N WS: 0.2m/s Rain: Nil	Agricultural Noise 28-65 Birds 28-56 Aircraft 28-54 Distant Traffic 30-34 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<30
06/10/2021	20:39 (Evening)	48	40	38	WD: E WS: 0.1m/s Rain: Nil	Agricultural Noise 35-45 Distant Traffic 35-48 Insects <35 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
06/10/2021	20:54 (Evening)	45	37	36	WD: E WS: 0.1m/s Rain: Nil	Traffic 34-45 Insects 34-36 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 7 October 2021. 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, wind in trees, traffic, agricultural noise and insects.

5.2 Discussion of Results - Location NM2

Quarry noise emissions were just audible for a short period during the daytime measurements conducted on Thursday 7 October 2021. 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 wind in trees, traffic, birds, insects and residential noise.

5.3 Discussion of Results - Location NM3

Quarry noise emissions were inaudible during the daytime measurements conducted on Thursday 7 October 2021. 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, agricultural noise and traffic.

5.4 Discussion of Results - Location NM4

Quarry noise emissions were audible during the daytime noise measurements conducted on Thursday 7 October 2021. Quarry noise contributions were estimated at 36dBA and 37dBA for both measurements and therefore 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 included aircraft, agricultural noise, traffic, birds and insects.

5.5 Discussion of Results - Location NM5

Quarry noise emissions were inaudible during the daytime measurements conducted on Thursday 7 October 2021. 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 agricultural noise, birds, traffic, aircraft 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 4, ending December 2021.

Attended noise measurements were undertaken on Wednesday 6 October 2021 and Thursday 7 October 2021 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 complied with relevant noise criteria specified in the Development Consent at all assessed residential receivers.

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Appendix A - Glossary of Terms

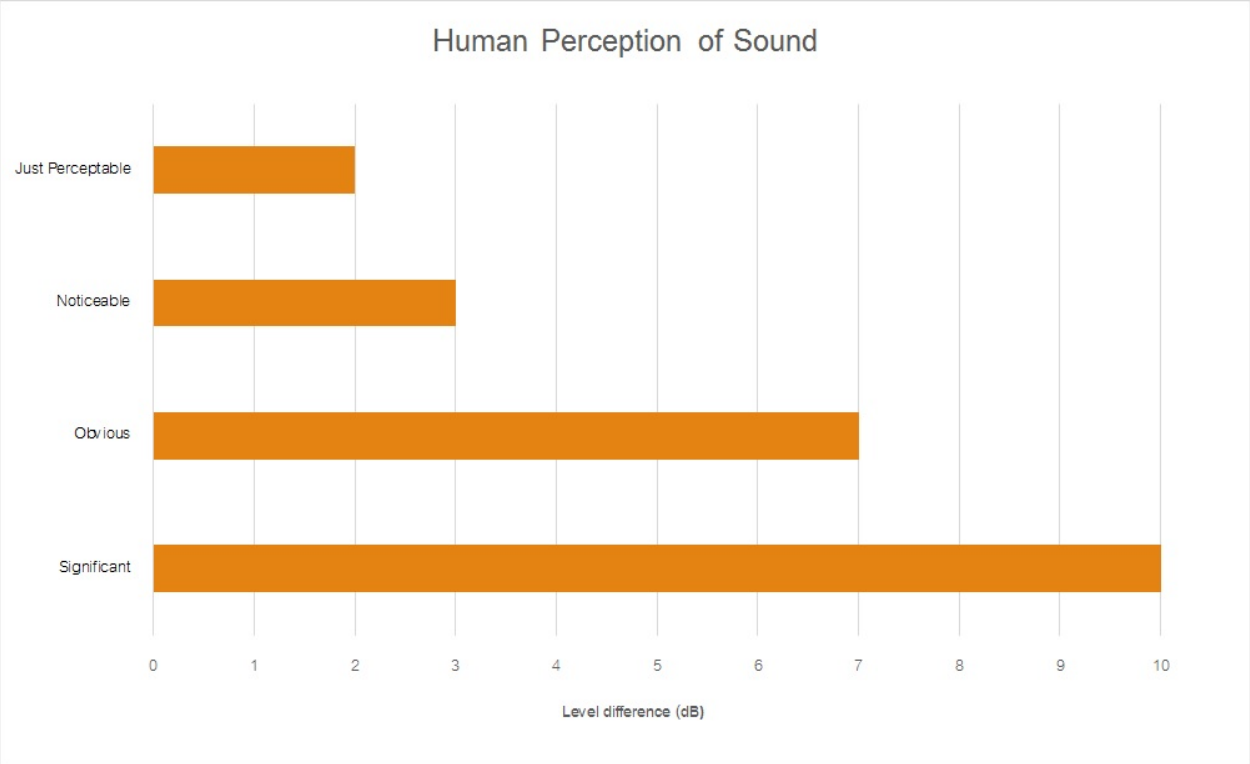
Table A1 provides a number of technical terms have been used in this report.

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 1 Ending March 2021.

Prepared for: Holcim (Australia) Pty Ltd
March 2021
MAC180611-06RP11

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Teven Quarry, Teven, NSW

Quarter 1 Ending March 2021

Prepared for: Holcim (Australia) Pty Ltd

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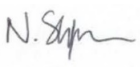
MAC180611-06RP11	Final	31 March 2021	Nicholas Shipman		Rod Linnett	

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 2021 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 2021 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 Wednesday 24 March 2021. 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

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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}		
24/03/2021	07:26 (Day)	70	54	39	WD: W WS: 0.1m/s Rain: Nil	Birds 37-70 Insects 37-53 Traffic 37-65 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
24/03/2021	07:41 (Day)	63	54	37	WD: W WS: 0.1m/s Rain: Nil	Insects 49-56 Birds 36-54 Traffic 32-63 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
24/03/2021	18:08 (Evening)	86	58	41	WD: NW WS: 0.4m/s Rain: Nil	Insects 38-46 Birds 38-44 Traffic <38 Dog bark 38-86 Local residential noise 38-54 Wind <42 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
24/03/2021	18:23 (Evening)	66	52	44	WD: NW WS: 0.3m/s Rain: Nil	Wind 38-44 Insects 42-48 Birds <44 Traffic 41-66 Aircraft 41-52 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}		
24/03/2021	08:09 (Day)	88	66	41	WD: W WS: 0.1m/s Rain: Nil	Traffic 43-88 Birds 41-57 Aircraft 41-48 Holcim processing 33-37 Local residential noise 43-59 Insects 38-46
Teven Quarry $L_{Aeq(15min)}$ Contribution						<37
24/03/2021	08:24 (Day)	88	66	40	WD: W WS: 0.1m/s Rain: Nil	Traffic 38-88 Birds 40-61 Insects <40 Local residential noise 46-56 Dogs 42-45 Aircraft 38-40 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
24/03/2021	18:50 (Evening)	93	63	47	WD: NW WS: 0.2m/s Rain: Nil	Insects 45-48 Traffic 45-93 Birds 45-49 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
24/03/2021	19:05 (Evening)	87	60	45	WD: NW WS: 0.2m/s Rain: Nil	Insects 46-52 Traffic 46-87 Birds 46-67 Aircraft 46-53 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.

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}		
24/03/2021	08:44 (Day)	62	43	38	WD: W WS: 0.1m/s Rain: Nil	Birds 36-62 Insects 36-45 Holcim processing 32-36 Holcim FEL 32-36
Teven Quarry $L_{Aeq(15min)}$ Contribution						<36
24/03/2021	08:59 (Day)	61	40	34	WD: W WS: 0.1m/s Rain: Nil	Holcim processing 32-36 Insects 36-42 Birds 40-61
Teven Quarry $L_{Aeq(15min)}$ Contribution						<36
24/03/2021	19:27 (Evening)	65	60	55	WD: NW WS: 0.1m/s Rain: Nil	Insects 48-65 Traffic <48 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
24/03/2021	19:42 (Evening)	65	62	60	WD: NW WS: 0.1m/s Rain: Nil	Insects 46-65 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}		
24/03/2021	09:23 (Day)	77	53	41	WD: W WS: 0.1m/s Rain: Nil	Holcim FEL 36-50 Holcim processing 35-37 Insects <38 Birds 39-46 Traffic 38-77 Local residential noise <38
	Teven Quarry $L_{Aeq(15min)}$ Contribution					37
24/03/2021	09:38 (Day)	78	59	41	WD: W WS: 0.1m/s Rain: Nil	Local residential noise <37 Holcim processing 34-41 Insects 37-42 Birds 37-45 Traffic 37-78
	Teven Quarry $L_{Aeq(15min)}$ Contribution					37
24/03/2021	20:05 (Evening)	54	51	50	WD: NW WS: 0.1m/s Rain: Nil	Insects 49-52 Traffic <49 Birds 49-54 Quarry Inaudible
	Teven Quarry $L_{Aeq(15min)}$ Contribution					Quarry not operational
24/03/2021	20:20 (Evening)	60	50	49	WD: NW WS: 0.1m/s Rain: Nil	Insects 49-52 Birds 49-60 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.

4.5 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}		
24/03/2021	10:11 (Day)	60	41	34	WD: W WS: 0.1m/s Rain: Nil	Birds 36-44 Insects 31-36 Holcim processing 31-36 Aircraft 38-60
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
24/03/2021	10:26 (Day)	57	40	35	WD: W WS: 1m/s Rain: Nil	Birds 36-48 Insects 36-40 Holcim processing 32-36 Wind 36-57
Teven Quarry $L_{Aeq(15min)}$ Contribution						<35
24/03/2021	20:41 (Evening)	55	50	48	WD: NW WS: 0.1m/s Rain: Nil	Insects 47-55 Traffic <47 Quarry Inaudible
Teven Quarry $L_{Aeq(15min)}$ Contribution						Quarry not operational
24/03/2021	20:56 (Evening)	53	49	47	WD: NW WS: 0.1m/s Rain: Nil	Insects 47-52 Traffic <47 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 24 March 2021. 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, dogs barking, local residential noise, wind in trees and aircraft.

5.2 Discussion of Results - Location NM2

Quarry noise emissions were audible during one of the daytime measurements conducted on Wednesday 24 March 2021. Quarry noise contributions were measured at <37dBA and therefore satisfied 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 traffic, birds, aircraft, local residential noise, insects, and dogs barking.

5.3 Discussion of Results - Location NM3

Quarry noise emissions were audible during the daytime noise measurements conducted on Wednesday 24 March 2021. Quarry noise contributions were estimated at <36dBA for both measurements and therefore 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 front end loader and the processing plant. Non quarry noise sources observed during the measurements included birds, insects, and traffic.

5.4 Discussion of Results - Location NM4

Quarry noise emissions were audible during the daytime noise measurements conducted on Wednesday 24 March 2021. Quarry noise contributions were estimated at 37dBA for both measurements and therefore 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 front end loader and the processing plant. Non quarry noise sources included birds, aircraft, traffic, and insects.

5.5 Discussion of Results - Location NM5

Quarry noise emissions were audible during the daytime measurements conducted on Wednesday 24 March 2021. Quarry noise contributions were estimated at <35dBA for both measurements and therefore 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-quarrying sources included insects, birds, traffic, wind in trees, and aircraft.

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 2021.

Attended noise measurements were undertaken on Wednesday 24 March 2021 at representative monitoring locations with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Teven Quarry complied with relevant noise criteria specified in the Development Consent at all assessed residential receivers.

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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.
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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.

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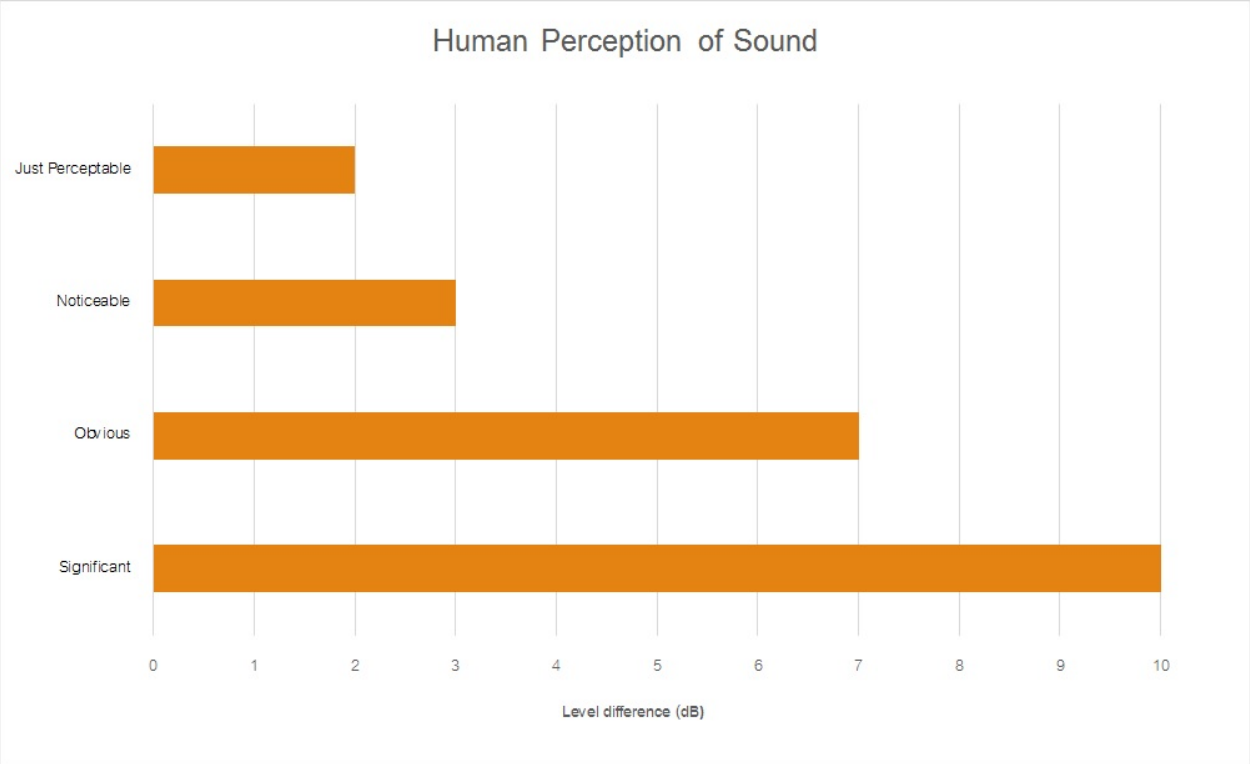
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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