

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW
Quarter 1 Ending March 2019.



Document Information

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW

Quarter 1 Ending March 2019

Prepared for: Holcim (Australia) Pty Ltd



Prepared by: Muller Acoustic Consulting Pty Ltd

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Document ID	Status	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-07RP3	Final	18 March 2019	Nicholas Shipman		Rod Linnett	

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APPENDIX A - GLOSSARY OF TERMS

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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 2019 for Dunloe Quarry (the 'quarry'), Pottsville, NSW.

The monitoring has been conducted in accordance with the Dunloe Project Approval and Noise Management Plan at four representative monitoring locations. This assessment represents the operations undertaken during Quarter 1, ending March 2019 and forms part of the annual noise monitoring program to address conditions of the project approval.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Dunloe Noise Management Plan (NMP), 2016; and
- Australian Standard AS 1055:2018- Acoustics - Description and measurement of environmental noise - General Procedures.

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 Section 2 of the sites Project Approval outlines the applicable noise criteria for residential receivers surrounding the quarry site.

The noise criteria are applicable when the site undertakes quarrying operations with the site permitted to operate Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday.

Table 1 presents the noise criteria for each of the receivers as outlined in the Project Approval.

Table 1 Noise Criteria	
Location	Day Criteria dB LAeq(15min) ²
All privately-owned receivers ¹	48

Note 1: Receiver locations are shown in Figure 1.

Note 2: Criteria applicable between Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday as the Table 2 of the Project Approval.

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3 Methodology

3.1 Locality

The quarry is approximately 2.5km south west of Pottsville, NSW. Receivers surrounding the quarry are primarily rural/residential situated in coastal bushland with elevated and undulating topography. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan shown in **Figure 1**.

3.2 Noise Monitoring Locations

Four monitoring locations have been selected as part of the NMA and are listed below:

- R1 is located at the property on Kellehers Road situated north of the quarry;
- R2 is located west of the quarry on the boundary of 574 Pottsville Road;
- R3 is located to the south-west of the quarry at the address of 122 Warwick Park Road; and
- R4 is located at 265 Warwick Park Road, south of the quarry.

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 Dunloe Quarry's Project Approval. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Thursday 7 March 2019. 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 $\pm 0.5\text{dBA}$.

One measurement was conducted at each monitoring location during the daytime period. 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 $L_{Aeq}(15\text{min})$ quarry 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
LOCALITY PLAN
REF: MAC180611-07

0 500m



KEY



RECEIVER LOCATION



SITE LOCATION

4 Results

4.1 Assessment Results - Location R1

The monitored noise level contributions and observed meteorological conditions for R1 for are presented in **Table 2**.

Table 2 Operator-Attended Noise Survey Results – Location R1						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
07/03/19	09:47	83	55	41	WD: S WS: 2m/s Rain: Nil	Birds 38-46
						Wind in grass 38-42
						Local residential noise 36-42
						Distant traffic <36
						Local traffic 38-83
						Quarry Inaudible
						Dunloe Quarry L _{Aeq} (15min) Contribution
						<31

4.2 Assessment Results - Location R2

The monitored noise level contributions and observed meteorological conditions for R2 are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location R2						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
07/03/19	10:09	82	64	53	WD: S	Highway traffic 48-60
					WS: 2m/s	Local traffic 46-82
					Rain: Nil	Wind in trees <48
						Quarry Inaudible
Dunloe Quarry L _{Aeq} (15min) Contribution						<43

4.3 Assessment Results - Location R3

The monitored noise level contributions and observed meteorological conditions R3 are presented in Table 4.

Table 4 Operator-Attended Noise Survey Results – Location R3						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
07/03/19	10:31	62	46	42	WD: S	Wind in trees 38-48
					WS: 2m/s	Birds 42-46
					Rain: Nil	Distant traffic <38
						Quarry Inaudible
Dunloe Quarry L _{Aeq} (15min) Contribution						<32

4.4 Assessment Results - Location R4

The monitored noise level contributions and observed meteorological conditions for R4 are presented in Table 5.

Table 5 Operator-Attended Noise Survey Results – Location R4						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
07/03/19	10:53	64	46	40	WD: S	Aircraft 38-53
					WS: 2m/s	Wind in grass 36-46
					Rain: Nil	Birds 48-62
						Quarry Inaudible
Dunloe Quarry L _{Aeq} (15min) Contribution						<30

5 Noise Compliance Assessment

The compliance assessment for each residential receiver R1, R2, R3 and R4 are presented in **Table 6** for day assessment periods.

Table 6 Daytime Noise Compliance Summary			
Receiver No.	Quarry Noise Contribution	Quarry Noise Criteria	Compliant
	dB LAeq(15min)	dB LAeq(15min)	
R1	<31	48	✓
R2	<43	48	✓
R3	<32	48	✓
R4	<30	48	✓

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6 Discussion

6.1 Discussion of Results - Location R1

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 7 March 2019 at location R1, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included birds, wind in grass, local residential noise, distant traffic, local traffic and were generally constant throughout the measurement.

6.2 Discussion of Results - Location R2

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 7 March 2019 at location R2, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included the continuous noise of the wind in trees, highway traffic and intermittent sources such as passing local traffic.

6.3 Discussion of Results - Location R3

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 7 March 2019 at location R3, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included highway traffic, local traffic and wind in trees. All extraneous noises were generally constant during the 15 minute measurement at R3.

6.4 Discussion of Results - Location R4

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 7 March 2019 at location R4, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included aircraft passby, wind in grass and birds were audible throughout the measurement.

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7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Dunloe Quarry, Pottsville, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Project Approval for relevant surrounding residential receivers for the Quarter 1, ending March 2019.

Attended noise monitoring was undertaken on Thursday 7 March 2019 at representative monitoring locations, with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Dunloe Quarry comply with relevant noise criteria specified in the Project Approval at all assessed residential receivers.

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Appendix A - Glossary of Terms

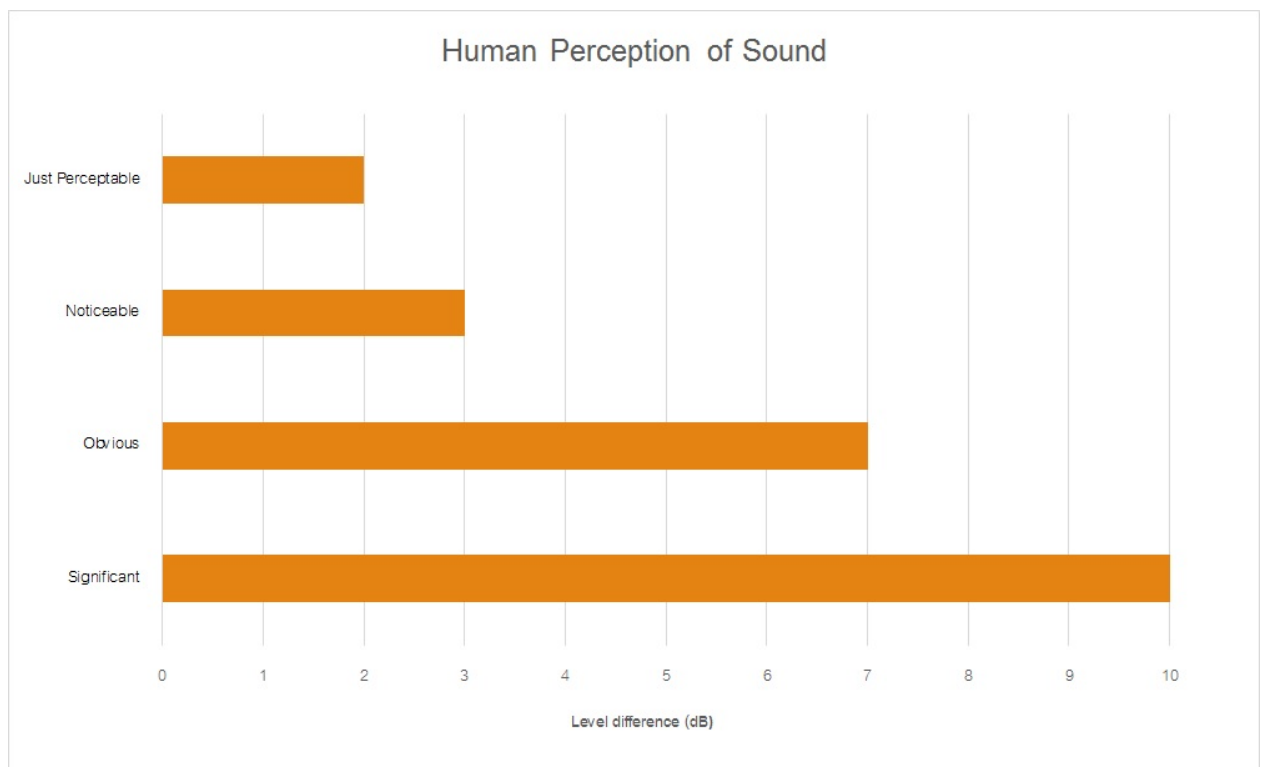
Table A1 provides a number of technical terms have been used in this report.

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.
LAm _{ax}	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)	<p>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 :</p> $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W₀ is the sound reference power at 10-12 watts.</p>

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

Dunloe Quarry, Pottsville, NSW
Quarter 2 Ending June 2019.

Document Information

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Quarter 2 Ending June 2019

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Prepared by: Muller Acoustic Consulting Pty Ltd

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MAC180611-07RP4	Final	9 July 2019	Robin Heaton	<i>Robin Heaton</i>	Rod Linnett	<i>RM LSA</i>

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1 Introduction

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The monitoring has been conducted in accordance with the Dunloe Project Approval and Noise Management Plan at four representative monitoring locations. This assessment represents the operations undertaken during Quarter 2, ending June 2019 and forms part of the annual noise monitoring program to address conditions of the project approval.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
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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 Section 2 of the Project Approval outlines the applicable noise criteria for residential receivers surrounding the quarry site.

The noise criteria are applicable when the site undertakes quarrying operations within the permitted operating hours Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday.

Table 1 presents the noise criteria for each of the receivers as outlined in the Project Approval.

Table 1 Noise Criteria	
Location	Day Criteria dB LAeq(15min) ²
All privately-owned receivers ¹	48

Note 1: Receiver locations are shown in Figure 1.

Note 2: Criteria applicable between Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday as the Table 2 of the Project Approval.

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3 Methodology

3.1 Locality

The quarry is approximately 2.5km south west of Pottsville, NSW. Receivers surrounding the quarry are primarily rural/residential situated in coastal bushland with elevated and undulating topography. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan shown in **Figure 1**.

3.2 Noise Monitoring Locations

Four monitoring locations have been selected as part of the NMA and are listed below:

- R1 is located at the property on Kellehers Road situated north of the quarry;
- R2 is located west of the quarry on the boundary of 574 Pottsville Road;
- R3 is located to the south-west of the quarry at the address of 122 Warwick Park Road; and
- R4 is located at 265 Warwick Park Road, south of the quarry.

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 Dunloe Quarry's Project Approval. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 18 June 2019. 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 $\pm 0.5\text{dBA}$.

One measurement was conducted at each monitoring location during the daytime period. 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 $\text{LA}_{\text{eq}}(15\text{min})$ quarry 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
LOCALITY PLAN
REF: MAC180611-07

0 500m



KEY



RECEIVER LOCATION



SITE LOCATION

4 Results

4.1 Assessment Results - Location R1

The monitored noise level contributions and observed meteorological conditions for R1 for are presented in **Table 2**.

Table 2 Operator-Attended Noise Survey Results – Location R1						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
18/06/2019	13:00	89	61	35	WD: NW	Cars on Farm 40-89
					WS: 1.6m/s	Residents Talking 45-55
					Rain: Nil	Cows 63-80
						Quarry Truck (5 Secs) 43
Dunloe Quarry L _{Aeq} (15min) Contribution						<25

4.2 Assessment Results - Location R2

The monitored noise level contributions and observed meteorological conditions for R2 are presented in **Table 3**.

Table 3 Operator-Attended Noise Survey Results – Location R2						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
18/06/2019	13:25	87	66	48	WD: NW	Traffic 50-87
					WS: 1.3m/s	Construction pumps in
					Rain: Nil	adjacent field 45-48
						Quarry Inaudible
Dunloe Quarry L _{Aeq} (15min) Contribution						<38

4.3 Assessment Results - Location R3

The monitored noise level contributions and observed meteorological conditions R3 are presented in Table 4.

Table 4 Operator-Attended Noise Survey Results – Location R3						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _A max	L _A eq	L _A 90		
18/06/2019	13:45	63	44	37	WD: NW WS: 0.5m/s Rain: Nil	Chainsaw 40-45
						Distant Traffic 35-40
						Birds 50-63
						Wind in Trees 30-35
						Quarry Inaudible
Dunloe Quarry L _A eq(15min) Contribution						<27

4.4 Assessment Results - Location R4

The monitored noise level contributions and observed meteorological conditions for R4 are presented in Table 5.

Table 5 Operator-Attended Noise Survey Results – Location R4						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		LAmax	LAeq	LA90		
18/06/2019	14:04	65	36	28	WD: NW	Distant Traffic 30-34
					WS: 0.1m/s	Aircraft 36-44
					Rain: Nil	Birds 40-65
						Quarry Inaudible
Dunloe Quarry LAeq(15min) Contribution						<18

5 Noise Compliance Assessment

The compliance assessment for each residential receiver R1, R2, R3 and R4 are presented in **Table 6** for day assessment periods.

Table 6 Daytime Noise Compliance Summary			
Receiver No.	Quarry Noise Contribution	Quarry Noise Criteria	Compliant
	dB LAeq(15min)	dB LAeq(15min)	
R1	<25	48	✓
R2	<38	48	✓
R3	<27	48	✓
R4	<18	48	✓

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6 Discussion

6.1 Discussion of Results - Location R1

Quarry noise emissions were briefly audible during noise monitoring conducted on Tuesday 18 June 2019 at location R1 however satisfied the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included birds, wind in grass, local residential noise, distant traffic, farm vehicles and were generally constant throughout the measurement.

6.2 Discussion of Results - Location R2

Quarry noise emissions were inaudible during noise monitoring conducted on Tuesday 18 June 2019 at location R2, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included the continuous noise of the wind in trees, traffic noise and pumps operating in the adjacent field.

6.3 Discussion of Results - Location R3

Quarry noise emissions were inaudible during noise monitoring conducted on Tuesday 18 June 2019 at location R3, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included distant traffic, birds and wind in trees. All extraneous noises were generally constant during the 15 minute measurement at R3.

6.4 Discussion of Results - Location R4

Quarry noise emissions were inaudible during noise monitoring conducted on Tuesday 18 June 2019 at location R4, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included aircraft passby, distant traffic and birds were audible throughout the measurement.

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7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Dunloe Quarry, Pottsville, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Project Approval for relevant surrounding residential receivers for the Quarter 2, ending June 2019.

Attended noise monitoring was undertaken on Tuesday 18 June 2019 at representative monitoring locations, with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Dunloe Quarry complies with the relevant noise criteria specified in the Project Approval at all assessed residential receivers.

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Appendix A - Glossary of Terms

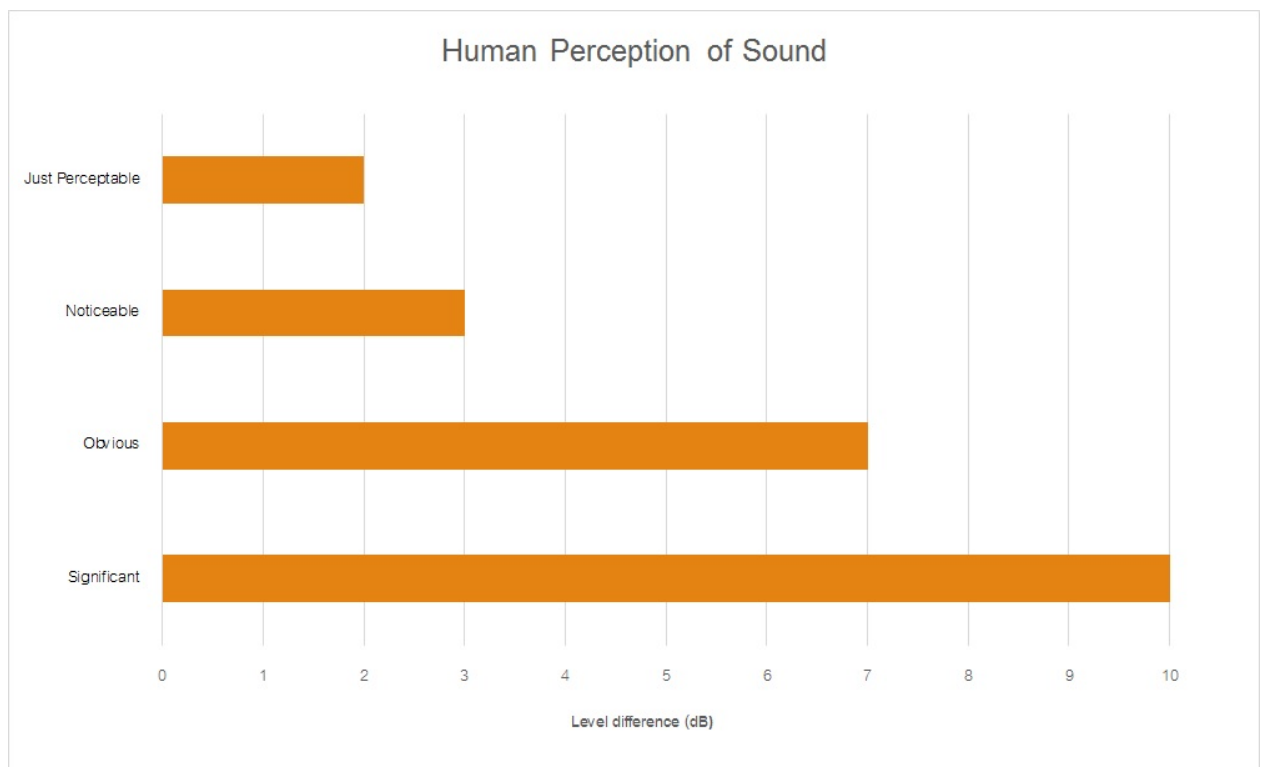
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Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature 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.
LAm _{ax}	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)	<p>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 :</p> $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W₀ is the sound reference power at 10-12 watts.</p>

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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APPENDIX A - GLOSSARY OF TERMS

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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 2019 for Dunloe Quarry (the 'quarry'), Pottsville, NSW.

The monitoring has been conducted in accordance with the Dunloe Project Approval (2008) and Noise Management Plan at four representative monitoring locations. This assessment represents the operations undertaken during Quarter 3, ending September 2019 and forms part of the annual noise monitoring program to address conditions of the project approval.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
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- Australian Standard AS 1055:2018- Acoustics - Description and measurement of environmental noise - General Procedures.

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 Section 2 of the Project Approval outlines the applicable noise criteria for residential receivers surrounding the quarry site.

The noise criteria are applicable when the site undertakes quarrying operations within the permitted operating hours Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday.

Table 1 presents the noise criteria for each of the receivers as outlined in the Project Approval.

Table 1 Noise Criteria	
Location	Day Criteria dB LAeq(15min) ²
All privately-owned receivers ¹	48

Note 1: Receiver locations are shown in Figure 1.

Note 2: Criteria applicable between Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday as the Table 2 of the Project Approval.

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3 Methodology

3.1 Locality

The quarry is approximately 2.5km south west of Pottsville, NSW. Receivers surrounding the quarry are primarily rural/residential situated in coastal bushland with elevated and undulating topography. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan shown in **Figure 1**.

3.2 Noise Monitoring Locations

Four monitoring locations have been selected as part of the NMA and are listed below:

- R1 is located at the property on Kellehers Road situated north of the quarry;
- R2 is located west of the quarry on the boundary of 574 Pottsville Road;
- R3 is located to the south-west of the quarry at the address of 122 Warwick Park Road; and
- R4 is located at 265 Warwick Park Road, south of the quarry.

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 Dunloe Quarry's Project Approval. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 20 August 2019. 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 $\pm 0.5\text{dBA}$.

One measurement was conducted at each monitoring location during the daytime period. 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 $\text{LA}_{\text{eq}}(15\text{min})$ quarry 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
LOCALITY PLAN
REF: MAC180611-07

0 500m



KEY



RECEIVER LOCATION



SITE LOCATION

4 Results

4.1 Assessment Results - Location R1

The monitored noise level contributions and observed meteorological conditions for R1 are presented in Table 2.

Table 2 Operator-Attended Noise Survey Results – Location R1						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _A max	L _A eq	L _A 90		
20/08/2019	13:55	71	46	34	WD: SE	Resident's Car 50-65
					WS: 1.5m/s	Aircraft 38-43
					Rain: Nil	Birds 38-45
						Quarry briefly audible
Dunloe Quarry L _A eq(15min) Contribution						<25

4.2 Assessment Results - Location R2

The monitored noise level contributions and observed meteorological conditions for R2 are presented in Table 3.

Table 3 Operator-Attended Noise Survey Results – Location R2						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
20/08/2019	13:28	76	57	47	WD: SE	Traffic 50-87
					WS: 1.5-2m/s	Tractor in field 36-41
					Rain: Nil	Quarry Inaudible
Dunloe Quarry L _{Aeq} (15min) Contribution						<37

4.3 Assessment Results - Location R3

The monitored noise level contributions and observed meteorological conditions for R3 are presented in Table 4.

Table 4 Operator-Attended Noise Survey Results – Location R3						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _A max	L _A eq	L _A 90		
20/08/2019	14:21	69	47	41	WD: SE WS: 1.5-2m/s Rain: Nil	Local Traffic 55-67
						Dog Bark 44-48
						Wind in Trees 35-40
						Quarry truck just audible
						~38-40 (5 secs)
Dunloe Quarry L _A eq(15min) Contribution						<35

4.4 Assessment Results - Location R4

The monitored noise level contributions and observed meteorological conditions for R4 are presented in Table 5.

Table 5 Operator-Attended Noise Survey Results – Location R4						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
20/08/2019	14:42	69	47	38	WD: SE	Aircraft 46-49
					WS: 1.5-2m/s	Birds 40-52
					Rain: Nil	Quarry Inaudible
Dunloe Quarry L _{Aeq} (15min) Contribution						<30

5 Noise Compliance Assessment

The compliance assessment for each residential receiver R1, R2, R3 and R4 are presented in **Table 6** for the day assessment period.

Table 6 Daytime Noise Compliance Summary			
Receiver No.	Quarry Noise Contribution	Quarry Noise Criteria	Compliant
	dB LAeq(15min)	dB LAeq(15min)	
R1	<25	48	✓
R2	<37	48	✓
R3	<35	48	✓
R4	<30	48	✓

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6 Discussion

6.1 Discussion of Results - Location R1

Quarry noise emissions were briefly audible during noise monitoring conducted on Tuesday 20 August 2019 at location R1 however satisfied the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included birds, local residential noise and aircraft.

6.2 Discussion of Results - Location R2

Quarry noise emissions were inaudible during noise monitoring conducted on Tuesday 20 August 2019 at location R2, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included the continuous operation of farm vehicles in adjacent paddock and local traffic noise.

6.3 Discussion of Results - Location R3

Quarry noise emissions were just audible for a very short period (<5 seconds) during noise monitoring conducted on Tuesday 20 August 2019 at location R3, with the contribution estimated to be <35dB LAeq(15min), satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included local traffic, dogs barking and wind in trees. All extraneous noises were generally constant during the 15 minute measurement at R3.

6.4 Discussion of Results - Location R4

Quarry noise emissions were inaudible during noise monitoring conducted on Tuesday 20 August 2019 at location R4, satisfying the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources included aircraft and birds throughout the measurement.

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7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Dunloe Quarry, Pottsville, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Project Approval for relevant surrounding residential receivers for the Quarter 3, ending September 2019.

Attended noise monitoring was undertaken on Tuesday 20 August 2019 at representative monitoring locations, with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Dunloe Quarry complies with the relevant noise criteria specified in the Project Approval at all assessed residential receivers.

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Appendix A - Glossary of Terms

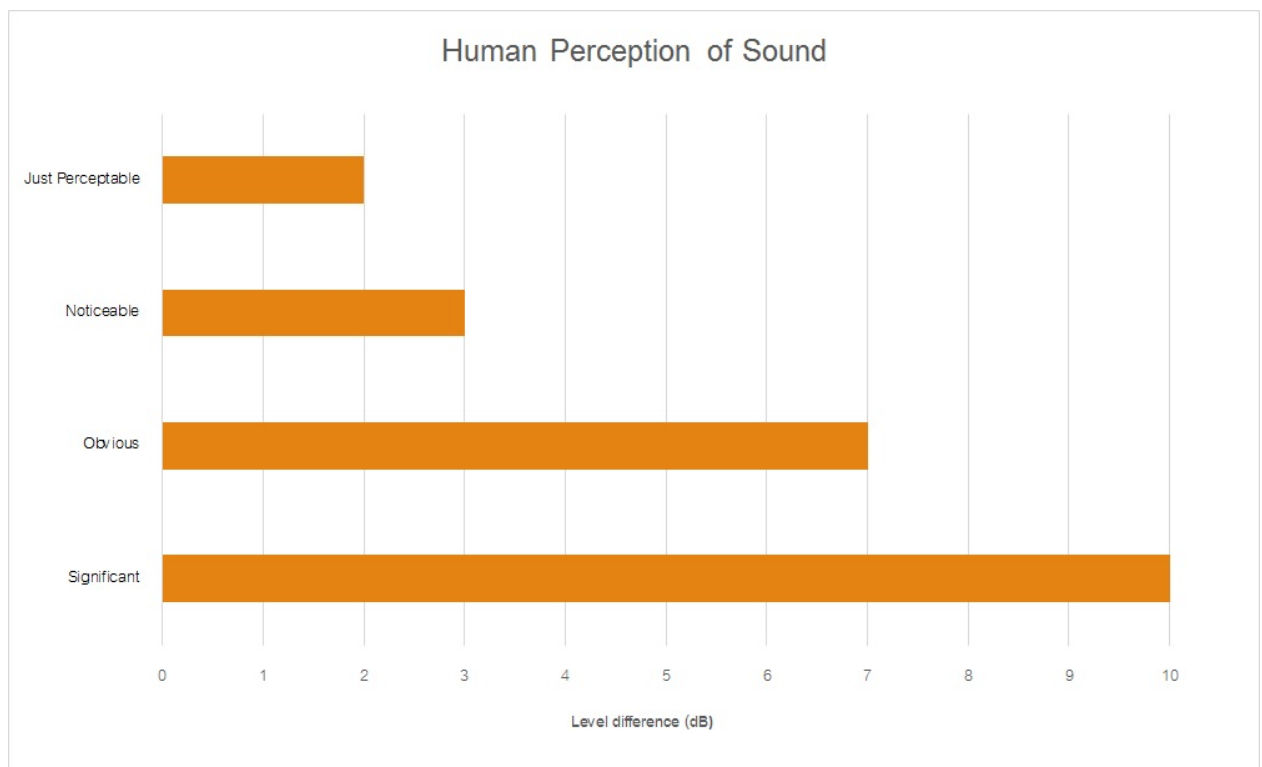
Table A1 provides a number of technical terms have been used in this report.

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.
LAm _{ax}	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)	<p>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 :</p> $= 10 \cdot \log_{10} (W/W_0)$ <p>Where : W is the sound power in watts and W₀ is the sound reference power at 10-12 watts.</p>

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

Dunloe Quarry, Pottsville, NSW
Quarter 4 Ending December 2019.

Document Information

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW

Quarter 4 Ending December 2019

Prepared for: Holcim (Australia) Pty Ltd



Prepared by: Muller Acoustic Consulting Pty Ltd

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Document ID	Status	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-07RP6	Final	11 December 2019	Nicholas Shipman		Oliver Muller	

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Extraneous noise sources were excluded from the analysis to determine the $\text{LA}_{\text{eq}}(15\text{min})$ quarry 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
LOCALITY PLAN
REF: MAC180611-07

0 500m



KEY



RECEIVER LOCATION



SITE LOCATION

4 Results

4.1 Assessment Results - Location R1

The monitored noise level contributions and observed meteorological conditions for R1 are presented in Table 2.

Table 2 Operator-Attended Noise Survey Results – Location R1						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _A max	L _A eq	L _A 90		
28/11/2019	11:44	82	57	33	WD: E	Birds 34-39
					WS: 2m/s	Insects <34
					Rain: Nil	Traffic 33-82
						Quarry inaudible
Dunloe Quarry L _A eq(15min) Contribution						<30

4.2 Assessment Results - Location R2

The monitored noise level contributions and observed meteorological conditions for R2 are presented in Table 3.

Table 3 Operator-Attended Noise Survey Results – Location R2						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _A max	L _A eq	L _A 90		
28/11/2019	12:08	85	64	46	WD: E	Traffic 46-76
					WS: 0.5m/s	Birds <46
					Rain: Nil	Local residential noise 46-60
						Quarry inaudible
Dunloe Quarry L _A eq(15min) Contribution						<30

4.3 Assessment Results - Location R3

The monitored noise level contributions and observed meteorological conditions for R3 are presented in Table 4.

Table 4 Operator-Attended Noise Survey Results – Location R3						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _A max	L _A eq	L _A 90		
28/11/2019	12:32	62	43	37	WD: E WS: 1m/s Rain: Nil	Aircraft 38-44
						Birds 36-62
						Wind 36-44
						Traffic <38
						Insects <38
						Quarry inaudible
Dunloe Quarry L _A eq(15min) Contribution						<30

4.4 Assessment Results - Location R4

The monitored noise level contributions and observed meteorological conditions for R4 are presented in Table 5.

Table 5 Operator-Attended Noise Survey Results – Location R4						
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L _{Amax}	L _{Aeq}	L _{A90}		
28/11/2019	13:00	57	44	40	WD: E	Traffic <36
					WS: 2m/s	Wind 34-44
					Rain: Nil	Birds 36-57
						Quarry inaudible
Dunloe Quarry L _{Aeq} (15min) Contribution						<30

5 Discussion

5.1 Discussion of Results - Location R1

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 28 November 2019 at location R1. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources include birds, insects and traffic during the monitoring period.

5.2 Discussion of Results - Location R2

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 28 November 2019 at location R2. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources include traffic, birds and local residential noise during the monitoring period.

5.3 Discussion of Results - Location R3

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 28 November 2019 at location R3. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources include aircraft, birds, wind in trees, traffic and insects during the monitoring period.

5.4 Discussion of Results - Location R4

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 28 November 2019 at location R4. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB LAeq(15min). Extraneous noise sources include traffic, wind in trees and birds during the monitoring period.

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6 Conclusion

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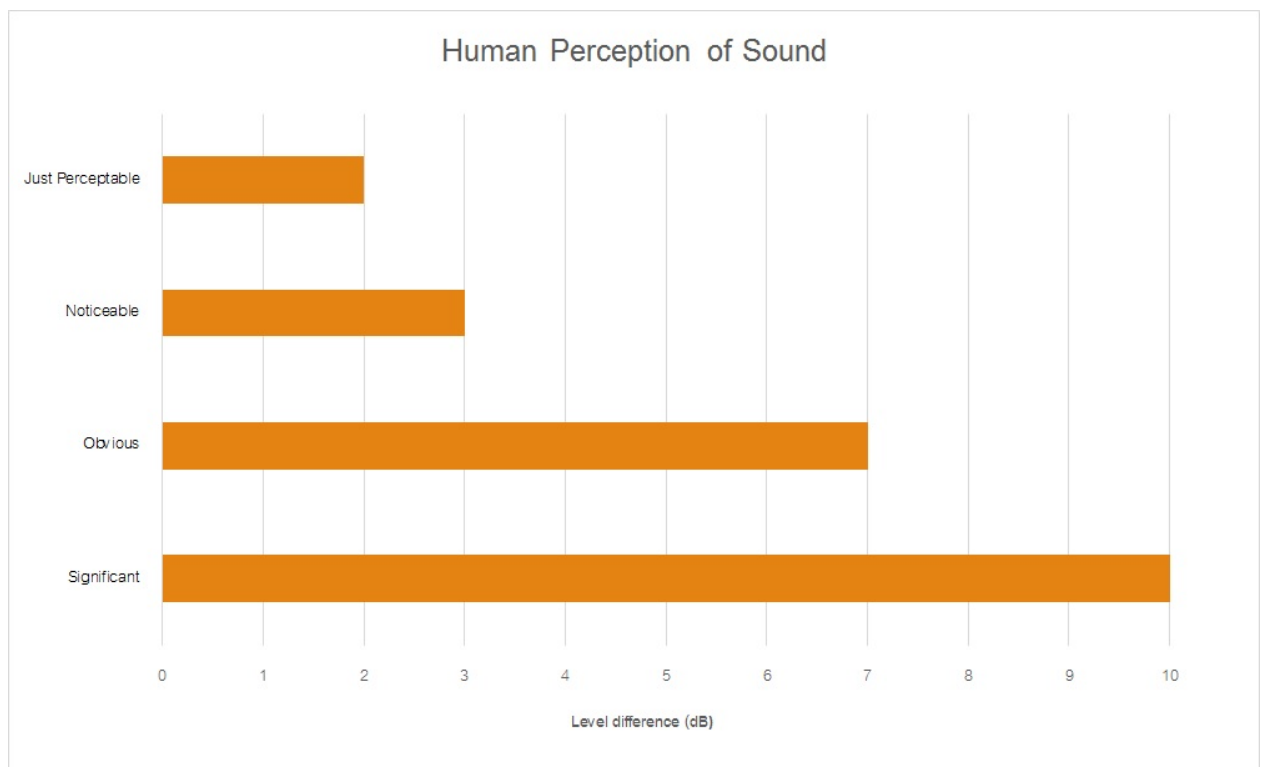
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