

Noise Monitoring Assessment

Wallerawang Quarry
April 2019



Document Information

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CONTENTS

1	INTRODUCTION	5
2	NOISE CRITERIA	7
2.1	ENVIRONMENTAL PROTECTION LICENSE NOISE LIMITS	7
3	METHODOLOGY	9
3.1	LOCALITY	9
3.2	ENVIRONMENTAL NOISE ASSESSMENT METHODOLOGY	9
4	RESULTS	11
4.1	ASSESSMENT RESULTS – REFERENCE LOCATION (RL1)	11
4.2	ASSESSMENT RESULTS - LOCATION N1	12
4.3	ASSESSMENT RESULTS - LOCATION N2	12
4.4	ASSESSMENT RESULTS - LOCATION N3	13
5	DISCUSSION	15
5.1	DISCUSSION OF RESULTS – REFERENCE LOCATION (RL1)	15
5.2	DISCUSSION OF RESULTS – LOCATION N1	15
5.3	DISCUSSION OF RESULTS – LOCATION N2	16
5.4	DISCUSSION OF RESULTS – LOCATION N3	16
6	CONCLUSION	17
APPENDIX A - GLOSSARY OF TERMS		

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Walker Quarries Pty Ltd to complete a bi-annual Noise Monitoring Assessment (NMA) for Wallerawang Quarry ('the quarry').

The NMA involved quantifying the noise contribution of the quarry by direct attended measurements to compare quarry emissions against relevant criteria. Monitoring has been conducted at three representative receiver locations in accordance with the Walker Quarry Noise Management Plan (NMP) and the quarry's Environmental Protection License (ref: 13172). An additional measurement at a nearfield reference location was also conducted to verify the operation of quarry plant and to quantify the noise contribution from site.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Environment Protection Licence EPL 13172 (EPL);
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise;
- Atkins Acoustics and Associates Pty Ltd, Noise and Blast Impact Assessment, 2001; and
- Umwelt (Australia) Pty Ltd, Wallerawang Quarry Noise Management Plan (NMP), 2019.

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

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2 Noise Criteria

2.1 Environmental Protection License Noise Limits

Table 1 reproduces the noise criteria for the quarry as per Condition L4.1 of EPL 13172.

Table 1 Noise Limits, dBA			
Location	Day	Evening	Night
	LAeq(15min)	LAeq(15min)	LAeq(15min)
All privately owned residences	43	43	39

Note: Day Period is 7am to 6pm, Evening Period is 6pm to 10pm, Night Period is 10pm to 7am.

It is noted that Condition L4.3 of EPL 13172 identifies conditions under which the noise criteria do not apply and include:

- a) Wind speeds greater than 3m/s at 10m above ground level;
- b) Temperature inversion conditions greater than 3 degrees Celsius / 100m; or
- c) Under “non-significant weather conditions”.

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3 Methodology

3.1 Locality

Wallerawang is located approximately 10km to the north west of Lithgow, NSW. Receivers in the locality surrounding the quarry are primarily rural/residential and for consistency the naming conventions for each receiver has been retained from the NMP. The monitoring locations with respect to the quarry are presented in **Table 2** and graphically in the locality plan shown in **Figure 1**.

Table 2 Receiver Locations

ID	Address	Distance to Quarry Boundary
RL1	Reference Location (adjacent to site office)	N/A
N1	139 Gemalong, Marrangaroo, NSW	1000m
N2	987 Great Western Highway, Marrangaroo, NSW	160m
N3	2 Cypress Close, Wallerawang, NSW	480m

3.2 Environmental Noise Assessment Methodology

The 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", the EPL and NMP. The measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 2 April 2019 and Wednesday 3 April 2019. The acoustic instrumentation used carries current NATA calibration and complies with AS 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 $\pm 0.5\text{dBA}$.

Two daytime measurements of 15 minutes in duration were completed at each monitoring location during standard onsite operations. Where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis to calculate the $\text{LAeq}(15\text{min})$ quarry noise contribution for comparison against the relevant EPL limits. Localised meteorological conditions (ie windspeed and temperature) were recorded during each measurement utilising a handheld weather station.



FIGURE 1

LOCALITY PLAN

REF: MAC160392



KEY

●N1 RECEIVER / MONITORING LOCATION

●RL1 REFERENCE LOCATION

▭ PROJECT SITE

4 Results

The monitoring and assessment results are presented in individual tables for each assessment location.

4.1 Assessment Results – Reference Location (RL1)

Operational attended noise monitoring was completed at RL1 on Tuesday 2 April 2019 and Wednesday 3 April 2019. **Table 3** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 3 Operator-Attended Noise Survey Results – Reference Location 1 (RL1)							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit ¹	Meteorology	Comments
		L _A max	L _A eq	L _A 90			
02/04/2019	12:47	76	69	67	N/A	WS: 1.2m/s WD: NE Rain: Nil	Process Plant 65-69
							Reverse Alarm 60-65
							Sand Screens 70-76
							Light Vehicle 68-76
							Service Truck 60-61
Quarry Site L _A eq(15min) Contribution							69
03/04/2019	10:24	80	66	64	N/A	WS: 0.7m/s WD: NW Rain: Nil	Loader Pass by 70-80
							Plant 64-66
							Reverse Alarm 43-45
							Export Truck 70-72
Quarry Site L _A eq(15min) Contribution							65

Note 1: EPL not applicable for this onsite reference location.

4.2 Assessment Results - Location N1

Operational attended noise monitoring was completed at N1 on Tuesday 2 April 2019 and Wednesday 3 April 2019. **Table 4** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 4 Operator-Attended Noise Survey Results – Location N1							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL	Meteorology	Comments
		L _A max	L _A eq	L _A 90	Limit		
02/04/2019	12:20	65	49	43	43	WS: 1.5m/s	Traffic 48-52
						WD: ENE	Livestock 46-48
						Rain: Nil	Birds 43-65
							Wind in Trees 38-42
Quarry Site L _A eq(15min) Contribution							Quarry Inaudible
03/04/2019	09:38	68	47	42	43	WS: 0.6m/s	Traffic 44-68
						WD: NW	Birds 40-54
						Rain: Nil	Music in House 35-39
Quarry Site L _A eq(15min) Contribution							Quarry Inaudible

4.3 Assessment Results - Location N2

Operational attended noise monitoring was completed at N2 on Tuesday 2 April 2019 and Wednesday 3 April 2019. **Table 5** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 5 Operator-Attended Noise Survey Results – Location N2							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL	Meteorology	Comments
		L _{Amax}	L _{Aeq}	L _{A90}	Limit		
02/04/2019	13:27	59	41	38	43	WS: 1.4m/s	Traffic 40-42
						WD: NE	Birds 35-59
						Rain: Nil	Wind in trees 30-40
Quarry Site L _{Aeq} (15min) Contribution							Quarry Inaudible
03/04/2019	10:03	73	49	42	43	WS: 0.7m/s	Traffic 41-73
						WD: NW	Birds 45-48
						Rain: Nil	
Quarry Site L _{Aeq} (15min) Contribution							Quarry Inaudible

4.4 Assessment Results - Location N3

Operational attended noise monitoring was completed at N3 on Tuesday 2 April 2019 and Wednesday 3 April 2019. **Table 6** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 6 Operator-Attended Noise Survey Results – Location N3							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L _A max	L _A eq	L _A 90			
02/04/2019	13:55	82	60	44	43	WS: 0.5m/s	Traffic 40-53
						WD: NE	Dogs 58-82
						Rain: Nil	Truck 53
							Quarry Operations 32-40
Quarry Site L _A eq(15min) Contribution							35dBA
03/04/2019	10:45	73	49	42	43	WS: 1.6m/s	Traffic 48-54
						WD: W	Birds 42-73
						Rain: Nil	Wind in Trees 40
Quarry Site L _A eq(15min) Contribution							Quarry Inaudible

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5 Discussion

5.1 Discussion of Results – Reference Location (RL1)

Noise measurements on Tuesday 2 April 2019 and Wednesday 3 April 2019 were conducted when Wallerawang Quarry was operating at normal production levels, which included use of mobile crushers several mobile screens, excavator, road trucks, water cart, and mobile sand plant. The noise contribution from the quarry at the reference location was 69dB LAeq(15min) and 65dB LAeq(15min). Operations were typical of the works undertaken over the last six months at the quarry which is now fully operational. The noise environment at the reference location was primarily dominated by the screens, sand plant and plant movements.

From the attended reference measurements, the sound power (Lw) for the acoustically significant items of plant was calculated to be 113dBA LAeq(15min) for reference measurement one and 109dBA LAeq(15min) for reference measurement two.

To verify the received noise contribution from the quarry at each of the monitoring locations, calculations were undertaken to estimate the attenuation from the site to each monitoring location. The attenuation calculations incorporated loss due to distance, and conservative topography (ie barrier attenuation) and air absorption losses. The results of the attenuation calculations identified received noise level and the results of the attended surveys are discussed for each monitoring location in **Section 5.2 to 5.4**.

5.2 Discussion of Results – Location N1

Measurements conducted on Tuesday 2 April 2019 and Wednesday 3 April 2019, identified that Wallerawang Quarry noise was inaudible for both attended measurements at this location. Therefore, the noise contribution from the quarry satisfied the relevant noise limits of 43dB LAeq(15min). Extraneous non-quarry related sources included highway traffic, birds and wind that were significant contributors to the ambient noise environment.

The calculated attenuation between the quarry site and N1, taking into account distance loss, the surrounding topography and air absorption was 82dBA. Based on the site Lw established from the near field measurements, the resulting received quarry contribution at N1 was <35dBA for each measurement. This level is lower than the ambient non quarry sources which mask site noise.

5.3 Discussion of Results – Location N2

Measurement results for N2 were dominated by highway traffic, wind in trees and bird noise that was constantly audible during all measurements on Tuesday 2 April 2019 and Wednesday 3 April 2019. Quarry emissions were inaudible during all measurements. Accordingly, quarry contributions remained below the relevant noise limit of 43dB LAeq(15min).

The attenuation between the quarry site and N2 taking into account distance between the locations, the loss due to surrounding topography (ie ground attenuation) and air absorption is 72dBA. Based on the current site Lw established from the near field measurements, the resulting received quarry contribution at N2 is <41dBA. Predicted quarry noise level at N2 verifies that quarry operations were inaudible for both attended measurements when compared to non-quarry sources.

5.4 Discussion of Results – Location N3

Measurements conducted on Tuesday 2 April 2019 and Wednesday 3 April 2019 for N3 were dominated by wind in trees, birds and traffic noise. Quarry contributions were audible on Tuesday 2 April 2019, however remained below the relevant criteria of 43dB LAeq(15min). The quarry was inaudible during the measurement on Wednesday 3 April 2019 thus satisfying the relevant noise limits of 43dB LAeq(15min) at the location.

The total attenuation due to distance, air absorption and surrounding topography for N3 was estimated to be 76dBA. This resulted in an estimated site noise contribution of <37dBA and therefore remained below relevant criteria.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment on behalf of Walker Quarries Pty Ltd. The assessment was completed to assess Wallerawang Quarry noise emissions against relevant criteria presented in EPL 13172.

Attended measurements for Tuesday 2 April 2019 and Wednesday 3 April 2019 identified that noise emissions generated by Wallerawang Quarry satisfy relevant noise limits specified in the Noise Management Plan and Environmental Protection Licence at all assessed locations. In summary, quarry noise was inaudible during all offsite measurements, with the exception on round one survey period at N3, with monitoring locations dominated by extraneous sources that mask quarry operations.

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Appendix A - Glossary of Terms

Several technical terms have been used in this report and are explained in **Table A1**.

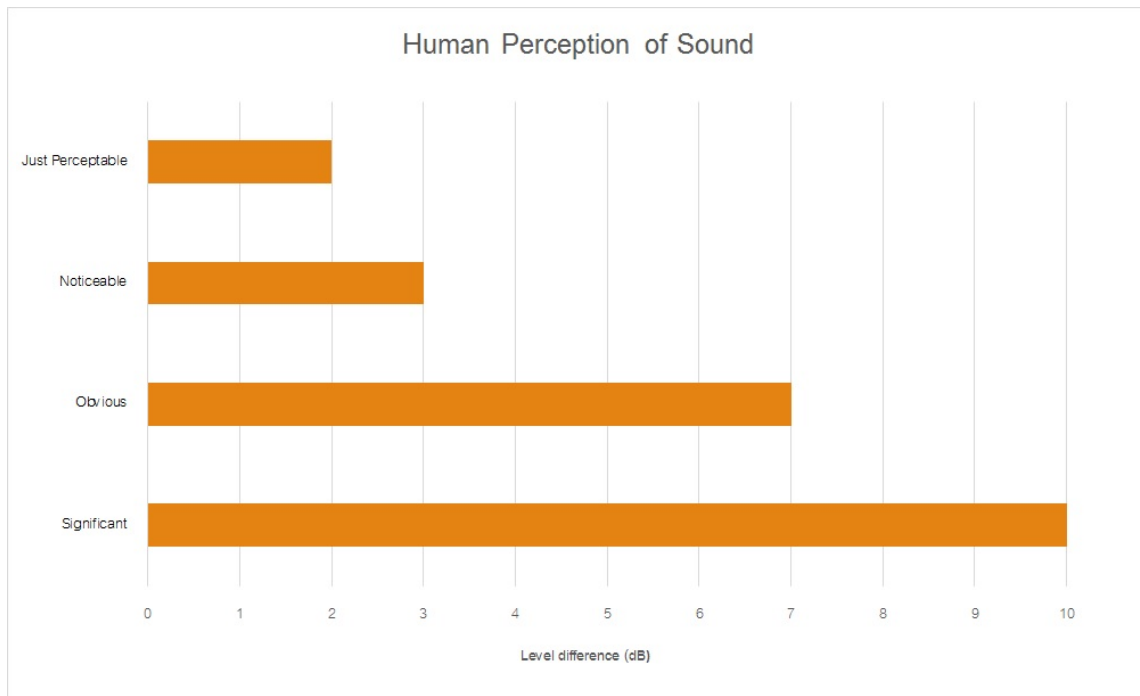
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
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)	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.
LAmx	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 (SWL)	<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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