

# Noise Monitoring Assessment

Wallerawang Quarry, September 2017.

Prepared for : Walker Quarries Pty Ltd  
October 2017



# Document Information

## Noise Monitoring Assessment

### Wallerawang Quarry, September 2017

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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 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.

As part of the monitoring assessment, a sound power audit has been completed for three plant items currently operating onsite as per the requirements of the sites Noise Management Plan (NMP).

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

- NSW Environment Protection Authority (EPA), Industrial Noise Policy (INP), 2000;
- Environment Protection Licence EPL 13172 (EPL);
- Standards Australia AS 1055.1:1997 - Acoustics - Description and measurement of environmental noise - General Procedures;
- Atkins Acoustics and Associates Pty Ltd, Noise and Blast Impact Assessment, 2001; and
- R.W.Corkery & Co. Pty Limited, Wallerawang Quarry Noise Management Plan (NMP), 2016.

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.

<b>Table 1 Noise Limits, dBA</b>			
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”

### 2.2 Quarry Plant Sound Power Noise Limits

Table 6 of the Noise and Blast Impact Assessment (Atkins Acoustics and Associates Pty Ltd, 2001) prepared for the Environmental Impact Statement (EIS) (R.W.Corkery & Co. Pty Limited, 2006) sets out the noise criteria for mobile plant operating at the quarry. The noise criteria are reproduced in **Table 2**.

<b>Table 2 Quarry Plant Sound Power Levels, dBA<sub>re10-12W</sub></b>	
Mobile Plant	Sound Power Level
Hydraulic Hammer Drill	116
Excavator	115
Rock Breaker	116
Mobile Crusher	115
Permanent Crusher	117
Front End Loader	115
Traxcavator	115
Truck	106

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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 3** and graphically in the locality plan shown in **Figure 1**.

**Table 3 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 1055-1997, "Acoustics - Description and Measurement of Environmental Noise", the EPL and NMP. The measurements were carried out using Svantek Type 1, 971 noise analyser on Tuesday 19 September 2017 and Wednesday 20 September 2017. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2004-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed  $\pm 0.5$  dBA.

Two daytime measurements of 15 minutes in duration were completed at each monitoring location over two consecutive days from Tuesday 19 September 2017 and Wednesday 20 September 2017. 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  $L_{Aeq}(15min)$  quarry noise contribution for comparison against the relevant EPL limits.

Prevailing meteorological conditions for the monitoring period were assessed during each attended measurement and analysed in accordance with Appendix E4 of the INP to determine the stability category present at the time of each measured sample. This was undertaken to determine applicability of results in accordance with Condition L4.3 of the EPL.

### 3.3 Sound Power Level Audit Methodology

Sound power measurements (L<sub>w</sub>) were conducted on the three plant items currently operating at the quarry. Measurements of the plant were conducted on Tuesday 19 September 2017 and Wednesday 20 September 2017. A list of the measured plant items is presented in **Table 4**.

<b>Table 4 Plant Surveyed</b>		
Plant item	Type	Operating Mode
Sandvik QA451	Mobile Screen/Crusher	Standard Operation
Komatsu WA502	Loader	Static High Idle
Wirtgen Kleeman MS953	Mobile Screen/Crusher	Standard Operation








FIGURE 1

LOCALITY PLAN

REF: MAC160392



KEY	
	RECEIVER / MONITORING LOCATION
	REFERENCE LOCATION
	PROJECT SITE

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## 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 19 September 2017 and Wednesday 20 September 2017. **Table 5** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 5 Operator-Attended Noise Survey Results – Reference Location 1 (RL1)							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L <sub>Amax</sub>	L <sub>Aeq</sub>	L <sub>A90</sub>			
19/09/2017	13:16	76	65	62	N/A	Wind Speed: 3.2m/s	Sand Plant 64 – 67
						Wind Dir: SW	Truck 56 – 58
						Temp: 14.6 °	Reverse Alarm 63
						Rain: Nil	Wind Turbulence 64 – 65
Quarry Site L <sub>Aeq</sub> (15min) Contribution							65
20/09/2017	9:44	79	65	62	N/A	Wind Speed: 1.0m/s	Sand Plant 63 – 67
						Wind Dir: W	Loader 64 – 66
						Temp: 16.8°	Trucks on Highway 50 – 56
						Rain: Nil	Truck onsite 66 – 73
Quarry Site L <sub>Aeq</sub> (15min) Contribution							65
Reverse Alarm 63 – 64							



#### 4.2 Assessment Results - Location N1

Operational attended noise monitoring was completed at N1 on Tuesday 19 September 2017 and Wednesday 20 September 2017. **Table 6** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 6 Operator-Attended Noise Survey Results – Location N1							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L <sub>Amax</sub>	L <sub>Aeq</sub>	L <sub>A90</sub>			
19/09/2017	12:41	67	52	47	43	Wind Speed: 3.2 m/s	Wind Noise 45 – 50
						Wind Dir: SW	Traffic 47 – 56
						Temp: 17.4 °	Airbrakes 55 – 67
						Rain: Nil	Birds 53 – 56
Quarry Site L <sub>Aeq</sub> (15min) Contribution							Quarry Inaudible
20/09/2017	8:58	59	49	41	43	Wind Speed: 1.1 m/s	Traffic 42 – 59
						Wind Dir: W	Birds 46 – 56
						Temp: 16.2°	Horse Noise 50 – 56
						Rain: Nil	Airbrakes 48 – 58
Quarry Site L <sub>Aeq</sub> (15min) Contribution							Quarry Inaudible

#### 4.3 Assessment Results - Location N2

Operational attended noise monitoring was completed at N2 on Tuesday 19 September 2017 and Wednesday 20 September 2017. **Table 7** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 7 Operator-Attended Noise Survey Results – Location N2							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L <sub>Amax</sub>	L <sub>Aeq</sub>	L <sub>A90</sub>			
19/09/2017	11:52	64	50	42	43	Wind Speed: 2.8 m/s	Traffic Noise 44 – 48
						Wind Dir: S	Birds 39 – 51
						Temp: 17.4 °	Aircraft 60 – 63
						Rain: Nil	Airbrakes 53 – 64
Quarry Site L <sub>Aeq</sub> (15min) Contribution							Quarry Inaudible
20/09/2017	9:23	60	45	38	43	Wind Speed: 0.5m/s	Traffic 40 – 49
						Wind Dir: W	Airbrakes 46 – 60
						Temp: 17.2°	Birds 35 – 41
						Rain: Nil	
Quarry Site L <sub>Aeq</sub> (15min) Contribution							Quarry Inaudible

#### 4.4 Assessment Results - Location N3

Operational attended noise monitoring was completed at N3 on Tuesday 19 September 2017 and Wednesday 20 September 2017. **Table 8** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

**Table 8 Operator-Attended Noise Survey Results – Location N3**

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L <sub>Amax</sub>	L <sub>Aeq</sub>	L <sub>A90</sub>			
19/09/2017	13:52	59	45	40	43	Wind Speed: 3.5m/s	Wind 45 – 55
						Wind Dir: SW	Traffic Noise 43 – 47
						Temp: 16.1 °	Airbrake 52 – 53
						Rain: Nil	Birds 50 – 59
Quarry Site L <sub>Aeq</sub> (15min) Contribution							Quarry Inaudible
20/09/2017	8:38	62	49	40	43	Wind Speed: 0.5m/s	Traffic 42 – 62
						Wind Dir: NW	Birds 36 – 51
						Temp: 15.6 °	Airbrakes 51
						Rain: Nil	
Quarry Site L <sub>Aeq</sub> (15min) Contribution							Quarry Inaudible

#### 4.5 Sound Power Audit Results

Octave band centre frequency analysis of sound power data for measured on-site plant is presented in **Table 9**. Results of the analysis identify that the overall sound power of items of plant used at the project site are below criteria outlined in the EIS and NMP.

**Table 9 Sound Power Levels**

Plant	Octave Band Centre Frequency, L <sub>w</sub> Spectrum									Sound Power dBA L <sub>w</sub>	Noise Criteria	Compliant
	32	63	125	250	500	1k	2k	4k	8k			
Sandvik Crusher	78	85	91	96	103	106	106	102	94	111	115	✓
Komatsu Loader	67	79	86	88	91	94	93	89	78	99	115	✓
Wirtgen Kleeman Crusher	78	87	96	101	107	110	107	102	96	114	115	✓

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## 5 Discussion

### 5.1 Discussion of Results – Reference Location (RL1)

Monitoring on Tuesday 19 September 2017 and Wednesday 20 September 2017 was conducted when Wallerawang Quarry was operating at typical production levels, which included use of a loader and sand plant (mobile screens) with noise contribution from the plant at the reference location measuring 65dBA LAeq(15min). Operations were typical of the works undertaken for the past 6-month period at the quarry. The reference location noise environment was dominated by the sand plant operations and occasional engine noise and reverse alarms of the loader.

From the attended reference measurements, the sound power (Lw) for the three items of operating plant was calculated to be 103dBA for both the measurements.

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 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

Monitoring on Tuesday 19 September 2017 and Wednesday 20 September 2017, 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 43dBA 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 the 1200m distance loss, the surrounding topography and air absorption, was 82dBA. Based on the current total site Lw established from the near field measurements, the resulting received quarry contribution at N1 was 21dBA. This level is significantly lower the ambient dominant sources which would mask site noise and confirms the quarry was inaudible at this location for both measurements.

### 5.3 Discussion of Results – Location N2

Monitoring results for N2 were dominated by highway traffic and bird noise that was constantly audible during all measurements on Tuesday 19 September 2017 and Wednesday 20 September 2017. Quarry emissions were inaudible during all measurements. Accordingly, quarry contributions remained below the relevant noise limit of 43dBA LAeq(15min).

The attenuation between the quarry site and N2 taking into account the 400m distance between the locations, the loss due to surrounding topography and air absorption is 72dBA. Based on the current total site Lw established from the near field measurements, the resulting received quarry contribution at N2 was 31dBA. Due to the low predicted received quarry noise level at N2, the masking effect of other dominant sources such as passing road traffic verifies that quarry operations were inaudible for both attended measurements.

### 5.4 Discussion of Results – Location N3

Monitoring conducted on Tuesday 19 September 2017 and Wednesday 20 September 2017 for N3 were dominated by local and highway traffic. Wind was also audible during the attended measurement on Tuesday 19 September 2017 with quarry noise remaining inaudible during all measurements hence, quarry contributions remained below the relevant criteria of 43dBA LAeq(15min).

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 27dBA and due to the presence of dominant extraneous noise sources such as passing traffic, the noise from the site was masked and verifies that the site was inaudible throughout both of the survey periods.

### 5.5 Discussion of Results – Sound Power Audit

The results of the sound power audit demonstrate that current plant used onsite comply with the relevant mobile and static sound power criteria as outlined in the NMP.

## 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 monitoring for 19 September 2017 and 20 September 2017 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 measurements with monitoring locations dominated by extraneous sources unrelated to quarry operations.

A sound power ( $L_w$ ) audit of the plant operating onsite demonstrated that the plant are operating within the applicable noise criteria.

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# Appendix A - Glossary of Terms

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

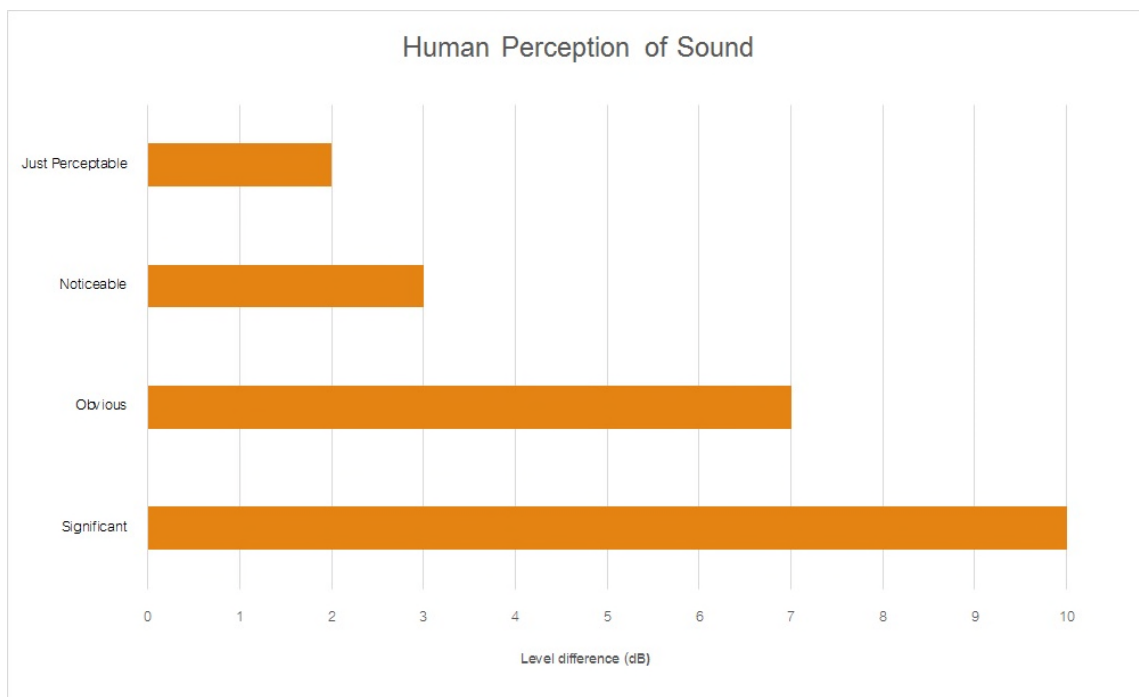
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single 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 W<sub>0</sub> 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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