

Noise Monitoring Assessment

Wallerawang Quarry
September 2019



Document Information

Noise Monitoring Assessment

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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 - General Procedures;
- Atkins Acoustics and Associates Pty Ltd, Noise and Blast Impact Assessment, 2001; and
- Umwelt, 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”.

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) (Pacrim Environmental, 2001) sets out the noise targets for mobile plant operating at the quarry. The noise criteria are reproduced in **Table 2**.

Table 2 Quarry Plant Sound Power Levels, dBA (re 10-12 Watts)	
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**.

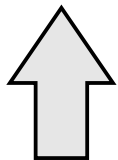
Table 3 Receiver Locations

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 1055:2018, "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 Wednesday 12 September 2019 and Thursday 13 September 2019. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ± 0.5 dB.

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 $L_{Aeq}(15min)$ quarry noise contribution for comparison against the relevant EPL limits.



BARDON AVENUE

GREAWESTER HIGHWAY



FIGURE
LOCALITY
REF: MAC1



KEY	
	RECEIVER OR MOUNTING LOCATION
	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 Wednesday 11 September 2019 and Thursday 12 September 2019. **Table 4** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 4 Operator-Attended Noise Survey Results – Reference Location 1 (RL1)

Date	Time (hrs)	Descriptor (dBA re 20 μ Pa)			EPL Limit ¹	Meteorology	Comments
		L _{Amax}	L _{Aeq}	L _{A90}			
11/09/2019	14:41	74	67	62	N/A	WS: 1.6m/s WD: SE Rain: Nil	Screening plant 60-72 Haul truck 60-66
Quarry Site L _{Aeq} (15min) Contribution							70
12/09/2019	08:13	79	70	68	N/A	WS: 0.5m/s WD: SE Rain: Nil	Screening plant 63-70 Road train 63-72
Quarry Site L _{Aeq} (15min) Contribution							70

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 Wednesday 11 September 2019 and Thursday 12 September 2019. **Table 5** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 5 Operator-Attended Noise Survey Results – Location N1							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L _{Amax}	L _{Aeq}	L _{A90}			
11/09/2019	15:23	61	45	39	43	WS: 2.4m/s	Traffic 40-56
						WD: SE	Birds 40-49
						Rain: Nil	Quarry hum <35
Quarry Site L _{Aeq} (15min) Contribution							<35 ¹
12/09/2019	09:37	65	51	46	43	WS: 2.5m/s	Wind 40-51
						WD: NE	Traffic 46-63
						Rain: Nil	Quarry Inaudible
Quarry Site L _{Aeq} (15min) Contribution							<36 ¹

Note 1: Quarry Site L_{Aeq}(15min) calculated based on nearfield measurements.

4.3 Assessment Results - Location N2

Operational attended noise monitoring was completed at N2 on Wednesday 11 September 2019 and Thursday 12 September 2019. **Table 6** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 6 Operator-Attended Noise Survey Results – Location N2							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L _{Amax}	L _{Aeq}	L _{A90}			
11/09/2019	14:19	75	58	40	43	WS: 2.2m/s WD: SE Rain: Nil	Wind in trees 40-42
							Traffic 38-48
							Birds 30-49
							Aircraft 63-75
Quarry Site L _{Aeq} (15min) Contribution							<43 ¹
12/09/2019	08:35	55	46	42	43	WS: 0.3m/s WD: SE Rain: Nil	Traffic 40-51
							Birds 43-46
							Quarry hum 35-40
Quarry Site L _{Aeq} (15min) Contribution							<43 ¹

Note 1: Quarry Site L_{Aeq}(15min) calculated based on nearfield measurements.

4.4 Assessment Results - Location N3

Operational attended noise monitoring was completed at N3 on Wednesday 11 September 2019 and Thursday 12 September 2019. **Table 7** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 7 Operator-Attended Noise Survey Results – Location N3							
Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		L _{Amax}	L _{Aeq}	L _{A90}			
11/09/2019	15:00	62	46	41	43	WS: 1.5m/s	Traffic 40-50
						WD: SE	Birds 41-62
						Rain: Nil	Screening plant 40-43
Quarry Site L _{Aeq} (15min) Contribution							<39 ¹
12/09/2019	08:57	59	47	43	43	WS: 2.0m/s	Wind 40-51
						WD: NW	Birds <42
						Rain: Nil	Traffic 40-54
Quarry Site L _{Aeq} (15min) Contribution							<39 ¹
Quarry impact noise to 45 (<10 secs)							

Note 1: Quarry Site L_{Aeq}(15min) calculated based on nearfield measurements.

4.5 Sound Power Audit Results

Octave band centre frequency analysis of sound power data for measured on-site plant is presented in **Table 8**. Results of the analysis identify that the overall sound power of items of plant used at the project site are below target sound power levels outlined in the EIS and NMP.

Table 8 Sound Power Levels												
Plant	Octave Band Centre Frequency, Lw Spectrum									Sound Power dBA Lw	Criteria	
	32	63	125	250	500	1k	2k	4k	8k			
Komatsu Loader WA480 #251	65	74	83	88	93	95	92	89	81	99	115	
Komatsu Loader WA480 #252	68	76	85	91	97	100	97	96	84	104	115	
Komatsu HM400 Haul Truck	70	79	96	94	99	100	98	73	84	105	106	
Sand Plant and Screens	83	91	96	100	104	107	106	101	93	112	115	
Komatsu WA500 Loader	69	79	90	91	97	98	97	94	83	103	115	
Komatsu PC450LC (old Digger)	73	80	93	91	100	103	99	96	82	106	115	
Cat D400E HT	71	94	86	94	100	104	103	96	86	108	115	
Main Crushers and Plant	85	92	97	101	106	110	111	107	96	115	115	

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5 Discussion

5.1 Discussion of Results – Reference Location (RL1)

Noise measurements on Wednesday 11 September 2019 and Thursday 12 September 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 70dBA LAeq(15min) for both measurements. The noise environment at the reference location was primarily dominated by the sand plant and road trucks.

From the attended reference measurements, the sound power (Lw) for the three acoustically significant items of plant was calculated to be 115dBA LAeq(15min) for both measurements.

To verify the offsite noise levels, 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 Wednesday 11 September 2019 and Thursday 12 September 2019, identified that Wallerawang Quarry noise was audible during the first measurement conducted on 11 September 2019, however satisfied the relevant noise limits of 43dBA LAeq(15min). The quarry was inaudible during the second measurement, conducted on 12 September 2019, which also satisfies the criteria at this location. 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 82dB. Based on the site Lw established from the near field measurements, the resulting received quarry contribution at N1 is <33dBA. This level is significantly lower than the ambient dominant sources and generally masks site noise and confirms the quarry was inaudible at this location for the second measurement.

5.3 Discussion of Results – Location N2

Measurement results for N2 were dominated by highway traffic and bird noise that was constantly audible during all measurements on Wednesday 11 September 2019 and Thursday 12 September 2019. Quarry emissions were audible during both measurements conducted at this location however remained below the relevant noise limit of 43dBA LAeq(15min) on both occasions.

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 72dB. Based on the current site Lw established from the near field measurements, the resulting received quarry contribution at N2 is <43dBA. This estimated noise level are consistent with the measured noise contribution from the attended monitoring.

5.4 Discussion of Results – Location N3

Measurements conducted on Wednesday 11 September 2019 and Thursday 12 September 2019 for N3 were dominated by local and highway traffic however quarry operation, in particular the screens and crusher were audible throughout both measurements. Notwithstanding, quarry contributions remained below the relevant criteria of 43dBA LAeq(15min) for both measurements conducted at the location. The current operational position of the crusher is considered worst case for this location and as the pit progresses, the crusher will be shielded by the quarry walls which is expected to reduce the noise contribution at this location.

The total attenuation due to distance, air absorption and surrounding topography for N3 was estimated to be 76dB. This resulted in an estimated site noise contribution of <39dBA which is consistent with the measured noise contribution from the attended monitoring.

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 measurements for Wednesday 11 September 2019 and Thursday 12 September 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 audible during several offsite measurements, however monitoring locations were dominated by extraneous sources that often masked quarry operations.

All plant were found to comply with their respective noise limits outlined in the NMP.

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Appendix A – Glossary of Terms

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

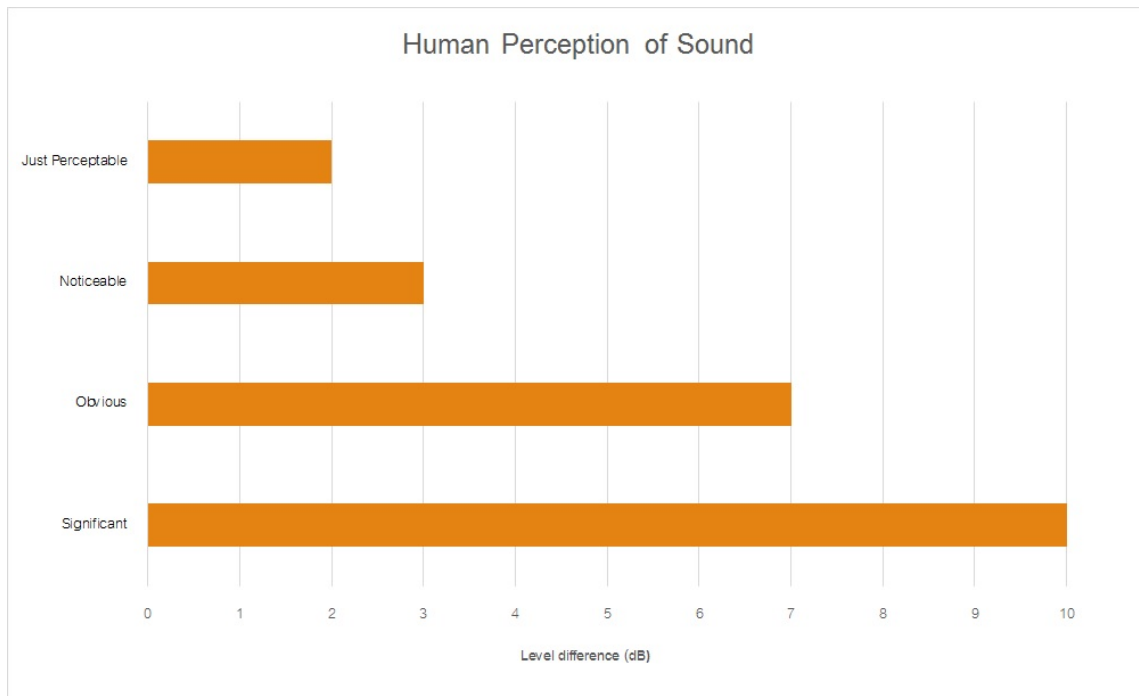
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single 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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Appendix B – Correspondence Register

Table B1 Correspondence Register

Date	Contact Between	Phone/Email	Comment
Monday 19 August 2019	R Heaton & A Irwin	Phone	Initial contact to schedule environmental compliance survey and sound power audit in September 2019.
Tuesday 20 August 2019	R Heaton & A Irwin	Email	Email to postpone the survey as adverse winds and heavy rain were forecast for the first week of September.
Wednesday 4 September 2019	A Irwin & R Heaton	Email	Johann Van Der Merwe and Trevor Hoffman details provided by A Irwin.
Wednesday 4 September 2019	J Van Der Merwe & R Heaton	Phone	Call to outline survey details and scheduled survey for Monday 9 September 2019 and Tuesday 10 September 2019.
Monday 9 September 2019	J Van Der Merwe & R Heaton	Phone	Call to reschedule survey due to crusher breakdown following belt failure, survey tentatively reschedule to Thursday 12 September 2019 and Friday 13 September 2019.
Monday 9 September 2019	R Heaton & A Irwin	Phone	A Irwin updated on break down and rescheduled survey details.

