Appendix 4

Noise Monitoring Reports

(Total No. of pages including blank pages = 30)

Note: A colour version of this Appendix is available on the digital version of this document

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46.6949.R2:GA/DT/2016

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Attention: Alex Irwin

20 July 2016

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Consulting Acoustical & Vibration Engineers

SITE ATTENDED NOISE AUDIT
WALLERAWANG QUARRY
WALLERAWANG
JULY 2016

Atkins Acoustics was engaged by R W Corkery & Co Pty Ltd on behalf of *Walker Quarries Pty Limited* to conduct an environmental noise audit of operations at the Wallerawang Quarry, Wallerawang.

The purpose of the audit was to assess noise emissions from current operations and assess compliance with Environment Protection Licence (EPL 13172) as follows:

L4 Noise Limits

L4.1 Noise from the premises must not exceed:
(a) 43dB(A) $L_{Aeq(15\ minute)}$ during the day (7am to 6pm) Monday to Friday and 7am to 1pm Saturday; and
(b) 43dB(A) $L_{Aeq(15\ minute)}$ during the evening (6pm to 10pm) Monday to Friday; and
(c) at all other times 39dB(A) $L_{Aeq(15\ minute)}$, except as expressly provided by this licence.

Where L_{Aeq} means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise occurring over a measurement period.

L4.2 Noise from the premises is to be measured at the nearest or most affected residence to determine compliance with this condition.

L4.3 The noise emission limits identified in this licence apply under all meteorological conditions except:
(a) during rain or wind speeds (at 10m height) greater than 3m/s; and
(b) under "non-significant weather conditions".

Note: Field meteorological indicators for non-significant weather conditions are described in the NSW Industrial Noise Policy, Chapter 5 and Appendix E in relation to wind and temperature inversions.

In addition to the Environment Protection Licence (EPL 13172) issued by the *Department of Environment, Climate Change and Water (now Environment Protection Authority)* the quarry development was approved by the *Department of Infrastructure, Planning and Natural Resources (now Department of Planning and Environment)* under DA 344-11-2001. Condition 2.1 of DA 344-11-2001 reflects the noise limits imposed by EPL 13172, however Condition 2.4 also required the preparation of a *Reactive Noise Management Plan (RNMP).*

Walker Quarries Pty Ltd *RNMP* dated December 2014 identifies three (3) reference noise measurement locations (N1, N2, N3) for noise monitoring purposes in addition to a schedule of plant and equipment with specified sound pressure levels at 10m from plant and equipment.

This report presents the results and findings of site attended audit noise measurements conducted between 8.00am and 1.00pm on Monday 4 July 2016. Prevailing weather conditions during the audit measurements were clear, cold and calm. Temperatures ranged from -1°C to 12° C.

A review of site operations during the audit confirmed that extraction was not occurring within the main quarry pit. Operating plant and equipment observed during the audit included:

Excavator (x1) working on the northern side of extraction ridge.
Dump Truck (6 wheeled) working on the northern side of extraction ridge.
Front-end loader (FEL) working in pug mill area.
Truck Loading from the pug mill.
Screen/Pug Mill.
Drill Rig, and
Generator

The attended offsite noise measurements were conducted in proximity of the *RNMP* three (3) reference locations *(Attachment 1)* identified as:

Location N1 Gemalong

Location N2 Site Access - 'Cockatoo Pines' gate

Location N3 Cypress Place

Due to access restrictions to private properties, the noise monitoring locations were selected to represent as close as practicable to the *RNMP* assessment locations.

The instrumentation utilised for the measurements consisted of a Svantek SVAN957 Sound & Vibration Analyser (Serial No. 21485). Instrumentation was checked before and after measurements with a Bruel & Kjaer Calibrator Type 4230 and remained with specification limits.

The offsite audit measurements were conducted over ten to fifteen (10-15) minute periods with statistical and instantaneous maximum noise levels recorded where appropriate. A summary of the measurement results is presented in *Table 1.*

Table 1: Audit Sound Pressure Level Measurement Results
dBA re: 20 x 10^{-6} Pa

Measured Statistical Noise Levels dBA			Estimated Quarry Contribution	Comments
$L_{Aeq,\ 15\ min}$	$L_{A90,\ 15\ min}$	$L_{Amin,\ 15min}$	$L_{Aeq,\ 15\ min}$	
Location N1: Gemalong				
48.6	44.7	43.2	<34	Quarry operations inaudible. Ambient noise controlled by highway road traffic.
Location N2: Site Access – 'Cockatoo Pines' gate				
59.1	48.3	48.1	<38	Quarry operations inaudible. Ambient noise controlled by highway road traffic.
Location N3: Cypress Place				
52.4	43.0	42.2	<33	Quarry operations generally inaudible. Quarry reversing alarm audible LAmax <30dBA; Ambient noise influenced by highway and Barton Avenue road traffic, dog and birds.

Observations during the audit confirmed that quarry operations were generally inaudible at the three (3) reference monitoring locations, accordingly the noise contributions from quarry operations were 10dB or more below the measured L_{A90} levels and satisfied the 43dB(A) noise limit in accordance with EPL 13172.

Nearfield audit measurements of plant and equipment were conducted at a reference distance of ten (10) metres during normal operation in accordance with the *RNMP*. A summary of the operating plant and measured noise levels is presented in *Table 2*.

Table 2: Plant and Equipment Noise Audits
$L_{Aeq,\ 90\ sec}$ re: 20 x 10^{-6} Pa

Item	Make & Model	SPL @10m dBA
Excavator 1	Komatsu PC300	79
Dump Truck	AD410	84
Loader	Komatsu WA501	78
Hydraulic Drill Rig	Ingersol Rand	87
Pug Mill/Screen	Scorpion Pugmill	77
Generator	Stamford	75 (radiator side) 68 (control side)

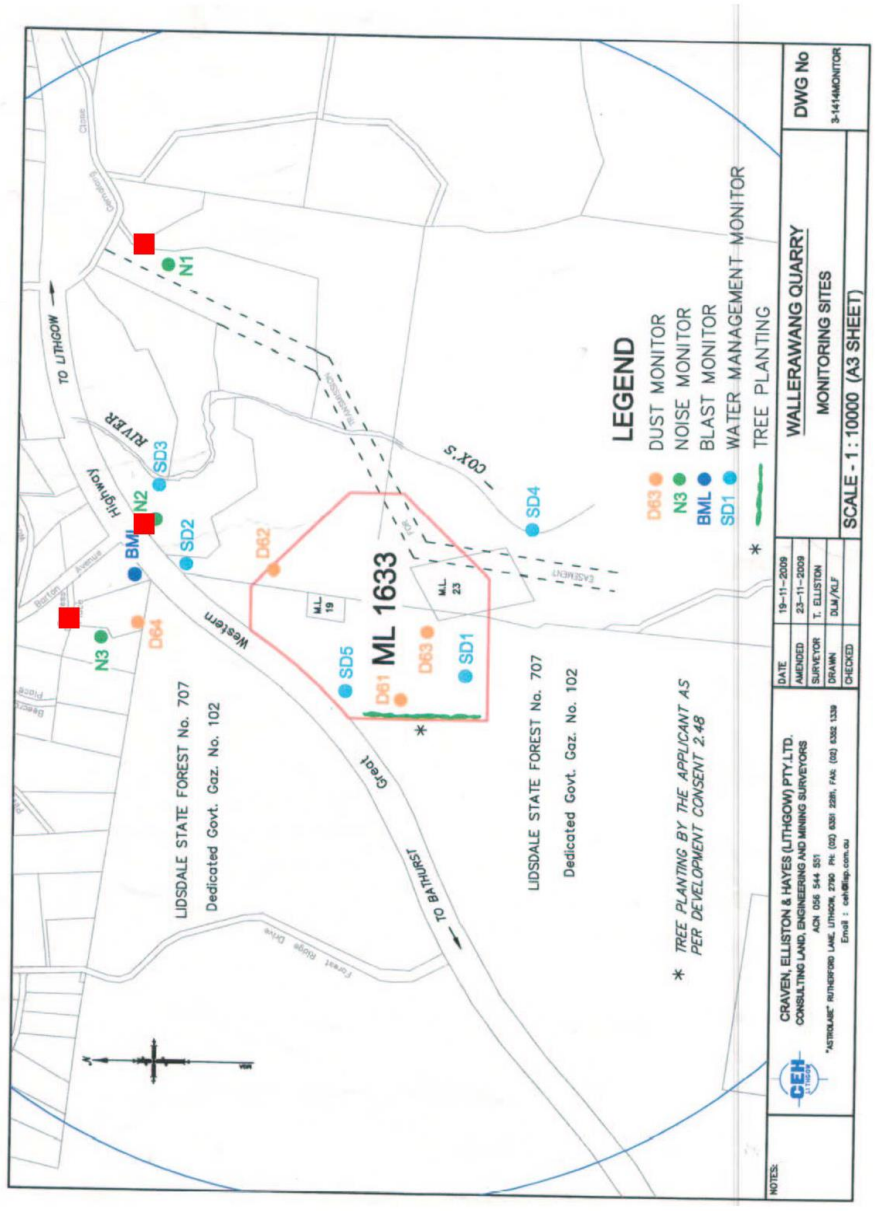
The attended noise audits confirmed that the EPL 13172 noise limit of $L_{Aeq(15\ minute)}$ 43dB(A) was satisfied at the three (3) reference receptor locations. The results of the nearfield audit measurements summarised in *Table 2* satisfy levels reported in *Reactive Noise Management Plan (RNMP)* dated December 2014.

Yours sincerely,

ATKINS ACOUSTICS & ASSOCIATES PTY LTD.

Graham Atkins

ATTACHMENT 1: NOISE MONITORING LOCATIONS



Noise Measurement Locations

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Noise Monitoring Assessment

Wallerawang Quarry, Wallerawang, NSW.

Prepared for : Walker Quarries Pty Ltd

January 2017

MAC
Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Wallerawang Quarry, 12 January 2017

Prepared for: Walker Quarries Pty Ltd

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Document ID	Status	Date	Prepared	Signed
MAC160392RP1	Final	23 January 2017	Oliver Muller (MAAS)	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Walker Quarries Pty Ltd to complete a 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 quarries Environmental Protection License (ref: 13172).

The assessment has been conducted in accordance with 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; and
- Wallerawang Quarry Noise Management Plan (NMP).

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

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2 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 1: 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 the locality plan shown in **Figure 1**.

3.2 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 Thursday 12 January 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 ±0.5dBA.

Two day time measurements of 15 minutes in duration were completed at each location before and after 12pm on Thursday 12 January 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.

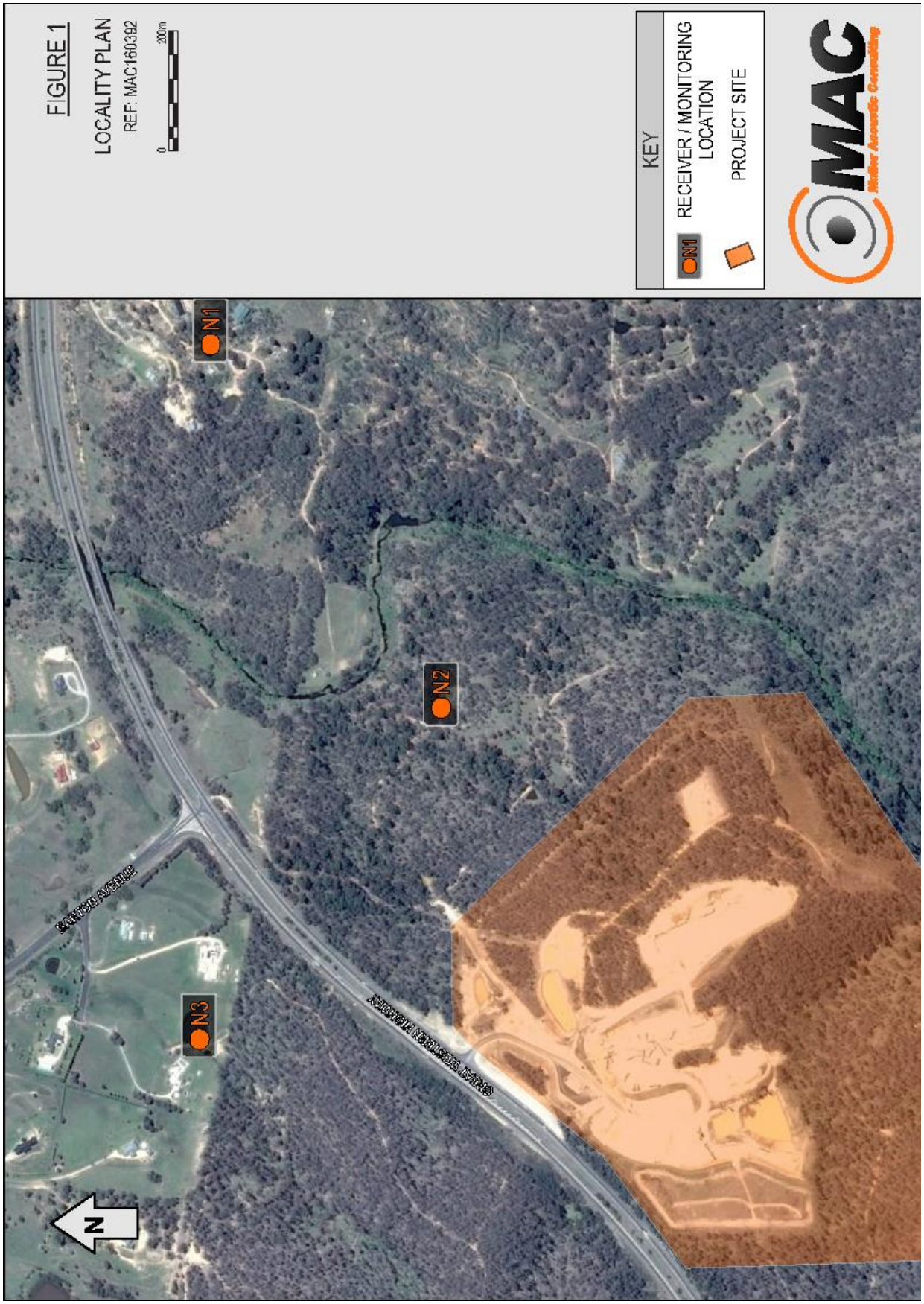
FIGURE 1
LOCALITY PLAN
REF: MAC160392
0
200m
KEY
RECEIVER / MONITORING LOCATION
N1
PROJECT SITE
MAC
N1
N2
N3
N
CASTLEREAGH HIGHWAY
EATON AVENUE

4 Results

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

4.1 Assessment Results - Location N1

The results of the attended noise measurements at location N1 for Thursday 12 January 2017 are summarised in Table 2 along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the quarry noise contribution.

Table 2 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		LAmax	L_{Aeq}	L_{A90}			
12/01/2017	8:25	72	45	43	43	Dir: NW 2-3 m/s	Highway traffic Birds Local residential noise Dog barely audible
Quarry Site $L_{Aeq(15min)}$ Contribution							Quarry Inaudible
12/01/2017	12:42	76	60	59	43	Dir: NW 1-2 m/s	Highway traffic Birds Local Residential noise Aircraft Horse
Quarry Site $L_{Aeq(15min)}$ Contribution							Quarry Inaudible

4.2 Assessment Results - Location N2

The results of the attended noise measurements at location N2 for Thursday 12 January 2017 are summarised in **Table 3** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the quarry noise contribution.

Table 3 Operator-Attended Noise Survey Results – Location N2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
		LAmax	LAeq	LA90			
12/01/2017	9:05	63	47	46	43	Dir: NW 1-2 m/s	Highway traffic Birds Insects
Quarry Site $LA_{eq(15min)}$ Contribution							Quarry Inaudible
12/01/2017	12:00	65	47	46	43	Dir: NW 2-3 m/s	Highway traffic Birds Insects
Quarry Site $LA_{eq(15min)}$ Contribution							Quarry Inaudible

4.3 Assessment Results - Location N3

The results of the attended noise measurements at location N3 for Thursday 12 January 2017 are summarised in **Table 4** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the quarry noise contribution.

Table 4 Operator-Attended Noise Survey Results – Location N3

Date	Time	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology	Comments
	(hrs)	LAmax	LAeq	LA90			
12/01/2017	9:26	58	45	43	43	Dir: NW 1-2 m/s	Highway traffic Aircraft Birds
Quarry Site $LA_{eq(15min)}$ Contribution							Quarry Inaudible
12/01/2017	12:24	61	43	41	43	Dir: NW 1-2 m/s	Birds Highway traffic Insects Lawn mower
Quarry Site $LA_{eq(15min)}$ Contribution							Quarry Inaudible

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5 Discussion

5.1 Discussion of Results – Location N1

Monitoring on Thursday 12 January 2017, identified that Wallerawang Quarry noise was inaudible for both attended measurements. Therefore, the noise contribution from the quarry satisfied the relevant noise limits of 43dBA $LA_{eq(15min)}$. Extraneous non-quarry related noise sources included highway traffic, birds, local residential noise, dogs, aircraft and livestock.

5.2 Discussion of Results – Location N2

Monitoring results for N2 were dominated by highway traffic that was constantly audible during all measurements. Quarry emissions were inaudible on all occasions. Furthermore, quarry contributions remained below the relevant noise limit of 43dBA $LA_{eq(15min)}$. Extraneous sources were also dominant throughout the 12 January 2017 survey with highway traffic, birds and insects all constantly audible.

5.3 Discussion of Results – Location N3

Monitoring results for N3 were dominated by highway traffic that was constantly audible during all measurements. Quarry emissions were not audible. Therefore, quarry contributions remained below the relevant criteria of 43dBA $LA_{eq(15min)}$. Extraneous sources were dominant during measurements with highway traffic, aircraft, local residential noise, birds and insects audible.

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6 Conclusion

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 EPL13172.

Attended monitoring for 12 January 2017 identified that noise emissions generated by Wallerawang Quarry comply with relevant statutory noise limits specified in NMA & EPL at all assessed locations. In summary, quarry noise was inaudible during all measurements and was dominated by extraneous noises unrelated to 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

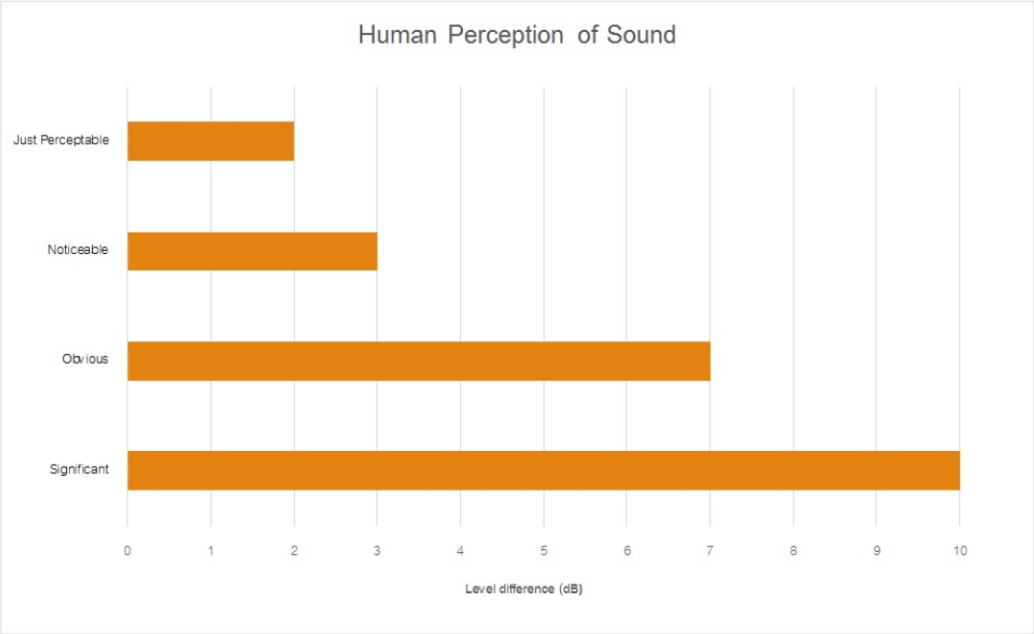
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for 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.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (SWL)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

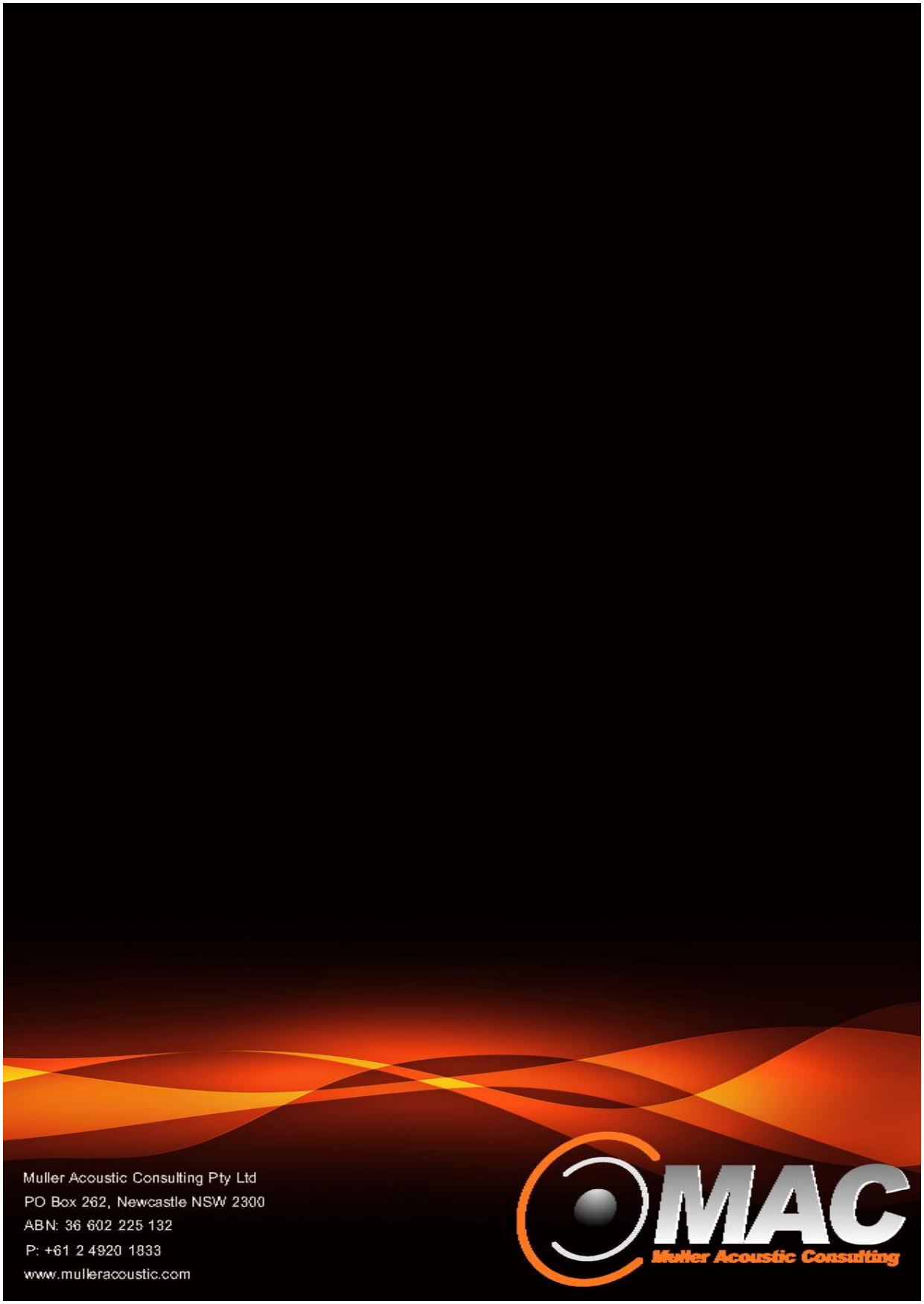
Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound

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