Noise Monitoring Assessment

Wallerawang Quarry
April 2024

Prepared for: Walker Quarries Pty Ltd
April 2024
MAC160392RP15

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Wallerawang Quarry

April 2024

Prepared for: Walker Quarries Pty Ltd

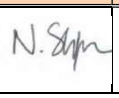
Prepared by: Muller Acoustic Consulting Pty Ltd

PO Box 678, Kotara NSW 2289

ABN: 36 602 225 132

P: +61 2 4920 1833

www.mulleracoustic.com

DOCUMENT ID	DATE	PREPARED	SIGNED	REVIEWED	SIGNED
MAC160392RP15	30 April 2024	Nicholas Shipman		Oliver Muller	

CONTENTS

This page has been intentionally left blank

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). This assessment has been undertaken as the first bi-annual assessment for 2024 (April 2024).

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 four representative receiver locations in accordance with the Walker Quarry, Noise Management Plan (NMP) and the quarry's Environmental Protection License (EPL #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;
- NSW Environment Protection Authority (EPA), Approved Methods for the measurement and analysis of environmental noise in NSW, 2022;
- Environment Protection Licence EPL #13172 (EPL);
- Development Consent (DA No. 344-11-2001) (Mod 3), February 2020;
- Standards Australia AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures;
- Muller Acoustic Consulting Pty Ltd (MAC), Noise and Vibration Impact Assessment (NVIA), 2019; and
- Umwelt, Wallerawang Quarry Noise Management Plan, Version 6 (NMP), 2024.

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

This page has been intentionally left blank

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 EPL Noise Limits, dBA

Location	Day	Evening	Night
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$
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 Development Consent Noise Limits

Schedule 3 of the site's Development Consent (DA No. 344-11-2001) outlines applicable noise criteria for the operation of the quarry. **Table 2** reproduces the criteria as outlined in the Development Consent.

Table 2 Development Consent Noise Limits, dBA

Location	Day	Evening	Night
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$
All privately owned residences	43	39	35

Additionally, Condition 3B of Schedule 3 of the Development Consent states, '*The noise criteria in Table 2 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.*'

2.3 Variance in noise limits

It is noted that the night-time criteria presented in the Development Consent differs from that outlined in the EPL. This is due to the consent being updated to reflect the recent modification for site. Hence, the more conservative criteria outlined in the consent have been adopted for this assessment.

Notwithstanding, as the quarry is not operational during the evening and night period, the variance in the applicable noise criteria is inconsequential.

2.4 Quarry Plant Sound Power Noise Limits

Table 15 of the Noise and Vibration Impact Assessment (NVIA) (Muller Acoustic Consulting Pty Ltd, April 2019) prepared for the Environmental Impact Statement (EIS) (Umwelt (Australia)) sets out the noise targets for mobile plant operating at the quarry. The logarithmic site total sound powers are reproduced in **Table 3.**

Table 3 Quarry Plant Sound Power Levels, dBA (re 10^{-12} Watts)

Noise Source/Item	Total dBA
Sandvik Crusher	111
Pugmill	108
Service Vehicle	82
Wirtgen Kleeman Secondary/Tertiary Crusher	111
Wirtgen MR130Z Track Mounted Impact Crusher	113
Wirtgen Kleeman Cone/Sand Plant	110
Wirtgen Kleeman Screen	111
Drill	115
Cat D8 Dozer	111
Komatsu PC450 Excavator	109
Komatsu Loader	99
Komatsu WA500 Loader	105
Komatsu WA480 Wheel Loader	100
Komatsu HM400 Articulated Dump Truck (x3)	106
Volvo 6 Wheeled Water Cart	101
Manitou	96
Standard Road Truck (x3)	102
Total Site Sound Power	**121**

3 Methodology

3.1 Locality

Wallerawang is located approximately 10km to the northwest 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 4** and graphically in the locality plan shown in **Figure 1.**

Table 4 Receiver Locations

ID	Address	Distance to Quarry Boundary
RL1	Reference Location (adjacent to site office)	N/A
N1	139 Gemalong, Marrangaroo, NSW	1200m
N2	42 Rocky Waterhole Drive, Wallerawang, NSW	980m
N3	2 Cypress Close, Wallerawang, NSW	550m

3.2 Environmental Noise Assessment Methodology

The attended noise surveys were conducted in general accordance with the procedures described in Standards Australia 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 Monday 8 April 2024. The acoustic instrumentation used carries appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per Approved Methods for the measurement and analysis of environmental noise in NSW (EPA, 2022) 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 ±0.5dBA.

Two day-time 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 $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant EPL limits.

FIGURE 1

LOCALITY PLAN

MAC160392-01

Wallerawang Quarry,

Wallerawang NSW

KEY

Attended Locations

Project Boundary

0 100 200 300 400 m

N

MAC
Muller Acoustic Consulting

4 Results

4.1 Meteorological Conditions

Weather data for the noise assessment period was sourced from Wallerawang Quarries on-site meteorological station as well as operator measured conditions on site of EPL nominated receiver locations to determine prevailing meteorological conditions at the time of the attended measurements and are presented in **Table 5**.

Table 5 Prevailing Meteorological Conditions

Date & Time	Wallerawang Quarries on-site Meteorological Station		Operator Measured Weather EPL Monitoring Location (1.8m AGL)	
	Wind Direction	Wind (m/s)	Wind Direction	Wind (m/s)
08/04/2024 14:17	WSW	2.5	S	1.5
08/04/2024 14:37	W	2.2	S	0.4
08/04/2024 14:56	WSW	2.3	S	1.0
08/04/2024 15:17	SW	2.1	S	1.0
08/04/2024 15:45	WSW	2.7	S	0.8
08/04/2024 16:06	WSW	1.8	S	1.5
08/04/2024 16:26	WSW	2.0	S	0.1
08/04/2024 16:44	WSW	1.8	S	0.5

4.2 Assessment Results –Reference Location (RL1)

Operational attended noise monitoring was completed at RL1 on Monday 8 April 2024. **Table 6** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 6 Operator-Attended Noise Survey Results – Reference Location 1 (RL1)

Date	Time (hrs)	Descriptor (dBA re 20µPa)			EPL Limit[1]	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
08/04/2024	15:17	66	55	49	N/A	WS: 1.0m/s WD: S Rain: Nil	Traffic 42-66 Quarry loader 48-58 (2 minutes) Quarry haul truck 48-63 (4 minutes)
Quarry Site $L_{Aeq(15min)}$ Contribution							53
08/04/2024	15:45	75	57	48	N/A	WS: 0.8m/s WD: S Rain: Nil	Traffic 45-75 Quarry loader 45-50 (5 minutes) Quarry haul truck 45-68 (2 minutes)
Quarry Site $L_{Aeq(15min)}$ Contribution							56

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

4.3 Assessment Results – Location N1

Operational attended noise monitoring was completed at N1 on Monday 8 April 2024. **Table 7** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 7 Operator-Attended Noise Survey Results – Location N1

Date	Time (hrs)	Descriptor (dBA re 20µPa)			EPL Limit	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
08/04/2024	14:17	75	52	44	43	WS: 1.5m/s WD: S Rain: Nil	Residential noise 50-75 Traffic 42-60 Insects <42 Birds 42-46 Dogs barking 42-54 Quarry inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution[1]							<34
08/04/2024	16:06	66	47	42	43	WS: 1.5m/s WD: S Rain: Nil	Traffic 40-66 Wind in vegetation 40-46 Dogs barking <46 Birds 40-54 Quarry mobile screen (barely perceptible)
Quarry Site $L_{Aeq(15min)}$ Contribution[1]							<33

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

4.4 Assessment Results – Location N2

Operational attended noise monitoring was completed at N2 on Monday 8 April 2024. **Table 8** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 8 Operator-Attended Noise Survey Results – Location N2

Date	Time (hrs)	Descriptor (dBA re 20μPa)			EPL Limit	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
08/04/2024	14:56	68	56	50	43	WS: 1.0m/s WD: S Rain: Nil	Traffic 49-68 Birds <49 Quarry inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution[1]							<40
08/04/2024	16:44	68	59	53	43	WS: 0.5m/s WD: S Rain: Nil	Traffic 45-68 Birds 45-52 Quarry inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution[1]							<43

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

4.5 Assessment Results – Location N3

Operational attended noise monitoring was completed at N3 on Monday 8 April 2024. **Table 9** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 9 Operator-Attended Noise Survey Results – Location N3

Date	Time (hrs)	Descriptor (dBA re 20µPa)			EPL Limit	Meteorology	Comments
		L_{Amax}	L_{Aeq}	L_{A90}			
08/04/2024	14:37	65	48	41	43	WS: 0.4m/s WD: S Rain: Nil	Traffic 38-58 Insects <38 Aircraft 50-65 Construction 38-44 Quarry inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution[1]							<31
08/04/2024	16:26	65	47	42	43	WS: 0.1m/s WD: S Rain: Nil	Traffic 39-58 Birds 40-65 Quarry inaudible
Quarry Site $L_{Aeq(15min)}$ Contribution[1]							<32

Note 1: Quarry Site LAeq(15min) calculated based on nearfield measurements.

4.6 Assessment Results – Sound Power Audit

Near field measurements of plant and equipment were also completed to determine their operating sound power levels. The measurements were conducted in general accordance with AS 5331:2019 – Acoustics – Determination of sound power levels of noise sources – Guidelines for the use of basic standards. 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 NVIA and are presented in **Table 10**.

Table 10 Sound Power Levels, LAeq

Plant	Octave Band Centre Frequency, Lw Spectrum									Sound Power Lw	Goal[1]
	32	63	125	250	500	1k	2k	4k	8k		
Komatsu HM400 Articulated Dump Truck	52	82	80	85	84	87	85	77	69	92	106
Komatsu WA500 Loader	48	71	76	82	83	85	83	78	65	90	105
Total Site Sound Power										**91**	**121**[2]

Note 1: These are the SWLs of individual plant modelled in the EIS / NVIA.

Note 2: This is the total SWL of all plant modelled in the EIS / NVIA.

It's noted that several fixed and mobile plant items were not operating during the April 2024 assessment, therefore other mobile and fixed plant items will be measured in the second round of monitoring for 2024.

5 Noise Verification Modelling Methodology

Due to the high ambient noise levels attributed to passing traffic on the Great Western Highway, site operations are often masked at the noise monitoring locations. To verify the offsite noise levels from the quarry and correlate the established noise contributions from attended noise monitoring, predictive noise modelling was undertaken.

Noise modelling utilised the DGMR (iNoise, Version 2024) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613:1 and ISO 9613:2 including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standards are the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

Site mobile and fixed equipment was positioned in locations representative of the areas in which they were operating during the attended noise monitoring survey (Monday 8 April 2024). The results of the predictive modelling are presented in **Section 6** and compared to the measured site contribution from the attended monitoring.

1 Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

This page has been intentionally left blank

6 Discussion

6.1 Discussion of Results – Reference Location (RL1)

Noise measurements were conducted on Monday 8 April 2024 when Wallerawang Quarry was operating at less than normal production levels, which included use of crusher train, mobile screen, front-end loader, road trucks and haul trucks. It is noted that levels at this location are lower than previous assessments as the on-site generator was not operational.

The noise contribution from the quarry at the reference location was 53dB $LA_{eq(15min)}$ and 56dB $LA_{eq(15min)}$ respectively. The noise environment at the reference location was primarily dominated by mobile plant and offsite highway traffic.

6.2 Discussion of Results – Location N1

Measurements conducted Monday 8 April 2024 identified that Wallerawang Quarry noise was inaudible or barely perceptible during both measurements conducted at N1 with contributions measured between <34dB $LA_{eq(15min)}$ and <33dB $LA_{eq(15min)}$ respectively. and satisfied the relevant noise limits of 43dB $LA_{eq(15min)}$ for this location. Extraneous non-quarry related sources included highway traffic, birds, insects, wind in vegetation, dogs barking and local residential noise, that were significant contributors to the ambient noise environment.

The predicted quarry site contribution at N1, which included distance loss, the surrounding topography and air absorption, was 32dBA, which is consistent with the site being inaudible at this location during the attended noise monitoring. This level is also significantly lower than the ambient dominant sources which generally masks site noise emissions.

6.3 Discussion of Results – Location N2

Measurements conducted on Monday 8 April 2024 for N2 were dominated by local and highway traffic. Quarry operations were inaudible during all measurements at this location with estimated contributions measured between <40dB $LA_{eq(15min)}$ and <43dB $LA_{eq(15min)}$ respectively, demonstrating that quarry contributions remained below the relevant criteria of 43dB $LA_{eq(15min)}$ for both measurements conducted at the location. Extraneous non-quarry related sources included traffic and birds that were significant contributors to the ambient noise environment.

The predicted quarry site contribution at N2, which included distance loss, the surrounding topography and air absorption, was 35dBA, which correlates with the measured site contribution at this location

during the attended noise monitoring. This level is also significantly lower than the ambient dominant sources which generally masks site noise.

6.4 Discussion of Results – Location N3

Measurements conducted on Monday 8 April 2024 identified that Wallerawang Quarry noise was inaudible during both measurements conducted at N3, with contributions measured between <31dB $LA_{eq(15min)}$ and <32dB $LA_{eq(15min)}$ respectively. Therefore, the relevant noise limit of 43dB $LA_{eq(15min)}$ was satisfied. Extraneous non-quarry related sources included traffic, insects, aircraft, construction, and birds that were significant contributors to the ambient noise environment.

The predicted quarry site contribution at N3 which included distance loss, the surrounding topography and air absorption, was 34dBA, which is consistent with the measured site contribution at this location during the attended noise monitoring.

6.5 Discussion of Results – Sound Power Audit

The results of the sound power audit demonstrate that the mobile plant measured onsite comply with the combined sound power goal as outlined in the NVIA. Other fixed and mobile plant used on site will be assessed and included in the second bi-annual 2024 assessment.

7 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 and DA No. 344-11-2001.

Quarry noise remained inaudible or barely perceptible at all residential locations conducted on Monday 8 April 2024, therefore satisfied the specified noise limits in the Noise Management Plan and Environmental Protection Licence at all locations.

All monitoring locations were dominated by extraneous sources such as traffic that predominantly masked quarry operations.

Predictive noise modelling was generally consistent with the findings of the attended noise monitoring, confirming the site the site complied with the applicable noise criteria at all assessed locations and also confirmed the site was inaudible when compared against extraneous ambient noise sources (ie masked by ambient levels).

The results of the sound power audit demonstrate that the fixed screen and crushing plant used onsite comply with the combined sound power goal as outlined in the NVIA.

This page has been intentionally left blank

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

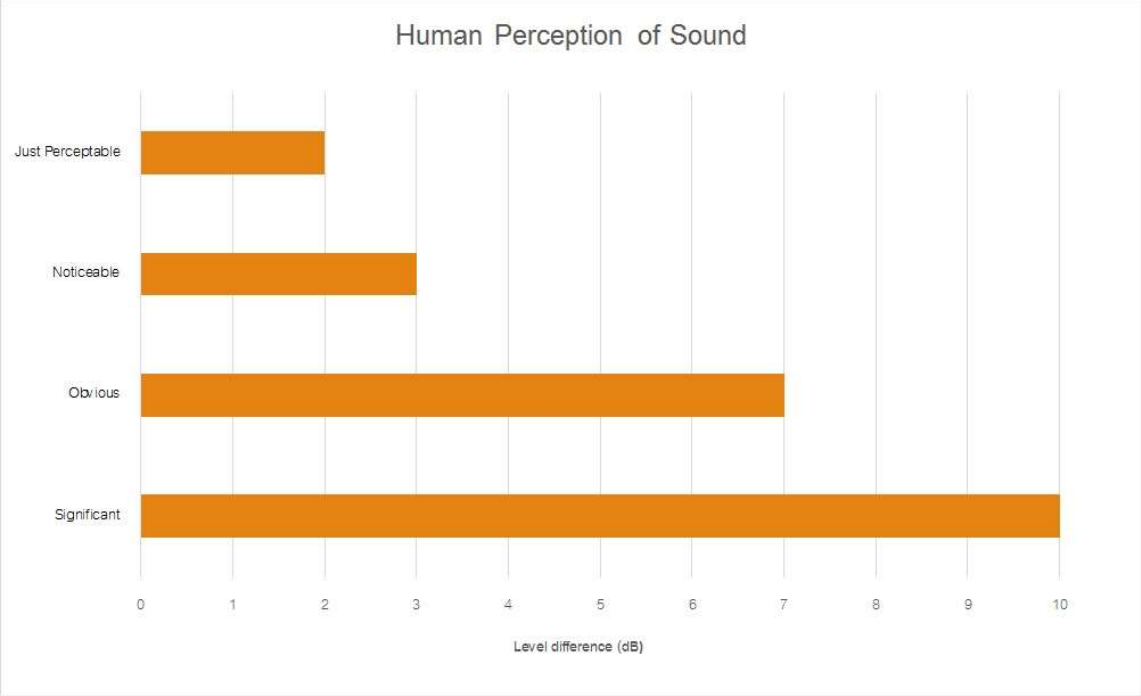
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for 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.
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
Lawnmower (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



Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
Ph: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting