Ground floor, 20 Chandos Street
St Leonards NSW 2065
PO Box 21
St Leonards NSW 1590

T 02 9493 9500
E info@emmconsulting.com.au

www.emmconsulting.com.au

17 December 2020

Chris Cooke
Quarry Manager
Hanson Construction Materials Pty Ltd
Level 5, 75 George Street
Parramatta NSW 2150

**Re: Quarter 4 - 2020: East Guyong Quarry noise and blast monitoring**

# 1 Introduction

EMM Consulting Pty Ltd (EMM) has been commissioned by Hanson Construction Materials Pty Ltd (NSW) (Hanson) to complete quarterly noise monitoring for the East Guyong Quarry, as required by the site's approved Noise Management Plan. The quarry is located approximately 22 km southeast of Orange, NSW. Operator-attended noise monitoring was undertaken on 26 November 2020.

The following material was referenced as part of this assessment:

- Environment Protection Authority (EPA), *Industrial Noise Policy* (INP) 2000;
- Environment Protection Authority (EPA), *Industrial Noise Policy - Application notes* 2017;
- Environment Protection Authority (EPA), *Noise Policy for Industry* (NPfI) 2017;
- Hanson Construction Materials and R. W. Corkery & Co Pty Limited (RWC), *Noise Management Plan for the East Guyong Quarry* (NMP) – Mod 2 Revision, July 2019;
- Department of Planning and Infrastructure (DP&I), *East Guyong Quarry Project Modification (06_0193 MOD 1) approval* (PA) 2012; and
- Australian and New Zealand Environment Council (ANZEC) 1990, *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.*

Analysis of data from one blast event that occurred on 17 November 2020 has also been included in this report.

Several technical terms are discussed in this report and are explained in Appendix A.

# 2 Methodology

## 2.1 Site operations

At the time of the attended noise monitoring on 26 November 2020, the quarry's activities comprised of the following:

- extraction of basalt using standard drill, load and haul techniques;
- processing of extracted basalt and stockpiling of material; and
- transportation of quarry products.

The quarry's approved hours of operation are:

- Monday to Friday (non-daylight savings) from 6 am to 6 pm;
- Monday to Friday (daylight savings) from 6 am to 8 pm; and
- Saturdays from 7 am to 1 pm.

Material crushing and screening currently occurs on site from Monday to Thursday. This restriction to approved hours is an operational decision by the quarry and aids in the planning for maintenance and repairs.

## 2.2 Noise monitoring

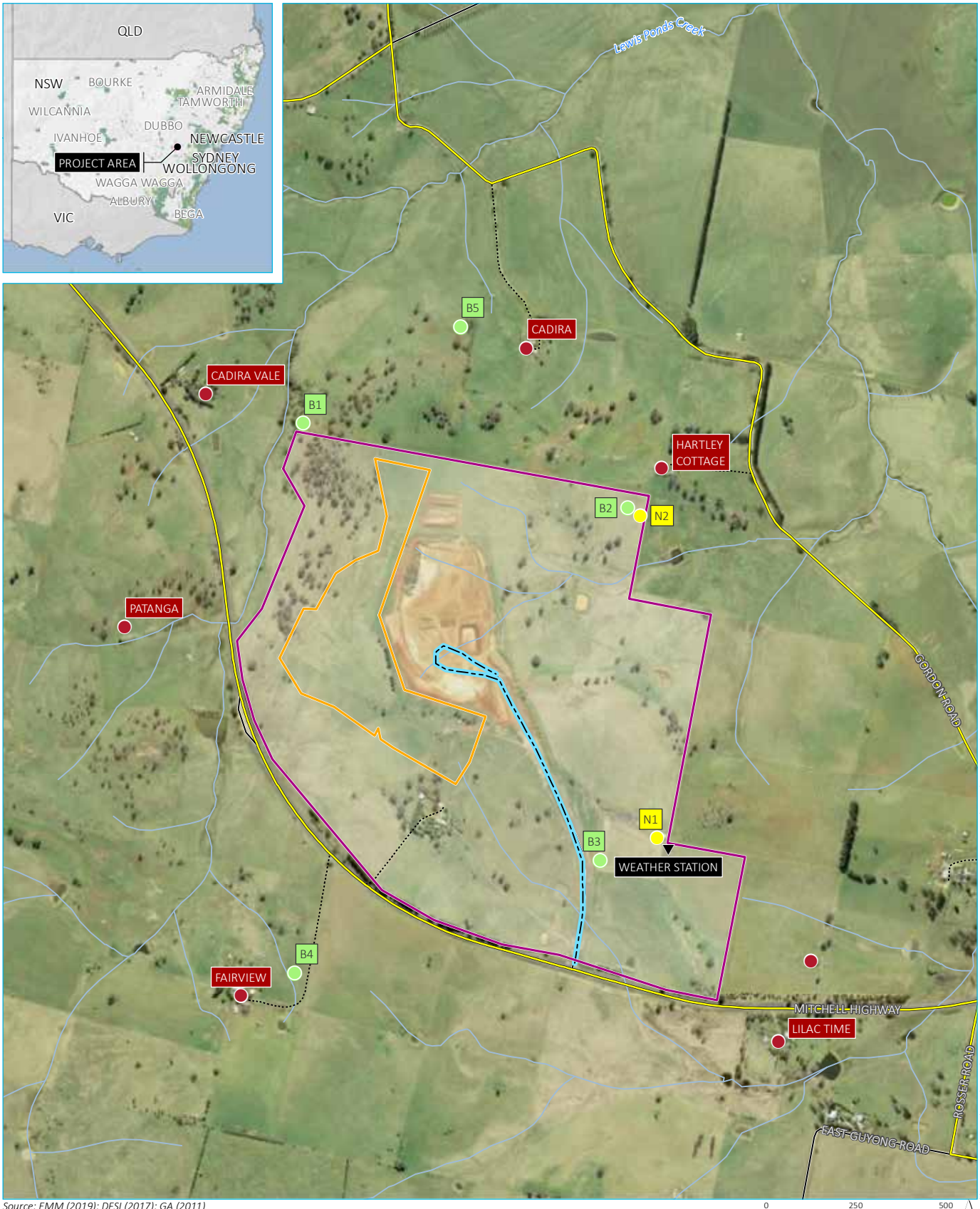
Operator-attended 15-minute noise measurements were conducted at locations N1 and N2, as shown in Figure 1, when the quarry was in full operation. The operator quantified the contribution of each significant quarry noise source where possible. Noise monitoring was conducted in general accordance with the INP and Australian Standard AS 1055.1-2018 *Acoustics - Description and Measurement of Environmental Noise - General Procedures*.

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 3008201) was used for the noise monitoring. The sound analyser was calibrated before and after the completion of the surveys using a Rion NC74 calibrator (s/n 34372752). The instruments were within a current NATA calibration period at the time of the noise monitoring.

## 2.3 Assessment locations

The noise monitoring included four 15-minute operator-attended noise measurements during the daytime period on 26 November 2020 to quantify noise emissions from the quarry at locations N1 and N2. Noise monitoring was not conducted prior to 7 am as the quarry was not in operation.

Locations N1 and N2 are near the south-east and north-east boundaries of the site, respectively. Location N1 is approximately 500 m from "Wheatfields", the closest residence situated south-east of the quarry. Location N2 is approximately 150 m from "Hartley Cottage", the closest residence situated north-east of the quarry. These monitoring locations were selected to not inconvenience surrounding residents and are consistent with the approved Noise Management Plan for the East Guyong Quarry (RWC, 2019). Monitoring at these locations, rather than at the residences, also provides a better opportunity to quantify site related noise since they are closer to the operations.




Source: EMM (2019); DFSI (2017); GA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Blast monitoring location
- Residences
- Attended noise monitoring location
- Weather station
- Site boundary
- Extraction area boundary
- Transport route
- Main road
- Local road
- Vehicular track
- Watercourse/drainage line

Site location and monitoring plan

East Guyong Quarry
Noise and blast monitoring
Figure 2.1

EMM creating opportunities

\\EMMSVR1\emm\Jobs\2019\J190114 - East Guyong Quarry Noise Monitoring 2019\8 GIS\02_Maps\G001_MonitoringPlan_20190318_01.mxd 20/03/2019

# 3 Criteria

## 3.1 Operational noise

Condition 3(5) of PA 06_0193 states that the noise assessment criteria are $L_{Aeq,15\ minute}$ 35 dB at any residence for all assessment periods. The exception is the "Fairview" residence which has a daytime criterion of $L_{Aeq,15\ minute}$ 36 dB. In accordance with the PA 06_0193, "*Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.*"

As per Condition 3(5) of PA_0193, to demonstrate compliance at residential locations, the noise monitoring results are to be assessed against the following (intermediate) noise criteria for monitoring locations N1 and N2:

- N1 - $L_{Aeq,15\ minute}$ 43 dB; and
- N2 - $L_{Aeq,15\ minute}$ 50 dB.

It is stated in the NMP that by satisfying criteria at these intermediate locations, quarry noise at neighbouring residences would also satisfy residential criteria. This assumes the presence of soil and product stockpiles, bunding and intervening topography between the site and surrounding residences, which provide some degree of attenuation of site noise.

Further to the above, section 11.1.3 of the INP identifies that a development is deemed to be in non-compliance if the monitored noise levels from the development are more than 2 dB above the statutory limit.

## 3.2 Low frequency noise criteria

Section 11.2.3 of the NMP states that modification factors in Section 4 of the INP (EPA 2000) should be applied to the measured noise levels where applicable. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source. Fact sheet C of the NPfI (EPA 2017) states that modification factor corrections shall be applied to the measured noise levels where relevant.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for annoying noise characteristics, such as tonal and low frequency noise emissions. The NPfI specifies that for low frequency noise, a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.1 below.

**Table 3.1 One-third octave low-frequency noise thresholds**

| | One-third octave $L_{Zeq,15\ minute}$ threshold level | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| dB (Z) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The modifying factor correction to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.1 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.1 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB positive adjustment applies for the daytime period.

Hence, where possible throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser ($L_{Ceq}$-$L_{Aeq}$). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.1 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 4.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard and/or noise-enhancing (ie applicable) meteorological conditions.

## 3.3 Blast monitoring

Blast overpressure and vibration monitoring is managed by Hanson for all blast events. Blast overpressure and ground vibration are monitored at three locations within or at the site's boundary as well as two locations outside of the site's boundary (one south of the Mitchell Highway near the Fairview property and one north of the site near the Cadira property). Monitoring locations are situated closer to blasting locations than the residential structures (refer to Figure 2.1), and therefore overpressure and vibration levels would likely be lower at the actual residential dwellings than those measured.

Blast emissions criteria for the quarry apply at any residence on privately-owned land surrounding the site and are presented in Table 3.2.

**Table 3.2 Blast overpressure and vibration criteria**

| Location | Airblast overpressure criteria (dB (Linear Peak)) | Ground vibration criteria (mm/s (Peak velocity)) | Allowable exceedance |
|---|---|---|---|
| Any privately-owned residence surrounding the site. | 115 | 5 | 5% of the total number of blasts in a 12-month period |
| | 120 | 10 | 0% |

# 4 Results

## 4.1 Noise monitoring results

Noise monitoring results for locations N1 and N2 are presented in Table 4.1. Data recorded by the site's weather station (shown in Figure 2.1) was used to identify weather conditions during the monitoring period and to determine the applicability of noise limits. Wind speed and direction observations are presented in Table 4.1

Wind speed averages were greater than 3 m/s (at 10 m above ground) during all of the four measurements at N1 and N2; hence noise limits were not applicable during all measurements. Regardless, site noise contribution was below (satisfied) the relevant noise limits during all attended measurements.

Low frequency noise modifying factors, in accordance with fact sheet C2 of the NPfI (EPA 2017), were not applied to any measured site contribution as measured noise levels did not exceed the relevant LFN thresholds.

All quarry contributions measured at locations N1 and N2 satisfied the relevant noise criteria as per the NMP. It is therefore expected that relevant criteria for surrounding residential receivers would also be satisfied.

Based on the preceding information, noise levels from the quarry were expected to satisfy the relevant residential criteria at all assessment locations identified in Condition 3(5) of PA_0193.

## Table 4.1 Attended noise monitoring summary – 26 November 2020

| Location | Start time | Attended noise monitoring results dB | | | | | Criteria dB | Meteorological conditions[1] | | Criteria Applies? (Y/N) | Exceedance | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total measured | | | Site contribution | | | Wind speed (m/s) | Wind direction[2] | | | |
| | | $L_{90}$ | $L_{Aeq}$ | $L_{Amax}$ | LFN mod. factor | $L_{Aeq}$ | $L_{Aeq}$ | | | | | |
| N2 | 12:55 pm | 36 | 42 | 75 | - | 40 | 50 | 4.0 | 237 | N | Nil | Quarry dominant throughout measurement including hum of crushing/screening plant, FEL handling material and trucks/machinery traversing.<br>Other ambient noise included frequent, highly variable birdsong and persistent cicada drone. |
| N2 | 12:11 pm | 36 | 39 | 58 | - | 39 | 50 | 4.3 | 216 | N | Nil | Quarry dominant throughout measurement including hum of crushing/screening plant, FEL handling material and trucks/machinery traversing.<br>Other ambient noise included frequent, highly variable birdsong and persistent cicada drone. |
| N1 | 1:46 pm | 37 | 50 | 72 | - | <37 | 43 | 4.2 | 217 | N | Nil | Quarry activities very faintly audible throughout measurement.<br>Other ambient noise included birdsong, persistent cicada drone, foliage rustle, highway traffic (dominant) and two turboprop aircraft fly-bys. |
| N1 | 2:02 pm | 39 | 46 | 60 | - | <39 | 43 | 4.3 | 214 | N | Nil | Quarry very faintly audible throughout measurement.<br>Other ambient noise included birdsong, persistent cicada drone, foliage rustle and highway traffic (dominant). |

Notes: 1. Meteorological data was obtained from the site weather station at a height of 10 m above ground.
2. Wind direction reported in degrees from north (0°)
3. N/A = Not Applicable

## 4.2 Blast overpressure and ground vibration

One blast event occurred at the quarry since the last quarterly noise monitoring in September 2020. The blast overpressure and vibration monitoring results were provided by Hanson and are presented in Table 4.2. The monitoring results show the relevant criteria were satisfied at all monitoring locations (refer to Figure 2.1).

**Table 4.2 Blast emissions monitoring results**

| Date | Monitoring location | Airblast overpressure level (dB(Linear Peak)) | | Ground vibration - Peak particle velocity (mm/s) | |
|---|---|---|---|---|---|
| | | Measured | Criteria[2] | Measured | Criteria[2] |
| 17/11/2020 | B1 | 0[1] | 115 | 0[1] | 5 |
| | B2 | 0[1] | 115 | 0[1] | 5 |
| | B3 | 99 | 115 | 1.12 | 5 |
| | B4 | 100 | 115 | 0.95 | 5 |
| | B5 | 113 | 115 | 0.08 | 5 |

Notes: 1. There was no trigger for this blasting event.
2. Criteria applies at the nearest residential location and not at the monitoring location.

# 5 Conclusion

EMM has completed an assessment of noise and blasting emissions from East Guyong Quarry operations. Noise monitoring was undertaken at locations around the site on 26 November 2020 as required by, and in accordance with, the site's approved NMP.

The results demonstrated that the received site noise levels at all monitoring locations satisfied the relevant noise criteria as per the PA_0193 and in accordance with the NMP for the East Guyong Quarry.

Therefore, it is concluded that noise levels from quarry operations satisfied the relevant criteria at all assessment locations identified in Condition 3(5) of PA_0193.

The blast overpressure and ground vibration monitoring results satisfied the relevant criteria at all monitoring locations for the one blast events that have been assessed.

Yours sincerely

**Oliver Janev**
Acoustic Engineer

ojanev@emmconsulting.com.au

Review: Katie Teyhan 17/12/2020

Appendix A

# Glossary of acoustic terms

A number of technical terms are required for the discussion of noise. These are explained in Table A.1.

### Table A.1 Glossary of acoustic terms

| Term | Description |
|---|---|
| dB | Noise is measured in units called decibels (dB). |
| A-weighting | There are several scales for describing noise, the most common being the 'A-weighted' scale. This is an adjustment made to sound-level measurement to approximate the response of the human ear. |
| C-weighting | This is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans. |
| $L_{A90}$ | Commonly referred to as the background noise level. The A-weighted noise level exceeded 90% of the time. |
| $L_{Aeq}$ | The A-weighted, energy average noise from a source. This is the equivalent continuous sound pressure level over a given period. The LAeq(15-min) descriptor refers to an LAeq noise level measured over a 15-minute period. |
| $L_{Amax}$ | The A-weighted maximum root mean squared sound pressure level received during a measuring interval. |
| Day period | Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm. |
| Evening period | Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm. |
| Night period | Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 pm. |
| $L_{peak}$ | The maximum instantaneous sound pressure during a measurement period or noise event. |
| PPV | The greatest instantaneous particle velocity during a given time interval. |

It is useful to have an appreciation of decibels, the unit of noise measurement. Table A.2 gives an indication as to what an average person perceives about changes in noise levels:

### Table A.2 Perceived change in noise

| Change in sound level (dB) | Perceived change in noise |
|---|---|
| 1 to 2 | typically indiscernible |
| 3 | just perceptible |
| 5 | noticeable difference |
| 10 | twice (or half) as loud |
| 15 | large change |
| 20 | four times (or quarter) as loud |

Examples of common noise levels are provided in Figure A.1.

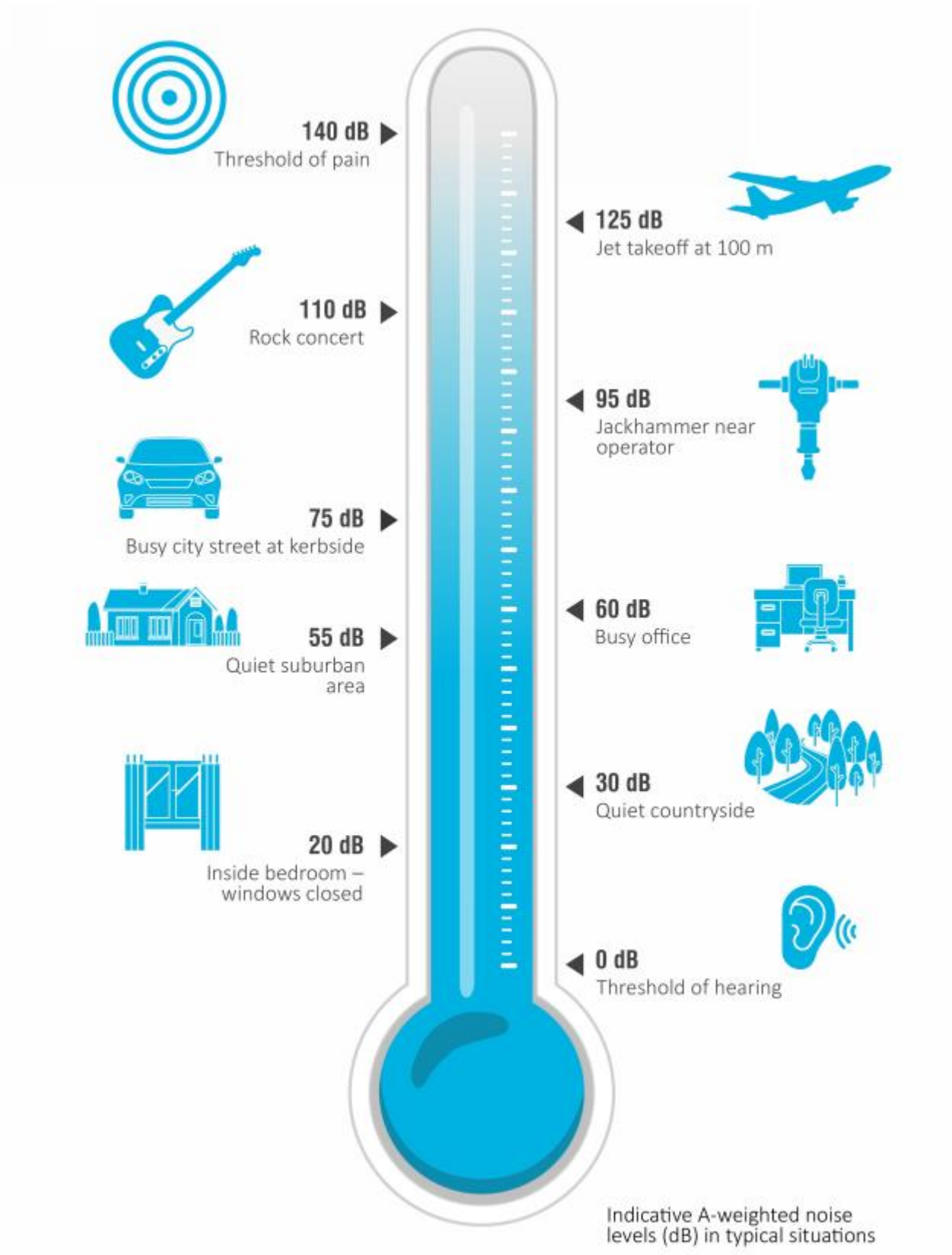



**Figure A.1 Common noise levels**

Appendix B

# Calibration certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.: SLM 25410 & FILT 5368**

| | | | |
|---|---|---|---|
| **Equipment Description:** | Sound Level Meter | | |
| **Manufacturer:** | B & K | | |
| **Model No:** | 2250 | **Serial No:** | 3008201 |
| **Microphone Type:** | B&K 4189 | **Serial No:** | 2983733 |
| **Preamplifier Type:** | B&K ZC0032 | **Serial No:** | 22666 |
| **Filter Type:** | 1/3 Octave | **Serial No:** | 3008201 |
| **Comments:** | All tests passed for class 1.<br>(See over for details) | | |
| **Owner:** | EMM Consulting<br>Ground Floor, Suite 01, 20 Chandos St<br>St Leonards NSW 2065 | | |
| **Ambient Pressure:** | 1002 hPa ±1.5 hPa | | |
| **Temperature:** | 23 °C ±2° C | **Relative Humidity:** | 29% ±5% |
| **Date of Calibration:** | 21/08/2019 | **Issue Date:** | 21/08/2019 |
| **Acu-Vib Test Procedure:** | AVP10 (SLM) & AVP06 (Filters) | | |

**CHECKED BY:** IRB **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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ELECTRONICS
**HEAD OFFICE**
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO:** 26415

**EQUIPMENT TESTED:** Sound Level Calibrator

**Manufacturer:** Rion
**Type No:** NC-74 **Serial No:** 34372752
**Owner:** EMM Consulting
20 Chandos Street
St Leonards NSW 2065

**Tests Performed:** Measured output pressure level was found to be:

| Parameter | Pre-Adj | Adj Y/N | Output: (db re 20 µPa) | Frequency: (Hz) | THD&N (%) |
|---|---|---|---|---|---|
| **Level 1:** | NA | N | 94.16 | 1002.63 | 4.47 |
| **Level 2:** | NA | N | NA | NA | NA |
| **Uncertainty:** | | | ±0.11 dB | ±0.05% | ±0.20 % |
| Uncertainty (at 95% c.l.) k=2 | | | | | |

**CONDITION OF TEST:**
**Ambient Pressure:** 1002 hPa ±1.5 hPa **Relative Humidity:** 56% ±5%
**Temperature:** 24 °C ±2° C
**Date of Calibration:** 21/02/2020 **Issue Date:** 24/02/2020
**Acu-Vib Test Procedure:** AVP02 (Calibrators)
**Test Method: AS IEC 60942 - 2017**
**CHECKED BY:** MB **AUTHORISED SIGNATURE:** .....
Jack Kidd

.Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
**HEAD OFFICE**
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au