Ambience Audio Services
Acoustic Measurement and Analysis

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Results of Noise Monitoring
February 2024

Blakebrook Quarry
550 Nimbin Road
Blakebrook NSW 2480

Prepared for

Ecoteam
13 Ewing Street
Lismore NSW 2480

Document Control				
Rev. No	**Date**	**Prepared By**		**Notes**
Final	26/02/2024	[redacted]	[redacted]	
Revision 1	27/02/2024	[redacted]	[redacted]	Update wording of conditions of approval

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1 INTRODUCTION

The Blakebrook Quarry operates under the New South Wales Government Environment Protection Authority, Environmental Protection Licence, EPL No. 3384 and Minister Conditions of Approval (MP07_0020).

Noise emissions from the quarry and asphalt plant operations at nearby residential receivers, is managed by the Noise and Blast Management Plan (NBMP) for Blakebrook Quarry (Lismore City Council Oct 2022), and includes an Out of Hours Work Protocol (OHWP) for the asphalt plant, which is anticipated to occur 5 nights per month on scheduled projects.

Ambience Audio Services were engaged by Ecoteam of Lismore to conduct a noise compliance assessment for Blakebrook Quarry at the three primary receiver locations for the summer period in accordance with the NBMP.

The day, evening and night compliance noise monitoring was scheduled for the 12th – 16th of February, however due to recent changes at the asphalt plant, there were no approved out of hours asphalt campaign operations to support evening and nighttime noise monitoring. Crushing operations at the quarry had been suspended due to sufficient stockpiles.

Subsequently, only daytime noise compliance monitoring was conducted at the three primary receiver locations on the 13th of February 2024. Operations consisted of the asphalt plant operating under normal load conditions, and haul trucks, water truck and front-end loaders operating within the quarry. Noise monitoring was undertaken during suitable weather conditions.

To assist with the interpretation of some of the terminology used in this report, Appendix A provides definitions of acoustic terms. Appendix B is a chart of everyday sound pressure levels.

Appendix D are the logged noise levels for the asphalt plant and at each receiver location.

2 NOISE MONITORING REQUIREMENTS

The noise monitoring requirements for the Blakebrook Quarry are outlined in Section 2.2, Sections 7.1, 7.2, 7.3, 7.4, 7.5 and 7.7 of the NBMP (LCC Oct 2022).

Extracts of the relevant parts are copied below.

Section 2.2

3. *The Proponent must ensure that the noise generated by the project does not exceed the criteria in Table 2 at any residence on privately owned land.*

Table 2: Noise Criteria dB(A)

Receiver	Day L_{Aeq} (15 minute)
Location 2 and 7	36
All other locations	35

Out of Hours Work Protocol – Asphalt Operations

The OHWP has provided management strategies for potential noise sources involving asphalt operations and truck movements. The evening and night project-specific noise level criterion is 35 dB(A) LAeq (15 minute).

L4.1 Noise from the licenced premises must not exceed an LAeq (15 minute) noise emission criteria of 36 dB(A) at Location 2 and 7, and 35 dB(A) at all other sensitive receivers, except as expressly provided by in this licence.

7.2 MONITORING LOCATIONS

The original Noise Assessment (ERM 2009) and updated NIA (Mitchel Hanlon, SEE 2019) included six (6) noise monitoring locations that were used throughout the assessment, based on proximity to nearby potentially sensitive receptors. Given the proximity between monitoring locations and the location of anticipated noise-generating plant and equipment, the monitoring locations have been revised and separated into primary and supplementary acoustic monitoring locations for the purposes of the NBMP.

Primary and supplementary acoustic locations are identified in *Figure 2*. Primary acoustic monitoring locations consist of locations **2**, **4** and **8** with the remainder of locations being supplementary acoustic monitoring locations.

An agreement was reached with the landowner located along Nimbin Road (previously identified as location 8, ERM 2009) in April 2016, wherein the landowner has agreed to the exceedances in noise levels from Quarry operations. As such the location has been removed as a primary acoustic monitoring location, and a new monitoring location selected being (current) location 8.

Primary monitoring locations will be utilised during noise compliance monitoring and are considered representative in determining compliance with the relevant Conditions of Approval.

In the event that additional monitoring is required then additional monitoring may be undertaken at the most practical supplementary acoustic monitoring locations, as well as at the primary acoustic monitoring locations.

7.4 METHODOLOGY

Noise

Operator attended noise measurements shall be conducted at all primary acoustic measurement locations (Locations 2, 4 and 8 – refer *Figure 2*) to quantify and characterise the maximum (L_{Amax}), the energy equivalent (L_{Aeq}), and the background (L_{A90}) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the L_{Aeq} (Period) noise contribution during Quarry activities, as well as the overall level of ambient noise. During attended monitoring, digital recordings will be conducted to allow for additional post analysis of the Quarry noise levels and source identification.

All acoustic instrumentation employed throughout the monitoring program shall meet with the requirements of AS/NZS IEC 61672.1 Sound level meters Specifications & AS/NZS IEC 61672.2 Sound level meters Pattern Evaluation.

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding $\pm$ 0.5 dBa.

7.5 METEOROLOGICAL PARAMETERS

Adverse meteorological conditions have the potential to increase noise levels, for example wind speeds up to 3 m/s or temperature inversions, however wind speeds above 5 m/s (and rainfall) have the potential to generate extraneous and erroneous noise events, which reduce the accuracy and confidence in measured data.

As such, meteorological parameters will be evaluated prior to undertaking works on site, to gain an understanding of the weather conditions and the potential for variations in noise levels.

All noise measurements shall be accompanied by both qualitative description (including cloud cover, approximate wind direction and speed) and quantitative measurements of prevailing local weather conditions throughout the survey period. Rainfall data and meteorological parameters will be collected from the weather station located on-site. as shown in *Table H*.

Table H: Meteorological Measurement Parameters

Measured Parameter	Unit	Sample Interval
Mean Wind Speed	m/s	15 minutes
Mean Wind Direction	Degrees	15 minutes
Aggregate Rainfall	mm	15 minutes
Mean Air Temperature	C°	15 minutes

Accounting For Annoying Noise Characteristics (Low Frequency Noise)

The *Noise Policy for Industry* (NPfI 2017) states that a noise source may exhibit a range of particular characteristics that increase annoyance, such as tones, impulses, low frequency noise and intermittent noise.

Where this is the case, an adjustment ('modifying factor corrections') is applied to the source noise level received at an assessment point before it is compared with criteria to account for the additional annoyance caused by the particular characteristic.

Application of these modifying factors is described in. *Fact Sheet C: Corrections for annoying noise characteristics* and outlines correction factors to be applied to the source noise level at the receiver before comparison with the project noise trigger levels to account for the additional annoyance caused by those modifying factors.

The modifying factor corrections should be applied having regard to:

- the contribution noise level from the premises when assessed/measured at a receiver location, and
- the nature of the noise source and its characteristics (as set out in this fact sheet).

The NPfI provides the following definitions to support the modifying factor corrections:

- Tonal Noise – Containing a prominent frequency and characterised by a definite pitch.
- Low Frequency Noise – Containing major components within the low frequency range (20 Hz to 250 Hz) of the frequency spectrum.
- Impulsive Noise – Having a high peak of short duration or a sequence of such peaks.
- Intermittent Noise – The level suddenly drops to that of the background noise several times during the assessment period, with a noticeable change in noise level of at least 5 dB.

The modifying factor corrections (and how they are applied) are present in *Table C1* of the NPfI and vary depending on the noise characteristic being assessed. All noise levels generated by the Quarry, which may generate tonal or low frequency content, will be assessed as part of the NBMP monitoring with due regard to these modifying factor penalties, and in accordance with the requirements presented in the NPfI.

Impulsive and intermittent noise, as defined by the NPfI, are not typical characteristics of the Quarry, hence tonal and low frequency noise (LFN) are most relevant to the Quarry and those modifying corrections are reproduced in *Table I*.

Tonal Noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (*ISO1996.2-2007 – Annex D*)	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.	5 dB [2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. **Note:** Narrow-band analysis using the reference method in *ISO1996-2:2007, Annex C* may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low Frequency Noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted Leq,T levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: • where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dB(A) positive adjustment applies for the daytime period.	2 or 5 dB [2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

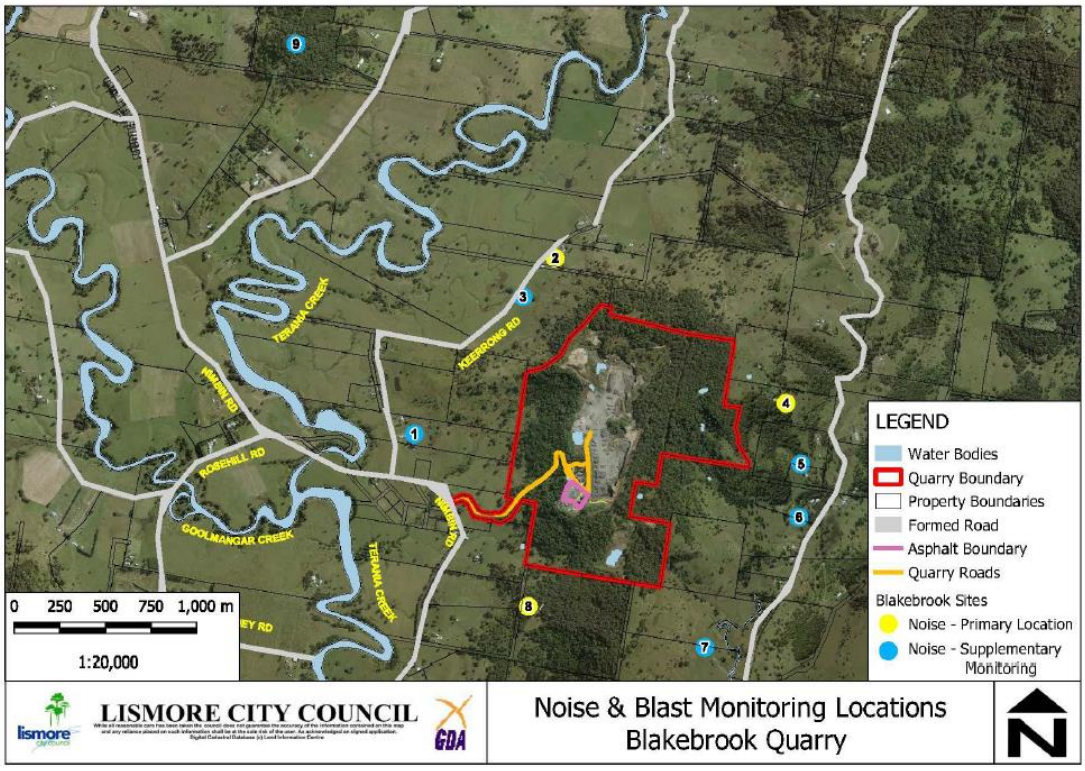
Notes:
1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.
2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the *ISO1996-2:2007* standard.

Noise monitoring at the receiver locations were conducted within 30m of the residential dwelling.

Table 2.1 Primary Receiver Locations	
Receiver	**Street Address**
2	[redacted] Keerrong Rd Blakebrook
4	[redacted] Booerie Creek Road Booerie Creek
8	[redacted] Nimbin Rd Blakebrook

Figure 2.1 Noise Monitoring Locations

Figure 2: Noise & Blast Monitoring Locations Map



3 MEASUREMENT PROCEDURE AND RESULTS

3.1 Instrumentation

Table 3.1 Instrumentation		
Instrument	**Serial #**	**Calibration Date**
Bruel & Kjaer 2250 G4 Sound Level Meter	3031300	Oct 2022
Bruel & Kjaer 2250 G4 Sound Level Meter	3006868	Oct 2023
Bruel & Kjaer 4231 Calibrator	3029274	Dec 2023

The sound level meters (SLM) used during the noise survey conform to Australian Standard 1259 "Acoustics - Sound Level Meters (1990), as type 1 precision sound level meters, and have an accuracy suitable for both field and laboratory use.
The meters' calibrations were checked before and after the measurement periods with a Bruel & Kjaer acoustic calibrator. No significant system drift occurred over the measurement periods.

The SLMs and calibrator have been checked, adjusted and aligned to conform to the factory specifications and issued with conformance certificates by a certified NATA facility.

3.2 Measurement Procedure

Measurements were conducted in general accordance with procedures in:

1. Australian Standard AS 1055 : 2018 *Acoustics - Description and measurement of environmental noise*

2. The NSW Government *Noise Policy for Industry* (EPA Oct 2017)

The microphone of a B&K 2250 G4 was mounted on a 1.5m high tripod, a Bruel and Kjær outdoor windscreen fitted to the microphone, and located near the asphalt plant to monitor noise levels of the asphalt plant while measurements were being conducted at the receiver locations.

A second SLM (B&K 2250 G4) was mounted on a 1.0 – 1.2m high tripod and a Bruel and Kjær outdoor windscreen fitted to the microphone. The SLM was used at the receiver locations to monitor noise levels while the asphalt plant and quarry was operating. Markers and sound recording were utilised on the sound level meter for post event analysis of acoustic events during each monitoring period.

A 15 minute period was recorded at each receiver location with A and C weighting, fast response, and 1 second samples. Spectrum data was recorded with a linear (Z) weighting in 1/3 octave bands.

The clocks on the 2 SLMs were synchronised to enable comparison of noise levels at the asphalt plant reference location with noise levels at the receiver locations.

3.3 Weather Conditions

Weather conditions were generally good for acoustic measurements. Observations were taken at each receiver location with a Kestrel 3000 pocket weather meter.

Table 3.2 Receiver Locations Weather Summary 13th February 2024						
Receiver	Time	Temp	Relative Humidity	Wind	Wind Dir	Cloud Cover
		˚C	%	Speed (m/s)		
2	12:00pm	30	56	0.5 - 1	E	4/8
4	11:30am	28	64	0 – 0.5	E	4/8
8	10:40am	27	64	0 – 0.5	E	4/8

Weather data from the weather station at Blakebrook Quarry is presented in Table 3.3 below.

Table 3.3 Blakebrook Quarry Weather Station Observations 13th February 2024						
Time	AVERAGE Air Temperature 10m – Deg C	AVERAGE Wind Speed 10m - km/h	AVERAGE Wind Speed 10m - m/s	AVERAGE Wind Direction 10m - Degs	S-THETA Wind Direction 10m - Degs	TOTAL Rain Gauge - mm
10:10:00 AM	25.6	6.1	1.7	57.6	57.6	0
10:20:00 AM	25.9	7	1.9	31.3	45.2	0
10:30:00 AM	26	5.9	1.6	45.5	36.8	0
10:40:00 AM	26.3	6.9	1.9	63.5	47.4	0
10:50:00 AM	26.2	8.1	2.3	32.7	41.1	0
11:00:00 AM	26.8	5.8	1.6	44.6	66.5	0
11:10:00 AM	26.7	7.3	2.0	47	34.1	0
11:20:00 AM	26.7	6.4	1.8	48.1	49	0
11:30:00 AM	26.9	7.6	2.1	74	43.5	0
11:40:00 AM	26.9	5.2	1.4	93.5	54.1	0
11:50:00 AM	27	5.5	1.5	352.3	69.4	0
12:00:00 PM	27.2	7.4	2.1	27.8	39.8	0
12:10:00 PM	27.3	7.2	2.0	25.2	52.7	0
12:20:00 PM	26.9	5.4	1.5	77.2	39.8	0
12:30:00 PM	26.7	8.2	2.3	50.6	43.3	0
12:40:00 PM	27.1	6.5	1.8	115	59.6	0
12:50:00 PM	27.6	6.6	1.8	36.7	61.1	0
1:00:00 PM	27.1	9	2.5	64.8	36.9	0

Wind Direction O and 360 degrees – North, 90 degrees – East, 180 degrees South, 270 degrees - West

3.4 Measurement Results

Table 3.4 Asphalt Plant Measurement Summary - 13th Feb 2024							
Start Time	**Elapsed Time h:mm:ss**	**L_{AFmax} [dB]**	**L_{Aeq} [dB]**	**L_{Ceq} [dB]**	**L_{Ceq}-L_{Aeq} [dB]**	**$L_{AF10.0}$ [dB]**	**$L_{AF90.0}$ [dB]**
10:06:41 AM	2:19:44	84.9	64.4	76.1	11.7	66.0	61.4

Table 3.5 Blakebrook Quarry Receiver Locations Measurement Summary - 13th Feb 2024								
Receiver	**Start Time**	**Elapsed Time h:mm:ss**	**L_{AFmax} [dB]**	**L_{Aeq} [dB]**	**L_{Ceq} [dB]**	**L_{Ceq}-L_{Aeq} [dB]**	**$L_{AF10.0}$ [dB]**	**$L_{AF90.0}$ [dB]**
2	11:58 AM	0:15:00	77.7	52.7	52.8	0.1	45.6	34.4
4	11:21 AM	0:15:00	68	58.7	60.1	1.4	63.1	49.7
8	10:32AM	0:15:00	76.1	63.3	64.2	0.9	67.5	49.7

Note:
The above results are the total ambient noise levels and includes noise from the rural surroundings and quarry noise if audible.

Table 3.6 Noise Observations at Receiver Locations 23rd August 2023 (All measurements 15 mins)			
Receiver	**Start Time**	**Observed Noise Sources**	**Quarry Noise**
2	11:58AM	Cicadas, occasional traffic on Keerrong Road, birds, distant aircraft, cattle, distant windmill	Quarry not audible
4	11:21AM	Cicadas dominant, distant agricultural machinery, birds, distant aircraft	Quarry not audible
8	10:32AM	Cicadas dominant, birds, distant aircraft, heavy vehicles and motorbike on Nimbin Road occasionally	Low frequency from asphalt plant occasionally audible

3.5 Low Frequency Analysis

The difference between the A and C L_{eq} levels at all three receiver locations was less than 15 decibels (mainy due to cicada noise), so no low frequency analysis was conducted.

4 DISCUSSION OF RESULTS

The noise logger near the asphalt plant indicated that there was consistent asphalt plant noise during the measurement periods at receiver locations (graph D1).

Receiver 2

The asphalt plant operations and reduced quarry operations were not audible.

There was inconsistent cicada noise, which contributed to the higher L_{Aeq} noise levels during the day, when compared to previous noise surveys.

Based on the measured data, analysis and observations from previous noise surveys, it is estimated the asphalt plant operations and reduced quarry operations at Receiver 2 are below 30 dB(A) $L_{Aeq,15\ min.}$

Receiver 4

The asphalt plant operations and reduced quarry operations were not audible.

There was consistent cicada noise, which contributed to the higher L_{Aeq} and L_{A90} noise levels during the day, when compared to previous noise surveys.

Based on the measured data, analysis, and observations from previous noise surveys, it is estimated the asphalt plant operations and reduced quarry operations at Receiver 4 are below 30 dB(A) $L_{Aeq,15\ min.}$

Receiver 8

Asphalt plant noise was generally not audible at Receiver 8. There was occasional low frequency noise (possibly the front end loader at the asphalt plant).

There was consistent cicada noise, which contributed to the higher L_{Aeq} and L_{A90} noise levels during the day, when compared to previous noise surveys.

Based on the measured data analysis, and observations from previous noise surveys, it is estimated the asphalt plant operations and reduced quarry operations at Receiver 8 are below 35 dB(A) $L_{Aeq,15\ min.}$

5 SUMMARY AND CONCLUSION

The Blakebrook Quarry operates under the New South Wales Government Environment Protection Authority, Environmental Protection Licence, EPL No. 3384 and Minister Conditions of Approval (MP07_0020). Noise emissions from the quarry and asphalt plant operations at nearby residential receivers, is managed by the Noise and Blast Management Plan (NBMP) for Blakebrook Quarry (Lismore City Council Oct 2022), and previously has included an Out of Hours Work Protocol (OHWP) for the asphalt plant, which is anticipated to occur 5 nights per month on scheduled projects.

Noise compliance monitoring was conducted at the three primary receiver locations with calibrated noise monitoring equipment on the 13th of February. At the time of monitoring, the asphalt plant was operating under normal load conditions and two front end loaders, haul trucks and a water truck operating within the quarry. Weather conditions were suitable to conduct noise monitoring.

During this time, there were no approved out of hours asphalt campaign operations to support evening and night time noise monitoring. Subsequently, only daytime noise compliance monitoring was conducted.

The quarry and asphalt plant operations were not audible at Receivers 2 and 4. Based on the measured data, analysis, and observations from previous noise surveys, it is estimated the quarry and asphalt plant operations at Receivers 2 and 4 are below 30 dB(A) $L_{Aeq,15\ min}$.

Occasional low frequency noise was audible at Receiver 8 and attributed to the asphalt plant front end loader at that location. Road traffic noise from Nimbin Road was not as noticeable as previous surveys, probably due to the slight easterly breeze.

Based on the measured data, analysis, and observations from previous noise surveys, it is estimated the asphalt plant operations and reduced quarry operations at Receiver 8 are below 35 dB(A) $L_{Aeq,15\ min}$.

Seasonal cicadas increased noise levels at all 3 receiver locations (2.5kHz – 16kHz).

The quarry and asphalt operations measured on the 13th of February 2024 comply with the NSW Environment Protection Authority, Environmental Protection Licence, EPL No. 3384 and Project Approval MP07_0020.

Acoustic Consultant
Ambience Audio Services

APPENDIX A
Definitions of Terms

Sound pressure level (L_p): A measurable quantity of the size or amplitude of the pressure fluctuations (sound waves) above and below normal atmospheric pressure compared to a reference pressure. Sound pressure levels are measured in decibels whereas sound pressure is measured in pascals (N/m^2).

Decibels (dB): a ratio of energy flows. When used for sound measurement, it is the ratio between a measured quantity of sound pressure and an agreed reference sound pressure. The dB scale is logarithmic and uses the threshold of hearing of 20 μPa (micro pascals) as the reference pressure. This reference level is defined as 0 dB.

Frequency (Hz): The number of pressure variations per second (cycles per second) is called the **frequency** of sound and is measured in **Hertz (Hz)**. The rumble of distant thunder has a low frequency, while a whistle has a high frequency. The normal range of hearing for a healthy young person extends from approximately 20Hz up to 20 000 Hz (20 kHz) while the range from the lowest to highest note on a piano is approximately 27.5 Hz to 4.2 kHz.

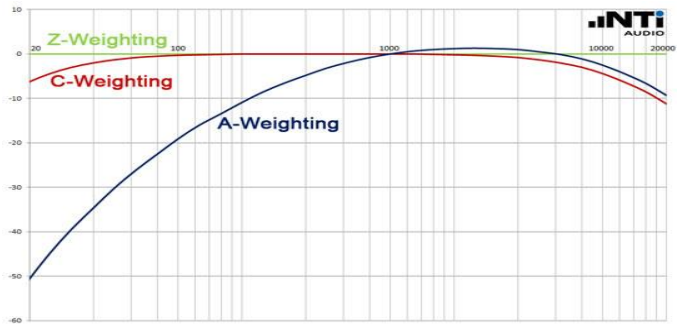
Spectral characteristics: The frequency content of noise.

Octave: a logarithmic unit for ratios between frequencies, with one octave corresponding to a doubling of frequency. For example, the frequency one octave above 40 Hz is 80 Hz.

1/3 Octave: a logarithmic unit of frequency ratio equal to one third of an octave.

"A" frequency weighting: The method of frequency weighting the electrical signal within a noise-measuring instrument to give a very approximate simulate to the human perception of loudness. The symbols for the noise parameters often include the letter "A" (e.g., L_{Aeq}, dBA) to indicate that frequency weighting has been included in the measurement. "A" weighting is most commonly used with regard to noise control issues, regulations and environmental standards.

"C" frequency weighting: The filters used in C weighting captures lower frequencies than A weighting as indicated in the chart below.



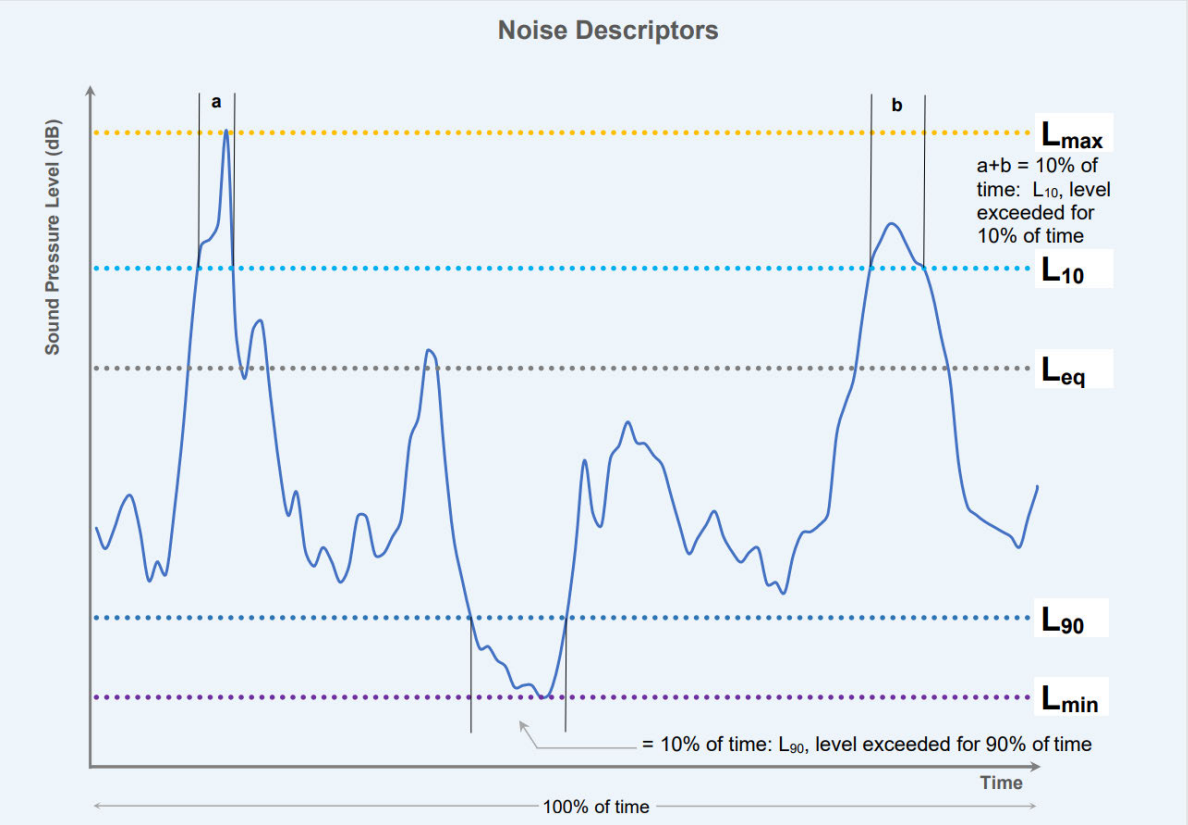
The A-weighting curve is used extensively for general purpose noise measurements but the C-weighting correlates better with the human response to high noise levels.

Fast, Slow and Impulse time weightings: Standardised root-mean-square (rms) averaging times to help define fluctuating noise levels. Impulsive noises have high peak levels with a very short duration (e.g., gun shot), or a sequence of such peaks. The 'Slow' time weighting averages the fluctuations over a one second time base whilst the 'Fast' time weighting averages the fluctuations over a one-eighth of a second time base. Environmental assessment standards usually specify the time weighting (**F**, **S**, or **I**) to be used.

L_{Aeq}: The A-weighted equivalent continuous noise level. A widely used noise descriptor which provides an average of the energy of a constant level of noise which is the same as the varying noise signal being measured. The time in which the measurement was sampled, is indicated with a subscripted number e.g. $L_{Aeq,15\ minute}$ is a 15-minute sample.

Percentile Levels L_N: The sound pressure level that is exceeded for N per cent of the time over which a given sound is measured. e.g. **L_{A90}** is the A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured.

L_{A90} is commonly used to describe the **background noise level** for community noise assessments.



Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Extraneous noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by events such as concerts or sporting events. Normal daily traffic is not to be considered extraneous.

Background noise: The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the $\mathbf{L_{A90}}$ descriptor, fast time weighting.

Intrusive Noise: Refers to noise that intrudes above the background level by more than 5 decibels.

Noise limits: Enforceable noise levels that appear in consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.

References:

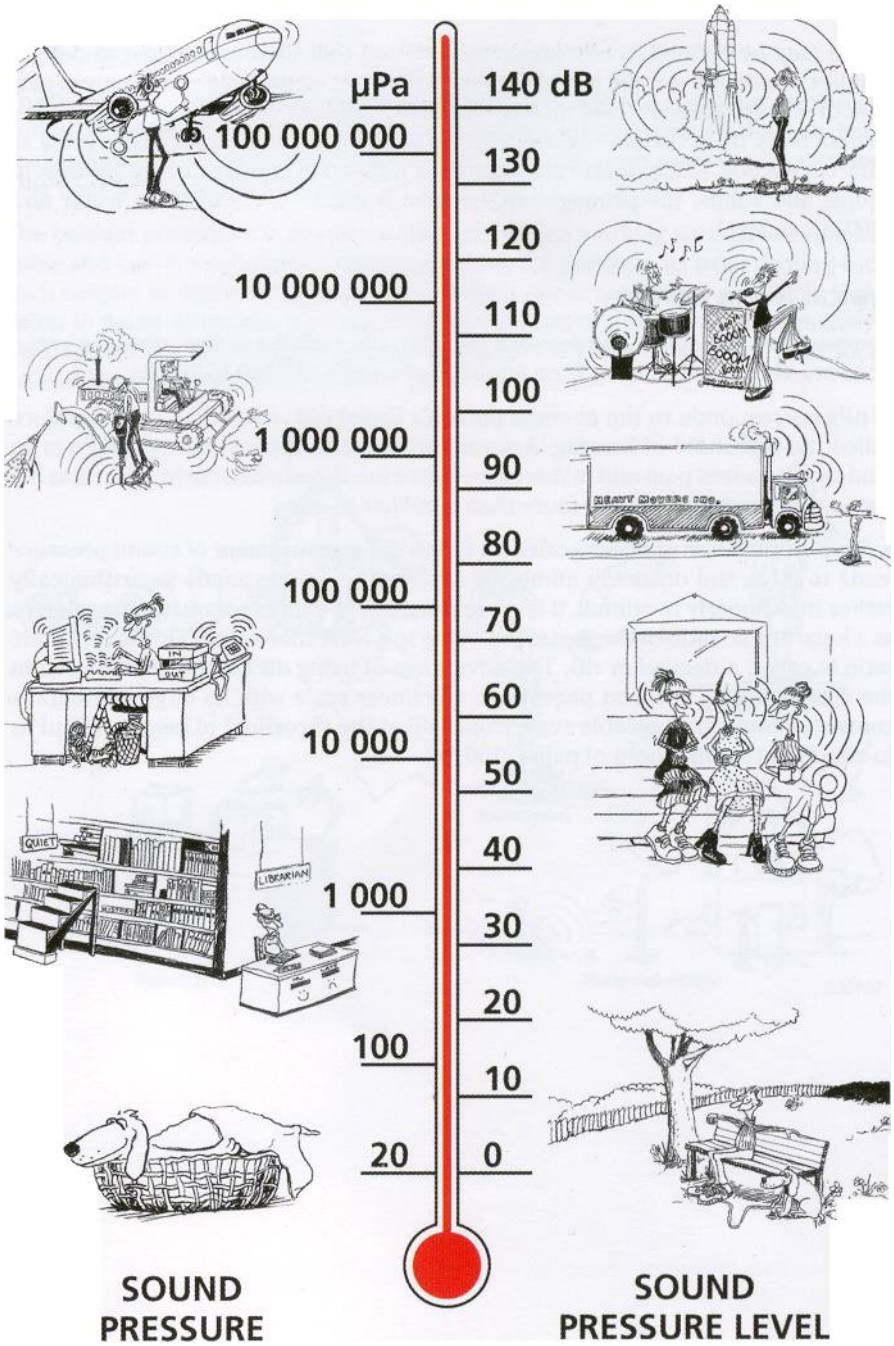
Measuring Sound Brüel and Kjær Sound & Vibration Measurements A/S September 1984

Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

New South Wales Industrial Noise Policy NSW Environment Protection Authority January 2000

https://www.nti-audio.com/en/support/know-how/frequency-weightings-for-sound-level-measurements

APPENDIX B
Comparison of Sound Pressure Levels



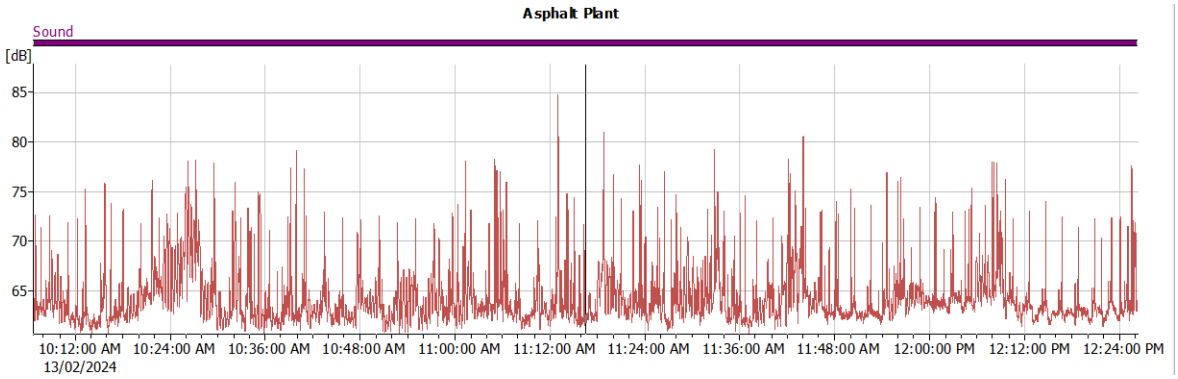
Our hearing covers a wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable.
Reproduced from
Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

Appendix C
Asphalt Plant Noise Monitoring Location 13th February 2024

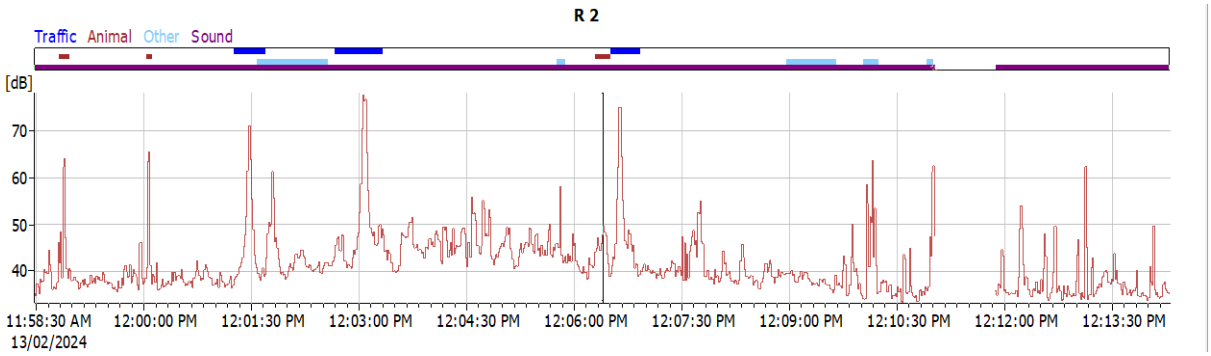
Image Source – Lismore City Council Online Mapping
Note : Aerial photo not of February13th operations

APPENDIX D
L_{AFmax} Logged Noise Level Graphs 13th February 2024

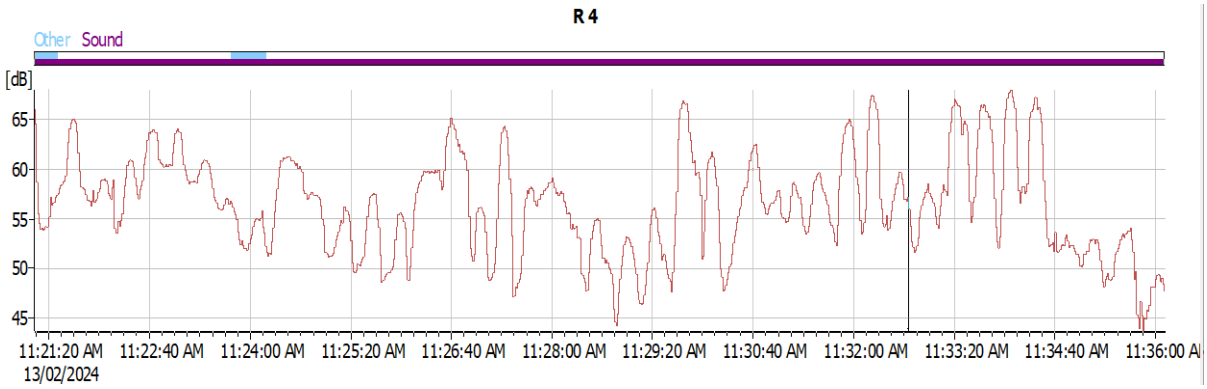
Graph D1



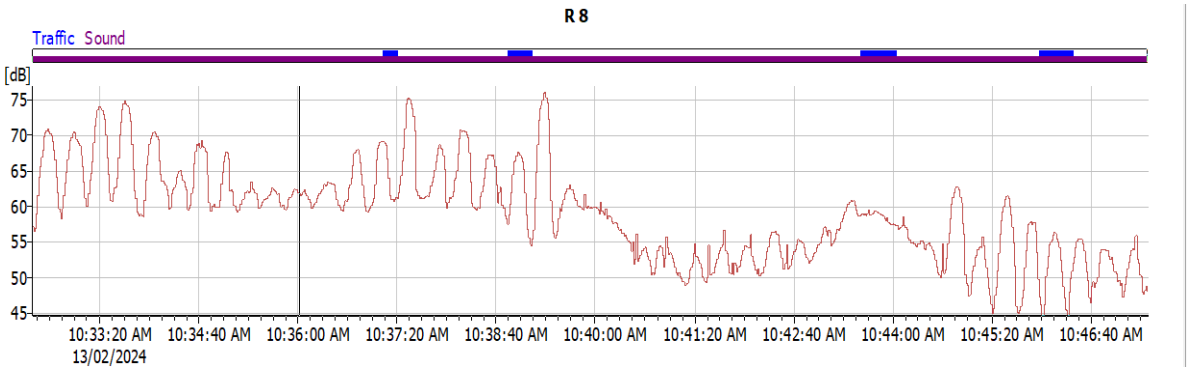
Graph D2



Graph D3



Graph D4



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Document Control			
Rev. No	**Date**	**Prepared By**	**Notes**
Draft	25/06/2024	[redacted]	Internal review
Revision 1	26/06/2024	[redacted]	Included low frequency analysis, added extra words for clarity- Table 3.7

Table of Contents

1 INTRODUCTION

Ambience Audio Services have been engaged by Ecoteam to conduct noise monitoring at Blakebrook Quarry, 550 Nimbin Road, Blakebrook NSW.

The current Noise and Blast Management Plan (NBMP) for Blakebrook Quarry (Lismore City Council Oct 2022) includes an Out of Hours Work Protocol (OHWP) for the asphalt plant, which is anticipated to occur 5 nights per month on scheduled projects. Section 7 of the NBMP details the noise monitoring program. Section 7.3 requires noise monitoring to be conducted once every 6 months to represent winter and summer conditions. The noise monitoring and reporting is to be conducted for each assessment time period; Day - 7am to 6pm, Evening – 6pm to 10pm, Night – 10pm to 7am).

Noise monitoring was conducted on the evening and night of the 29th of May 2024 with the asphalt plant operating under normal load conditions and suitable weather conditions.

The asphalt plant was producing hot mix during the evening and night time noise monitoring periods. There were truck movements on the internal haul roads, entry/exit haul road and Nimbin Road during the evening and night time noise monitoring.

To assist with the interpretation of some of the terminology used in this report, Appendix A provides definitions of acoustic terms. Appendix B is a chart of everyday sound pressure levels.

Appendix D are the logged noise levels for the asphalt plant, and at each receiver location.

2 NOISE MONITORING REQUIREMENTS

The noise monitoring requirements for the Blakebrook Quarry are outlined in Section 2.2, Sections 7.1, 7.2, 7.3, 7.4, 7.5 and 7.7 of the NBMP (LCC Oct 2022).

Extracts of the relevant parts are copied below.

Section 2.2

3. *The Proponent must ensure that the noise generated by the project does not exceed the criteria in Table 2 at any residence on privately owned land.*

Table 2: Noise Criteria dB(A)

Receiver	Day L_{Aeq} (15 minute)
Location 2 and 7	36
All other locations	35

Out of Hours Work Protocol – Asphalt Operations

The OHWP has provided management strategies for potential noise sources involving asphalt operations and truck movements. The evening and night project-specific noise level criterion is 35 dB(A) LAeq (15 minute).

L4.1 Noise from the licenced premises must not exceed an LAeq (15 minute) noise emission criteria of 36 dB(A) at Location 2 and 7, and 35 dB(A) at all other sensitive receivers, except as expressly provided by in this licence.

7.2 MONITORING LOCATIONS

The original Noise Assessment (ERM 2009) and updated NIA (Mitchel Hanlon, SEE 2019) included six (6) noise monitoring locations that were used throughout the assessment, based on proximity to nearby potentially sensitive receptors. Given the proximity between monitoring locations and the location of anticipated noise-generating plant and equipment, the monitoring locations have been revised and separated into primary and supplementary acoustic monitoring locations for the purposes of the NBMP.

Primary and supplementary acoustic locations are identified in *Figure 2*. Primary acoustic monitoring locations consist of locations **2**, **4** and **8** with the remainder of locations being supplementary acoustic monitoring locations.

An agreement was reached with the landowner located along Nimbin Road (previously identified as location 8, ERM 2009) in April 2016, wherein the landowner has agreed to the exceedances in noise levels from Quarry operations. As such the location has been removed as a primary acoustic monitoring location, and a new monitoring location selected being (current) location 8.

Primary monitoring locations will be utilised during noise compliance monitoring and are considered representative in determining compliance with the relevant Conditions of Approval.

In the event that additional monitoring is required then additional monitoring may be undertaken at the most practical supplementary acoustic monitoring locations, as well as at the primary acoustic monitoring locations.

7.4 METHODOLOGY

Noise

Operator attended noise measurements shall be conducted at all primary acoustic measurement locations (Locations 2, 4 and 8 – refer *Figure 2*) to quantify and characterise the maximum (L_{Amax}), the energy equivalent (L_{Aeq}), and the background (L_{A90}) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the L_{Aeq} (Period) noise contribution during Quarry activities, as well as the overall level of ambient noise. During attended monitoring, digital recordings will be conducted to allow for additional post analysis of the Quarry noise levels and source identification.

All acoustic instrumentation employed throughout the monitoring program shall meet with the requirements of AS/NZS IEC 61672.1 Sound level meters Specifications & AS/NZS IEC 61672.2 Sound level meters Pattern Evaluation.

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding $\pm$ 0.5 dBa.

7.5 METEOROLOGICAL PARAMETERS

Adverse meteorological conditions have the potential to increase noise levels, for example wind speeds up to 3 m/s or temperature inversions, however wind speeds above 5 m/s (and rainfall) have the potential to generate extraneous and erroneous noise events, which reduce the accuracy and confidence in measured data.

As such, meteorological parameters will be evaluated prior to undertaking works on site, to gain an understanding of the weather conditions and the potential for variations in noise levels.

All noise measurements shall be accompanied by both qualitative description (including cloud cover, approximate wind direction and speed) and quantitative measurements of prevailing local weather conditions throughout the survey period. Rainfall data and meteorological parameters will be collected from the weather station located on-site. as shown in *Table H*.

Table H: Meteorological Measurement Parameters

Measured Parameter	Unit	Sample Interval
Mean Wind Speed	m/s	15 minutes
Mean Wind Direction	Degrees	15 minutes
Aggregate Rainfall	mm	15 minutes
Mean Air Temperature	C°	15 minutes

Accounting For Annoying Noise Characteristics (Low Frequency Noise)

The *Noise Policy for Industry* (NPfI 2017) states that a noise source may exhibit a range of particular characteristics that increase annoyance, such as tones, impulses, low frequency noise and intermittent noise.

Where this is the case, an adjustment ('modifying factor corrections') is applied to the source noise level received at an assessment point before it is compared with criteria to account for the additional annoyance caused by the particular characteristic.

Application of these modifying factors is described in. *Fact Sheet C: Corrections for annoying noise characteristics* and outlines correction factors to be applied to the source noise level at the receiver before comparison with the project noise trigger levels to account for the additional annoyance caused by those modifying factors.

The modifying factor corrections should be applied having regard to:

- the contribution noise level from the premises when assessed/measured at a receiver location, and
- the nature of the noise source and its characteristics (as set out in this fact sheet).

The NPfI provides the following definitions to support the modifying factor corrections:

- Tonal Noise – Containing a prominent frequency and characterised by a definite pitch.
- Low Frequency Noise – Containing major components within the low frequency range (20 Hz to 250 Hz) of the frequency spectrum.
- Impulsive Noise – Having a high peak of short duration or a sequence of such peaks.
- Intermittent Noise – The level suddenly drops to that of the background noise several times during the assessment period, with a noticeable change in noise level of at least 5 dB.

The modifying factor corrections (and how they are applied) are present in *Table C1* of the NPfI and vary depending on the noise characteristic being assessed. All noise levels generated by the Quarry, which may generate tonal or low frequency content, will be assessed as part of the NBMP monitoring with due regard to these modifying factor penalties, and in accordance with the requirements presented in the NPfI.

Impulsive and intermittent noise, as defined by the NPfI, are not typical characteristics of the Quarry, hence tonal and low frequency noise (LFN) are most relevant to the Quarry and those modifying corrections are reproduced in *Table I*.

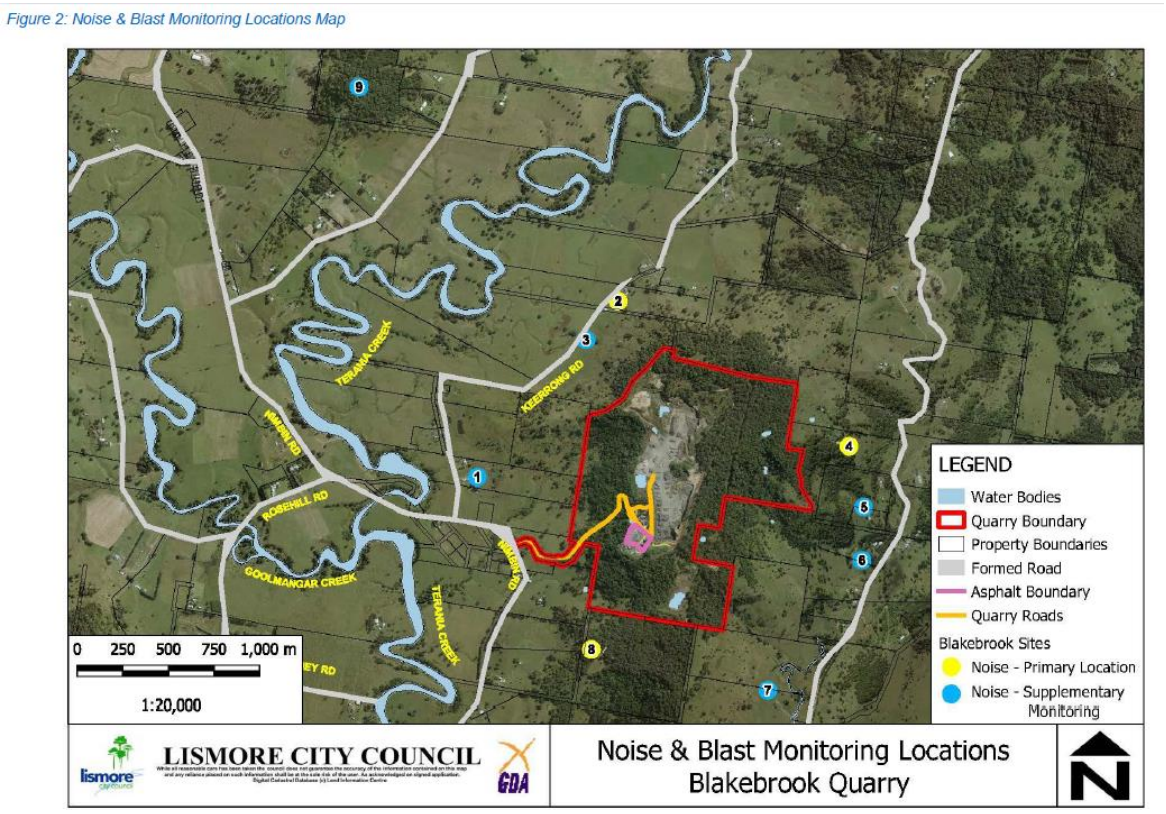
Tonal Noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (*ISO1996.2-2007 – Annex D*)	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.	5 dB [2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. **Note:** Narrow-band analysis using the reference method in *ISO1996-2:2007, Annex C* may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low Frequency Noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted Leq,T levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: • where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dB(A) positive adjustment applies for the daytime period.	2 or 5 dB [2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

Notes:
1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.
2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the *ISO1996-2:2007* standard.

Noise monitoring at the receiver locations were conducted within 30m of the residential dwelling in the direction of the quarry.

Table 2.1 Primary Receiver Locations	
Receiver	**Street Address**
2	[redacted] Keerrong Rd Blakebrook
4	[redacted] Booerie Creek Road Booerie Creek
8	[redacted] Nimbin Rd Blakebrook

Figure 2.1 Noise Monitoring Locations



3 MEASUREMENT PROCEDURE AND RESULTS

3.1 Instrumentation

Table 3.1 Instrumentation		
Instrument	**Serial #**	**Calibration Date**
Brüel and Kjær 2250 G4 Sound Level Meter	3008548	Jan 2024
Brüel and Kjær 2250 G4 Sound Level Meter	3031300	Oct 2022
Bruel & Kjaer 4231 Calibrator	3029274	Dec 2023

The sound level meters (SLM) used during the noise survey conform to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) as type 1 precision sound level meters, and have an accuracy suitable for both field and laboratory use.
The meters' calibrations were checked before and after the measurement periods with a Bruel & Kjaer acoustic calibrator. No significant system drift occurred over the measurement periods.

The SLMs and calibrator have been checked, adjusted and aligned to conform to the factory specifications and issued with conformance certificates by a certified NATA facility.

3.2 Measurement Procedure

Measurements were made in general accordance with procedures in:

1. Australian Standard AS 1055 : 2018 *Acoustics - Description and measurement of environmental noise*

2. The NSW Government *Noise Policy for Industry* (EPA Oct 2017)

The microphone of a B&K 2250 G4 was mounted on a 1.5m high tripod, a Bruel and Kjær outdoor windscreen fitted to the microphone, and located near the asphalt plant to monitor noise levels of the asphalt plant while measurements were being conducted at the receiver locations.

The SLM was set to record continuously for the duration of receiver monitoring.

A second SLM (B&K 2250 G4) was mounted on a 1.2m – 1.5m high tripod and a Bruel and Kjær outdoor windscreen fitted to the microphone. The SLM was used at the receiver locations to monitor noise levels while the asphalt plant was operating. Markers and sound recording were utilised on the sound level meter for post event analysis of acoustic events during each monitoring period.

A 15 minute period was recorded at each receiver location with A and C weighting, fast response, and 1 second samples. Spectrum data was recorded with a linear (Z) weighting in 1/3 octave bands.

The clocks on the 2 SLMs were synchronised to enable comparison of noise levels at the asphalt plant and top of quarry reference locations with noise levels at the receiver locations.

3.3 Weather Conditions

Weather conditions were generally good for acoustic measurements. Observations were taken at each receiver location with a Kestrel 3000 pocket weather meter.

Table 3.2 Receiver Locations Weather Summary 29th May 2024

Receiver	Time	Temp	Relative Humidity	Wind	Wind Dir	Cloud Cover
		°C	%	Speed (m/s)		
2	8:20 PM	12	95	Calm		0/8
	11:38 AM	10	97	Calm		0/8
4	8:58 PM	11	95	Calm		0/8
	10:55 PM	10	97	Calm		0/8
8	9:45 PM	11	95	Calm		0/8
	10:02 PM	10	94	Calm		0/8

Weather data from the weather station at Blakebrook Quarry is presented in Table 3.4 below.

Table 3.3 Blakebrook Quarry Weather Station Observations 29th May 2024

Date	Time	AVERAGE Air Temperature 10m – Deg C	AVERAGE Wind Speed 10m - km/h	AVERAGE Wind Speed 10m -m/s	AVGDIR Wind Direction 10m - Degs	S-THETA Wind Direction 10m - Degs	STDEV Wind Speed 10m - km/h	TOTAL Rain Gauge - mm
29/05/2024	8:00:00 PM	16.2	1.2	0.3	9.9	21.5	0.5	0
	8:10:00 PM	16.2	1	0.3	2	30.1	0.5	0
	8:20:00 PM	15.9	0.9	0.3	332.6	26.3	0.3	0
	8:30:00 PM	15.8	2	0.6	328.8	28.2	0.8	0
	8:40:00 PM	15.7	2.5	0.7	4	29.1	0.4	0
	8:50:00 PM	15.7	2.2	0.6	7.8	20.8	0.5	0
	9:00:00 PM	15.5	2.5	0.7	358	21.3	0.5	0
	9:10:00 PM	15.4	2.8	0.8	21.7	26	0.5	0
	9:20:00 PM	15.3	2.6	0.7	28	20.4	0.4	0
	9:30:00 PM	15.2	1.5	0.4	5	37	0.8	0
	9:40:00 PM	15.1	3.8	1.1	13.3	24.9	0.7	0
	9:50:00 PM	15.2	3.2	0.9	12.6	21.5	0.2	0
	10:00:00 PM	15.2	2.5	0.7	353.3	24.4	0.6	0
	10:10:00 PM	15	3.4	0.9	2.7	24.8	0.9	0
	10:20:00 PM	14.9	3.6	1.0	5.4	24	1.2	0
	10:30:00 PM	14.9	3.1	0.9	2.2	25.4	0.3	0
	10:40:00 PM	15	3.3	0.9	10.5	24.8	0.6	0
	10:50:00 PM	14.9	2.4	0.7	4.4	26.7	0.5	0
	11:00:00 PM	14.8	1.8	0.5	21.6	23.4	0.8	0
	11:10:00 PM	14.6	0.8	0.2	331.2	50.5	0.5	0
	11:20:00 PM	14.3	1.2	0.3	338.2	28.6	0.5	0
	11:30:00 PM	14.2	1.6	0.4	347.1	22.1	0.7	0
	11:40:00 PM	13.9	2	0.6	333.5	18.3	0.6	0
	11:50:00 PM	13.6	1.8	0.5	340.4	32.9	0.8	0
	12:00:00 AM	13.6	2.1	0.6	346.1	38.4	0.5	0

Wind Direction O and 360 degrees – North, 90 degrees – East, 180 degrees South, 270 degrees - West

3.4 Measurement Results

Table 3.4 Blakebrook Quarry Receiver Locations Measurement Summary - 29th May 2024 (All measurements 15 mins)								
Receiver	**Start Time**	**Elapsed Time h:mm:ss**	**L_{AFmax} [dB]**	**L_{Aeq} [dB]**	**L_{Ceq} [dB]**	**$L_{Ceq-LAeq}$ [dB]**	**$L_{AF10.0}$ [dB]**	**$L_{AF90.0}$ [dB]**
2	8:20 PM	0:15:00	61.4	35.1	48.1	13.0	35.9	28.5
	11:38 PM	0:15:00	78.3	50.2	52.5	2.3	30.8	21.7
4	8:58 PM	0:15:00	45.7	27.7	45.7	17.9	29.0	25.2
	10:56PM	0:15:00	45.3	26.9	42.7	15.8	28.3	23.6
8	9:45 PM	0:15:00	68.8	41.4	51.7	10.2	39.9	32.7
	10:02 PM	0:15:00	60.0	43.0	52.5	9.5	44.7	33.6

Note:
The above results are the total ambient noise levels and includes noise from the rural surroundings and asphalt plant and haul road noise if audible.

Post processing was conducted in Bruel & Kjaer BZ 5505 sound processing software to exclude other noise sources for the receiver location measurements. The exclude function was enabled for the traffic, animal and other markers. The total – exclude data enables a more accurate assessment of the noise source under investigation, by eliminating the periods that other random noise sources occur during monitoring. The results for the 3 receiver locations are presented below.

Table 3.5 Receiver 2 Measurement Summary Total - Exclude 29th May 2024 (All measurements 15 mins)							
Start Time	**Elapsed Time h:mm:ss**	**L_{AFmax} [dB]**	**L_{Aeq} [dB]**	**L_{Ceq} [dB]**	**$L_{Ceq-LAeq}$ [dB]**	**$L_{AF10.0}$ [dB]**	**$L_{AF90.0}$ [dB]**
8:20 PM	0:10:29	36.2	< 25	41.8	na	33.1	28.4
11:38 PM	0:13:31	47.2	< 25	36.7	na	29.7	21.6

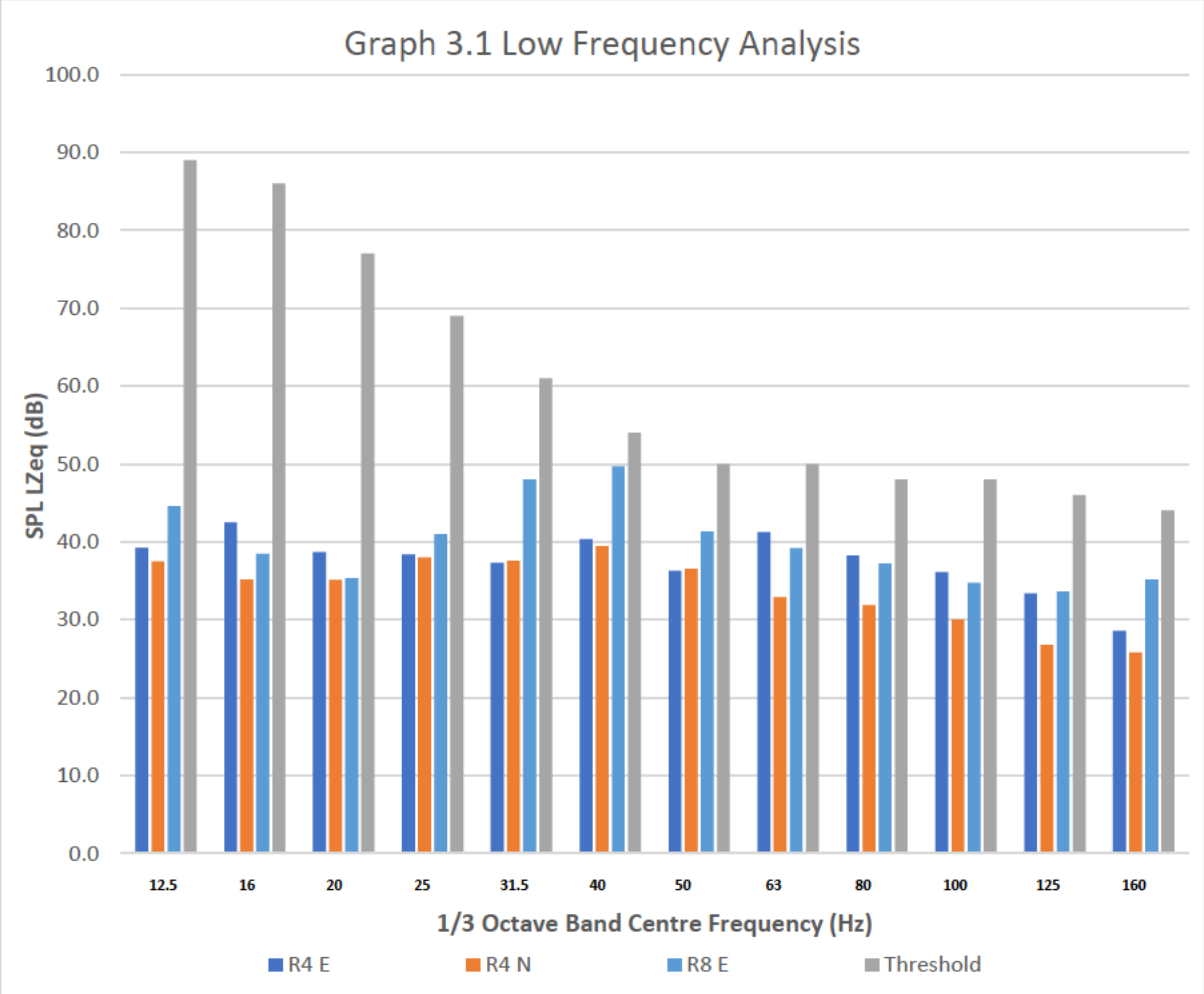
Table 3.6 Receiver 4 Measurement Summary Total - Exclude 29th May 2024 (All measurements 15 mins)							
Start Time	**Elapsed Time h:mm:ss**	**L_{AFmax} [dB]**	**L_{Aeq} [dB]**	**L_{Ceq} [dB]**	**$L_{Ceq-LAeq}$ [dB]**	**$L_{AF10.0}$ [dB]**	**$L_{AF90.0}$ [dB]**
8:58 PM	0:12:08	40.7	26.6	44.6	18.1	27.9	25.1
10:56 PM	0:12:55	36.7	26.0	42.6	16.6	27.7	23.5

Table 3.7 Receiver 8 Measurement Summary Total - Exclude 29th May 2024 (All measurements 15 mins)								
	Start Time	**Elapsed Time h:mm:ss**	**L_{AFmax} [dB]**	**L_{Aeq} [dB]**	**L_{Ceq} [dB]**	**$L_{Ceq-LAeq}$ [dB]**	**$L_{AF10.0}$ [dB]**	**$L_{AF90.0}$ [dB]**
	9:45 PM	0:08:45	43.6	35.5	50.9	15.4	36.7	32.0
Entry / Exit Road Included	10:02 PM	0:09:00	60.0	43.9	52.5	8.6	46.8	32.9
Entry /Exit Road Excluded	10:02 PM	0:07:29	43.7	35.9	50.7	14.8	38.2	32.7

Table 3.8 Noise Observations at Receiver Locations 29th May 2024 (All measurements 15 mins)			
Receiver	**Start Time**	**Observed Noise Sources**	**Asphalt Plant Noise**
2	8:20 PM	Distant cattle, distant traffic Nimbin Road, 2 distant aircraft flyovers, horse.	Asphalt plant not audible
	11:38 PM	Aircraft flyover, vehicle pass by	Asphalt plant not audible
4	8:58 PM	Very distant traffic, very distant dog, distant cattle	Asphalt plant just audible
	10:55 PM	Very distant traffic, trucks leaving quarry	Asphalt plant just audible
8	9:45 PM	Distant traffic Nimbin Road, trucks and loader moving around AP	Asphalt plant audible
	10:02 PM	Distant traffic Nimbin Road, truck leaving quarry with exhaust brakes, truck on Nimbin road.	Asphalt plant audible, truck using exhaust brake very audible.

3.5 Low Frequency Analysis

The difference between the A and C L_{eq} levels at Receivers 4 and 8 was greater than 15 decibels during some measurements.



4 DISCUSSION OF RESULTS

The noise logger near the asphalt plant indicated that there was consistent asphalt plant noise during the measurement periods at receiver locations (graph D1). Comparing with previous measurements at the same location, the noise levels are approximately 2 – 3 decibels higher than previous noise surveys.

Receiver 2

Quarry noise was not audible for either monitoring period. The background noise level (approx. 22 dB(dB $L_{A90,15min}$) near midnight was very low and is consistent with previous noise surveys at night with very little insect noise.

Consistent low level insect noise (mainly 4kHz) was observed during both measurement periods – more noticeable in the 8:20PM measurement.

The $L_{Aeq,15\ min}$ of asphalt operations is estimated to be below 25 dB(A).

Receiver 4

Evening and night time background noise levels ranged from 27.7 dB(A) to 27.9 dB(A) and are low. Asphalt plant operations were just audible at Receiver 4.

The L_{Ceq} - L_{Aeq} level exceeded 15 decibels for both measurement periods. The low frequency analysis (graph 3.1) indicates no 1/3 octave band frequency exceeded the reference threshold by more than 5 decibels, so no low frequency modifying factor is required.

The $L_{Aeq,15min}$ noise level of the asphalt plant was calculated to be 26.6 dB(A) for the evening and 26.0 dB(A) for the night period.

Based on the measured data and analysis, it is estimated asphalt plant operations at Receiver 4 are below 27 dB(A) $L_{eq,15min}$ for calm meteorological conditions.

Receiver 8

Quarry noise was audible at Receiver 8 for the evening and night time periods.

Evening and night time background noise levels ranged from 32.0 dB(A) to 32.9 dB(A).

The L_{Ceq} - L_{Aeq} level exceeded 15 decibels for the evening measurement period. The low frequency analysis (graph 3.1) indicates no 1/3 octave band frequency exceeded the reference threshold by more than 5 decibels, so no low frequency modifying factor is required.

It was noted during the night time measurement period starting at 10:02 PM, a truck using the entry/exit haul road, used exhaust brakes and was very audible at the monitoring location at Receiver 8.

The $L_{Aeq,15min}$ of the asphalt plant was calculated to be 35.5 dB(A) for the evening and 35.9 dB(A) for the night period, when the truck using exhaust brakes on the entry/exit haul road is excluded.

The $L_{Aeq,15min}$ noise level at the monitoring location was 43.9 dB(A) when the truck on the entry/exit haul road is included. The exceedance is quite significant, however this event appears to be a one-off occurrence, as generally trucks on the entry/exit haul road are not very audible at Receiver 8.

Tables 4.1 and 4.2 of the NPfI specifies the significance of residual noise levels (exceedances).

An exceedance of ≤ 2 decibels is considered negligible and would not be discernible by the average listener and there-fore would not warrant receiver-based treatments or controls.

An exceedance of > 5 decibels is considered significant and would require noise mitigation measures.

There is a sign on the entry/exit haul road to remind drivers to limit the use of compression (exhaust/engine) braking.

It is recommended a well lit sign is installed to remind drivers to not use exhaust/engine brakes, except for emergency and safety reasons.

5 SUMMARY AND CONCLUSION

A noise monitoring survey was conducted to assess compliance of the evening and night time operational noise of the asphalt plant at Blakebrook Quarry, Blakebrook, via Lismore NSW. Measurements were undertaken with calibrated noise monitoring equipment on the 29th of May 2024, and conducted in general accordance with procedures in Australian Standard AS 1055:2018 and the NSW EPA Noise Policy for Industry.

The Blakebrook Quarry operates under the New South Wales Government Environment Protection Authority, Environmental Protection Licence, EPL No. 3384. Noise emissions from quarry and asphalt plant operations at nearby residential receivers, is managed by the Noise and Blast Management Plan (NBMP) for Blakebrook Quarry (Lismore City Council Oct 2022), and includes an Out of Hours Work Protocol (OHWP) for the asphalt plant, which is anticipated to occur 5 nights per month on scheduled projects.

The evening (6pm – 10pm) and night time (10pm – 7am) noise limit is 35dB(A) $L_{Aeq,15min}$ at all receiver locations without a written agreement with the quarry.

Measurements were conducted at the 3 primary receiver locations (Receivers 2, 4, 8) while the asphalt plant was operating under normal load conditions for the production of hot mix. A front end loader was operating near the asphalt plant, with trucks operating on the internal haul roads and the entry/exit haul road.

The quarry operations were not audible at Receiver 2 for the evening and night time periods. Low level insect noise (mainly 4 kHz) was consistent during both measurement periods.

It is estimated asphalt plant operations at Receiver 2 are below 25 dB(A) $L_{Aeq,15min,}$ which is well below the evening and night time noise limits of 35 dB(A) $L_{Aeq,15min}$.

Low frequency noise from asphalt plant operations was just audible at Receiver 4 during the evening and night time periods. The low frequency analysis indicates the measured low frequency is below the low frequency spectrum criteria. It is estimated quarry operations at Receiver 4 are below 27 dB(A) $L_{eq,15min}$ for calm meteorological conditions.

The measured noise levels of the asphalt plant at Receiver 8 exceeded the evening and night time noise limit criteria of 35dB(A) $L_{Aeq,15min}$ by 0.5 decibels and 0.9 decibels respectively. The exceedance is considered negligible and does not warrant receiver-based treatments or controls.

The low frequency analysis at Receiver 8 indicates the measured low frequency is below the low frequency spectrum criteria, so no low frequency modifying factor is required.

The night time criteria was exceeded by 8.7 decibels when a truck was using the exhaust brake on the entry/exit haul road. The exceedance is significant, however this event appears to be a one-off occurrence, as generally trucks on the entry/exit haul road are not very audible at Receiver 8.

It is recommended a well lit sign is installed to remind drivers not to use exhaust/engine brakes, except for emergency and safety reasons.

Acoustic Consultant
Ambience Audio Services

APPENDIX A
Definitions of Terms

Sound pressure level (L_p): A measurable quantity of the size or amplitude of the pressure fluctuations (sound waves) above and below normal atmospheric pressure compared to a reference pressure. Sound pressure levels are measured in decibels whereas sound pressure is measured in pascals (N/m^2).

Decibels (dB): a ratio of energy flows. When used for sound measurement, it is the ratio between a measured quantity of sound pressure and an agreed reference sound pressure. The dB scale is logarithmic and uses the threshold of hearing of 20 μPa (micro pascals) as the reference pressure. This reference level is defined as 0 dB.

Frequency (Hz): The number of pressure variations per second (cycles per second) is called the **frequency** of sound and is measured in **Hertz (Hz)**. The rumble of distant thunder has a low frequency, while a whistle has a high frequency. The normal range of hearing for a healthy young person extends from approximately 20Hz up to 20 000 Hz (20 kHz) while the range from the lowest to highest note on a piano is approximately 27.5 Hz to 4.2 kHz.

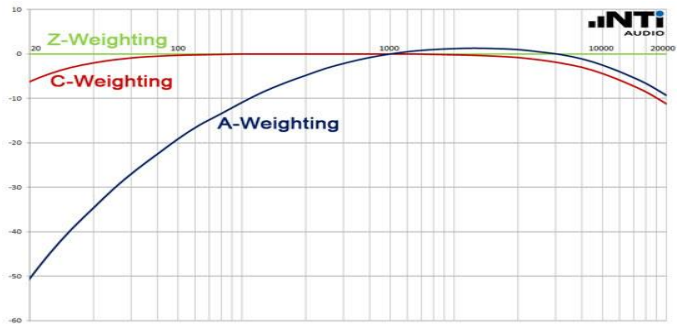
Spectral characteristics: The frequency content of noise.

Octave: a logarithmic unit for ratios between frequencies, with one octave corresponding to a doubling of frequency. For example, the frequency one octave above 40 Hz is 80 Hz.

1/3 Octave: a logarithmic unit of frequency ratio equal to one third of an octave.

"A" frequency weighting: The method of frequency weighting the electrical signal within a noise-measuring instrument to give a very approximate simulate to the human perception of loudness. The symbols for the noise parameters often include the letter "A" (e.g., L_{Aeq}, dBA) to indicate that frequency weighting has been included in the measurement. "A" weighting is most commonly used with regard to noise control issues, regulations and environmental standards.

"C" frequency weighting: The filters used in C weighting captures lower frequencies than A weighting as indicated in the chart below.



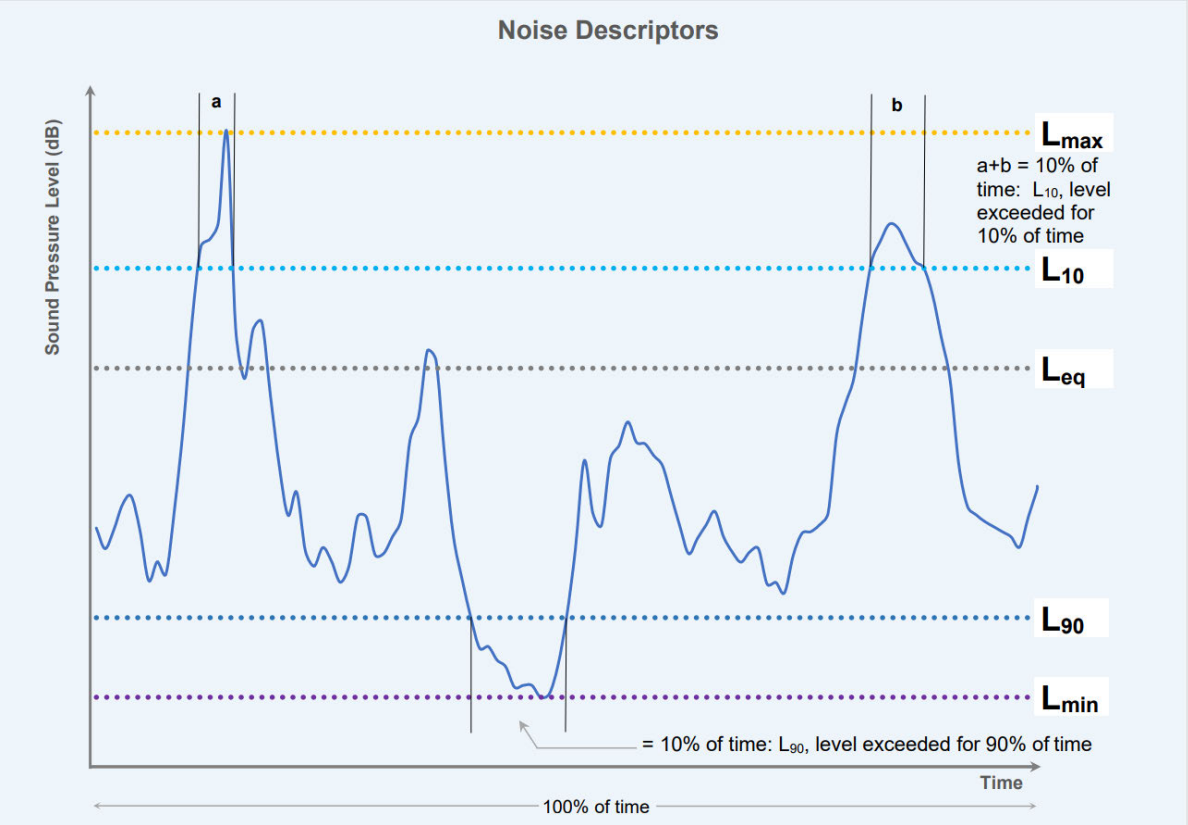
The A-weighting curve is used extensively for general purpose noise measurements but the C-weighting correlates better with the human response to high noise levels.

Fast, Slow and Impulse time weightings: Standardised root-mean-square (rms) averaging times to help define fluctuating noise levels. Impulsive noises have high peak levels with a very short duration (e.g., gun shot), or a sequence of such peaks. The 'Slow' time weighting averages the fluctuations over a one second time base whilst the 'Fast' time weighting averages the fluctuations over a one-eighth of a second time base. Environmental assessment standards usually specify the time weighting (**F**, **S**, or **I**) to be used.

L_{Aeq}: The A-weighted equivalent continuous noise level. A widely used noise descriptor which provides an average of the energy of a constant level of noise which is the same as the varying noise signal being measured. The time in which the measurement was sampled, is indicated with a subscripted number e.g. $L_{Aeq,15\ minute}$ is a 15-minute sample.

Percentile Levels L_N: The sound pressure level that is exceeded for N per cent of the time over which a given sound is measured. e.g. **L_{A90}** is the A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured.

L_{A90} is commonly used to describe the **background noise level** for community noise assessments.



Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Extraneous noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by events such as concerts or sporting events. Normal daily traffic is not to be considered extraneous.

Background noise: The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the $\mathbf{L_{A90}}$ descriptor, fast time weighting.

Intrusive Noise: Refers to noise that intrudes above the background level by more than 5 decibels.

Noise limits: Enforceable noise levels that appear in consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.

References:

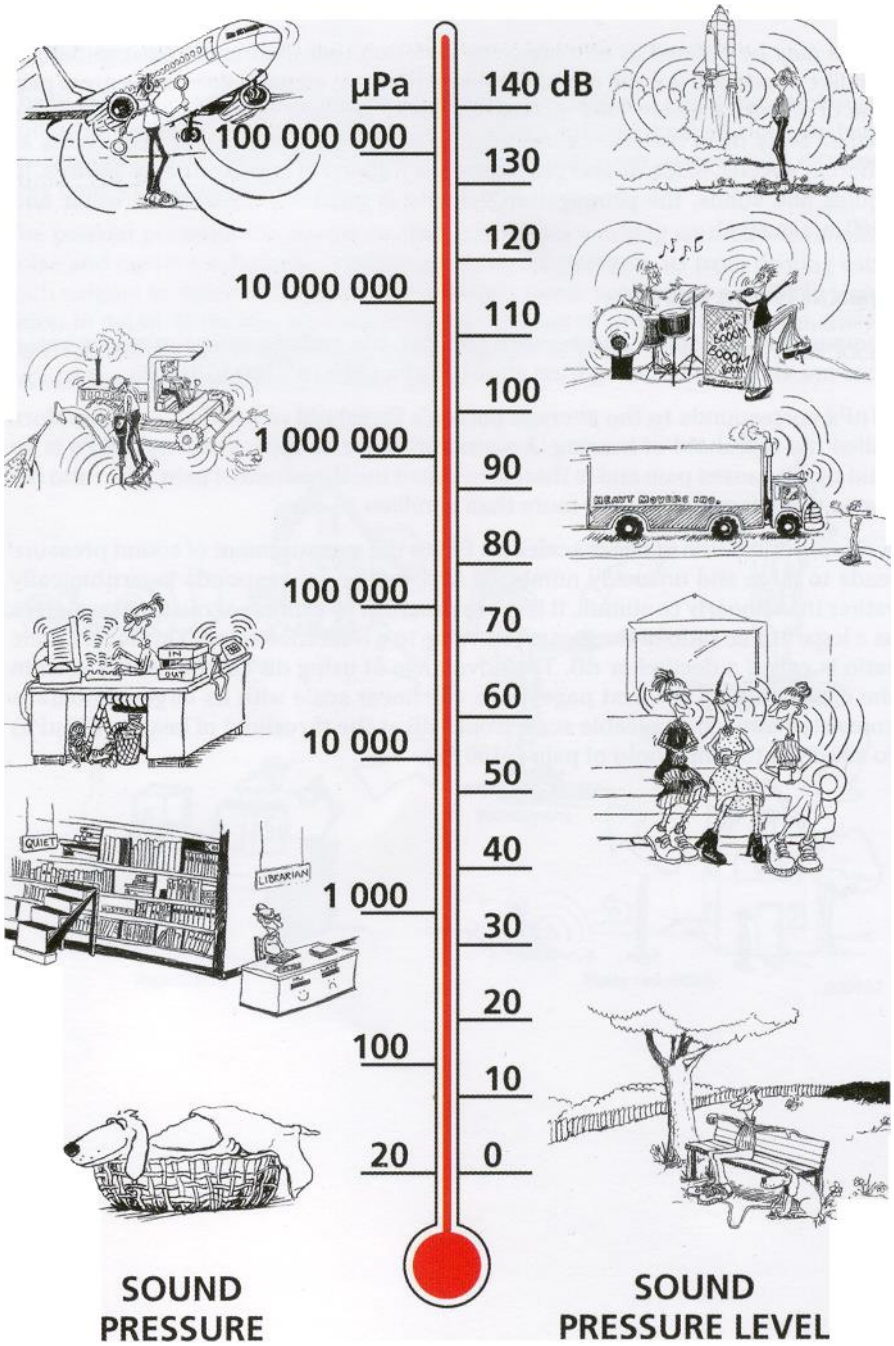
Measuring Sound Brüel and Kjær Sound & Vibration Measurements A/S September 1984

Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

New South Wales Industrial Noise Policy NSW Environment Protection Authority January 2000

https://www.nti-audio.com/en/support/know-how/frequency-weightings-for-sound-level-measurements

APPENDIX B
Comparison of Sound Pressure Levels



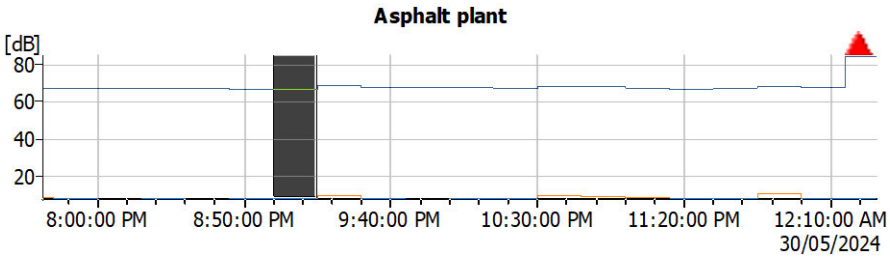
Our hearing covers a wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable.
Reproduced from
Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

Appendix C
Asphalt Plant Operations 29th May 2024

Image Source – Lismore City Council Online Mapping
Note : Aerial photo not of May 2024 operations

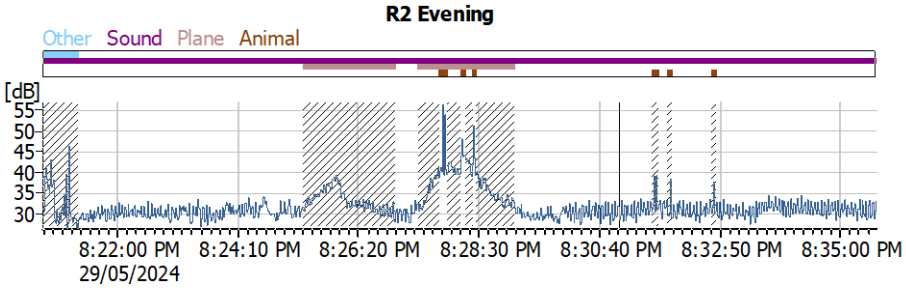
APPENDIX D
L_{AFmax} Logged Noise Level Graphs 29th May 2024

Graph D1



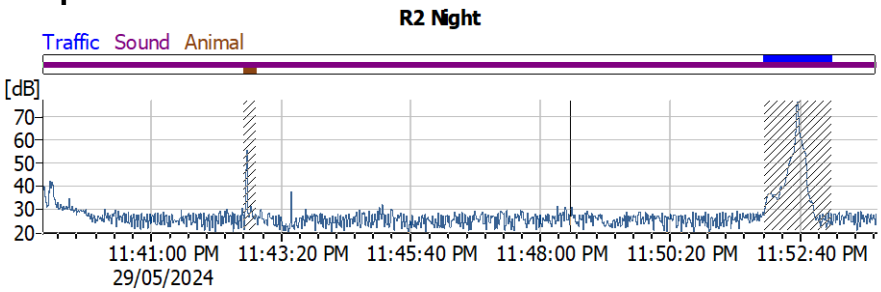
Cursor values
Logged
X: 9:00:00 PM - 9:15:00 PM
LAeq: 66.9 dB
LCeq-LAeq: 8.3 dB

Graph D2



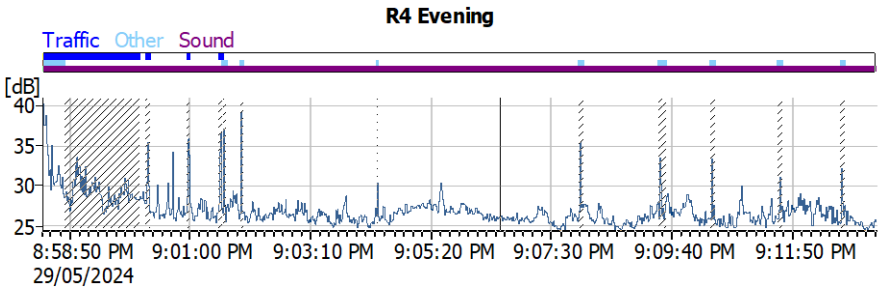
Cursor values
Logged
X: 8:31:01 PM - 8:31:02 PM
LAeq: 28.5 dB

Graph D3



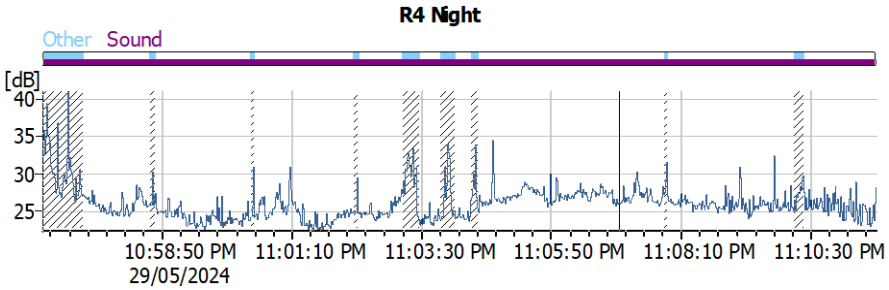
Cursor values
Logged
X: 11:48:32 PM - 11:48:33 PM
LAeq: 26.8 dB

Graph D4



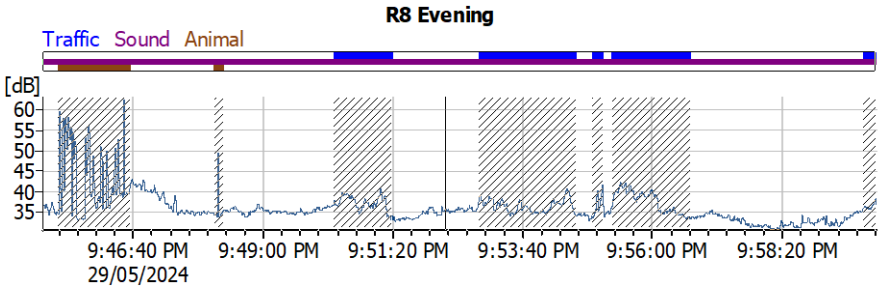
Cursor values
Logged
X: 9:06:33 PM - 9:06:34 PM
LAeq: 26.1 dB

Graph D5



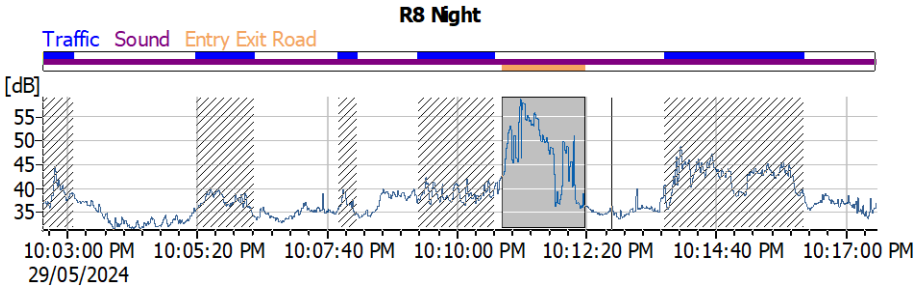
Cursor values
Logged
X: 11:07:03 PM - 11:07:04 PM
LAeq: 26.1 dB

Graph D6



Cursor values
Logged
X: 9:52:16 PM - 9:52:17 PM
LAeq: 35.6 dB

Graph D7



Cursor values
Logged
X: 10:12:47 PM - 10:12:48 PM
LAeq: 36.3 dB