

## Ambience Audio Services

Acoustic Measurement and Analysis

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### **Results of Noise Monitoring**

**Blakebrook Quarry  
186A Keerrong Road  
Blakebrook NSW 2480**

Prepared for

**Northern Rivers Quarry & Asphalt  
186A Keerrong Road  
Blakebrook NSW 2480**

Prepared by  
Garry Hall  
November 14<sup>th</sup> 2017

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## 1 INTRODUCTION

Ambience Audio Services conducted noise monitoring of quarry operations for Northern Rivers Quarry & Asphalt at Blakebrook via Lismore, northern NSW. The noise monitoring was requested by the Commercial Services Co-ordinator for NRQA, Mr Kurt Bezjak, to measure and report on quarry operational noise levels at the closest affected residential receiver locations.

Noise monitoring was conducted on the 7<sup>th</sup> and 9<sup>th</sup> of November 2017 with full quarry operating conditions and suitable weather conditions. Measurements were conducted over 2 days due to excessive wind on the 7<sup>th</sup> being unable to complete all receiver locations. Measurements were also attempted on the 2<sup>nd</sup> but a breakdown occurred so measurements without the quarry operating were conducted at one of the receiver locations.

Quarry operations while noise monitoring was conducted included crushing and stockpiling on the eastern side of the quarry floor, asphalt production at the mobile plant at the top of the quarry and trucks and loaders on the internal haul roads. A diagram of equipment operating on the quarry floor during noise monitoring at residential receivers is provided in Appendix D

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.

## 2 NOISE MONITORING REQUIREMENTS

The noise monitoring requirements for the Blakebrook Quarry are outlined in Section 6.2 of the Noise, Vibration and Blasting Sub Plan 08/04/11 prepared by Environmental Resources Management Australia (ERM).

Extracts of the relevant parts are copied below.

### 6.2.2 *Noise and Vibration and Blasting Monitoring Locations*

Noise, vibration and blasting monitoring will be undertaken at the nearest residential receptors marked as locations 1 to 6 on *Figure 6.1*.

#### 6.2.4 *Noise, Vibration and Blasting Monitoring Methodology*

Operator - attended noise measurements shall be conducted at Locations 1 to 4, Location 6 and Location 9 (refer *Figure 6.1*) to quantify and characterise the maximum (LA<sub>max</sub>), the energy equivalent (LA<sub>eq</sub>), and background (LA<sub>90</sub>) noise levels from ambient noise sources and quarrying operations over a 15 minute measurement period.

The operator shall quantify noise emissions and estimate the LA<sub>eq</sub>(Period) noise contribution during day time activities from each of the quarrying operations, 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 1259.2-1990, "Sound Level Meters".

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

To measure blasts a blast monitor will be employed that records air blast and vibration levels once triggered by an electronic trigger connected to shot firing switch. That is, when the shot is fired, the monitor will be triggered by means of a hardwire switch and will start recording and capture the blast event. This will ensure that the event captured is the blast, significantly reducing the influence of other extraneous sources that could affect the measurement.

#### 6.2.5 *Meteorological Parameters*

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.

#### 6.2.7 *Assessment Criteria*

The purpose of the noise, vibration and blasting monitoring program is to track potential impacts of operations over time as quarrying continues, to demonstrate that quarrying is not impacting on residential receptors.

Currently the EPL No 3384 for Blakebrook Quarry has in place existing conditions for noise, blasting and vibration levels which are as follows:

*L6.1 Noise from the premises must not exceed:*

*(a) 35dB(A) LA<sub>eq</sub>(15 minute) during the day (7am to 6pm) Monday to Saturday;*

*Where LA<sub>eq</sub> means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.*

The closest noise sensitive receivers and required noise monitoring locations are indicated in figure 6.1 from the ERM Noise, Vibration and Blasting Sub Plan, which is copied on the following page.

Noise monitoring at locations 1,2,3 and 4 were conducted within 30m of the residential dwelling in the direction of the quarry. Location 6 was conducted at the road frontage.

In April 2016, the owner and permanent resident at Location 9 provided the NSW Department of Planning and Environment a signed letter confirming a private agreement between Blakebrook Quarry and Sensitive Receiver No.9, that they agree to exceedances in noise levels from quarry operations. No noise monitoring was conducted at Location 9.

**Table 2.1 Noise Monitoring Receiver Locations**

<b>Receiver Location</b>	<b>Street Address</b>
1	28 Keerrong Rd Blakebrook
2	166 Keerrong Rd Blakebrook
3	190 Keerrong Rd Blakebrook
4	365 Boerie Creek Road Boerie Creek
6	289 Boerie Creek Rd Boerie Creek

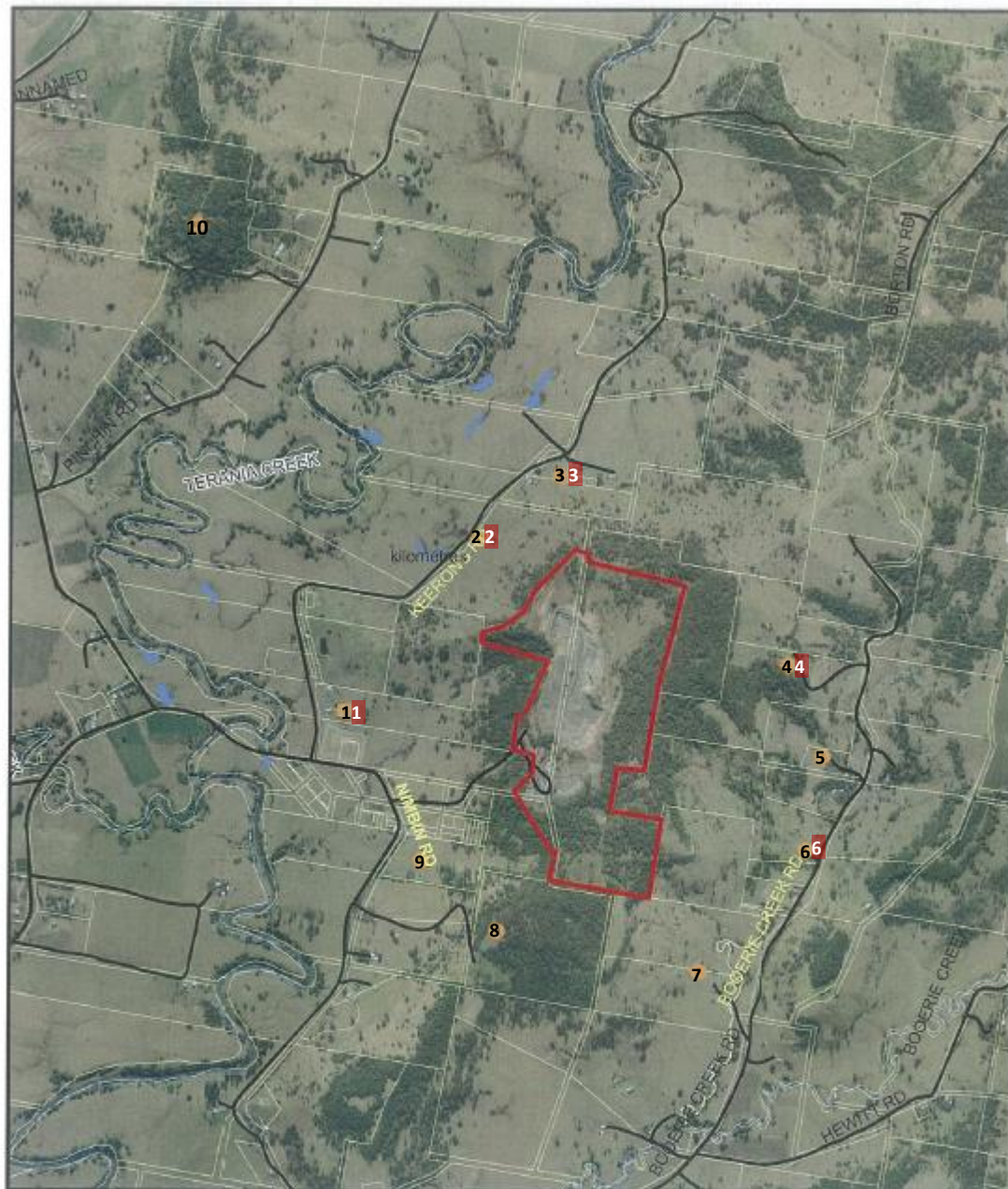
Note:

Some street addresses on Keerrong Road have been changed from the previous assessments due to updated surveying.

Receiver 1 was 122 now 28

Receiver 2 was 126 now 166

Figure 2.1 Noise Monitoring Locations



Client:	Lismore City Council
Project:	Blakebrook Quarry
Drawing No:	0066641pm_GIS11
Date:	02/05/2010
Drawn By:	AM
Reviewed By:	MM
Scale:	Refer to Scale Bar (approximate only)

**Figure 6.1**  
**Noise and Vibration**  
**Sensitive Receptor Locations**

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 PC Box 5711, Port Macquarie, NSW, 2444  
 Telephone +61 2 6584 7155



### 3 MEASUREMENT PROCEDURE AND RESULTS

#### 3.1 Instrumentation

**Table 3.1 Instrumentation for Noise Monitoring**

Instrument	Serial #	Calibration Date
Brüel and Kjær 2250 Sound Level Meter	2449940	October 2016
Brüel and Kjær 2250 Sound Level Meter	3006868	September 2017
Brüel and Kjær Acoustical Calibrator model 4231	2292735	October 2017

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 Brüel and Kjær acoustical calibrator model 4231. No significant system drift occurred over the measurement periods.

The SLMs and calibrator have been checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates. The internal test equipment used is traceable to the National Measurement Laboratory at CSIRO, Lindfield, NSW.

#### 3.2 Measurement Procedures

Measurements were made in general accordance with procedures laid down in:

1. **Australian Standard AS 1055.1-1997:** 'Acoustics - Description and measurement of environmental noise - General procedures';
2. **The NSW Government Industrial Noise Policy (2000) EPA 00/1 (INP).**

The microphone of a B&K 2250 SLM was mounted on a 1.5m high tripod and a Brüel and Kjær outdoor windscreen fitted to the microphone. The SLM was located on a flat area of land above the cliff face where the working equipment was used, to monitor noise levels while measurements were being conducted at the receiver locations (*see Appendix D*). The SLM was set to record continuously for the duration of receiver monitoring with 1 second samples. A sound recording was conducted simultaneously.

The microphone of another B&K 2250 SLM was mounted on a 1.5m high tripod and a Brüel and Kjær outdoor windscreen fitted to the microphone. The SLM was used at the various receiver locations to monitor noise levels while the quarry was operating under full load conditions. The noise monitoring location was within 30m of the residential dwelling in the general direction of the quarry depending on vegetation and cattle in paddocks.

A 15 minute period was recorded at each location with 1 second samples with a simultaneous sound recording.

### 3.3 Weather Conditions

Weather conditions were generally good for acoustic measurements. Observations were taken at each receiver location.

**Table 3.2 Observed Weather Conditions at Receiver Locations**

Weather Conditions at Receiver Locations Nov 2017								
Date	Time	Receiver	Temp	Relative Humidity	Wind	Wind Dir	Cloud	
			°C	%	Speed		Cover	
					(m/s)			
2-Nov	9:05am	4	22	70	Calm		2/8	Scattered high cloud
2-Nov	10:30am	4	24	64	Calm		3/8	Scattered high cloud
7-Nov	8:15am	4	21	80	Calm		7/8	Low Clouds
7-Nov	8:45am	6	22	75	1 - 1.5	SSW	7/8	Low Clouds
7-Nov	9:00am	6	22	75	1 - 2	SSW	7/8	Low Clouds
7-Nov	9:40am	1	23	66	2 - 3.5	SSE	8/8	Low Clouds
9-Nov	8:10am	2	20	60	0 - 1	SE	0/8	
9-Nov	8:50am	3	21	65	0.5 - 1.5	SW	1/8	Scattered high cloud
9-Nov	9:15am	1	22	55	1.5 - 2.5	S	2/8	Scattered high cloud

The meteorological data for Lismore Airport (approximately 7kms to the south) for the monitoring period was downloaded from the Bureau of Meteorology website and is provided in Tables 3.3 and 3.4.

**Table 3.3 Weather Observations at Lismore Airport 07/11/2017**

Lismore Airport Tuesday 07/11/2017					
Date /Time	Temp °C	Rel. Humidity %	Wind		
			Dir.	Speed	
				km/h	m/s
07/10:00am	22.9	65	SSE	26	7.2
07/09:30am	21.6	69	SSE	26	7.2
07/09:00am	21.4	73	SSE	22	6.1
07/08:30am	21.3	81	S	19	5.3
07/08:00am	20.6	82	S	19	5.3



**Table 3.4 Weather Observations at Lismore Airport 09/11/2017**

Lismore Airport Tuesday 09/11/2017					
Date /Time	Temp °C	Rel. Humidity %	Wind		
			Dir.	Speed	
				km/h	m/s
07/10:00am	20.1	65	SW	13	3.6
07/09:30am	18.9	67	SW	17	4.7
07/09:00am	19.1	68	SSW	19	5.3
07/08:30am	17.7	68	SSE	17	4.7
07/08:00am	16.7	70	SSW	15	4.2

### 3.3 Measurement Results

The measurements were conducted over 3 days due to equipment breakdown and inclement weather.

**Table 3.5 Measurement Results**

Summary of Measured Noise Levels at Receivers - 02,07,09 Nov 2017									
Receiver and Measurement #	Date	Start time	Elapsed time	L <sub>AFmax</sub> [dB]	L <sub>Ceq</sub> [dB]	L <sub>Aeq</sub> [dB]	L <sub>Ceq</sub> <sup>-</sup> L <sub>Aeq</sub> [dB]	L <sub>AF10</sub> [dB]	L <sub>AF90</sub> [dB]
R1 M1	07/11/2017	09:39:18 AM	0:15:00	67.6	67.0	49.0	18.0	51.7	43.2
R1 M2	09/11/2017	09:18:38 AM	0:15:00	56.5	57.8	43.2	14.6	45.7	38.0
R2	09/11/2017	08:11:54 AM	0:15:00	61.8	55.8	45.4	10.5	48.9	32.7
R3	09/11/2017	08:46:47 AM	0:15:00	66.6	63.1	44.7	18.4	45.7	34.9
R4 M1	02/11/2017	09:02:11 AM	0:15:00	59.8	48.1	39.5	8.5	42.5	31.2
R4 M2	02/11/2017	10:19:33 AM	0:15:00	51.1	47.9	37.6	10.3	41.4	31.5
R4 M3	07/11/2017	08:14:32 AM	0:15:00	64.7	53.2	44.7	8.5	44.7	34.3
R6 M1	07/11/2017	08:45:35 AM	0:15:00	74.2	52.7	44.5	8.2	45.1	35.5
R6 M2	07/11/2017	09:00:54 AM	0:15:00	66.4	56.9	45.5	11.4	46.4	35.7

Note:

The above results are the ambient noise levels and includes noise from the rural surroundings and quarry noise if audible. No tonal, low frequency or impulsive noise characteristics from the quarry operations were observed at the receiver locations.

**Table 3.6 Noise Observations at Receiver Locations**

<b>Noise Observations at Receiver Locations</b> (All measurements 15 mins)				
<b>Receiver and Measurement #</b>	<b>Date</b>	<b>Start time</b>	<b>Observed Noise Sources</b>	<b>Quarry Noise</b>
R1 M1	07/11/2017	09:39:18 AM	Birds, distant traffic on Nimbin Road, local traffic on Keerrong Rd, dog barking, wind in trees, cattle	Quarry, audible at times – rock crusher – breeze dependant
R1 M2	09/11/2017	09:18:38 AM	Birds, distant traffic on Nimbin Road, local traffic on Keerrong Rd, dog barking, wind in trees	Quarry not audible
R2	09/11/2017	08:11:54 AM	Birds, local traffic on Keerrong Rd, distant cattle, distant overhead aircraft	Quarry just barely audible
R3	09/11/2017	08:46:47 AM	Birds, local traffic on Keerrong Rd, distant overhead aircraft, insects, wind in trees	Quarry just audible occasionally
R4 M1	02/11/2017	09:02:11 AM	Birds, distant overhead aircraft, insects, very distant noise to south from roadworks	Quarry not operating
R4 M2	02/11/2017	10:19:33 AM	Birds, distant overhead aircraft, insects, distant people talking	Quarry not operating
R4 M3	07/11/2017	08:14:32 AM	Birds, distant overhead aircraft, insects, very distant road noise at times	Quarry not audible
R6 M1	07/11/2017	08:45:35 AM	Birds, wind in trees, distant people talking	Quarry not audible
R6 M2	07/11/2017	09:00:54 AM	Birds, local traffic on Booerie Creek Rd, distant dog barking, wind in trees, cattle, distant overhead aircraft	Quarry not audible

## 4 DISCUSSION OF RESULTS

The measurements were undertaken while the quarry was operating under normal operating conditions (see *Appendix D for diagram for location of equipment*). A second noise logger was located above the quarry floor as a reference for quarry crushing operations noise levels.

The measured results in Table 3.5 are from the combined noise of the quarry (if audible) and the ambient noises.

At Receiver 1, a second recording was conducted on the 9<sup>th</sup> as the wind had picked up on the 7<sup>th</sup> and wind in trees noise levels were higher. The background noise levels ( $L_{A90,15min}$ ) were lower on the 9<sup>th</sup> but distant traffic from Nimbin Road was underlying for most of the time. There was audible quarry noise (rock crusher) on the 7<sup>th</sup> with changes in breezes and possibly larger rocks being crushed for several brief periods 10 -15 seconds during the 15 minute monitoring period. It was observed that noise levels were 40 – 45 decibels for these brief periods. The quarry was not audible at other times. It is estimated that the quarry  $L_{Aeq,15 min}$  is below the Project Specific Noise Level of 35 dB(A).

At Receiver 2, quarry noise was just barely audible when no other noises were present. It is estimated that the quarry  $L_{Aeq,15 min}$  is below 33dB(A).

At Receiver 3, quarry noise was just audible occasionally. Observed levels were 35 – 40 dB(A). Quarry noise appeared to be tipping at the overburden stockpile. It is estimated that the quarry  $L_{Aeq,15 min}$  is below 33dB(A).

At Receiver 4, two 15 minute periods were recorded on the 2<sup>nd</sup> when equipment was broken down and the crushing was not operating. The wind conditions were calm and background was 31.2 and 31.5. The quarry was not audible on the 7<sup>th</sup> when the quarry was operating under load conditions. The  $L_{A90,15min}$  had increased approximately 3 decibels to 34.3. It is estimated that the quarry  $L_{Aeq,15 min}$  is below 33dB(A).

At Receiver 6, the quarry was not audible.  $L_{A90,15min}$  was 35.5 and 35.7 due to moving foliage. It is estimated that the quarry  $L_{Aeq,15 min}$  is below 35dB(A).

## 5 SUMMARY

A noise monitoring survey was conducted to assess compliance of quarry operational noise levels at the Northern Rivers Quarry and Asphalt quarry at Blakebrook. Measurements were undertaken with calibrated noise monitoring equipment and conducted in general accordance with procedures laid down in Australian Standard AS 1055.1-1997 and the NSW Industrial Noise Policy.

The Blakebrook Quarry operates under EPL No. 3384. Condition L6.1 stipulates that noise from the premises must not exceed 35dB(A)  $L_{Aeq,15min}$  during the day (7am to 6pm) Monday to Saturday.

Measurements were conducted at 5 receiver locations while the quarry was operating under load conditions. The quarry was not audible at Receiver locations 4 and 6. The quarry was just barely audible at Receiver location 2 and just audible for brief periods at Receiver locations 1 and 3.

The quarry operational noise levels ( $L_{Aeq,15min}$ ) were not able to be accurately assessed at residential receiver monitoring locations as the quarry noise was not audible or just audible for short periods of time.

It is estimated from the recorded  $L_{A90,15min}$  levels and observations that the quarry noise levels are below the Project Specific Noise Level of 35 dB(A)  $L_{eq,15mins}$  at Receiver locations 1, 2, 3, 4 and 6.

Garry Hall



Acoustic Consultant

Ambience Audio Services

## APPENDIX A Definitions of Terms

**Sound pressure level (SPL):** A measurable quantity of the size or amplitude of the pressure fluctuations (sound waves) above and below normal atmospheric pressure. Sound pressure levels are measured in decibels.

**Decibels (dB):** a ratio of energy flows. When used with sound measurement, it is the ratio between a measured quantity and an agreed reference level. The dB scale is logarithmic and uses the threshold of hearing of 20  $\mu\text{Pa}$  (micro pascals) as the reference level. This reference level is defined as 0 dB.

One useful aspect of the decibel scale is that it gives a much better approximation to the human perception of relative loudness than the Pascal scale. This is because the ear reacts to a logarithmic change in level, which corresponds to the decibel scale where 1 dB is the same relative change every on the scale. *Refer Appendix B*

**Tonality:** Noise containing a prominent frequency and characterized by a definite pitch.

**Spectral characteristics:** The frequency content of noise.

**“A” frequency weighting:** The method of frequency weighting the electrical signal within a noise-measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. 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.

**Fast, Slow and Impulse time weightings:** Standardised response 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. Slow helps average out the fluctuations and is used to for better visual indication of the noise source. Environmental assessment standards usually specify the time weighting (**F**, **S**, or **I**) to use.

**$L_{Aeq}$ :** The A-weighted continuous noise level. A widely used noise parameter that calculates a constant level of noise with the same energy content as the varying noise signal being measured. The time in minutes, which the measurement was sampled, is indicated with a following number. e.g.  $L_{Aeq15}$  is a 15 minute sample.

**$L_{AN}$ :** The A-weighted 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  $L_{A90}$  descriptor.

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

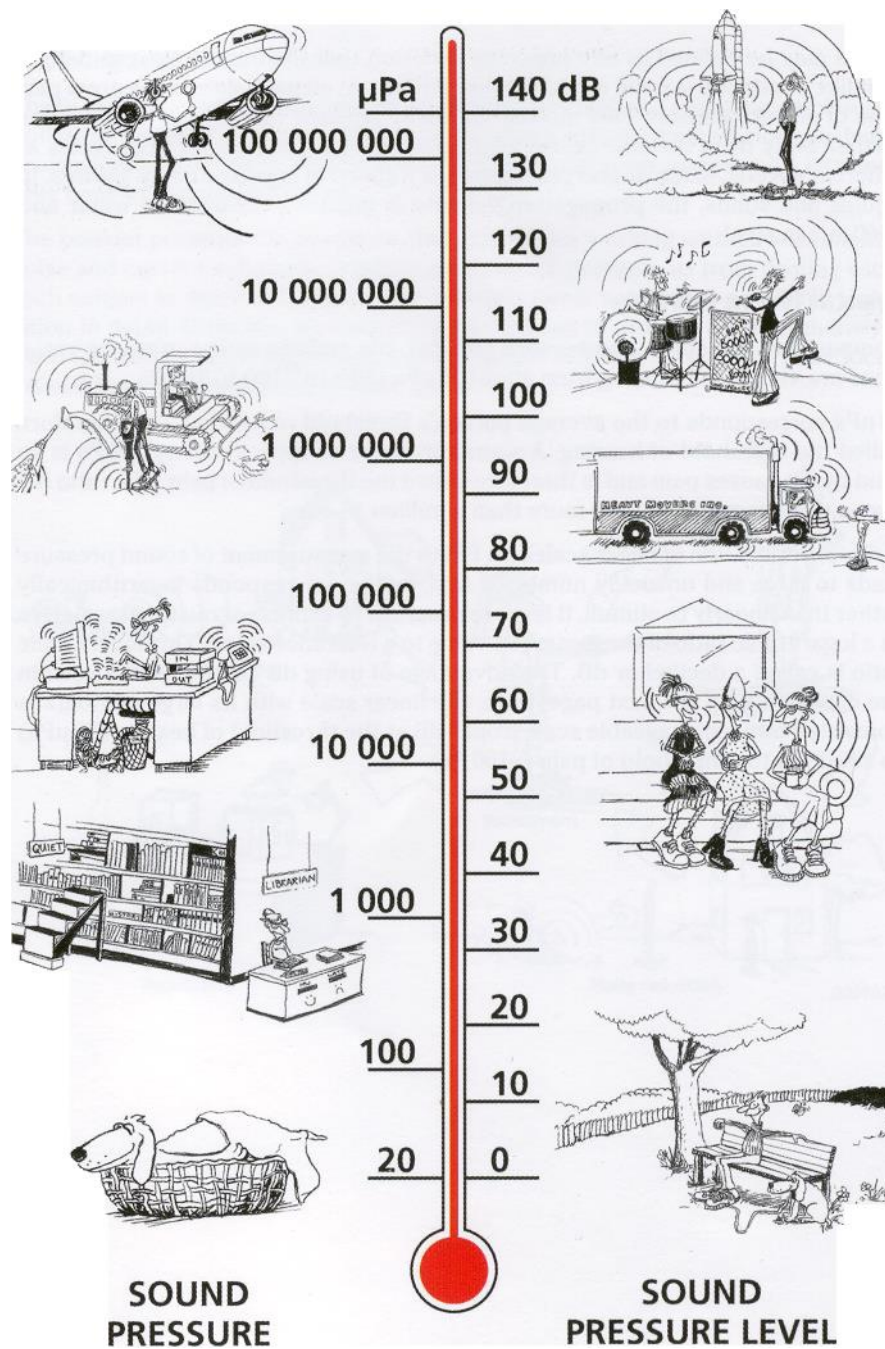
References:

*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

## APPENDIX B Comparison of Sound Pressure Levels



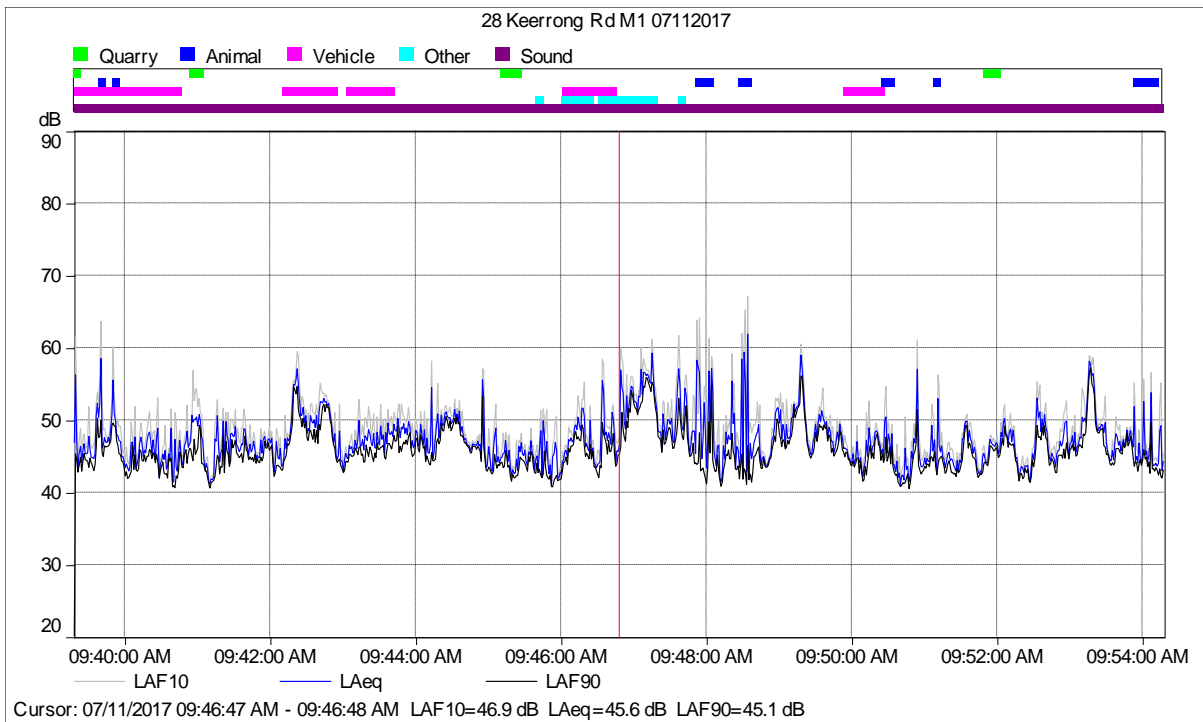
Our hearing covers a wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable.

Reproduced from

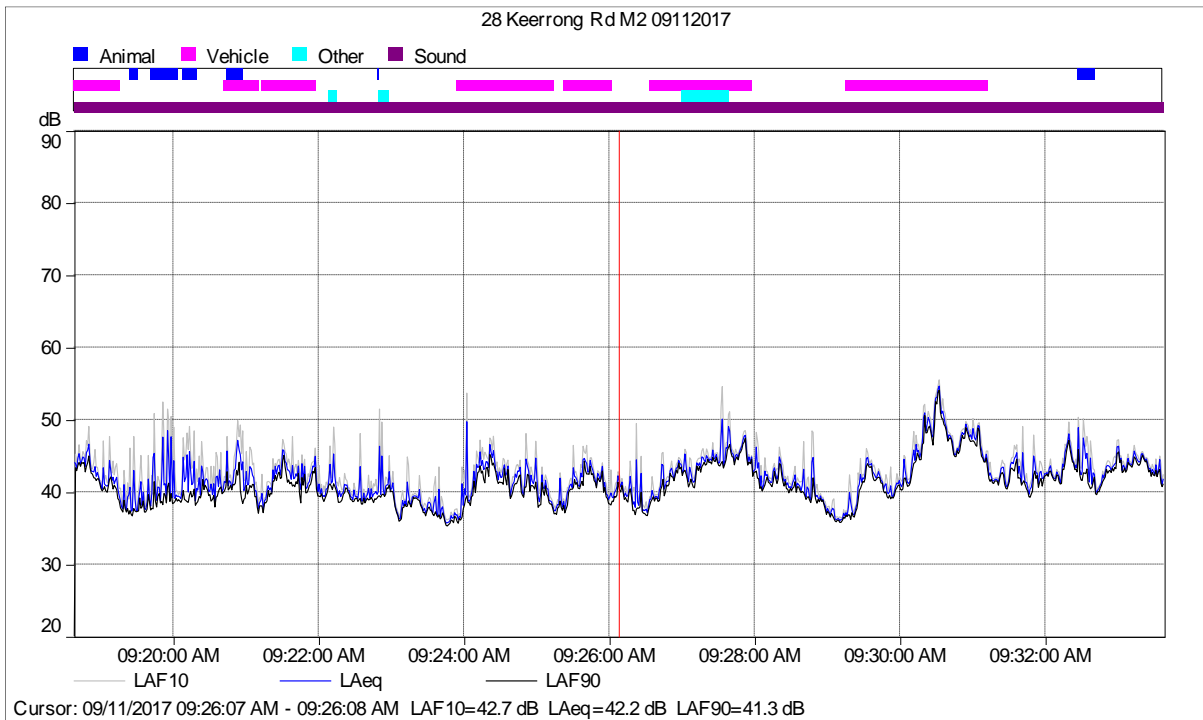
*Environmental Noise* Brüel and Kjær Sound & Vibration Measurements A/S  
2000, 2001

## APPENDIX C Logged Levels at Receiver Locations – Graphs

Graph C.1 Receiver 1 07/11/2017

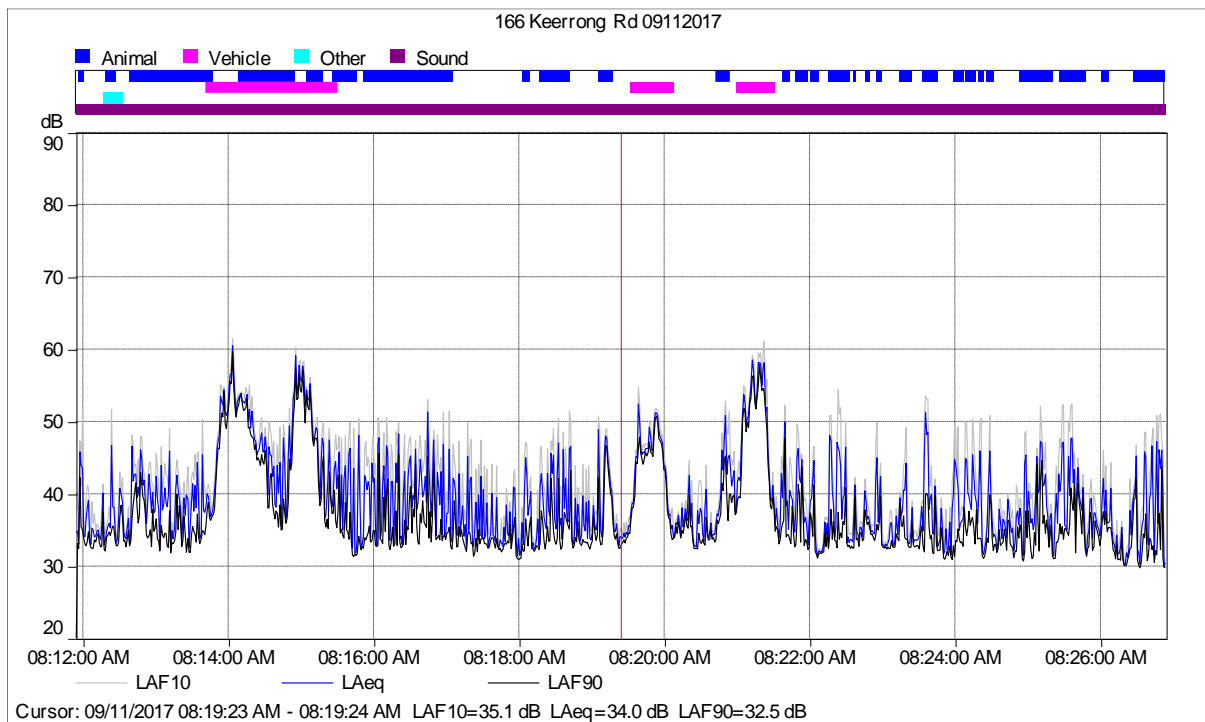


Graph C.2 Receiver 1 09/11/2017

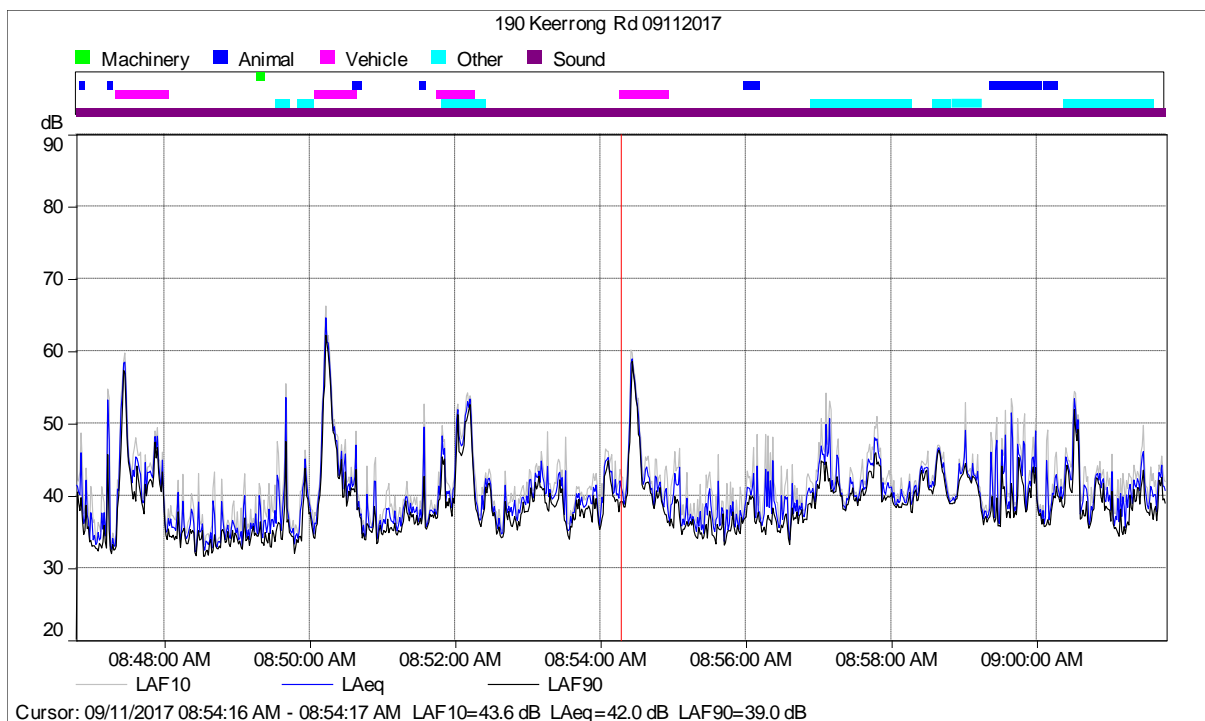




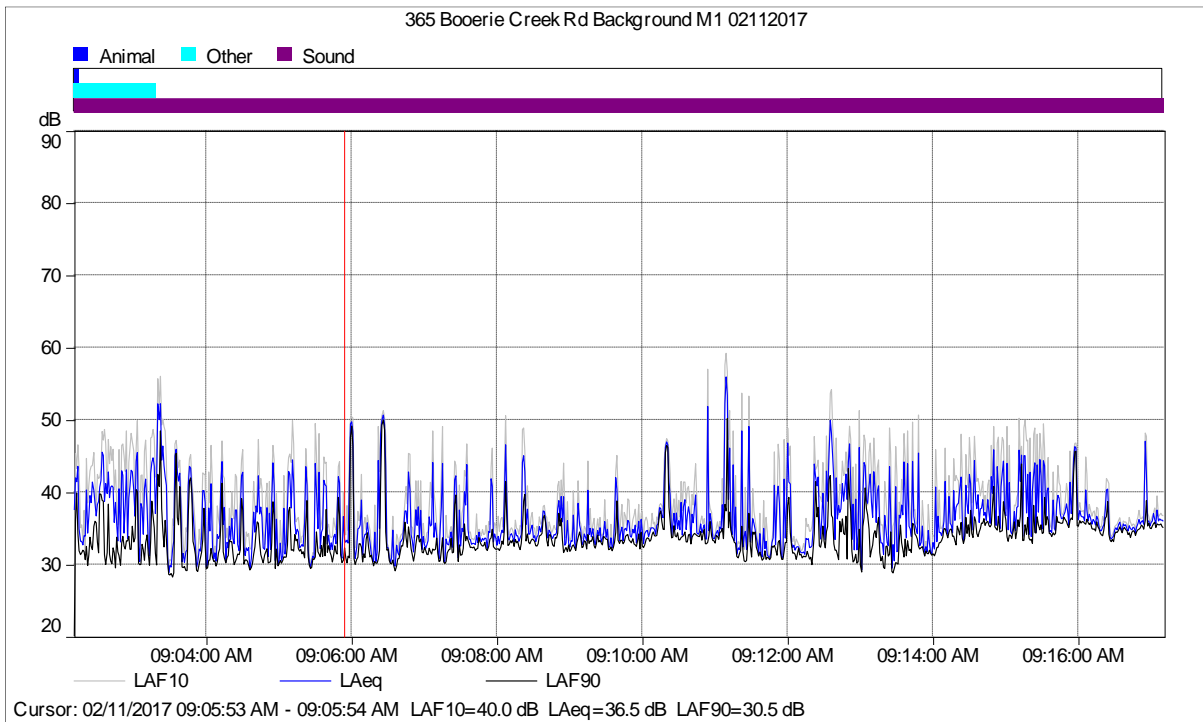
Graph C.3 Receiver 2 09/11/2017



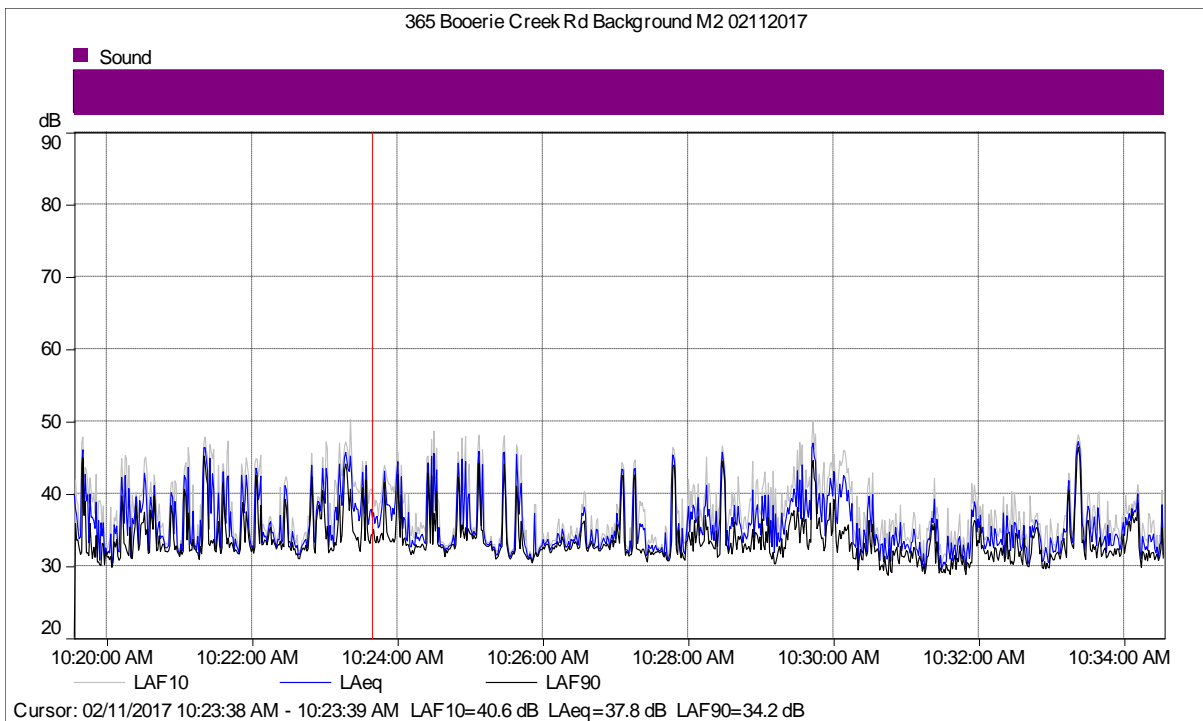
Graph C.4 Receiver 3 09/11/2017



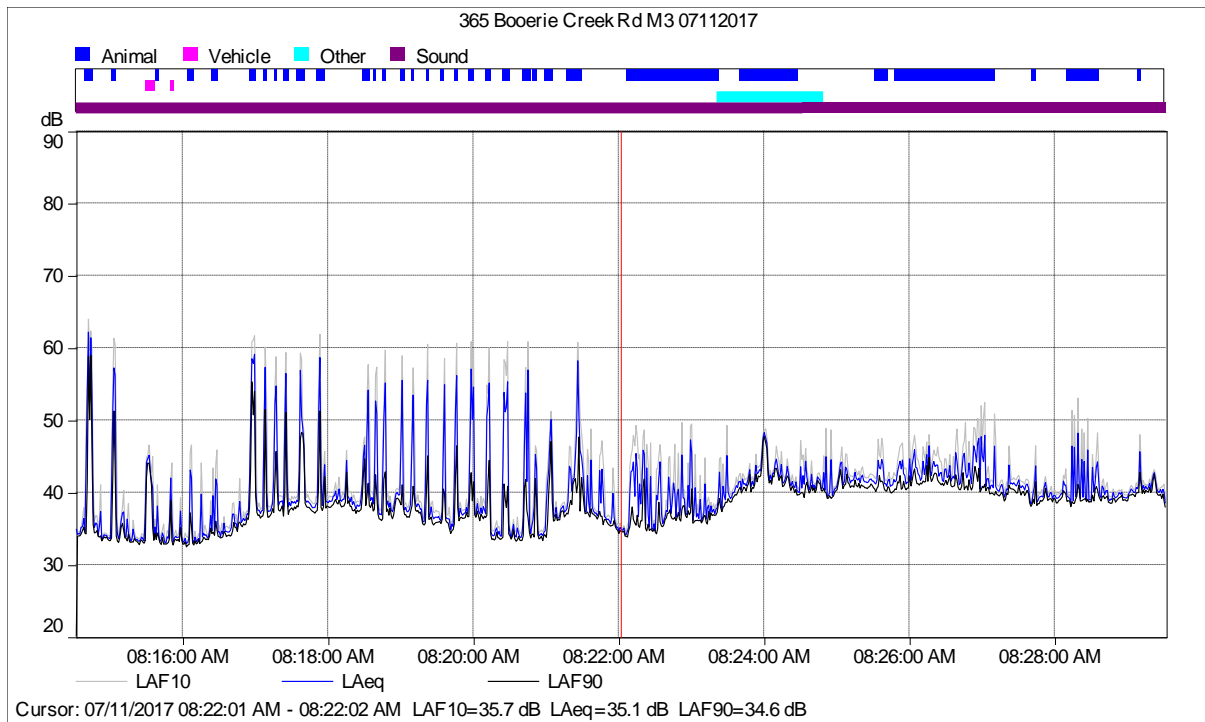
Graph C.5 Receiver 4 02/11/2017 Background – Quarry Not Operating M1



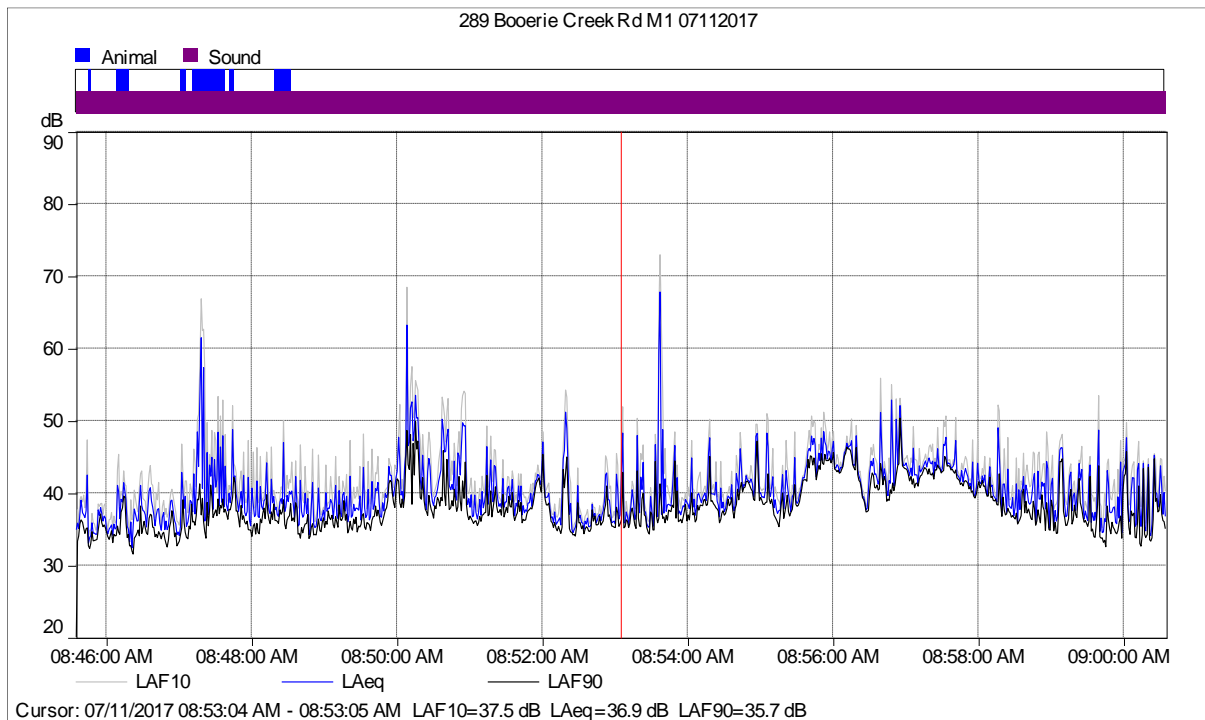
Graph C.6 Receiver 4 02/11/2017 Background – Quarry Not Operating M2



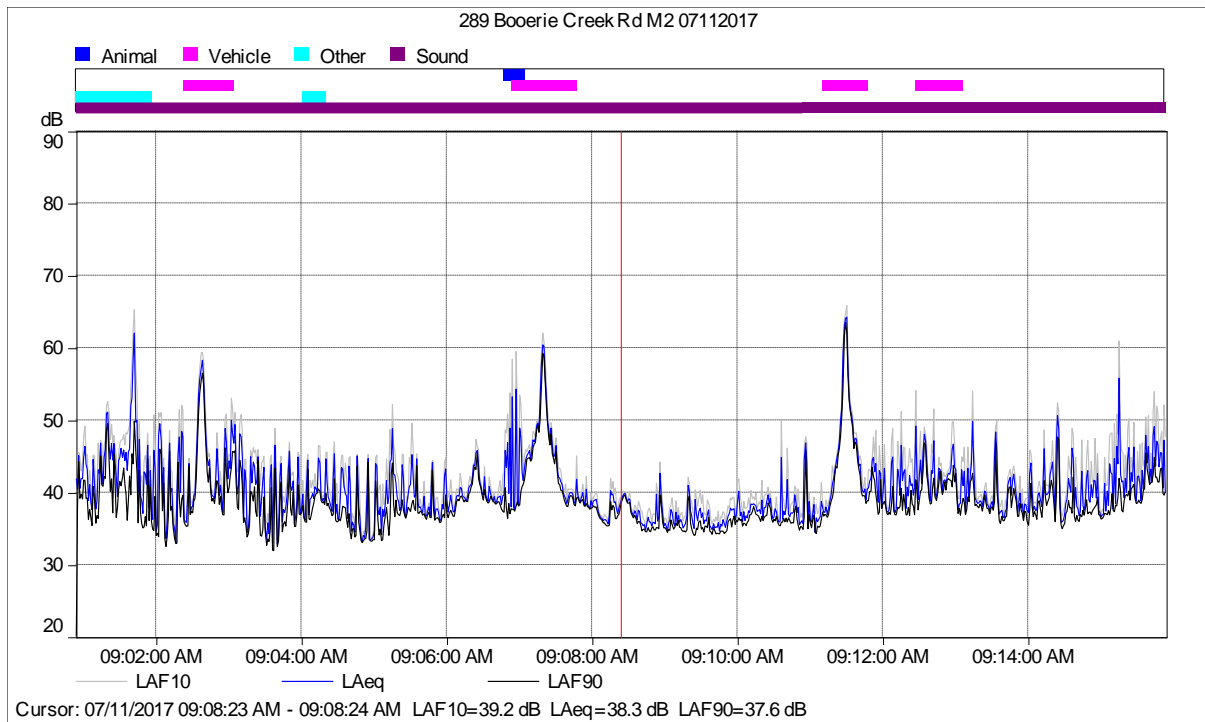
Graph C.7 Receiver 4 07/11/2017



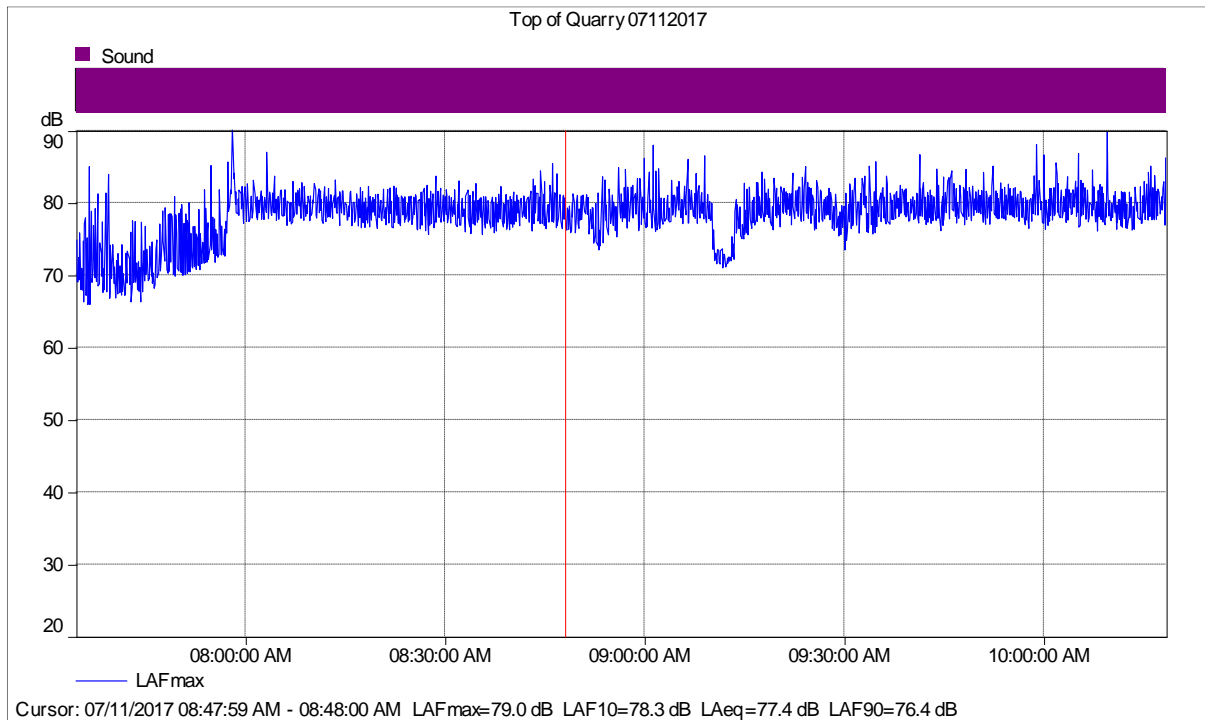
Graph C.8 Receiver 6 07/11/2017 M1



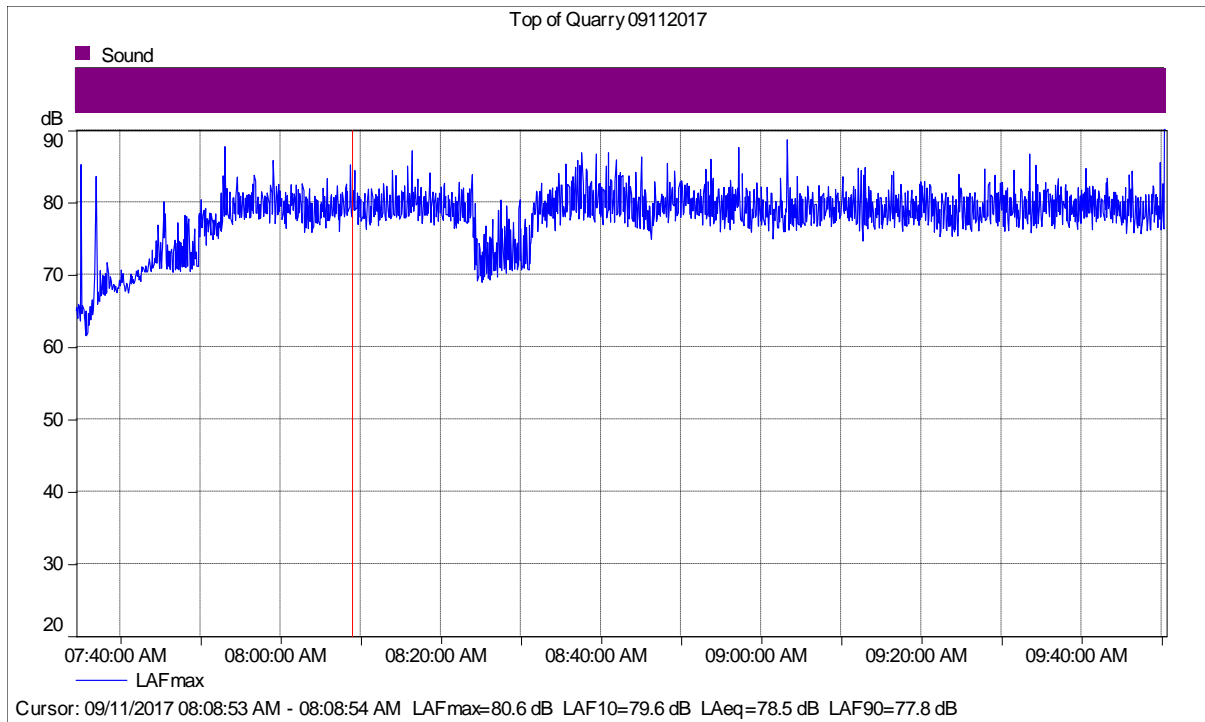
Graph C.9 Receiver 6 07/11/2017 M2



Graph C.10 Measured Noise Levels at Top of Quarry Above Crushing 07/11/2017



Graph C.11 Measured Noise Levels at Top of Quarry Above Crushing 09/11/2017



**Appendix D**  
**Quarry Operations 7<sup>th</sup> and 9<sup>th</sup> November 2017**



Source – Google Earth – Image Date 17/02/2017

Note : Aerial photo not of operations on 7th and 9th of November 2017

## Crushing Operations 07, 09 November 2017



2 jaw crushers

4 screen decks

1 cone crusher

1 VSI crusher

4 excavators

2 dump trucks

2 front end loaders

various haul trucks

## Mobile Asphalt Plant November 2017

