Monthly Noise Monitoring Assessment

Tomingley Gold Mine, February 2017

Prepared for : Tomingley Gold Operations Pty Limited

March 2017

MAC
Muller Acoustic Consulting

Document Information

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Document ID	Status	Date	Prepared	Signed
MAC160270RP8	Final	14 March 2017	Oliver Muller (MAAS)	

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Tomingley Gold Operations Pty Ltd (TGO) to complete a Noise Monitoring Assessment (NMA) for Tomingley Gold Mine ('the mine').

The NMA involved quantifying the noise contribution of the mine by direct attended measurements to determine mining noise emissions so that effective management and controls can be implemented to minimise noise levels within the surrounding community. The monitoring has been conducted in accordance with the TGO Noise Management Plan and in general accordance with Conditions L4.2 to L4.7 of the EPL at six representative receiver locations. It is noted that this assessment has not been completed as part of the annual noise monitoring program to address conditions of the Environmental Protection License (EPL).

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Industrial Noise Policy (INP), 2000;
- Environment Protection Licence EPL 20169 (EPL); and
- Standards Australia AS 1055.1:1997 - Acoustics - Description and measurement of environmental noise - General Procedures.

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

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2 Environmental Protection License Noise Limits

Historic assessments for the mine categorise receivers into Noise Assessment Groups (NAGs). The NAGs were derived based on ambient noise data that controlled receiver RBLs.

Table 1 reproduces the operational and sleep disturbance noise limits for assessed receivers referenced from the EPL that have been adopted for this NMA and are consistent with historic EPL monitoring locations.

Table 1 Noise Limits, dBA

Noise Assessment Group	Receivers	Day	Evening	Night	
		LAeq(15-min)	LAeq(15-min)	LAeq(15-min)	LA1(1-min)
NAG A	R1, R6	36	36	36	45
	R5	37	37	37	45
	R4	36	36	36	45
NAG B	R2	36	36	36	45
NAG C	R3	49	40	40	45
	R29	48	40	40	45
NAG D	R23	43	39	39	46

Note: Refer to figure in Appendix 4 of Project Approval 09-0155 for noise locations. However, these criteria do not apply if the Proponent has an agreement with the relevant owner(s) of these residences / land to generate higher noise levels, and the Proponent has advised the Department of Planning and Infrastructure and EPA in writing of the terms of this agreement.

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3 Methodology

3.1 Locality

TGO is located to the south of the village of Tomingley, NSW. Receivers in the locality surrounding the mine are primarily rural/residential and for consistency the naming conventions for each receiver has been retained from historic noise assessments. The monitoring location with respect to the mine is presented in the locality plan shown in **Figure 1**.

3.2 Assessment Methodology

The attended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055-1997, "Acoustics - Description and Measurement of Environmental Noise" and the EPL. The measurements were carried out using Svantek Type 1, 971 noise analyser from Tuesday 14 February 2017 to Friday 17 February 2017. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2004-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Both evening and night measurements were of 15 minutes in duration at each location over three consecutive dates. Where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis as to calculate the $L_{Aeq(15\text{-}min)}$ mine noise contribution for comparison against the relevant EPL limit.

Prevailing meteorological conditions for the monitoring period were sourced from TGO's meteorological station and analysed in accordance with Appendix E4 of the INP to determine the stability category present at the time of each measured sample. This was undertaken to determine applicability of results in accordance with Condition L4.3 of the EPL. Results obtained during non-prevailing meteorological conditions (ie F Class Stability in conjunction with a 2m/s drainage wind or a G Class Stability) are considered not applicable against the EPL criteria.

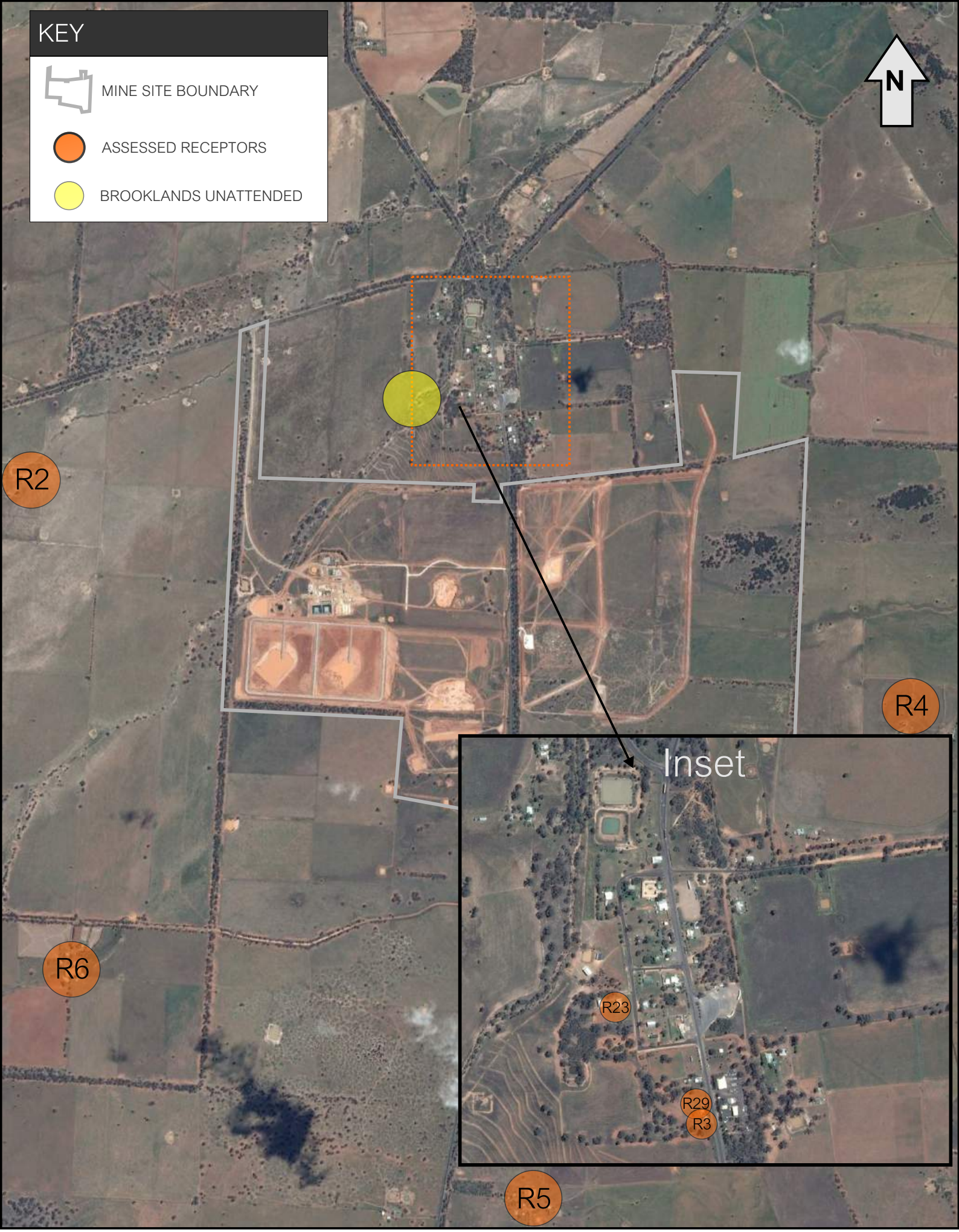

FIGURE 1 - LOCALITY PLAN AND ASSESSMENT LOCATIONS

TOMINGLEY GOLD MINE EPL NOISE MONITORING

REF: MAC160270

0 1000m

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4 Results

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

4.1 Assessment Results - Location R2

The results of the attended noise measurements at location R2 for Tuesday 14 February 2017 to Thursday 16 February 2017 are summarised in **Table 2** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 2 Operator-Attended Noise Survey Results – Location R2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LA_{eq}	LA_{90}			
14/02/2017	21:59	55	28	25	36	Dir: SW 2 m/s Stab Class: E	Insects Highway traffic Livestock
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
14/02/2017	22:15	47	27	25	36	Dir: SW 2 m/s Stab Class: E	Insects Highway traffic Livestock
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
15/02/2017	21:42	57	37	33	36	Dir: SW 1 m/s Stab Class: F	Insects Dog Livestock
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
15/02/2017	22:01	69	55	43	36	Dir: W 2 m/s Stab Class: F	Insects Highway traffic Livestock Dog
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
16/02/2017	20:49	57	37	36	36	Dir: NW 1 m/s Stab Class: D	Insects Highway traffic Livestock
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
16/02/2017	22:00	53	36	34	36	Dir: NW 2 m/s Stab Class: F	Insects Highway traffic Livestock Mine hum
		TGO Site LAeq(15-min) Contribution					33

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.2 Assessment Results - Location R3/R29

The results of the attended noise measurements at location R3/R29 for Tuesday 14 February 2017 to Thursday 16 February 2017 are summarised in **Table 3** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution. It is noted that both locations R3 and R29 are within 10m of each other and therefore have been assessed simultaneously.

Table 3 Operator-Attended Noise Survey Results – Location R3/R29

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
14/02/2017	21:21	88	66	64	40	Dir: SW 2 m/s Stab Class: E	Highway traffic Rock crushing plant Insects
		TGO Site LAeq(15-min) Contribution					40
14/02/2017	23:06	86	65	63	40	Dir: SW 3 m/s Stab Class: D	Highway traffic Insects Livestock
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
15/02/2017	21:00	87	66	64	40	Dir: ESE 1 m/s Stab Class: D	Highway traffic Insects Rock crushing plant
		TGO Site LAeq(15-min) Contribution					45
15/02/2017	22:45	92	67	64	40	Dir: W 2 m/s Stab Class: F	Mine hum Highway traffic Insects Dog
		TGO Site LAeq(15-min) Contribution					38
16/02/2017	20:07	87	68	65	40	Dir: N 1 m/s Stab Class: D	Highway traffic Birds Insects
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
16/02/2017	22:44	88	65	63	40	Dir: N 2 m/s Stab Class: D	Highway traffic Insects
		TGO Site LAeq(15-min) Contribution					TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.3 Assessment Results - Location R4

The results of the attended noise measurements at location R4 for Tuesday 14 February 2017 to Thursday 16 February 2017 are summarised in **Table 4** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 4 Operator-Attended Noise Survey Results – Location R4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
14/02/2017	20:35	56	34	30	36	Dir: SW 2 m/s Stab Class: E	Haul trucks & Tipping Insects Birds
TGO Site LAeq(15-min) Contribution							33
14/02/2017	23:57	71	45	43	36	Dir: N 3 m/s Stab Class: E	Wind in trees
TGO Site LAeq(15-min) Contribution							TGO Inaudible
15/02/2017	20:00	59	37	35	36	Dir: SW 1 m/s Stab Class: E	Haul trucks & Tipping Highway traffic Reversing noise Birds
TGO Site LAeq(15-min) Contribution							29
15/02/2017	23:37	60	30	27	36	Dir: W 2 m/s Stab Class: F	Insects Mine hum
TGO Site LAeq(15-min) Contribution							28
16/02/2017	19:12	65	33	27	36	Dir: NW 2 m/s Stab Class: D	Haul trucks & Tipping Reversing noise Wind in trees
TGO Site LAeq(15-min) Contribution							33
16/02/2017	23:36	58	36	34	36	Dir: NW 2 m/s Stab Class: E	Mine hum Highway traffic Insects
TGO Site LAeq(15-min) Contribution							27

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.4 Assessment Results - Location R5

The results of the attended noise measurements at location R5 for Tuesday 14 February 2017 to Friday 17 February 2017 are summarised in **Table 5** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 5 Operator-Attended Noise Survey Results – Location R5

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
14/02/2017	20:11	80	59	58	37	Dir: SW 3 m/s Stab Class: E	Insects Livestock Highway traffic Dog
TGO Site LAeq(15-min) Contribution							TGO Inaudible
15/02/2017	00:22	78	57	56	37	Dir: N 5 m/s Stab Class: D	Wind in trees Highway traffic
TGO Site LAeq(15-min) Contribution							TGO Inaudible
15/02/2017	19:35	77	60	58	37	Dir: WSW 2 m/s Stab Class: E	Highway traffic Insects Birds
TGO Site LAeq(15-min) Contribution							TGO Inaudible
16/02/2017	00:01	81	60	58	37	Dir: W 2 m/s Stab Class: F	Dog Insects Highway traffic
TGO Site LAeq(15-min) Contribution							TGO Inaudible
16/02/2017	18:19	79	61	59	37	Dir: NW 4 m/s Stab Class: D	Insects Highway traffic
TGO Site LAeq(15-min) Contribution							TGO Inaudible
17/02/2017	00:00	83	61	58	37	Dir: NW 2 m/s Stab Class: F	Highway traffic Insects Mine hum
TGO Site LAeq(15-min) Contribution							28

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.5 Assessment Results - Location R6

The results of the attended noise measurements at location R6 for Tuesday 14 February 2017 to Thursday 16 February 2017 are summarised in **Table 6** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 6 Operator-Attended Noise Survey Results – Location R6

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
14/02/2017	21:02	59	33	29	36	Dir: SW 3 m/s Stab Class: E	Insects Livestock Highway traffic
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
14/02/2017	23:29	70	40	38	36	Dir: SE 4 m/s Stab Class: D	Wind in trees Highway traffic Mine hum Insects
		TGO Site LAeq(15-min) Contribution					33
15/02/2017	20:35	72	37	27	36	Dir: W 1 m/s Stab Class: E	Insects Livestock Highway traffic Motorbike
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
15/02/2017	23:07	53	30	26	36	Dir: W 2 m/s Stab Class: E	Insects Mine hum Highway traffic
		TGO Site LAeq(15-min) Contribution					30
16/02/2017	19:39	60	36	29	36	Dir: NW 2 m/s Stab Class: E	Birds Insects Mine hum
		TGO Site LAeq(15-min) Contribution					28
16/02/2017	23:07	62	35	33	36	Dir: N 3 m/s Stab Class: E	Insects Mine hum
		TGO Site LAeq(15-min) Contribution					28

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.6 Assessment Results - Location R23

The results of the attended noise measurements at location R23 for Tuesday 14 February 2017 to Thursday 16 February 2017 are summarised in **Table 7** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 7 Operator-Attended Noise Survey Results – Location R23

Date	Time (hrs)	Descriptor (dBA re 20 µPa) LAmax	LAeq	LA90	EPL Limit	Meteorology[1]	Description and SPL, dBA
14/02/2017	21:40	54	43	41	39	Dir: SW 1 m/s Stab Class: E	Rock crushing plant Highway traffic Insects
		TGO Site LAeq(15-min) Contribution					36
14/02/2017	22:48	61	45	43	39	Dir: SW 2 m/s Stab Class: D	Rock crushing plant Highway traffic Insects
		TGO Site LAeq(15-min) Contribution					36
15/02/2017	21:18	62	43	42	39	Dir: SW 1 m/s Stab Class: D	Mine hum Highway traffic Insects
		TGO Site LAeq(15-min) Contribution					36
15/02/2017	22:25	66	44	42	39	Dir: SW 2 m/s Stab Class: F	Dog Mine hum Highway traffic
		TGO Site LAeq(15-min) Contribution					36
16/02/2017	20:25	57	42	40	39	Dir: N 1 m/s Stab Class: E	Dog Insects Highway traffic
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
16/02/2017	22:25	52	41	40	39	Dir: NW 2 m/s Stab Class: E	Highway traffic Insects
		TGO Site LAeq(15-min) Contribution					TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

5 Discussion

5.1 Discussion of Results - Location R2

Monitoring between Tuesday 14 February 2017 to Thursday 16 February 2017 identified that TGO noise was audible only during the night period on 16 February 2017. Notwithstanding, the noise contribution from TGO when audible was measured at 33dBA and therefore satisfied the relevant night noise limits of 36dBA. All remaining measurements satisfied the relevant evening and night EPL criteria.

5.2 Discussion of Results - Location R3/R29

Monitoring results for R3/R29 were dominated by highway traffic that were constant during all measurements. TGO emissions were audible on three of six occasions, with one exceedance being attributable to the rock crushing plant, although was masked by ambient highway traffic noise. With the exception of the exceedance on 15 February 2017, all remaining measurements were below relevant EPL criteria. Extraneous sources other than highway traffic were also audible during the three dates with birds, dogs, and insects all audible.

5.3 Discussion of Results - Location R4

Mine noise was audible during all but one attended survey at R4 with all measurements remaining below criteria. The $LA_{eq(15\text{-}min)}$ mine noise contribution ranged between 27dBA to 33dBA with mining emissions such as haul trucks and tipping audible. All measurements satisfied the EPL criteria during the attended measurements throughout the February 2017 survey period. Non-mining noise sources included wind in trees, birds, highway traffic and insects.

5.4 Discussion of Results - Location R5

Mining noise emissions were inaudible during all but one attended noise monitoring survey at this location for the February 2017 monitoring period. Mining noise was audible during the night period on 17 February 2017 with a contribution of 28dBA $LA_{eq(15\text{-}min)}$. Highway traffic was the dominant source at this receiver during the February 2017 assessment period. Other non-mining sources include birds, insects, highway traffic, livestock and a dog.

5.5 Discussion of Results - Location R6

TGO mine hum was audible on four of the six occasions throughout the February 2017 monitoring period at R6. The $LA_{eq(15\text{-}min)}$ mine noise contribution ranged between 28dBA and 33dBA and satisfied the relevant EPL noise limit of 36dBA $LA_{eq(15\text{-}min)}$. TGO noise emissions where inaudible during both evening measurements on 14 February 2017 and 15 February 2017. Non-mining sources included Insects, livestock, highway traffic, birds and wind in trees.

5.6 Discussion of Results - Location R23

Mining noise was audible on four of six occasions at this location. TGO was inaudible during both measurements on the evening and night periods of 16 February 2017 although remained below the relevant EPL criteria. The four occasions where TGO was audible, $LA_{eq(15\text{-}min)}$ mine noise contributions stayed consistent at 36dBA with the rock crushing plant the primary audible source. Non-mining sources included highway traffic, insects, a dog, wind in trees, livestock and local residential noise.

6 Comparison of Attended and Unattended Monitoring Results

To address Condition 6 of Schedule 3 of the Project Approval, a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results has been completed.

The validation compares monthly attended monitoring results against the closest assessed unattended monitoring location. Currently, TGO has one unattended real time monitoring terminal installed at the Brooklands property (nearest to R23). The **Figure 1** locality plan identifies the location of the monitor with respect to the attended monitoring locations. It is noted that the Brooklands unattended monitor is situated 600m west of the attended noise monitoring location R23, therefore, background (LA90) noise levels are significantly lower due to offset distance to highway traffic.

A comparison of mine noise contributions between attended and unattended noise monitoring demonstrates a general consistency between attended and unattended results. It was noted that wind and insect noise influenced measured noise levels for this assessment period with mine noise remaining below criteria and was generally inaudible throughout the February 2017 assessment period. Furthermore, for February 2017, results remained below the relevant criteria for both attended and unattended locations.

Table 8 provides a summary comparison of results between the attended and unattended noise surveys for R23.

Table 8 Comparison of Attended and Unattended Results – R23								
Assessment Type	Time (hrs)	Descriptor (dBA re 20 µPa)			Criteria	Mine Noise Contribution	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90				
14 February 2017								
Attended	21:40	54	43	41	39	36	Dir: SW 1 m/s Stab Class: E	Rock Crushing Highway traffic Insects
Unattended	21:30	59	40	37	39	35		Mine hum Highway traffic Insects
Attended	22:48	61	45	43	39	36	Dir: SW 2 m/s Stab Class: D	Rock Crushing Highway traffic Insects
Unattended	22:45	57	41	34	39	34		Mine hum Highway traffic Insects
15 February 2017								
Attended	21:18	62	43	42	39	36	Dir: SW 1 m/s Stab Class: D	Mine hum Highway traffic Insects
Unattended	21:15	54	39	33	39	32		Mine hum Highway traffic Insects
Attended	22:25	66	44	42	39	36	Dir: SW 2 m/s Stab Class: F	Dog Mine hum Highway traffic
Unattended	22:15	56	42	35	39	35		Mine hum Highway traffic Insects
16 February 2017								
Attended	20:25	57	42	40	39	inaudible	Dir: N 1 m/s Stab Class: E	Dog Insects Highway traffic
Unattended	20:15	48	37	26	39	inaudible		Dog Insects Highway traffic
Attended	22:25	52	41	40	39	inaudible	Dir: NW 2 m/s Stab Class: E	Highway traffic Insects
Unattended	22:15	53	40	33	39	inaudible		Highway traffic Insects

7 Conclusion

MAC has completed a noise monitoring assessment on behalf of Tomingley Gold Operations (TGO). The assessment was completed to provide monthly monitoring data so that TGO can actively quantify and manage site noise emissions.

Attended monitoring for three consecutive dates, from 14 February 2017 to 17 February 2017, has identified that noise emissions generated by TGO exceeded limits on one occasion at R3 during the evening period on the 15 February 2017. Notwithstanding, TGO were identified to generally comply with relevant statutory noise limits specified in EPL conditions at all other assessed locations

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Appendix A - Glossary of Terms

Several technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Terms

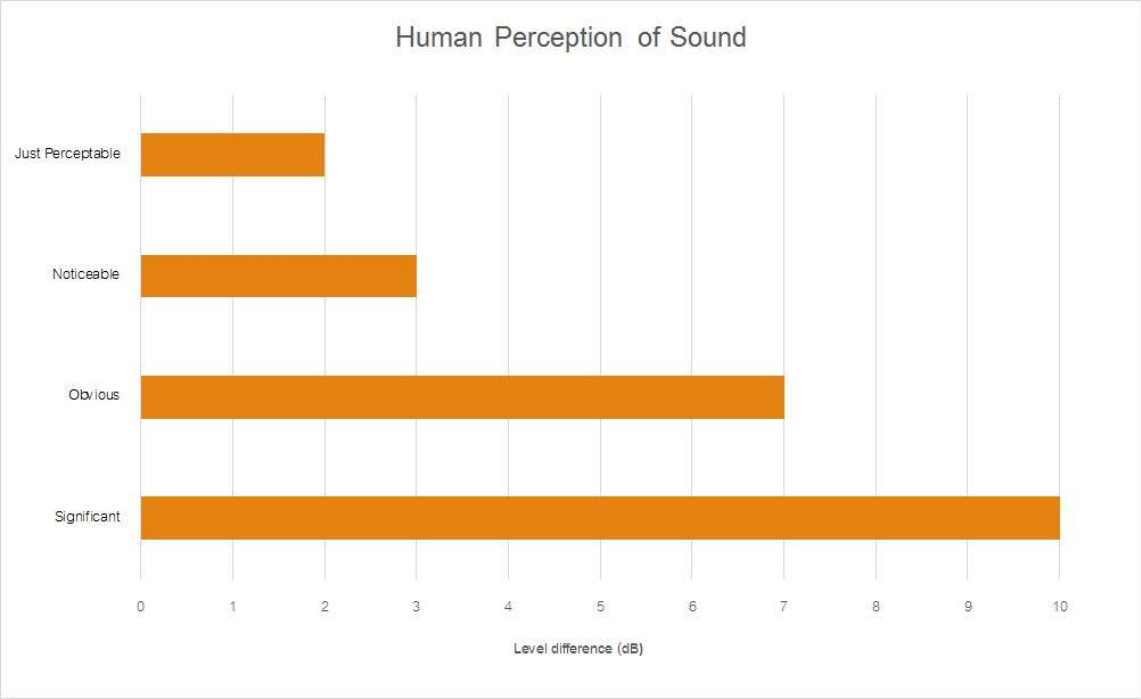
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (SWL)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

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

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

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

Figure A1 – Human Perception of Sound



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