Monthly Noise Monitoring Assessment

Tomingley Gold Mine, January 2017

Prepared for : Tomingley Gold Operations Pty Limited

January 2017

MAC
Muller Acoustic Consulting

Document Information

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Document ID	Status	Date	Prepared	Signed
MAC160270RP7	Final	15 February 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 Sunday 22 January 2017 to Wednesday 25 January 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.

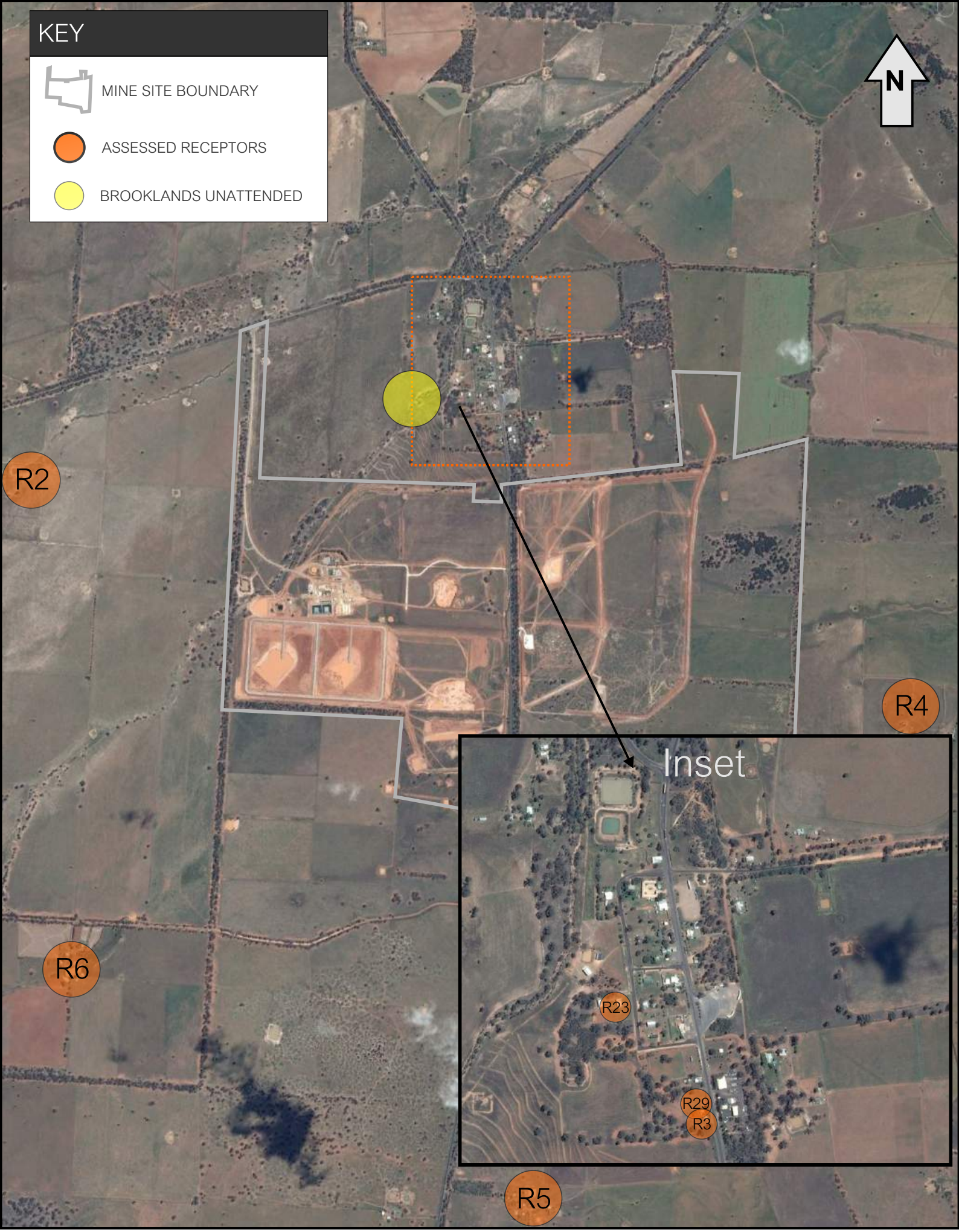

FIGURE 1 - LOCALITY PLAN AND ASSESSMENT LOCATIONS

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 Sunday 22 January 2017 to Tuesday 24 January 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}			
22/1/2017	21:58	78	46	41	36	Dir: E 4 m/s Stab Class: E	Insects and livestock Wind Local residential noise
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
22/1/2017	22:14	70	43	38	36	Dir: E 3 m/s Stab Class: E	Insects Wind Highway traffic
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
23/1/2017	21:42	60	38	36	36	Dir: N 4 m/s Stab Class: D	Insects and livestock Highway traffic Mine hum
		TGO Site LAeq(15-min) Contribution					30
23/1/2017	22:00	64	39	35	36	Dir: NE 3 m/s Stab Class: D	Local residential noise Insects and livestock Mine hum
		TGO Site LAeq(15-min) Contribution					30
24/1/2017	20:23	74	46	43	36	Dir: S 1 m/s Stab Class: E	Local residential noise Insects and livestock Mine hum
		TGO Site LAeq(15-min) Contribution					28
24/1/2017	22:00	58	39	38	36	Dir: S 2 m/s Stab Class: D	Insects and livestock Mine hum Local residential noise
		TGO Site LAeq(15-min) Contribution					36

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 Sunday 22 January 2017 to Tuesday 24 January 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			
22/1/2017	21:24	85	63	61	40	Dir: E 3 m/s Stab Class: D	Highway traffic Dog Insects
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
23/1/2017	00:35	84	58	55	40	Dir: E 6 m/s Stab Class: D	Highway traffic Insects
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
23/1/2017	21:00	84	62	60	40	Dir: N 4 m/s Stab Class: D	Highway traffic Insects Mine hum Local residential noise
		TGO Site LAeq(15-min) Contribution					34
23/1/2017	22:53	87	66	64	40	Dir: NE 3 m/s Stab Class: E	Highway traffic Insects
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
24/1/2017	19:30	83	62	59	40	Dir: S 3 m/s Stab Class: D	Highway traffic Mine hum Birds
		TGO Site LAeq(15-min) Contribution					32
24/1/2017	22:44	84	61	60	40	Dir: S 2 m/s Stab Class: D	Insects Mine hum Highway traffic Aircraft
		TGO Site LAeq(15-min) Contribution					36

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 Sunday 22 January 2017 to Tuesday 24 January 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			
22/1/2017	20:34	59	38	36	36	Dir: E 2 m/s Stab Class: E	Birds Livestock Dog Wind in trees
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
22/1/2017	23:49	68	37	34	36	Dir: E 4 m/s Stab Class: D	Wind in grass Insects
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
23/1/2017	20:11	64	38	34	36	Dir: N 3 m/s Stab Class: D	Haul trucks Dog Birds Highway traffic
		TGO Site LAeq(15-min) Contribution					32
23/1/2017	23:43	59	42	39	36	Dir: NW 3 m/s Stab Class: D	Mine hum and tipping Wind in grass Insects Highway traffic Rain may affect results
		TGO Site LAeq(15-min) Contribution					34
24/1/2017	18:29	74	48	45	36	Dir: S 3 m/s Stab Class: D	Local residential noise Wind in trees Car Birds
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
24/1/2017	23:54	48	45	41	36	Dir: S 1 m/s Stab Class: E	Highway traffic Insects Mine hum
		TGO Site LAeq(15-min) Contribution					33

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 Sunday 22 January 2017 to Wednesday 25 January 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			
22/1/2017	20:07	79	61	59	37	Dir: E 3 m/s Stab Class: E	Birds and Insects Highway traffic Local residential noise Livestock
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/1/2017	00:15	77	56	55	37	Dir: E 5 m/s Stab Class: D	Insects Wind in trees Highway traffic
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/1/2017	19:46	81	63	61	37	Dir: N 4 m/s Stab Class: D	Wind in trees Highway traffic Insects and birds
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/1/2017	23:59	82	61	59	37	Dir: NW 7 m/s Stab Class: D	Highway traffic Wind in trees Rain may affect results
TGO Site LAeq(15-min) Contribution							TGO Inaudible
24/1/2017	18:04	80	63	61	37	Dir: S 6 m/s Stab Class: D	Highway traffic Birds and Insects Wind in trees
TGO Site LAeq(15-min) Contribution							TGO Inaudible
25/1/2017	00:04	85	59	55	37	Dir: S 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.

4.5 Assessment Results - Location R6

The results of the attended noise measurements at location R6 for Sunday 22 January 2017 to Tuesday 24 January 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			
22/1/2017	21:02	75	43	39	36	Dir: E 2 m/s Stab Class: E	Insects Mine hum Highway traffic Rock crusher
		TGO Site LAeq(15-min) Contribution					36
22/1/2017	23:20	71	44	43	36	Dir: E 3 m/s Stab Class: E	Insects Wind Rock crusher
		TGO Site LAeq(15-min) Contribution					36
23/1/2017	20:39	52	39	38	36	Dir: N 3 m/s Stab Class: D	Insects Wind Mine hum Local residential noise
		TGO Site LAeq(15-min) Contribution					35
23/1/2017	23:15	57	45	44	36	Dir: N 3 m/s Stab Class: E	Insects Mine hum Tipping
		TGO Site LAeq(15-min) Contribution					36
24/1/2017	19:01	68	45	42	36	Dir: S 4 m/s Stab Class: D	Birds and insects Highway traffic Local residential noise Wind in trees
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
24/1/2017	23:08	60	42	41	36	Dir: S 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.

4.6 Assessment Results - Location R23

The results of the attended noise measurements at location R23 for Sunday 22 January 2017 to Tuesday 24 January 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
22/1/2017	21:41	72	43	38	36	Dir: E 4 m/s Stab Class: D	Dog Highway traffic Insects
TGO Site LAeq(15-min) Contribution							TGO Inaudible
22/1/2017	22:36	61	44	42	36	Dir: E 4 m/s Stab Class: D	Dog Highway traffic
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/1/2017	21:18	67	47	45	36	Dir: N 2 m/s Stab Class: D	Livestock Dog Insects
TGO Site LAeq(15-min) Contribution							TGO Inaudible
23/1/2017	22:35	59	46	45	36	Dir: SW 1 m/s Stab Class: F	Highway traffic Insects Dog
TGO Site LAeq(15-min) Contribution							TGO Inaudible
24/1/2017	19:47	72	52	46	36	Dir: S 3 m/s Stab Class: D	Mine hum Highway traffic Birds and Insects Local residential noise
TGO Site LAeq(15-min) Contribution							36
24/1/2017	22:25	52	43	42	36	Dir: S 2 m/s Stab Class: D	Insects Highway traffic Mine hum Dog
TGO Site LAeq(15-min) Contribution							32

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

5 Discussion

5.1 Discussion of Results – Location R2

Monitoring between Sunday 22 January 2017 to Wednesday 25 January 2017 identified that TGO noise was audible on both 23 January 2017 and 24 January 2017 during the January 2017 measurements. Notwithstanding, the noise contribution from TGO when audible was measured between 30dBA to 36dBA and therefore satisfied the relevant evening and night noise limits of 36dBA $LA_{eq(15min)}$ for all measurements. TGO was inaudible on 22 January 2017.

5.2 Discussion of Results – Location R3/R29

Monitoring results for R3/R29 were dominated by highway traffic that were constantly audible during all measurements. TGO emissions were audible on three of six occasions. This occurred during the evening period on Monday 23 January 2017 and both the evening and night periods on 24 January 2017 with the contribution measured between 32dBA and 36dBA. This remained below the criteria of 40dBA $LA_{eq(15min)}$. Extraneous sources other than highway traffic were also audible during the three dates with local residential noise, birds, dogs, aircrafts and insects all audible.

5.3 Discussion of Results – Location R4

Mine noise was audible during three of six attended surveys at R4 with all measurements remaining below criteria. The $LA_{eq(15\text{-}min)}$ mine noise contribution ranged between 32dBA to 34dBA with mining emissions such as haul trucks and tipping being audible. All measurements satisfied the EPL criteria during the attended measurements throughout the January 2017 survey period. Non-mining noise sources included wind in trees, birds, highway traffic, insects, a dog and livestock.

5.4 Discussion of Results – Location R5

Mining noise emissions were inaudible during all attended noise monitoring surveys at this location during the this period. Highway traffic noise was the dominant source at this receiver during the January 2017 assessment period on most occasions. Other non-mining sources include birds, insects, highway traffic, livestock and a dog.

5.5 Discussion of Results – Location R6

TGO was audible on four of the six occasions throughout the January 2017 monitoring period at R6 as mine hum and tipping was audible. When audible, $LA_{eq(15\text{-}min)}$ mine noise contribution ranged between 35dBA and 36dBA which satisfied the relevant EPL noise limit of 36dBA $LA_{eq(15\text{-}min)}$. TGO noise emissions where inaudible during both evening and night measurements on 24 January 2017. Non-mining sources included insects, birds and wind in trees.

5.6 Discussion of Results – Location R23

Mining noise was audible on two occasions at this location both during the evening and night periods of 24 January 2017 measurements, with no exceedances of the EPL criteria. The two occasions where TGO was audible, the $LA_{eq(15\text{-}min)}$ mine noise contribution ranged between 32dBA and 36dBA. TGO was inaudible on 22 January 2017 and 23 January 2017. 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 methodology adopted to achieve this has compared monthly attended monitoring results for 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 monitoring is situated 600m east of the attended noise monitoring location R23, therefore, background (LA90) noise levels are significantly lower due to offset distance to highway traffic. Notwithstanding, the TGO mine noise contribution has been the key indicator in validating noise levels for this assessment.

A comparison of mine noise contributions between attended and unattended noise monitoring demonstrates a general consistency between attended and unattended results, although it was noted that wind and insect noise influenced measured noise levels for this assessment period with mine noise remaining generally inaudible throughout the January 2017 assessment period. Furthermore, results identify that for the January 2017, results remained below the relevant criteria for both attended and unattended locations. Therefore, the unattended monitoring systems are considered an appropriate tool for managing noise emissions from TGO.

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				
22 January 2017								
Attended	21:41	72	43	38	36	inaudible	Dir: E 4 m/s Stab Class: D	Dog Highway traffic Insects
Unattended	21:45	56	41	34	36	inaudible		Highway traffic Insects
Attended	22:36	61	44	42	36	inaudible	Dir: E 4 m/s Stab Class: D	Dog Highway traffic
Unattended	22:45	57	40	33	36	inaudible		Highway traffic
23 January 2017								
Attended	21:18	67	47	45	36	inaudible	Dir: N 2 m/s Stab Class: D	Livestock Dog Insects
Unattended	21:15	56	43	36	36	inaudible		Insects
Attended	22:35	59	46	45	36	inaudible	Dir: SW 1 m/s Stab Class: F	Highway traffic Insects Dog

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				
Unattended	22:30	51	39	31	36	inaudible		Wind
24 January 2017								
Attended	19:47	72	52	46	36	36	Dir: S 3 m/s Stab Class: D	Mine hum Highway traffic Birds and Insects Local residential noise
Unattended	19:45	52	37	31	36	30		Mine hum Highway traffic Wind
Attended	22:25	52	43	42	36	32	Dir: S 2 m/s Stab Class: D	Insects Highway traffic Mine hum Dog
Unattended	22:30	51	39	34	36	34		Highway traffic Mine hum

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7 Conclusion

MAC has completed a noise monitoring assessment on behalf of Tomingley Gold Operations. 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 days, from 22 January 2017 to 25 January 2017, has identified that noise emissions generated by TGO comply with relevant statutory noise limits specified in EPL conditions at all assessed locations.

Furthermore, a comparisons of results between the attended and unattended noise surveys for R23 identified that mine noise emissions remained below relevant criteria for both positions.

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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

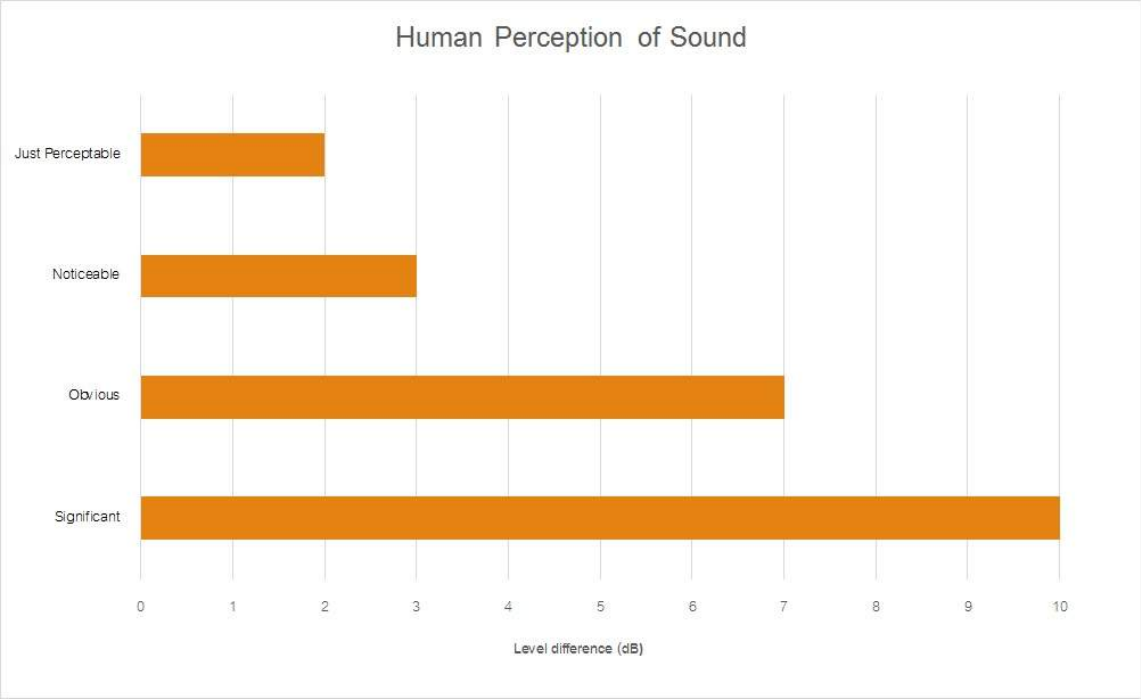
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for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