Noise Monitoring Assessment

Dargues Gold Mine
Majors Creek, NSW
Quarter Ending September 2023

Prepared for: Aurelia Metals Ltd
September 2023
MAC201092-01RP15

Muller Acoustic Consulting

Document Information

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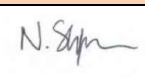
MAC201092-01RP15	12 September 2023	Nicholas Shipman		Oliver Muller	

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Aurelia Metals Ltd to complete a quarterly Noise Monitoring Assessment (NMA) for Dargues Gold Mine, Majors Creek, NSW (the mine).

The monitoring has been conducted in accordance with Condition L2 of the Environmental Protection Licence (EPL) #20095, and in accordance with the site's Noise Management Plan (NMP) 20170123, at six representative monitoring locations. This assessment has been undertaken during Quarter 3, 2023 on Wednesday 6 September 2023 and Thursday 7 September 2023 and forms part of the noise monitoring program to address relevant conditions.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- NSW Environment Protection Authority (EPA), Environment Protection Licence EPL #20095 (EPL);
- NSW Environment Protection Authority (EPA's), Approved Methods for the measurement and analysis of environmental noise in NSW, 2022;
- Standards Australia AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures;
- Dargues Gold Mine Noise Management Plan (NMP) 20170123; and
- Dargues Gold Mine Project Approval, 10_0054.

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

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2 Noise Criteria

2.1 Operational Noise Criteria

Section L2 of the project's EPL (EPL #20095) outlines the applicable operational noise criteria for all privately owned residential receivers surrounding the mine. The criteria outlined in the EPL is reproduced below:

L2.1 Noise from the premises must not exceed the sound pressure level (noise) limits presented in the Table below. Note that the limits apply to the operation of the project and represent the sound pressure level (noise) contribution, at the nominated receiver locations in the table.

Table 1 summaries the applicable noise criteria at the five monitoring locations in accordance with the sites EPL and NMP.

Table 1 Noise Monitoring Program

Monitoring Location	Noise Criteria, dBA $LA_{eq(15min)}$			Noise Criteria, dB $LA_{1(1min)}$
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	Night (10pm to 7am)
At any residence	35	35	35	45
Majors Creek State Conservation Area (when in use by any person)	35	35	35	45

L2.2 For the purpose of Noise Limit Conditions above:

'Day' is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays;

'Evening' is defined as the period from 6pm to 10pm on any day; and

'Night' is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and Public Holidays.

L2.3 The noise emission limits identified in the table above apply under meteorological conditions of:

a) Wind speeds up to 3 m/s at 10m above ground level; or

b) temperature inversion conditions of up to 3 °C/100m and wind speeds up to 2 m/s at 10m above ground level .

L2.4 For the purpose of the Condition L4.3:

a) The meteorological data to be used for determining meteorological conditions is the data recorded by the meteorological weather station established at the premises for the purposes of this Environment Protection Licence ("Point 59" as outlined in Weather Monitoring conditions below); and

b) Stability category temperature inversion conditions are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the New South Wales Industrial Noise Policy (EPA 2000).

L2.5 Determining Compliance

To determine compliance:

a) with the Leq(15 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located:

i) approximately on the property boundary, where any dwelling is situated 30 meters or less from the property boundary closest to the premises; or

ii) within 30 meters of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30 meters from the property boundary closest to the premises; or, where applicable

iii) within approximately 50 meters of the boundary of a National Park, Nature Reserve or State Conservation Area.

b) with the LA1(1 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located within 1 meter of a dwelling façade.

c) with the noise limits in the Noise Limits table, the noise measurement equipment must be located:

i) at the most affected point at a location where there is no dwelling at the location; or

ii) at the most affected point within an area at a location prescribed by part (a) or part (b) of this condition.

L2.6 For the purposes of determining the noise generated at the premises the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

L2.7A breach of this license will still occur where noise generated from the premises in excess of the appropriate limit is measured: i) at a location other than an area prescribed in part (a) and part (b) of Condition L4.5; and/or ii) at a point other than the most affected point at a location.

MAC Technical Note: For sleep disturbance, the $L_{A1(1\ minute)}$ descriptor is meant to represent a maximum noise level measured under 'fast' time response. DEC will accept analysis based on either $L_{A1(1\ minute)}$ or $L_{A(max)}$.

2.2 Road Noise Criteria

Section 2.2.2 of the NSW Road Noise Policy specifies noise criteria for principal haulage routes applicable to off-site traffic from the mine and are reproduced in **Table 2**.

Table 2 Traffic Noise Impact Assessment Criteria dB(A)

Road	Assessment Criteria - dBA	
	Day (7am to 10pm)	Night (10pm to 7am)
Majors Creek Road, Araluen Road, Captains Flat Road, Coghill Street and Wallace Street	60dBA $L_{Aeq(15hour)}$	55dBA $L_{Aeq(9hour)}$

Note: The noise generated by the project is to be measured in accordance with the relevant procedures in the NSW Road Noise Policy.

Section 8.7 of the Noise Management Plan regarding the traffic noise monitoring is reproduced below:

> *During the initial stages of the Project and annually thereafter, the Company would undertake a traffic noise monitoring program at 600 Majors Creek Road, the closest residence to Majors Creek Road, between the Project Site and the intersection with Araluen Road.*

The traffic noise monitoring assessment has been completed during Quarter 1, 2023 and therefore is not included in this assessment.

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3 Methodology

All attended noise surveys for this assessment were conducted in general accordance with the procedures described in Standards Australia AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the EPL.

The acoustic instrumentation used carries appropriate and current NATA (or manufacturer) calibration certificates with records of all calibrations maintained by MAC as per Approved Methods for the measurement and analysis of environmental noise in NSW (EPA, 2022) and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

3.1 Operator Attended Noise Measurement Methodology

The locality surrounding the mine is primarily rural/residential. Operator attended noise monitoring was undertaken at five representative receivers outlined in the mine's NMP and are presented in **Table 3**.

Table 3 Receiver Location[1]

Monitoring Location	Resident Identifier	Coordinates (GDA94-MGA55)	
		Easting	Northing
NM1	R29	748148	6061931
NM2	R108	747454	6062651
NM3	R20	748672	6061250
NM5	R27	748998	6061467
NM6	R34	751242	6064950
NM7[2]	R88	748187	6060143

Note 1: As per the Mine's NMP.

Note 2: Extra measurement not included in the Mine's NMP.

The receiver locations and unattended real-time noise monitor location are presented in **Figure 1.**

Attended measurements were carried out using a Svantek Type 1, 971 noise analyser on Wednesday 6 September 2023 and Thursday 7 September 2023. Where possible throughout each survey the operator quantified the contribution of any significant noise sources. It is noted that an extra measurement was completed during the morning shoulder period at Location R88 to address noise related concerns.

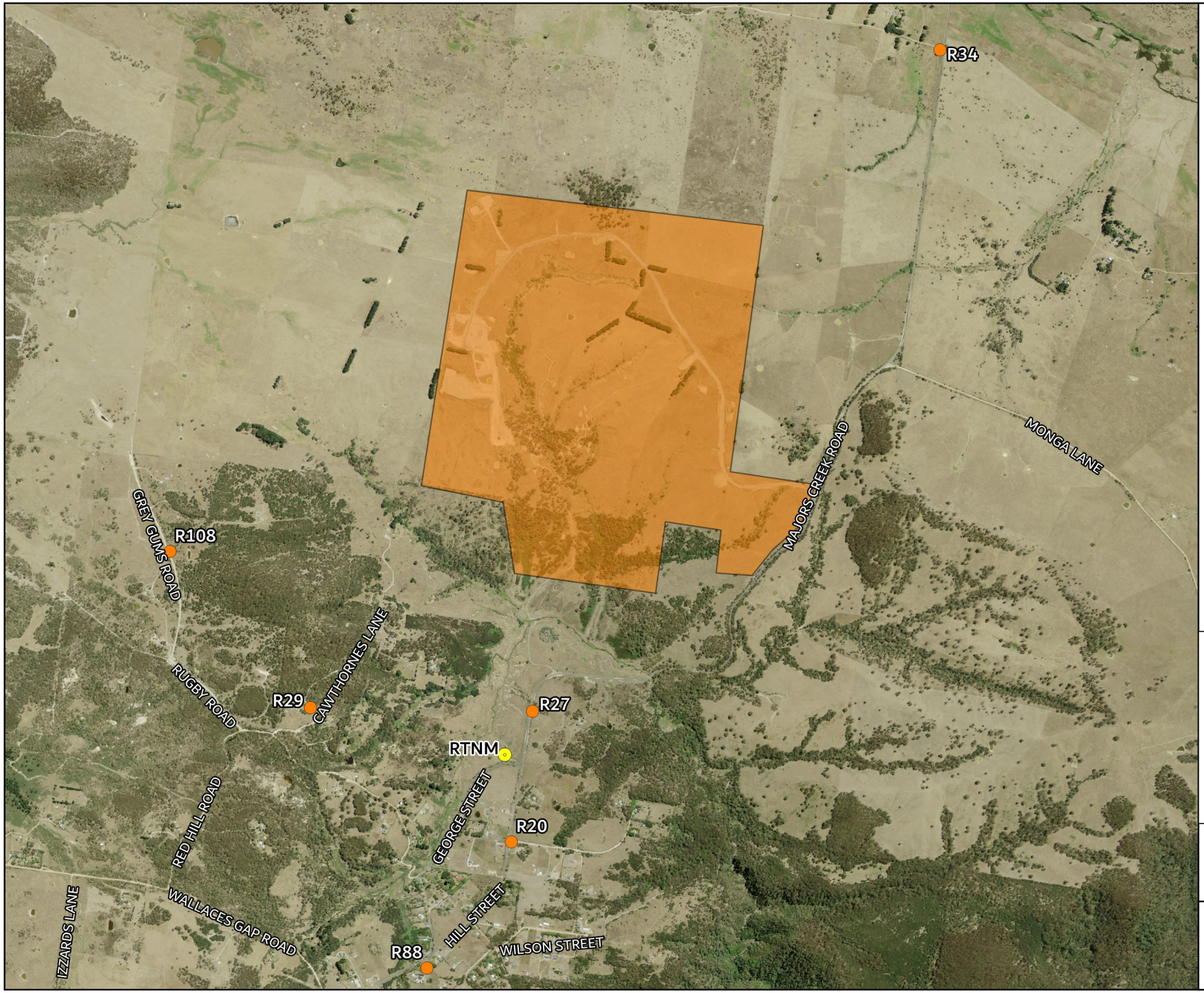

FIGURE 1

LOCALITY PLAN

MAC201092-01

Dargues Gold Mine

KEY

- Project Boundary
- Attended Monitoring Location
- Real-Time Noise Monitoring Terminal

0 200 400 600 800 1,000 m

N

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4 Results

4.1 Meteorological Conditions

Weather data for the noise assessment was sourced from DGMs on-site meteorological station as well as operator measured conditions on site of EPL nominated receiver locations. The data was used to determine prevailing meteorological conditions at the time of the attended measurements, which are presented in **Table 4**. It is noted that as per Condition L2.3 of the EPL, noise emission limits are applicable for the monitoring period.

Table 4 Prevailing Meteorological Conditions

Time & Date	DGM on-site Meteorological Station		Operator Measured Weather Monitoring Location (1.8m AGL)	
	Wind Direction	Wind (m/s)	Wind Direction	Wind (m/s)
16:15 06/09/2023	NNW	2.2	W	2.0
16:36 06/09/2023	NW	2.4	W	1.5
16:53 06/09/2023	NNW	1.9	W	1.5
17:16 06/09/2023	NW	1.8	W	0.6
18:10 06/09/2023	NNW	1.0	W	0.6
18:30 06/09/2023	NNW	0.9	NW	0.3
18:52 06/09/2023	NNW	1.1	NW	0.4
19:10 06/09/2023	NNW	1.0	NW	0.1
19:32 06/09/2023	N	1.0	NW	0.1
04:50 06/09/2023	N	1.7	W	0.1
05:11 07/09/2023	N	1.5	W	0.6
05:29 07/09/2023	N	1.6	W	0.1
05:48 07/09/2023	N	1.5	W	0.1
06:09 07/09/2023	N	1.5	W	0.1
06:28 07/09/2023	N	1.3	W	0.1
07:00 07/09/2023	N	1.4	W	0.1

4.2 Assessment Results – Location R20

The results of the attended noise measurements at location R20 for the September 2023 survey are summarised in **Table 5** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

Table 5 Operator-Attended Noise Survey Results – Location R20

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}			
06/09/2023 (Day)	16:53	78	52	36	35	WD: NNW WS: 1.9m/s Stab Class: D	Birds 32-58 Dog bark 34-36 Traffic 32-78 Wind in trees 32-39 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<26
Dargues Site L_{Amax} Contribution							<26
06/09/2023 (Evening)	18:52	76	53	29	35	WD: NNW WS: 1.1m/s Stab Class: D	Traffic 26-76 Insects 26-34 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20
07/09/2023 (Night)	05:29	79	57	33	35	WD: N WS: 1.6m/s Stab Class: E	Birds 26-64 Rooster 34-50 Traffic 30-79 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<23
Dargues Site L_{Amax} Contribution							<23

Note 1: Meteorology data obtained from DGM onsite weather station.

4.3 Assessment Results – Location R27

The results of the attended noise measurements at location R27 for the September 2023 survey are summarised in **Table 6** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

Table 6 Operator-Attended Noise Survey Results – Location R27

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}			
06/09/2023 (Day)	16:36	78	56	30	35	WD: NW WS: 2.4m/s Stab Class: D	Traffic 27-78 Wind in vegetation 27-48 Birds 36-56 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20
06/09/2023 (Evening)	19:10	75	50	23	35	WD: NNW WS: 1.0m/s Stab Class: D	Traffic 21-75 Insects 21-25 Dog bark 26-38 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20
07/09/2023 (Night)	05:11	76	52	27	35	WD: N WS: 1.5m/s Stab Class: E	Birds 24-63 Wind in vegetation <24 Traffic 30-76 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20

Note 1: Meteorology data obtained from DGM onsite weather station.

4.4 Assessment Results – Location R29

The results of the attended noise measurements at location R29 for the September 2023 survey are summarised in **Table 7** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

Table 7 Operator-Attended Noise Survey Results – Location R29

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}			
06/09/2023 (Day)	17:16	67	46	26	35	WD: NW WS: 1.8m/s Stab Class: D	Dog bark 56-62 Birds 22-58 Wind in vegetation <22 Traffic 36-67 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20
06/09/2023 (Evening)	18:30	72	46	32	35	WD: NNW WS: 0.9m/s Stab Class: D	Insects 23-43 Traffic 23-72 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<22
Dargues Site L_{Amax} Contribution							<22
07/09/2023 (Night)	06:09	63	41	30	35	WD: N WS: 1.5m/s Stab Class: E	Birds 28-63 Traffic 28-37 Wind in vegetation <28 DGM hum <27
Dargues Site $L_{Aeq(15min)}$ Contribution							<27
Dargues Site L_{Amax} Contribution							<27

Note 1: Meteorology data obtained from DGM onsite weather station.

4.5 Assessment Results – Location R34

The results of the attended noise measurements at location R34 for the September 2023 survey are summarised in **Table 8** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

Table 8 Operator-Attended Noise Survey Results – Location R34

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}			
06/09/2023 (Day)	16:15	80	59	41	35	WD: NNW WS: 2.2m/s Stab Class: D	Wind in trees 37-60 Birds 37-56 Traffic 37-80 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<31
Dargues Site L_{Amax} Contribution							<31
06/09/2023 (Evening)	19:32	81	58	41	35	WD: N WS: 1.0m/s Stab Class: E	Insects 37-41 Traffic 37-81 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<31
Dargues Site L_{Amax} Contribution							<31
07/09/2023 (Night)	04:50	52	37	26	35	WD: N WS: 1.7m/s Stab Class: D	Insects 19-30 Birds 30-52 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20

Note 1: Meteorology data obtained from DGM onsite weather station.

4.6 Assessment Results – Location R108

The results of the attended noise measurements at location R108 for the September 2023 survey are summarised in **Table 9** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

Table 9 Operator-Attended Noise Survey Results – Location R108

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}			
07/09/2023 (Day)	07:00	63	39	27	35	WD: N WS: 1.4m/s Stab Class: D	Birds 23-63 Livestock 23-38 Local residential noise 26-32 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20
06/09/2023 (Evening)	18:10	80	50	28	35	WD: NNW WS: 1.0m/s Stab Class: D	Insects 23-36 Livestock 23-45 Dog bark 30-36 Traffic 24-80 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20
07/09/2023 (Night)	06:28	56	36	27	35	WD: N WS: 1.3m/s Stab Class: E	Livestock 30-52 Birds 24-56 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<20
Dargues Site L_{Amax} Contribution							<20

Note 1: Meteorology data obtained from DGM onsite weather station.

4.7 Assessment Results – (Additional) Location R88

The results of the attended noise measurements at location R88 for the September 2023 survey are summarised in **Table 10** with the relevant EPL limits, the calculated mining noise contribution and prevailing meteorological conditions at the time of each measurement.

Table 10 Operator-Attended Noise Survey Results – (Additional) Location R88

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}			
07/09/2023 (Night)	05:48	71	49	33	35	WD: N WS: 1.5m/s Stab Class: E	Birds 27-68 Traffic 30-71 DGM inaudible
Dargues Site $L_{Aeq(15min)}$ Contribution							<23
Dargues Site L_{Amax} Contribution							<23

Note 1: Meteorology data obtained from DGM onsite weather station.

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5 Discussion

5.1 Discussion of Results – Location R20

Operator attended measurement results at R20, on Wednesday 6 September 2023 and Thursday 7 September 2023 identified that DGM emissions remained inaudible during the measurement period, therefore remained below relevant criteria. Generally, birds, dogs barking, traffic, wind in trees, insects and roosters were audible throughout all three monitoring periods.

In summary, the noise contribution from the mine satisfied the relevant noise criteria for the attended measurements on Wednesday 6 September 2023 and Thursday 7 September 2023.

5.2 Discussion of Results – Location R27

Operator attended measurement results at R27, on Wednesday 6 September 2023 and Thursday 7 September 2023 identified that DGM emissions remained inaudible during the measurement period, therefore remained below relevant criteria. Generally, traffic, wind in vegetation, birds, insects and dogs barking were audible throughout all three monitoring periods.

In summary, the noise contribution from the mine satisfied the relevant noise criteria for the attended measurements on Wednesday 6 September 2023 and Thursday 7 September 2023.

5.3 Discussion of Results – Location R29

Operator attended measurement results at R29, on Wednesday 6 September 2023 and Thursday 7 September 2023 identified that DGM hum was audible on one occasion during the night period. DGM hum was measured below 27dBA and therefore remained below relevant criteria. Generally, dogs barking, birds, wind in vegetation, traffic and insects were audible throughout all three monitoring periods.

In summary, the noise contribution from the mine satisfied the relevant noise criteria for the attended measurements on Wednesday 6 September 2023 and Thursday 7 September 2023.

5.4 Discussion of Results – Location R34

Operator attended measurement results at R34, on Wednesday 6 September 2023 and Thursday 7 September 2023 identified that DGM activities remained inaudible during the assessment periods and therefore remained below relevant criteria. Generally, wind in trees, birds, traffic and insects were audible sources throughout all three monitoring periods.

In summary, the noise contribution from the mine satisfied the relevant noise criteria for the attended measurements on Wednesday 6 September 2023 and Thursday 7 September 2023.

5.5 Discussion of Results – Location R108

Operator attended measurement results at R108, on Wednesday 6 September 2023 and Thursday 7 September 2023 identified that DGM activities remained inaudible during the assessment periods and therefore remained below relevant criteria. Generally, birds, livestock, local residential noise, insects, dogs barking, and traffic were audible sources throughout all three monitoring periods.

In summary, the noise contribution from the mine satisfied the relevant noise criteria for the attended measurements on Wednesday 6 September 2023 and Thursday 7 September 2023.

5.6 Discussion of Results – (Additional) Location R88

Operator attended measurement results at R88, on Thursday 7 September 2023 identified that DGM activities remained inaudible during the morning shoulder period and therefore remained below relevant criteria. Generally, birds and traffic were audible sources throughout the monitoring period.

In summary, the location R88 is an additional measurement and does not form part of the EPL quarterly monitoring. The noise contribution from the mine satisfied the relevant noise criteria for the attended measurement on Thursday 7 September 2023.

6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Aurelia Metals Ltd at Dargues Gold Mine, Majors Creek, NSW. The assessment was completed to quantify site noise emissions against relevant noise criteria pertaining to mine operations during Quarter 3, 2023.

Attended monitoring on Wednesday 6 September 2023 and Thursday 7 September 2023 has identified that operational noise emissions generated by the mine comply with relevant $LA_{eq(15min)}$ and LA_{max} noise limits at all assessed receivers.

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Appendix A – Glossary of Terms

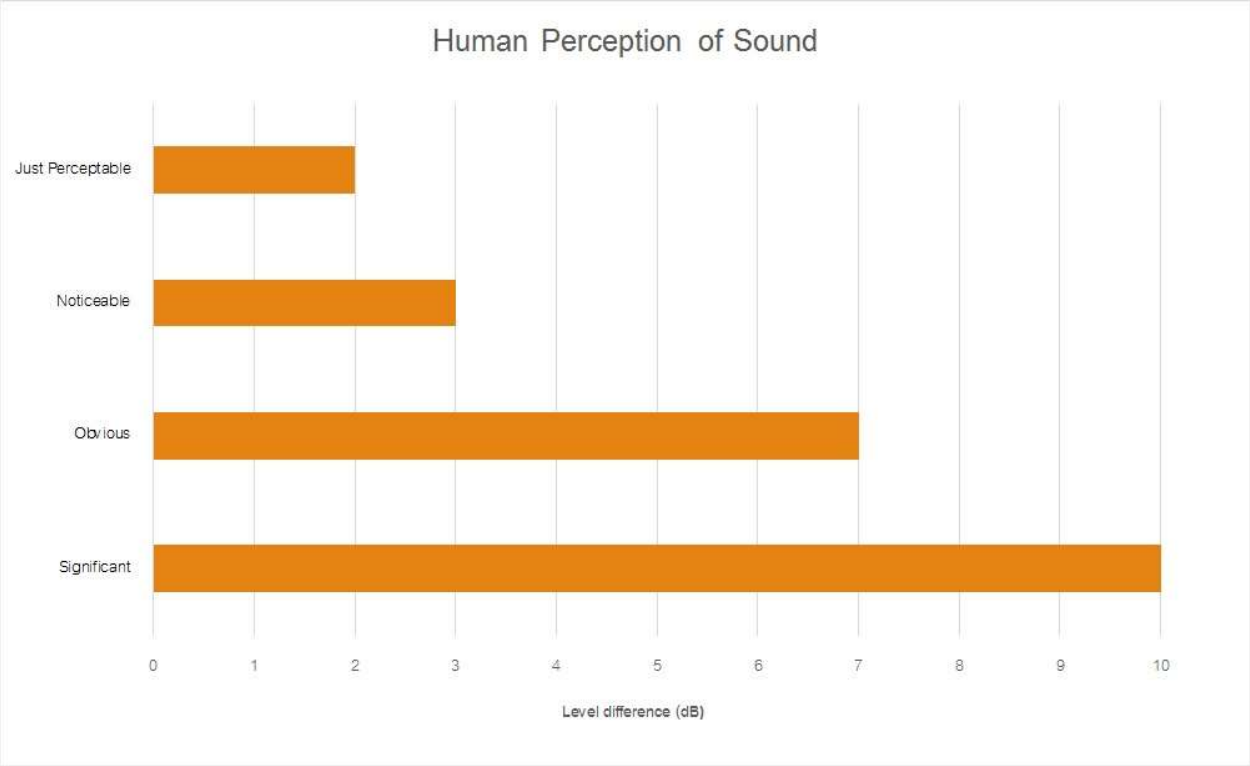
Table A1 provides a number of technical terms have been used in this report.

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 NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
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), dB(L)	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 (LW)	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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