Appendix Q

Noise Assessment (GHD 2020a)

Moora Minesite Noise Control Plan 2021

RedOHMS P17096:RPT001 Moora Noise Survey 2018 Final

Appendix Q1: North Kiaka Approvals and Supporting Studies Noise Assessment GHD 2020

Simcoa Operations Pty Ltd

North Kiaka Approvals and Supporting Studies

Noise Assessment

August 2020

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List of abbreviated terms

Acronym	Description
GHD	GHD Pty Ltd
NSR	Noise sensitive receptor
ROM	Run of mine
Simcoa	Simcoa Operations Pty Ltd
SOP	Small open pit
tpa	Tonnes per annum
ANL	Assigned noise level

1. Introduction

1.1 Project description

Simcoa Operations Pty Ltd (Simcoa) operates the Moora Quartzite Mine in Moora, approximately 150 km north of Perth and the Kemerton Silicon Smelter located within the Kemerton Strategic Industrial Area approximately 17 km north-east of Bunbury. The Moora Quartzite Mine produces high purity quartzite. Simcoa have proposed to develop a new greenfield quartzite mine at North Kiaka (the Project), which is expected to extend the life of the mine operation by 30-40 years.

1.2 Purpose of report

The purpose of this report is to carry out a noise assessment to support the environmental approvals for the proposed North Kiaka mine expansion.

1.3 Scope of works

The assessment will include the following scope of works:

- Carry out noise monitoring to establish baseline noise levels from the existing mine.
- Identify key environmental noise catchment areas and noise sensitive receptors (NSRs).
- Review project specific noise goals with consideration to local guidelines, including:
  - *Environmental Protection (Noise) Regulations 1997*
  - Existing licencing conditions in relation to noise and vibration criteria.
- Identify likely principal noise and vibration sources during construction and operations.
- Carry out a desktop assessment for construction noise and vibration emissions associated with the Project.
- Carry out a desktop assessment for noise impacts from road transport routes and road traffic.
- Undertake one noise modelling scenario using the noise modelling software, to predict sound pressure levels associated with operation of the Project.

1.4 Approach

The approach adopted for the assessment of noise and vibration impacts from the Project is summarised in the following points. Each point is described in detail in the subsequent sections of the report.

- Outline key components of the proposed North Kiaka Mine (Section 2).
- Identify noise and vibration criteria under the legal framework and standards and identify noise sensitive receptors (Section 3).
- Characterise the existing noise environment through noise monitoring data (Section 4).
- Identify anticipated construction and operational noise and vibration sources associated with the existing Moora Quartzite Mine and the proposed North Kiaka Mine (Section 5).
- Noise and vibration assessment including:
  - Desktop assessment for construction noise and vibration impacts
  - Desktop assessment for noise impacts from road traffic

– Noise modelling for the assessment of predicted noise impacts from operation of the existing Moora Quartzite Mine and proposed North Kiaka Mine (Section 6).

- Conclusions drawn from the above assessments, subject to the scope of works and limitations (Section 7).

1.5 Limitations

This report has been prepared by GHD for Simcoa Operations Pty Ltd and may only be used and relied on by Simcoa Operations Pty Ltd for the purpose agreed between GHD and the Simcoa Operations Pty Ltd as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Simcoa Operations Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Simcoa Operations Pty Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1.6 Assumptions

This assessment assumes the following:

- All information provided by Simcoa is correct.
- All parameters and calculations used in the model are based on best estimates using information provided by Simcoa and other relevant data.
- Manufacturer's specific sound power data is not available for the specific crushers and screens as found onsite so other relevant source data is used.as estimates of the noise sources in and surrounding the Project area.

- The noise sources will not contain an audible tonal characteristic at the nearest receiver to processing plant and ROM area, due to the distance of over 1250 m between source area and receptor point.

2. Project overview

2.1 Current operations

The existing Moora Quartzite Mine (Moora Mine) is located 15 km north of the Moora tenements M70/191, G70/92, G70/92 and G70/93, in the Wheatbelt region of Western Australia. Quartzite mining at Moora Mine commenced in 1989. Ore is currently mined from Main and West open pits and is processed through an onsite crushing and wet screening plant at an approved rate of approximately 160,000 tonnes lump quartz per annum (tpa). Ore is stockpiled into different grades in a stockpile area. Waste rock is deposited to one of two waste rock landforms. Some of the mined rock is crushed to produce aggregate, which is sold as a by-product.

The quartzite from Moora mine is trucked offsite to the Kemerton Silicon Smelter approximately 17 km north-east of Bunbury in the south-west of WA, where it is smelted to produce silicon. The smelter commenced operation in 1989 and is authorised to produce 64,000 tpa of silicon.

2.1.1 Operating schedule

Mining and processing at Moora Mine is undertaken on a campaign basis and approximately twelve people are required on site. Operations continue during week days, through daylight hours from 6:00 am to approx. 6:00 pm.

2.2 Proposed North Kiaka Mine expansion

Simcoa proposes to develop a mine on a greenfield quartzite mine at North Kiaka on M70/1292 (the Site). The Site is located approximately 2 km north of the existing Moora Mine, shown in Figure 2-1. The disturbance area is expected to be 134 hectares (Soil Water Group 2019).

Figure 2-1 Location of Project highlighted in yellow above

Mining is to be undertaken by drill and blast methods. The quartz material will be moved using excavators and haul trucks. Quartzite material will be moved from pit to run of mine (ROM) area for storage or alternatively will be moved by road to the current Moora processing area where it is tipped into crushers and then goes through screening process, carried by conveyor and then temporarily stockpiled on site before being trucked offsite to Kemerton Silicon Smelter.

All mined products from the North Kiaka site will be trucked to the Moora site for processing.

2.2.1 Key components

Key components of the Project will include the following:

- Four main pits
- Waste rock dump
- Run of mine area
- Stockpile area
- Access road corridor

3. Legal framework and standards

The following section reviews the legal standards in terms of noise criteria relevant to the Project.

3.1 Environmental Protection (Noise) Regulations 1997

Environmental Protection (Noise) Regulations 1997 (the Regulations) outline the most relevant noise criteria for the Project. As stated in the Regulations:

"Noise emitted from any premises or public place when received at other premises –

a. Must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

b. Must be free of –

(i) Tonality; and

(ii) Impulsiveness; and

(iii) Modulation…"

A noise emission is said to *significantly contribute* to a level of noise if it exceeds a value that is 5 dB below the assigned level (Government of Western Australia 1997).

The assigned noise levels for a noise sensitive area are shown in Table 3-1.

Table 3-1 Assigned noise levels

Type of premises receiving noise	Time of day	Assigned level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	7:00 am to 7:00 pm Monday to Saturday	45 + IF	55 + IF	65 + IF
	9:00 am to 7:00 pm Sunday and public holidays	40 + IF	50 + IF	65 + IF
	7:00 pm to 10:00 pm all days	40 + IF	50 + IF	55 + IF
	10:00 pm on any day to 7:00 am Monday to Saturday and 9:00 am Sunday and public holidays	35 + IF	45 + IF	55 + IF

IF = influencing factor

The influencing factor is determined based on the surrounding land use of the premises and road traffic data. The influencing factor is calculated in Section 3.4.

It is noted that construction related works are exempt from the assigned noise level criteria as long as good industry standard noise attenuation principals are adhered to. It is also noted that traffic related noise doesn't fall under these regulations either, which are both relevant for the construction phase of the new mine site works.

3.2 Licence L6149/1988/8

The Department of Water and Environmental Regulation (DWER) set out conditions to which Simcoa must adhere as part of their Licence under the *Environmental Protection Act 1986*. The conditions are set out in Licence L6149/1988/8, held by Simcoa for the Moora Quartzite Mine.

In regard to ground vibration:

"The Licensee shall ensure ground vibration levels generated by blasting are such that the level generated by at least 95% of all blasts is 5 mm/s peak particle velocity or less. The level generated by all blasts is 10 mm/s peak particle velocity or less when measured at any point on the most affected noise sensitive premises at least the longest dimension of the foundations of a building or structure away from such building or structure."

3.3 Construction noise

Demolition, dismantling and construction works are considered under Regulation 13 of EPNR 1997. The Regulations state that for construction work carried out between 7.00 am and 7.00 pm on any day which is not a Sunday or public holiday:

- Construction work must be carried out in accordance with control of environmental noise practices set out in Section 6 of Australian Standard (AS) 2436-2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.
- The equipment used for construction must be the quietest reasonably available.
- The Chief Executive Officer (CEO) of DWER may request that a noise management plan be submitted for the construction work at any time and complied with during construction activities.

For construction work done outside these hours:

- The construction work must be carried out in accordance with control of environmental noise practices set out in Section 6 of AS 2436-2010.
- The equipment used for construction must be the quietest reasonably available.
- The contractor must advise all nearby sensitive receptors likely to receive noise levels which fail to comply with the assigned levels under Regulation 8 (Table 4-1) of the work to be done at least 24 hours before it commences.
- The contractor must show that it was reasonably necessary for the work to be done out of hours.
- The contractor must submit to the CEO a noise management plan at least seven days prior to the commencement of out of hours work and the plan must be approved by the CEO before work commences. The plan must include details of:
  - Reasons for the construction work needing to be completed out of hours.
  - Details of activities which are likely to result in noise emissions that lead to exceedance of assigned levels.
  - Predictions of the noise emissions on the site.
  - Details of measures used to control noise (including vibration) emissions.
  - Procedures to be adopted for monitoring noise (including vibration) emissions.
  - Complaint response procedures to be adopted.

3.4 Noise sensitive receptors

A noise sensitive premises is defined as a premises occupied solely or mainly for residential or accommodation purposes, or a rural premises (Government of Western Australia 1997). Based on this, three noise sensitive premises (referred to henceforth as noise sensitive receptors) were identified based on a desktop review of aerial imagery. These are shown in Table 3-2 and Figure 3-1.

Table 3-2 Noise sensitive receptors

ID	Address details	Location (m UTM)		Distance from existing Mine boundary	Distance from proposed Project boundary
		Easting	Northing		
R01	3536 Midlands Road, Moora	407961	6622546	170 m south	2500 m south
R02	180 Kiaka Road, Moora	408664	6624776	750 m east	0 m south
R03	4034 The Midlands Road, Moora	407954	6627598	2800 m north	350 m north-west

Influencing factors as described in Section 3.1 were calculated for each sensitive receptor as follows based on current land use and proximity to main or secondary roads. As the NSRs are located in a rural area well away from any such busy roads with rural land zoning then it is considered relevant and prudent that the IF is zero for the three NSRs. Please refer to Appendix C for IF calculation.

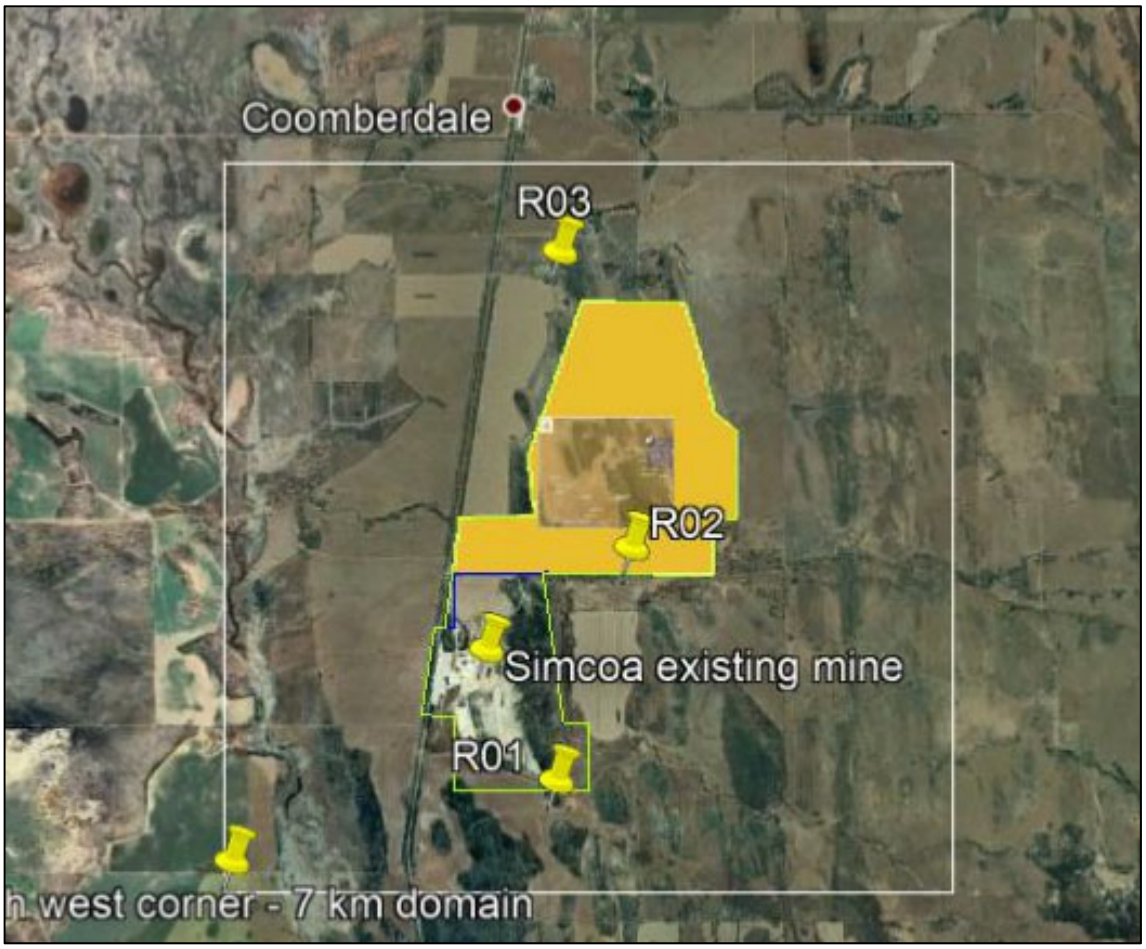


Figure 3-1 Location of noise sensitive receptors

4. Noise monitoring

4.1 Noise monitoring locations

A baseline noise survey was conducted by GHD between 10 and 17 July 2019. Noise monitoring results were used to verify the noise model and compare predicted noise levels above the current existing ambient noise levels.

Unattended and attended noise monitoring was undertaken at two locations, based on the nearest noise sensitive receptors to the proposed mine:

These locations were chosen to provide representation of the noise environment prior to construction of the Project. The location were also identified as being safe and secure for unattended equipment, minimising the risk of theft or vandalism.

Figure 4-1 provides a map of the Project area to indicate the noise monitoring locations.

A summary of relevant information such as site coordinates are provided in Table 4-1, along with photographs of the noise logger set up.

Table 4-1 Noise monitoring location summary

Site ID	Location	Coordinates (UTM)	Distance to Project boundary	Logger set up
R02	180 Kiaka Road, Moora Logger placed at front of property at edge of veranda	408660 m E 6624783 m S	<10 m	
R03	4034 The Midlands Road, Moora Logger placed at rear of property just beyond veranda	407955 m E 6627588 m S	345 m	

Figure 4-1 Noise monitoring locations

4.1 Noise monitoring method

Noise monitoring was conducted using two Svan 955 noise loggers. At each location, the noise logger was set to continuously record L_{Amax}, L_{Amin}, L_{A10}, L_{A90} and L_{Aeq} noise levels. The loggers were programmed to accumulate environmental noise data continuously over sampling periods of 15-minutes for the entire monitoring period. Table 4-2 provides details of the noise loggers used.

Table 4-2 Noise logger details

Parameter	Site A	Site B
Model	Svan 955	Svan 955
Serial number	27622	27623
Time interval	15-minutes	15-minutes
Pre calibration	94.5 dB	94.3 dB
Post calibration	94.2	94.1 dB
Frequency weighting	A weighted	A weighted
Time response	Slow	Slow

Prior to deployment and at monitoring completion, the noise loggers were calibrated with a sound pressure level of 94 dB at 1 kHz using a Larson Davis CAL200 sound level calibrator (serial number 10496). The data collected by the loggers was downloaded and analysed and any invalid data removed.

All noise sampling activities were undertaken with consideration to the specifications outlined in *Noise Regulations: Part 3 – Noise measurement* (Department of Environment Regulation 2015).

As a quality assurance measure, short term (15-minute) attended noise monitoring was conducted at each monitoring location at the commencement and completion of the unattended logging period.

4.2 Noise monitoring results

Sampled noise levels for the monitoring period are provided graphically in Appendix D along with the corresponding meteorological conditions (precipitation, wind speed and wind direction) during the monitoring period at each site. Data excluded during filtering for sample periods of rainfall > 0.2 mm and/or wind speed >18 km/h at the noise logger have been highlighted in Appendix D.

Daily noise monitoring results for each site are shown in Table 4-3, with entries significantly affected by meteorological conditions removed.

Table 4-3 Daily L_{A10} noise levels (dBA)

Site ID	Site A – R02			Site B – R03		
Date	L_{A10} day[1]	L_{A10} evening[2]	L_{A10} night[3]	L_{A10} day	L_{A10} evening	L_{A10} night
Wednesday 10 July 2019	44.0	28.7	35.1	41.1	33.1	38.5
Thursday 11 July 2019	39.6	28.3	33.6	42.8	32.6	37.1
Friday 12 July 2019	40.4	29.8	N/A	41.2	37.2	N/A-
Saturday 13 July 2019	32.2	30.0	40.3	34.6	0.0	40.5
Sunday 14 July 2019	41.5	29.5	34.0	40.6	34.1	35.6
Monday 15 July 2019	44.2	26.3	37.0	52.7	36.3	40.0
Tuesday 16 July 2019	45.2	30.3	37.1	48.5	34.2	39.6
Wednesday 17 July 2019	46.6	N/A	N/A	47.5	N/A	N/A

Table 4-4 provides the rating background level (RBL) for each location. The RBL is defined as:

The overall single figure background level representing each assessment period (day/evening/night) over the whole monitoring period, defined as the median value of:

- All the day assessment background levels over the monitoring period for the day (7.00 am to 7.00 pm).
- All the evening assessment background levels over the monitoring period for the evening (7.00 pm to 10.00 pm).
- All the night assessment background levels over the monitoring period for the night (10.00 pm to 7.00 am).

Table 4-4 Overall L_{Aeq} noise levels (dBA)

Site ID	L_{A10} day	L_{A10} Evening (dB)	L_{A10} Night (dB)
Site A - R02	43.2	29.1	36.8

[1] 7:00 am to 7:00 pm, Monday to Saturday
[2] 7:00 pm to 10:00 pm, Monday to Saturday
[3] 10:00 pm to 7:00 am, Monday to Saturday

Site ID	L_{A10} day	L_{A10} Evening (dB)	L_{A10} Night (dB)
Site B - R03	46.7	34.2	38.9

Noise monitoring and observations indicate a noise environment for each location as follows:

- **Site A: 180 Kiaka Road, Moora 6510** – A rural environment with the main sources of noise as occasional vehicle traffic on Kiaka Road approximately 45 m from the property fence, distant aeroplanes passing and sounds of nature (birds, insects and wind in trees). Residences noted that no blasting from the existing Moora mine was heard during the monitoring period.
- **Site B: 4034 the Midlands Road, Moora 6510** – A rural environment with the main sources of noise as vehicle traffic on adjacent wildflower farm and The Midlands Road approximately 545 m from the residence, (distant) livestock such as sheep, sounds of nature (birds, insects and wind in trees), distant farming equipment from the wildflower farm and general household noise such as talking, children and domestic dogs. It is noteworthy that noise monitoring was conducted during the school holiday period and as such, day time noise levels may be higher than typical levels during school periods.

It is noted that night noise levels are higher than evening noise levels at both noise monitoring locations.

Noise monitoring at the sensitive receptors in the vicinity of the proposed Project indicates there were no existing noise sources, operating at the time of the noise monitoring, which need to be considered as ‘significantly contributing’. On this basis, the assessment has been completed for noise impacts from the proposed Project in isolation.

5. Noise emission sources

5.1 Existing noise impacts

Noise sources currently associated with the existing mine include plant and equipment such as crushers, screens, wash plant, workshop, conveyor system and mobile plant.

5.2 Post-construction

The fixed processing plant equipment is expected to remain unchanged with the opening of the new Kiaka site.

Additional noise sources expected after the completion of the Project include the following:

- ROM pad with mobile plant tipping product
- Wash bay
- Workshop
- Generators
- Refuelling facility
- Large mobile plant and light vehicle movements

6. Noise assessment

6.1 Assessment of vibration emissions

Vibration impacts generally have the potential to cause structural damage to properties within close proximity to the vibration source. Vibration may arise from the use of particular equipment or machinery during mining and activities such as blasting, however can often be associated with construction activities.

It is possible that vibration from operation at the mining facilities may be perceived at times by local sensitive receptors, however the level of annoyance depends on individuals' perceptions of the vibration felt and the nature of the vibration source.

Distance and ground makeup are the major attenuation factors in the area of vibration. Due to the distance from the expected pit areas to sensitive receptors, it is not expected that any ground vibration transfer will take place from normal construction or operational works that is likely to have any negative effect on the structural integrity of sensitive receptors.

Blasting operations will need to be assessed on an operational basis to ensure that no over blast or extreme vibration events occur at the sensitive receptors.

6.2 Noise modelling software package – SoundPLAN

Construction and operational noise modelling was undertaken using SoundPLAN v 8.1 software to predict the potential noise impacts due to the construction and operation of the Project.

SoundPLAN is a computer program for the calculation, assessment and prognosis of noise propagation. It calculates environmental noise propagation according to the CONCAWE calculation algorithm. Propagation calculations take into account sound intensity losses due to hemispherical spreading, atmospheric absorption and ground absorption. Additional factors such as directivity were not considered in the noise modelling. This provides a measure of conservatism.

The CONCAWE algorithm also takes into account the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs in a clear, calm nights or 'downwind' conditions which are favourable to sound propagation. As a result, predicted received noise levels are expected to overstate actual received levels and thus provide a measure of conservatism.

SoundPLAN considers local characteristics, site sources and the location of receptor areas to predict noise levels. The method specified consists of octave band algorithms (with nominal min band frequencies from 31.5 Hz to 8 kHz) for calculating the attenuation of sound. The algorithm used in this model accounts for the following physical features:

- Geometrical divergence
- Atmospheric absorption
- Ground effect
- Reflection from surfaces
- Screening by obstacles
- Meteorological conditions

6.3 Noise model configuration

The assessment has been modelled based on available data. The proposed layouts for the Project and noise generating facilities were based on information provided by Client and other relevant data at the time of the assessment.

The following general settings were used in the operational noise model:

- Modelling was based on WA EPA Draft Guidance[4] atmospheric conditions of 20 C, 50% relative humidity, 4 m/s wind speed and Pasquil Stability Category E to represent worst case daytime scenario meteorological conditions.
- Ground adsorption was taken into account in the calculations. A general ground absorption coefficient of 0.6 was used throughout the model to represent absorption of the sound by the ground. A ground absorption of 0.0 represents no absorption of sound, and a ground absorption of 1.0 represents complete absorption of sound.
- All sensitive receptors were modelled at 1.5 m height above ground.
- All area noise sources were modelled at a minimum of 2.0 m height above ground, with crushers and screens modelled up to 7 m high relative to ground noise sources.
- Noise emission data for current and proposed extended mine site are based on in-situ noise measurements carried out by RedOHMS.
- It is noted that the WA EPA noise criteria is for an L_{A10} noise descriptor. The SoundPLAN noise model outputs L_{Aeq} noise levels. Although noise sources that are steady state in nature will have L_{Aeq} noise levels similar or equivalent to L_{A10} noise levels, a +3 BA correction has been applied to predicted L_{Aeq} noise levels to provide a level of conservatism.

6.4 Noise sources relative to construction phase

The main sources of noise during the construction phase are expected to be from ground works. Additionally vehicle volume rates will increase during this phase.

It has been assumed that 20 heavy vehicle movements per hour will occur during this phase. Traffic data used in the SoundPLAN model is presented in Table 6-1.

Table 6-1 Assumed traffic volume details

Location	Main road to proposed mine site and on site
Vehicle category	Veh/h(d)
HGV	20
Posted speed (km/hr)	40

The construction work areas were modelled as a noise source with an A-weighted sound power level (SWL) of L_{wA} 110 dBA, which is considered representative of noise emissions from similar construction works.

6.5 Construction noise modelling results

Predicted construction noises levels at nearby noise sensitive receptors are presented in Table 6-2 and presented graphically in Figure 6-1.

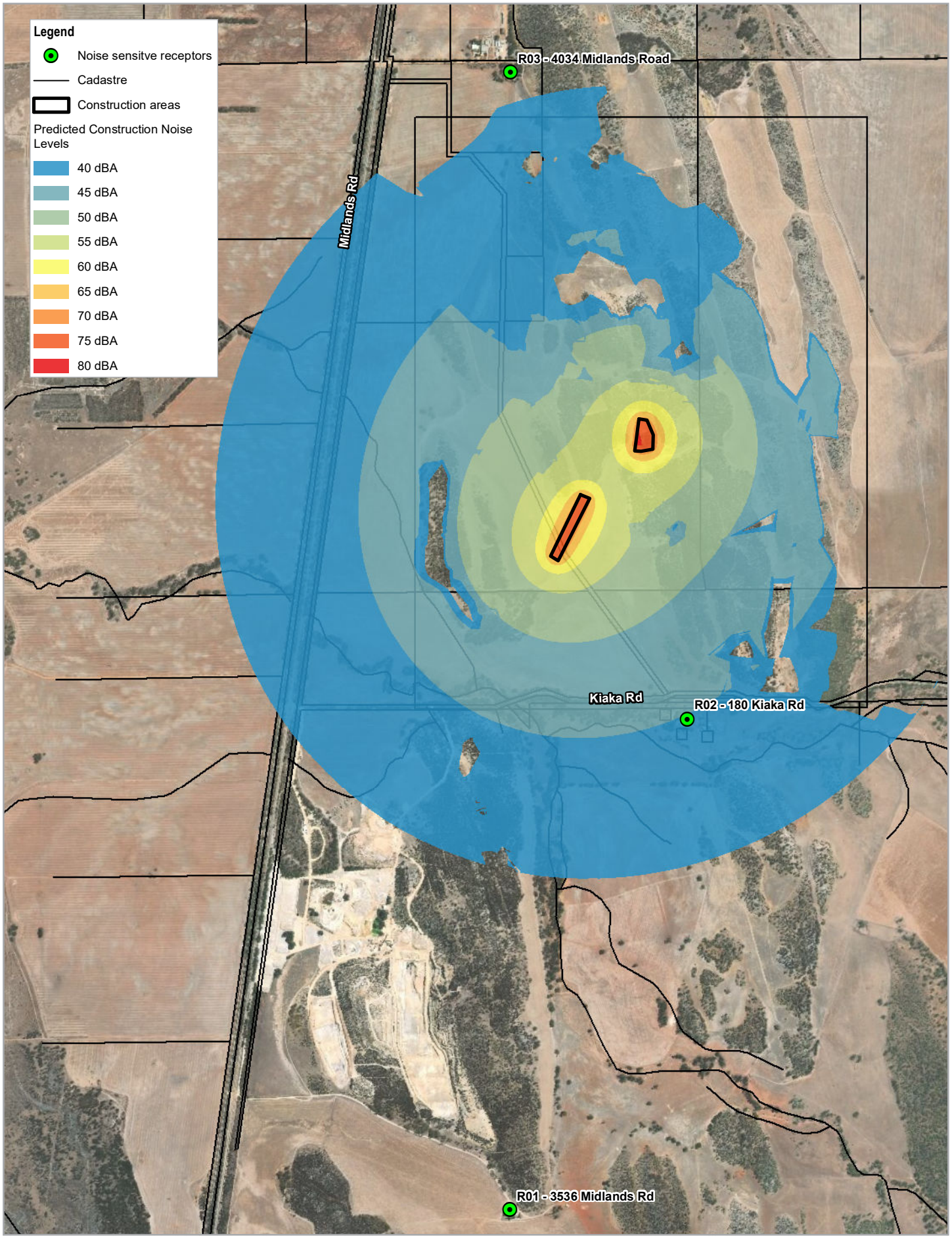
[4] Draft EPA Guidance for the Assessment of Environmental Factors No.8 Environmental Noise. Although this document is now withdrawn the parameters specified are considered as the worst case representation for acoustic modelling propagation.

Table 6-2 Predicted construction noise levels at noise sensitive receptors

Receiver	Receiver details	EPNR 1997 day criteria L_{A10} dBA	Predicted construction noise levels L_{A10} dBA
R01	3536 Midlands Road	45	31
R02	180 Kiaka Road	45	45
R03	4034 The Midlands Road	45	39

Construction noise levels are not predicted to exceed the criteria at any of the nearby sensitive receptors.

Note that construction work will ideally take place between the hours of 7:00 am and 7:00 pm on normal working days so as to fall under Regulation 13.



Paper Size ISO A4

0 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Simcoa Operations Pty Ltd
Moora, Western Australia
Noise Impact Assessment

Predicted Construction Noise Levels Grid Noise Map – 1.5m Above Ground Level - Daytime L_{A10} dBA

Project No. 12518217
Revision No. 0
Date 25 Aug 2020

Figure 6-1

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Print date: 25 Aug 2020 - 12:32

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: fmackay

6.6 Noise sources relative to mine site operational works

Noise sources used in the operational assessment were based on information provided to GHD from the client as well as the equipment schedule as per RedOHMS report[5].Where necessary relevant sound power estimates for the current plant were made.

Sound power levels used in the model are presented in Table 6-3. Fixed and mobile plant were allocated sound power levels based on manufacturers published noise data where available. Sources were modelled as point or area sources in SoundPLAN in lieu of specific operating equipment data for each element of facility.

The operating hours of the mine site are 6:00 am to 6:00 pm. During this time it is assumed that all fixed plant is continuously operational. It is understood that elements of the site will become operational from 6:00 am which requires noise levels emanating from the site between 6:00 am to 7:00 am to comply with the night time noise criteria of EPNR 97 at the NSRs.

Given the distance between noise sources and receivers it is considered unlikely that any of the external noise sources will have tonal or intermittent characteristics therefore no adjustments have been incorporated into the model.

Table 6-3 Allocated sound power levels and height above ground for fixed and mobile plant

Source	A-Weighted Sound Power Level (LwA dB)	Source height above ground (metres)
Excavator	100	3
Mobile dump truck	96	3
Primary crusher	112	7
Secondary crusher	112	7
McCloskey Conveyor	100	4
Screen 01	99	4
Tertiary crusher	108	7
Screen 02	99	4
Generator set	96	5
Screen 03	97	4
MCC	96	5
Workshop	90	2
Wash bay	90	2
Water cart	96	3

A full list of the utilised in-situ octave band noise measurement spectra from current operational plant and the calculated sound power levels used for calculation purposes are presented in Appendix B.

6.7 Operational noise modelling results

The following operational scenario has been modelled:

- Moora site fully operational plus North Kiaka site being mined with the raw product being transported over road by haul trucks to Moora site for crushing and screening processing. The model includes the following:
  - Fixed processing plant in current location at Moora site

[5] RedOHMS P17096:RPT001 Moora Noise Survey 2018 Final

– 2 x excavators at Moora site

– 2 x excavators at proposed North Kiaka mine site

– 1 x dozer at proposed North Kiaka mine site

– ROM and Waste rock dump at proposed North Kiaka site

– Generators at proposed North Kiaka site

– Dump trucks operational at both sites

– 2 haul truck movements per hour between the two sites

– ROM and all fixed processing plant located in existing Moora site

The predicted noise impact at noise sensitive receptor locations and relevant criteria are presented in Table 6-4 presented graphically in Figure 6-2.

Table 6-4 Predicted operational noise levels at noise sensitive receptors

Receiver	Receiver details	EPNR 1997 day criteria L_{A10} dBA		Predicted operational noise levels L_{A10} dBA
		Day	Night	
R01	3536 Midlands Road	45	35	27
R02	180 Kiaka Road	45	35	33
R03	4034 The Midlands Road	45	35	36

Operational noise levels are not predicted to exceed the EPNR day time criteria at any of the nearby sensitive receptors during the daytime period.

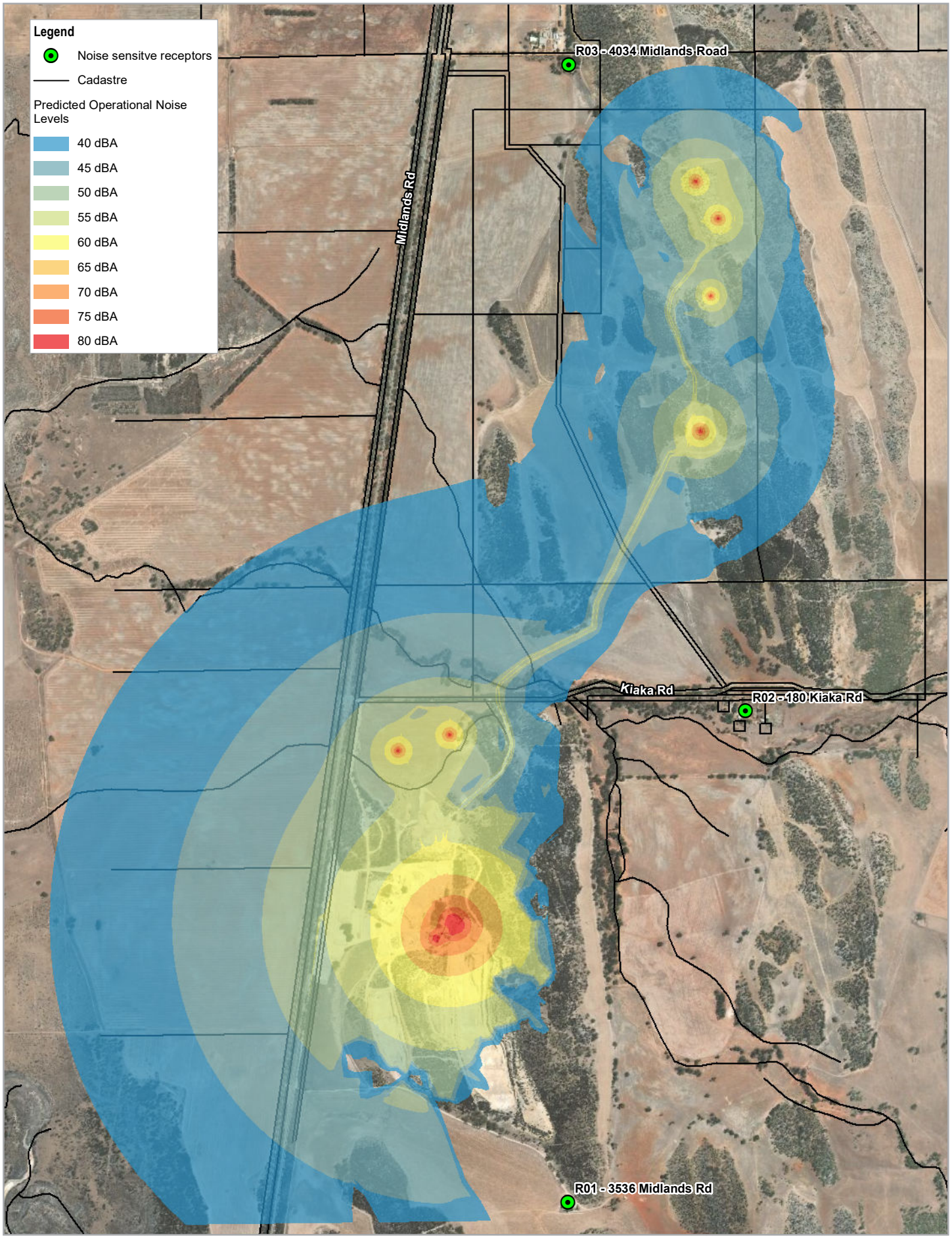
Operational noise levels are not predicted to exceed the EPNR night time criteria at receivers R01 and R02 however a 1dBA exceedance is predicted at receiver R03 during the 6:00 am to 7:00 am period.

Although it is predicted that the night time criteria will be exceeded during the 6:00 am to 7:00 am period it should be noted that the predicted noise levels are based on a worst-case noise scenario with all fixed and mobile plant operating at one time. It is should also be noted that although the criteria is predicted to be exceeded it does not automatically follow that all people exposed to the noise would find the noise unacceptable. In subjective terms, exceedances of the criteria can be generally described as follows:

- Negligible noise level increase <1 dBA (Not noticeable by all people).
- Marginal noise level increase 1 dBA to 2 dBA (Not noticeable by most people).
- Moderate noise level increase 3 dBA to 5 dBA (Not noticeable by some people but may be noticeable by others).
- Appreciable noise level increase >5 dBA (Noticeable by most people).

Given the exceedance is marginal the predicted noise levels could be considered acceptable as long as management procedures are implemented including:

- Prompt response to any community issues of concern.
- Refinement of onsite noise mitigation measures and plant operating procedures where practical.



Paper Size ISO A4

0 150 300 450 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Simcoa Operations Pty Ltd
Moora, Western Australia
Noise Impact Assessment

Predicted Operational Noise Levels Grid Noise Map – 1.5m Above Ground Level - Daytime L_{A10} dBA

Project No. 12518217
Revision No. 0
Date 25 Aug 2020

Figure 6-2

N:\AU\Perth\Projects\61\12518217\GIS\Maps\Deliverables\NoiseImpactAssessment\12518217_NIA002_OperationalNoiseLvls_0.mxd
Print date: 25 Aug 2020 - 12:32

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: fmackay

7. Conclusion

GHD was engaged by Simcoa Operations Pty Ltd (Simcoa) to conduct an acoustic review of the proposed new green-field quartzite mine at North Kiaka, located north of Moora, WA. Simcoa already operates a similar quartzite mine site to the south of the proposed mine site.

Acoustic design has been addressed in relation to *Environmental Protection (Noise) Regulations 1997.*

In summary:

- Attended and unattended noise monitoring was conducted at two of the identified noise receptor locations to establish the existing noise levels and major sources of noise.
- A SoundPLAN computer noise model was developed in order to assess predicted noise levels associated with the construction and operation of the proposed North Kiaka expansion onto nearby noise sensitive receptors. Predicted noise levels at receptors were compared against EPNR 97 noise criteria.
- The SoundPLAN model assumes atmospheric daytime conditions of 20 C, 50% relative humidity, 4 m/s wind speed and Pasquil Stability Category E as per the WA EPA Draft Guidance.
- Noise levels are not predicted to exceed the EPNR day time criteria at any of the noise sensitive receptors during construction of the North Kiaka development.
- Operational noise levels are not predicted to exceed the EPNR day time criteria at any of the nearby sensitive receptors during the daytime period.
- Operational noise levels are not predicted to exceed the EPNR night time criteria at receivers R01 and R02 however a 1dBA exceedance is predicted at receiver R03 during the 6:00 am to 7:00 am period. However, given that the predicted noise levels represent a worst-case noise scenario and the exceedance is considered marginal it is the predicted noise levels could be considered acceptable as long as management procedures are implemented including:
  - Prompt response to any community issues of concern.
  - Refinement of onsite noise mitigation measures and plant operating procedures where practical.

Appendices

Appendix A – Glossary of noise terminology

Term	Definition
Ambient noise	Level of noise from all sources, including background noise from near and far and the source of interest.
A-weighted	A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not sensitive to lower frequencies as it is to higher frequencies. A-weighted sound level is described as L_A dB.
Background noise	Noise level from sources other than the source of concern.
dB	Decibels is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.
Hz	Units for frequency are known as hertz.
Impulsive noise	An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is: "A variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amx\ slow}$ is more than 15 dB when determined for a single representative event".
L_{Aslow}	This is the noise level in decibels, obtained using A-weighted and S time weighting as specified in AS1259.1-1990. Unless assessing modulation, all measurements use the slow time weighting characteristic.
L_{Afast}	This is the noise level in decibels, obtained using A-weighting and F time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.
L_{Apeak}	This is the maximum reading in decibels using A weighting and P time weighting specified in AS1259.1-1990.
L_{Amax}	This is the maximum A-weighted noise level during a particular measurement.
L_{A1}	This is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.
L_{A10}	This is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the intrusive noise level.
L_{A90}	This is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the background noise level.
L_{Aeq}	The equivalent steady state A-weighted sound level ('equal energy') in decibels which, in a specified period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the average noise level.
L_{Amax} assigned level	Means an assigned level which, measured as a L_{Aslow} value, is not to be exceeded at any time.
L_{A1} assigned level	Mean an assigned level which, measured as a L_{Aslow} value, is not to be exceeded for more than one percent of the time.
L_{A10} assigned level	Means an assigned level which, measured as a L_{Aslow} value, is not to be exceeded for more than 10 percent of the representative assessment period.
Linear	Sound levels measured without any weightings are referred to as 'linear' and the units are expressed as dB(lin).
L linear, peak	Maximum reading in decibels are obtained using P-time-weighting characteristic as specified in AS1259.1-1990.
Maximum design sound level	The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.
Modulating noise	A modulating source is regular, cyclic and audible and is present for at least 10 percent of the measurement period. The quantitative definition of modulation is: More than 3 dB L_{Afast} or is more than 3 dB L_{Afast} in any one-third octave band

Term	Definition
	Present for at least 10 percent of the representative assessment period Regular, cyclic and audible.
One-third octave band	Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20,000 Hz inclusive.
Representative assessment period	Means a period of time not less than 15 minutes and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.
Reverberation time	Of an enclosure, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the enclosure to decrease by 60 decibels.
RMS	Root mean square level, used to represent the average level of a wave form such as vibration.
Satisfactory design sound level	The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.
Sound pressure level (SPL)	The sound pressure level of a noise source is dependent upon its surroundings (influenced by distance, ground absorption, topography, meteorological conditions etc.) and is what the human ear actually hears. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.
Sound power level (SWL)	Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. The sound power of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.
Specific noise	Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.
Tonal noise	A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whinging or droning. The quantitative definition of tonality is: The difference between - The A-weighted sound pressure level in any one-third octave band The arithmetic mean of the A-weighted sound pressure levels in the two adjacent one-third octave bands is greater than 3 dB when the sound pressure levels are determined as L_{Aeq}, T levels where the time period T I s greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as L_{Aslow} levels. This is relatively common in most noise sources.

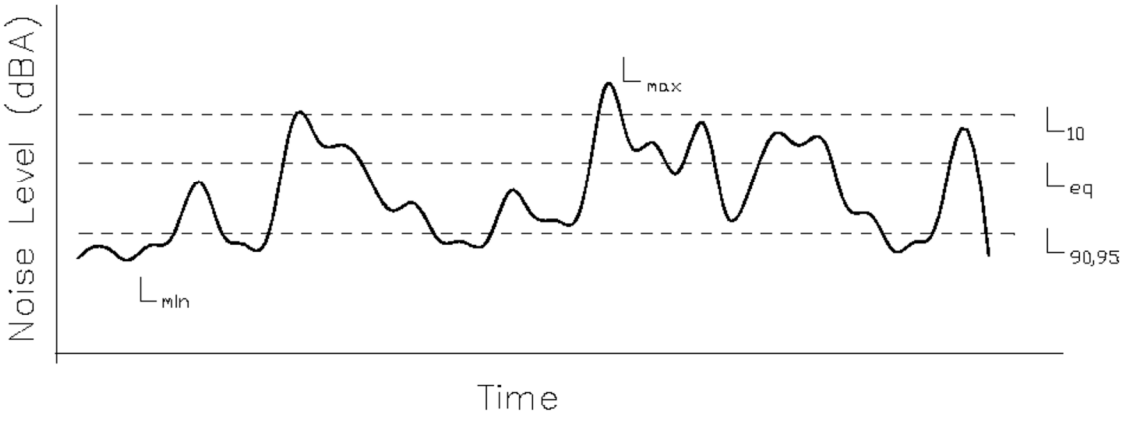
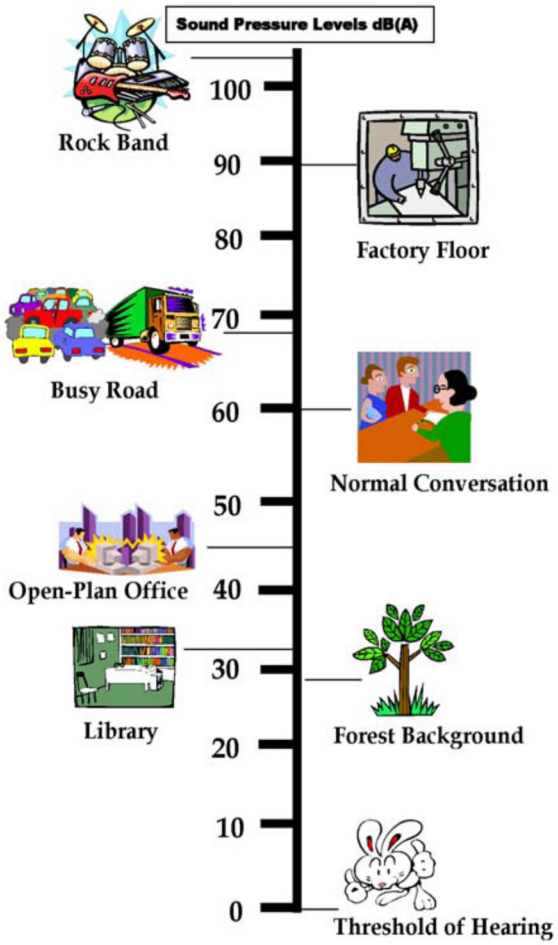


Chart of noise level descriptors

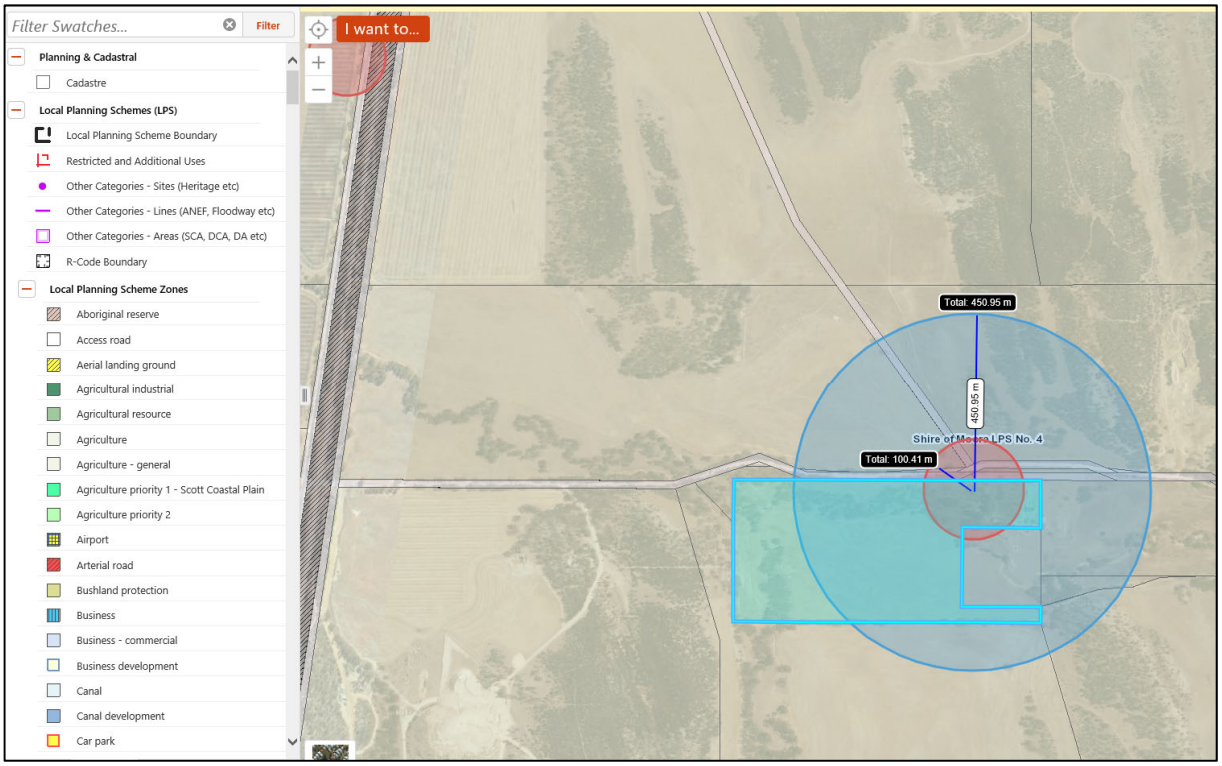


Typical noise levels

Appendix B - Sound power levels

Noise source	Sound power spectra Lw dB								
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	LwA
Screen 1	96	95	97	96	95	95	91	85	99
Screen 2	96	96	94	92	90	88	88	88	99
Screen 3	94	95	94	93	92	89	87	82	97
Primary Crusher	88	107	105	108	109	108	102	93	112
Secondary Crusher	82	94	102	110	110	107	102	90	112
Tertiary Crusher	89	101	109	104	102	102	102	99	108
Conveyor	84	88	87	87	84	84	84	82	90
Generator	80	84	91	94	92	90	87	84	96
MCC	77	90	92	91	92	88	88	86	96
Excavators	98	94	100	93	91	94	94	90	100
Haul/dump trucks	99	97	99	98	94	92	89	86	100

Appendix C - EPNR 97 assigned noise IF calculation at noise sensitive receivers



Major Roads = 0 within 100/450 m radius

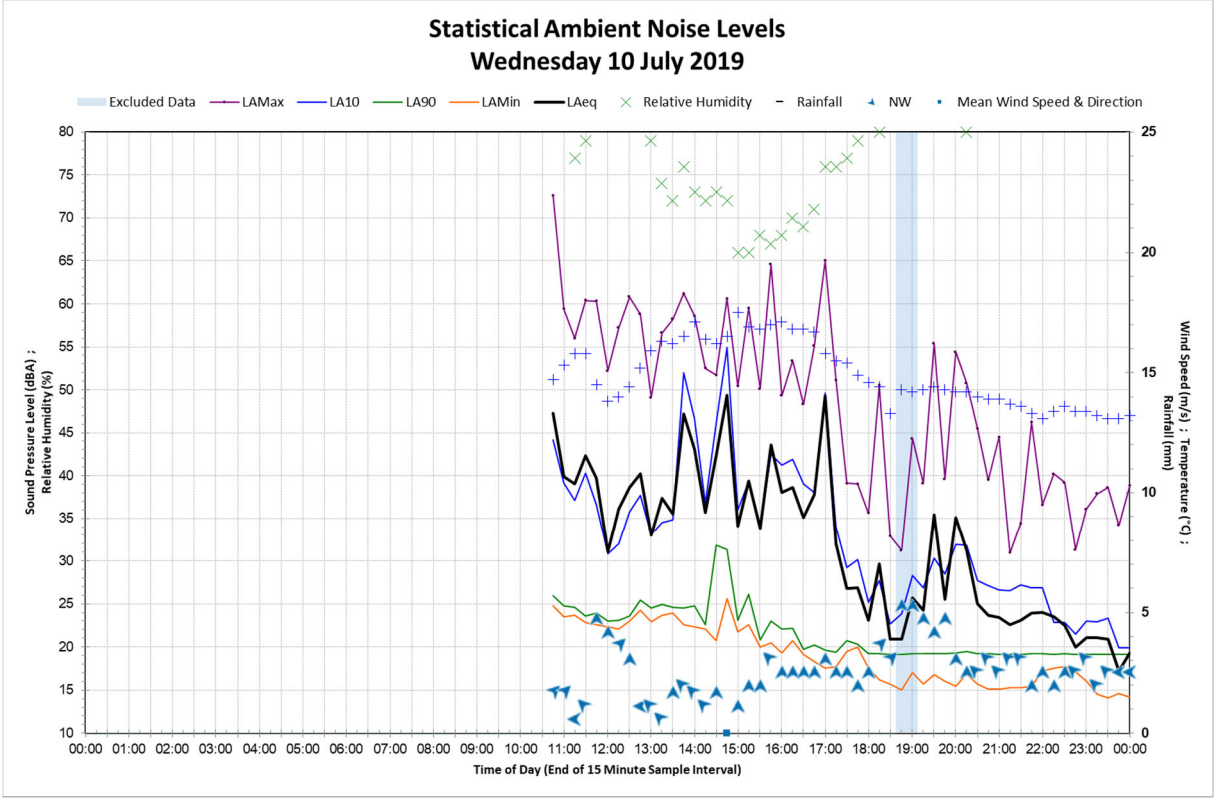
Minor Roads = 0 within 100/450 m radius

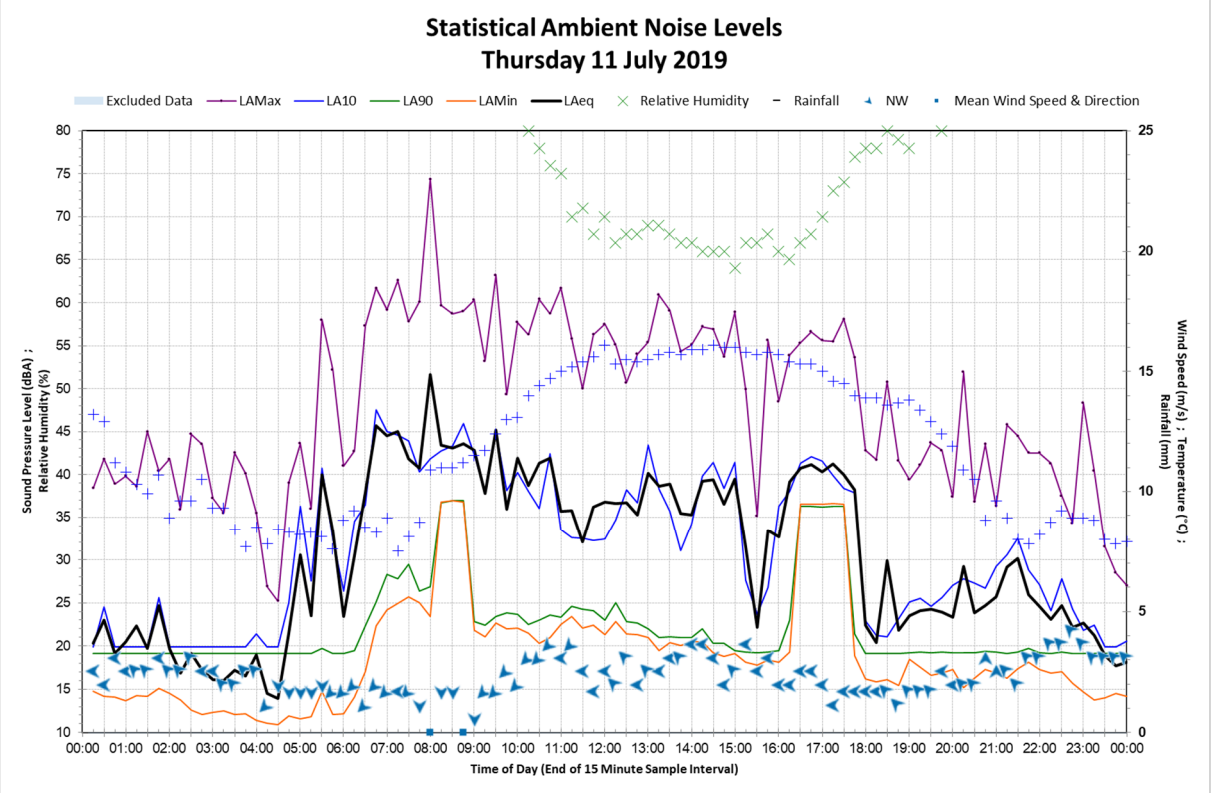
Zoning Rural/Residential = 100%

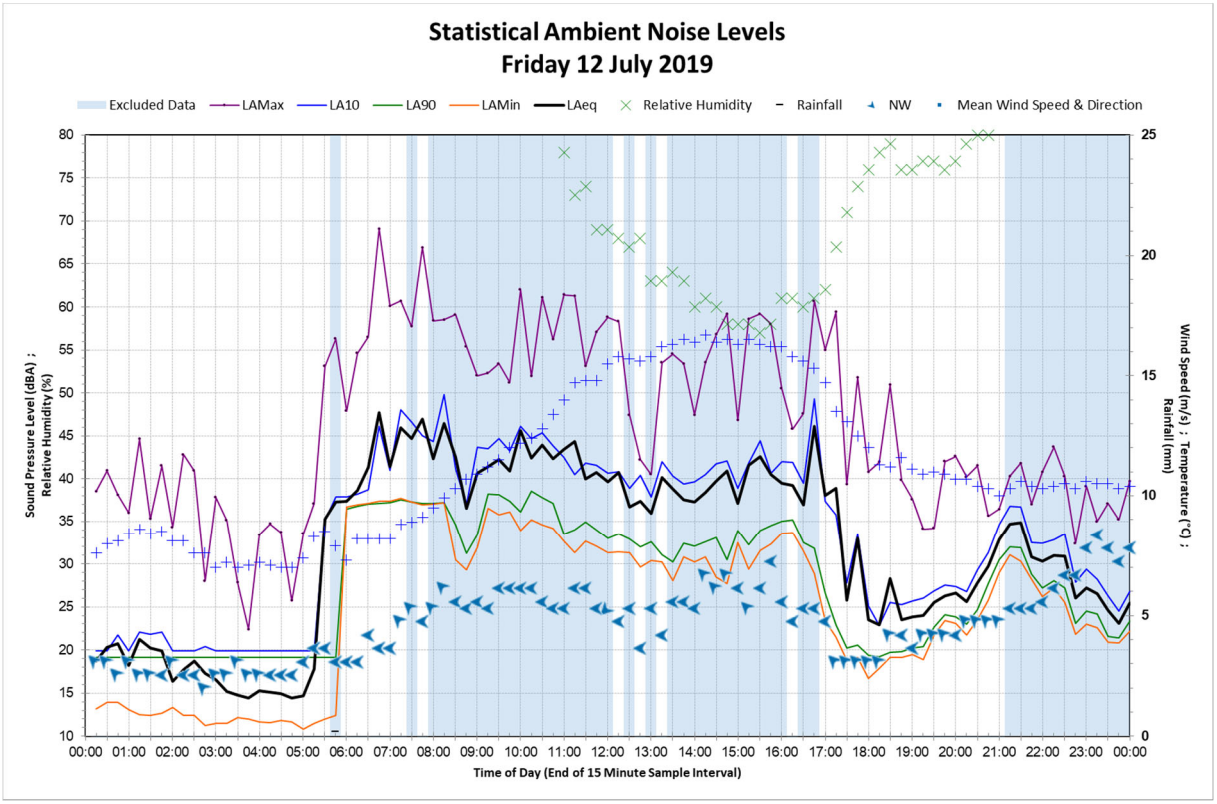
Influencing Factor = 0

Appendix D – Noise monitoring results and site survey sheets

SITE A – R02



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LA10
LA90
LAMin
LAeq
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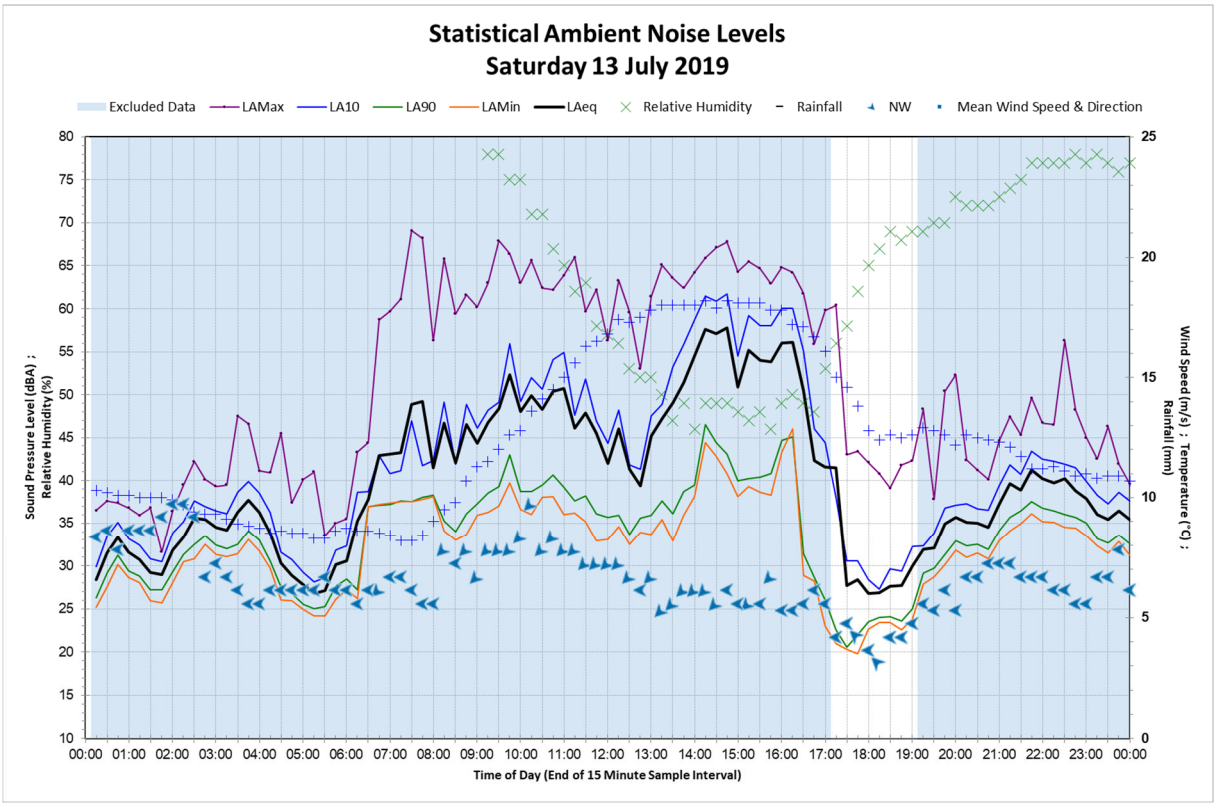
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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Rainfall
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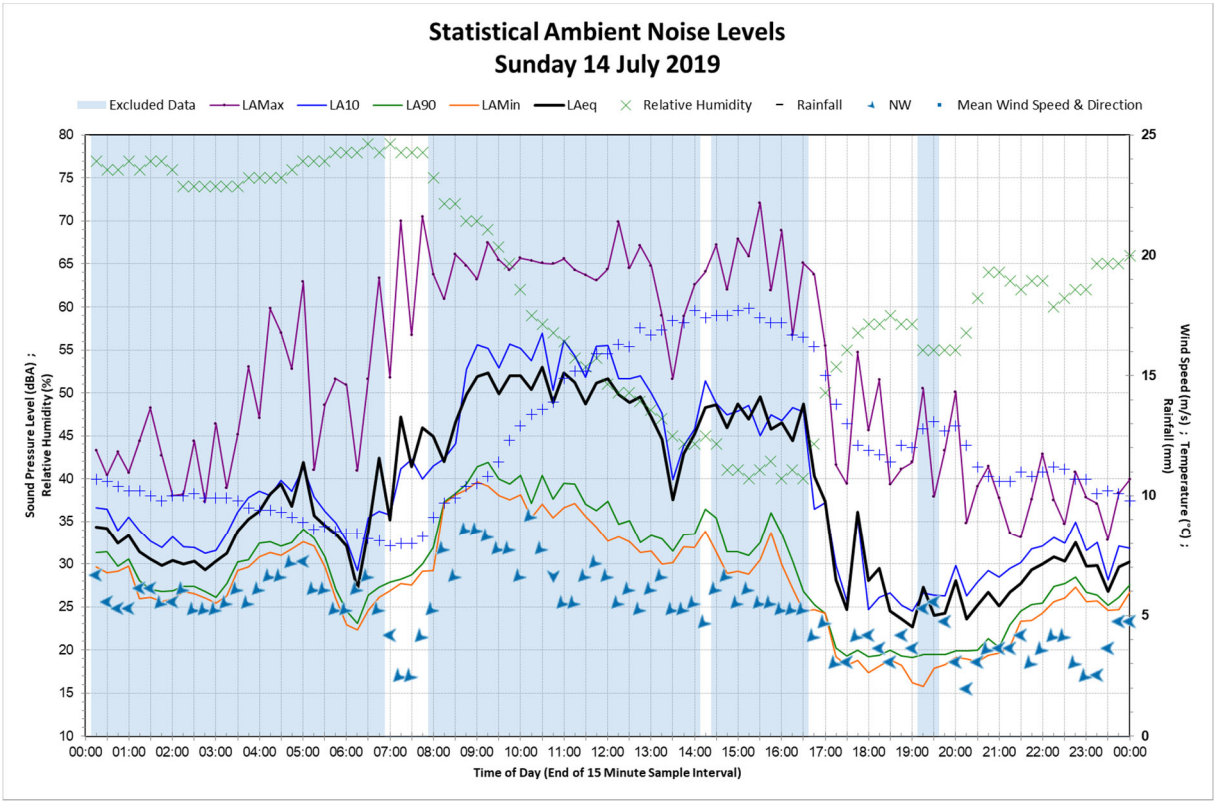
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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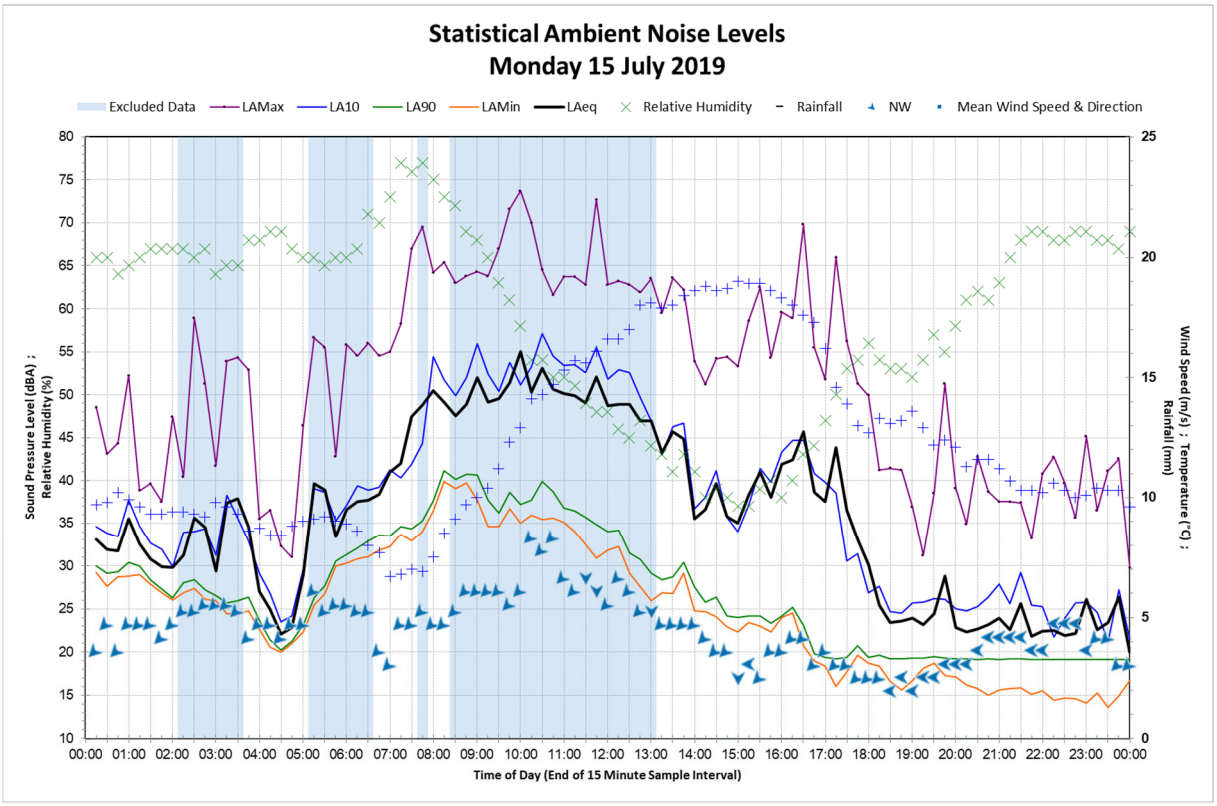
Time of Day (End of 15 Minute Sample Interval)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Rainfall
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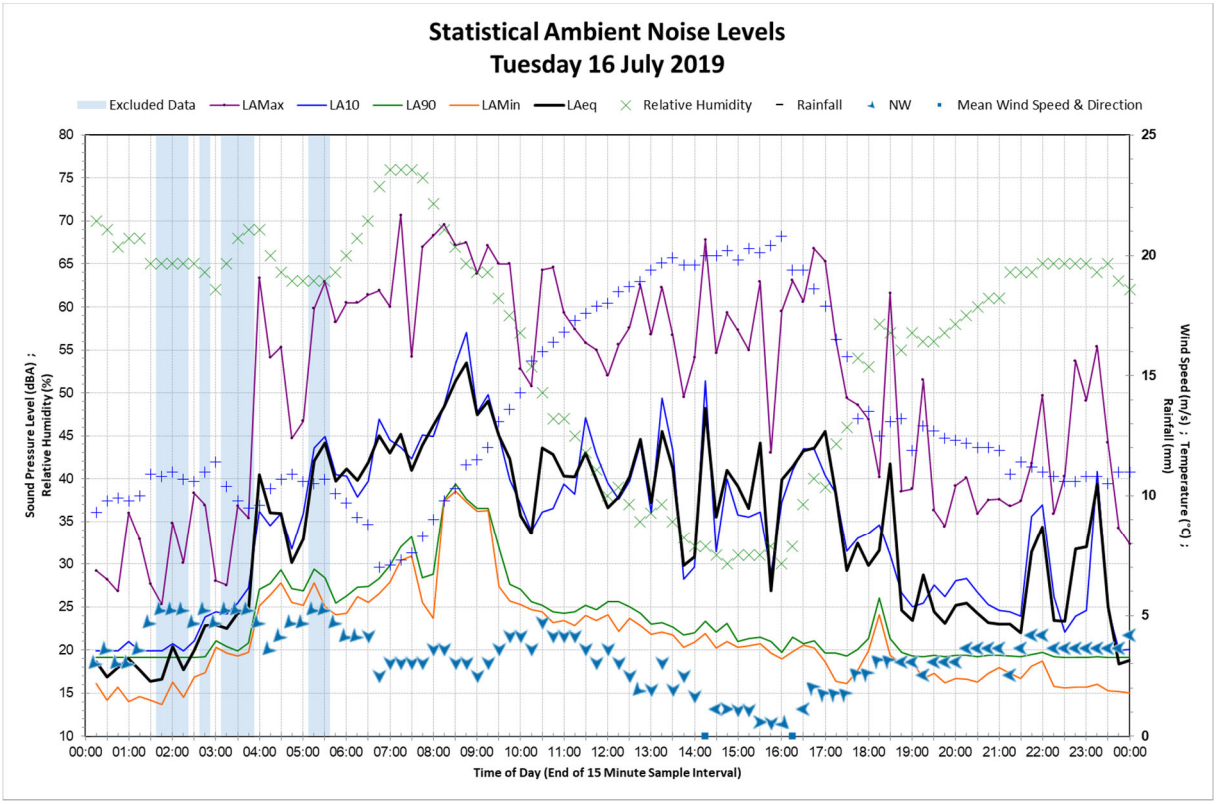
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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LAeq
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Rainfall
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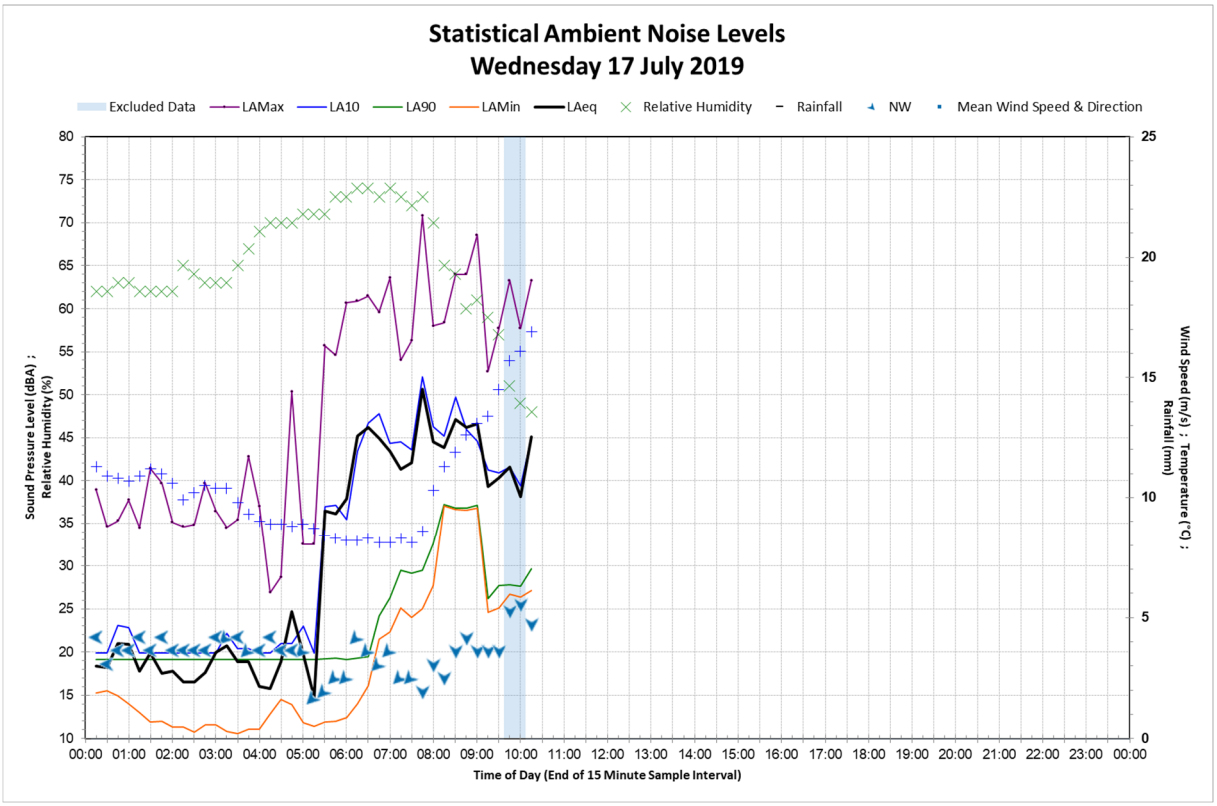
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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LAMin
LAeq
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Rainfall
NW
Mean Wind Speed & Direction
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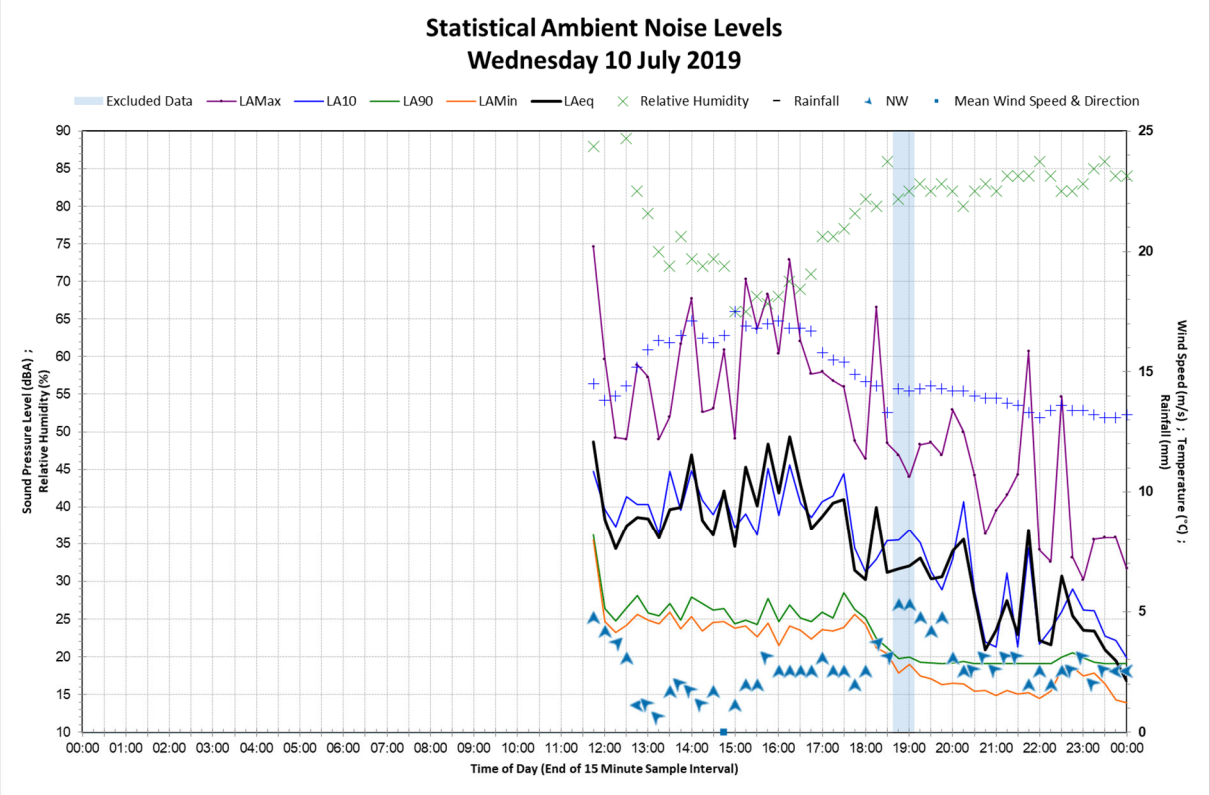
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

SITE B – R03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Rainfall
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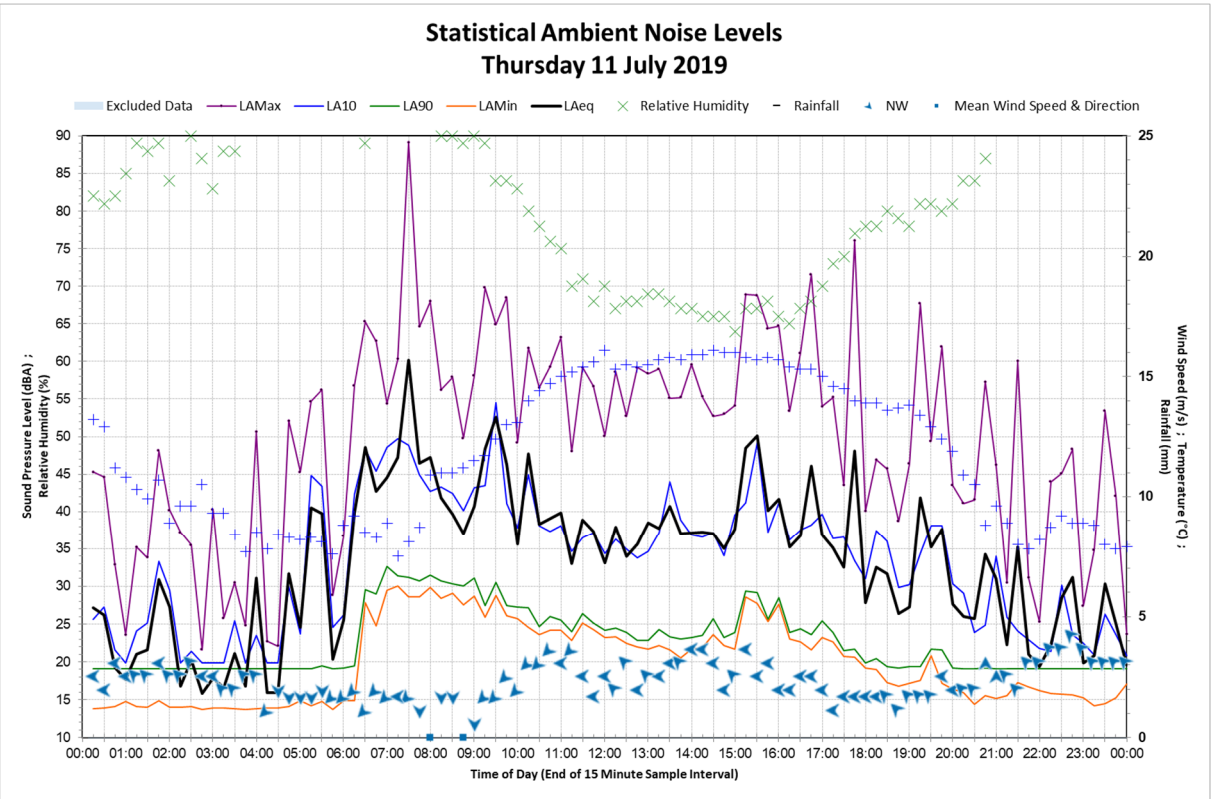
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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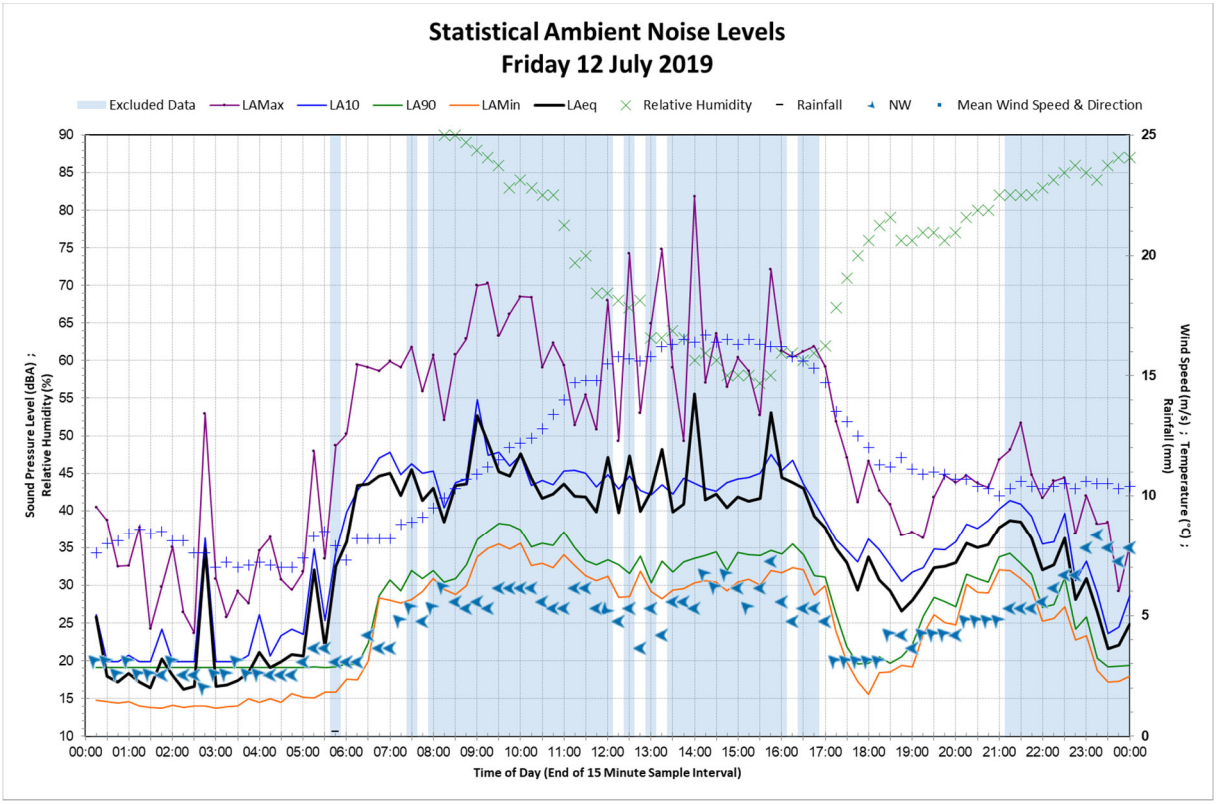
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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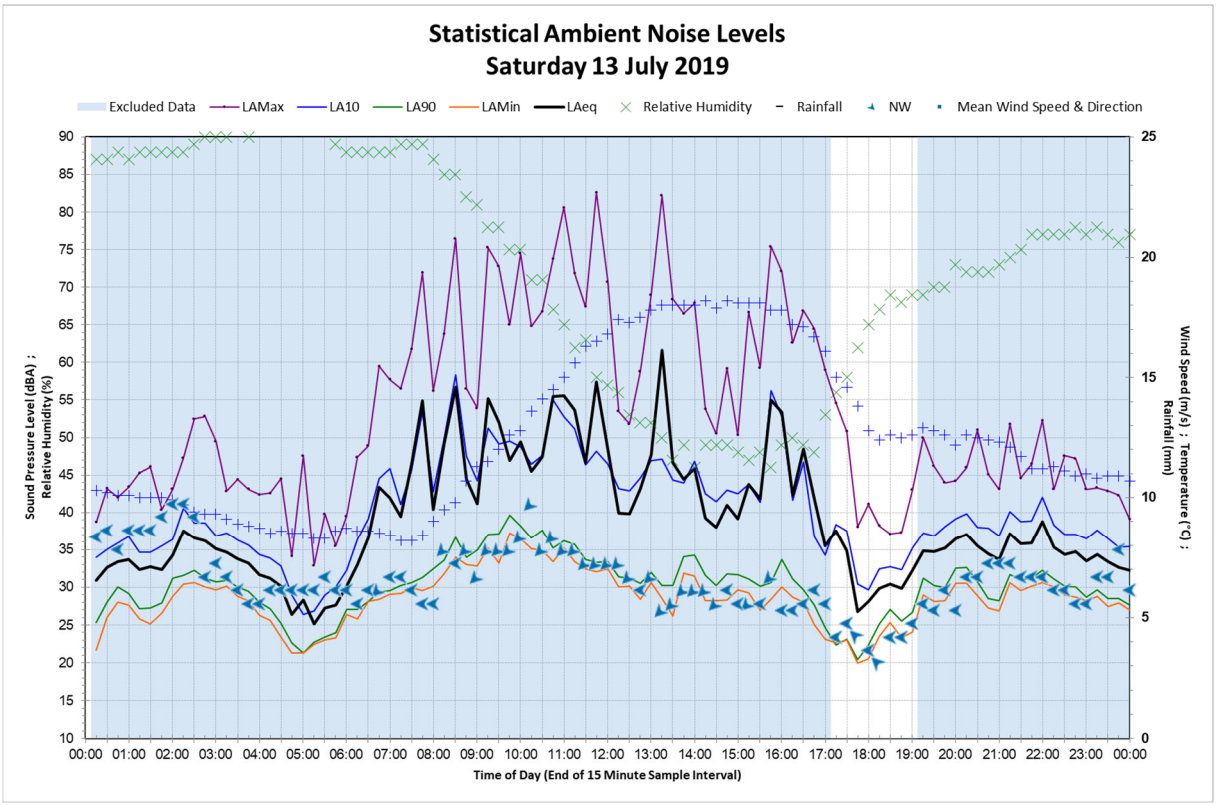
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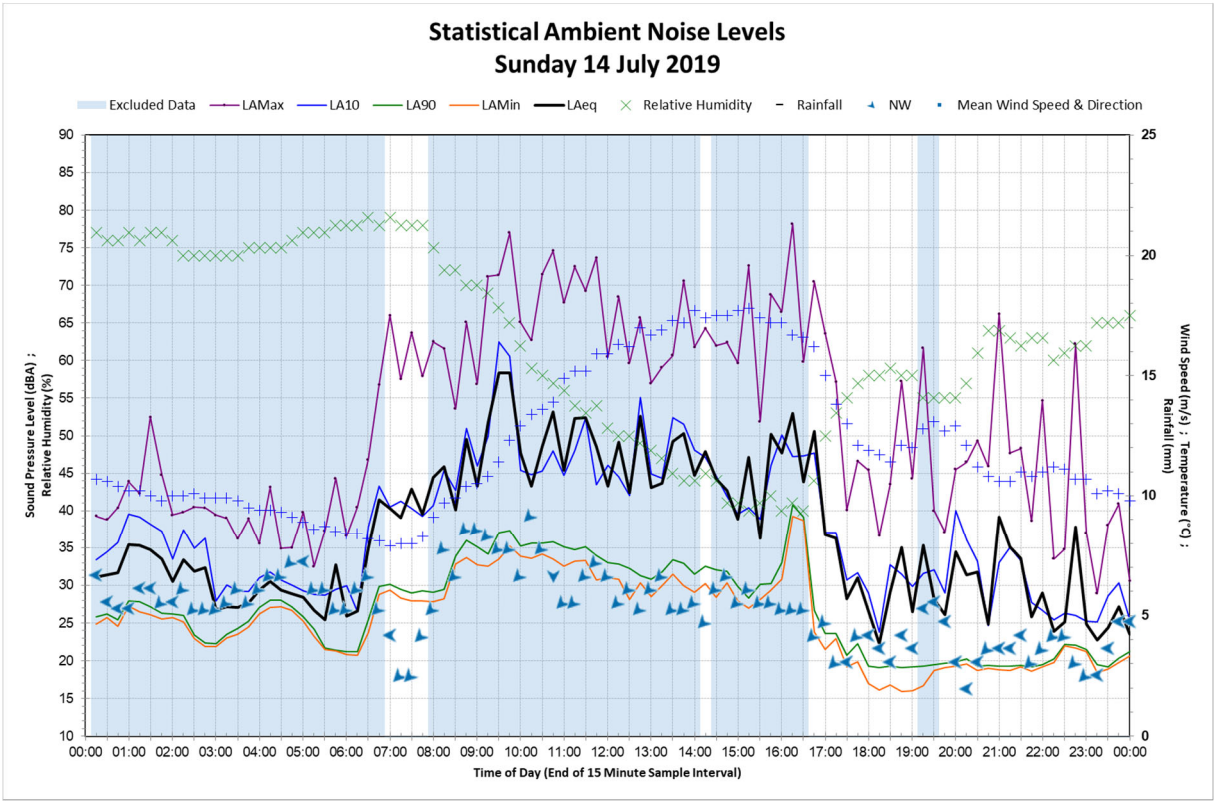
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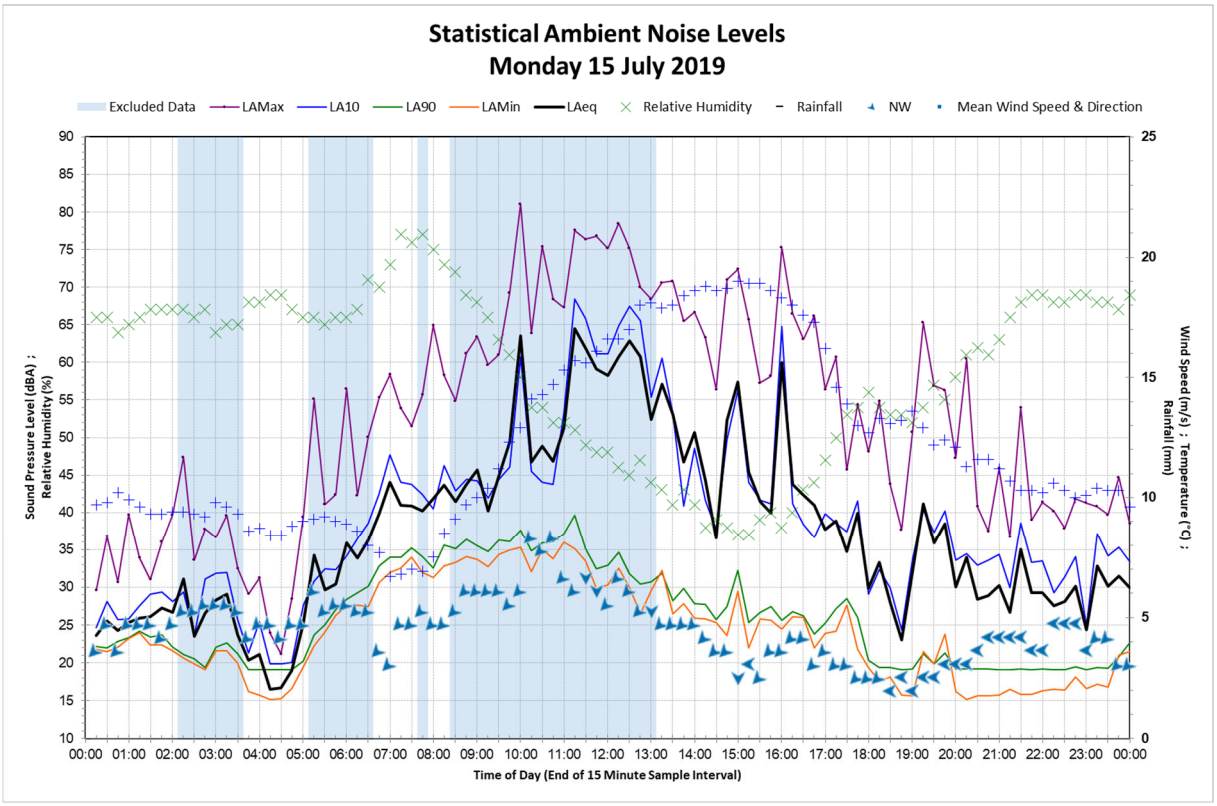
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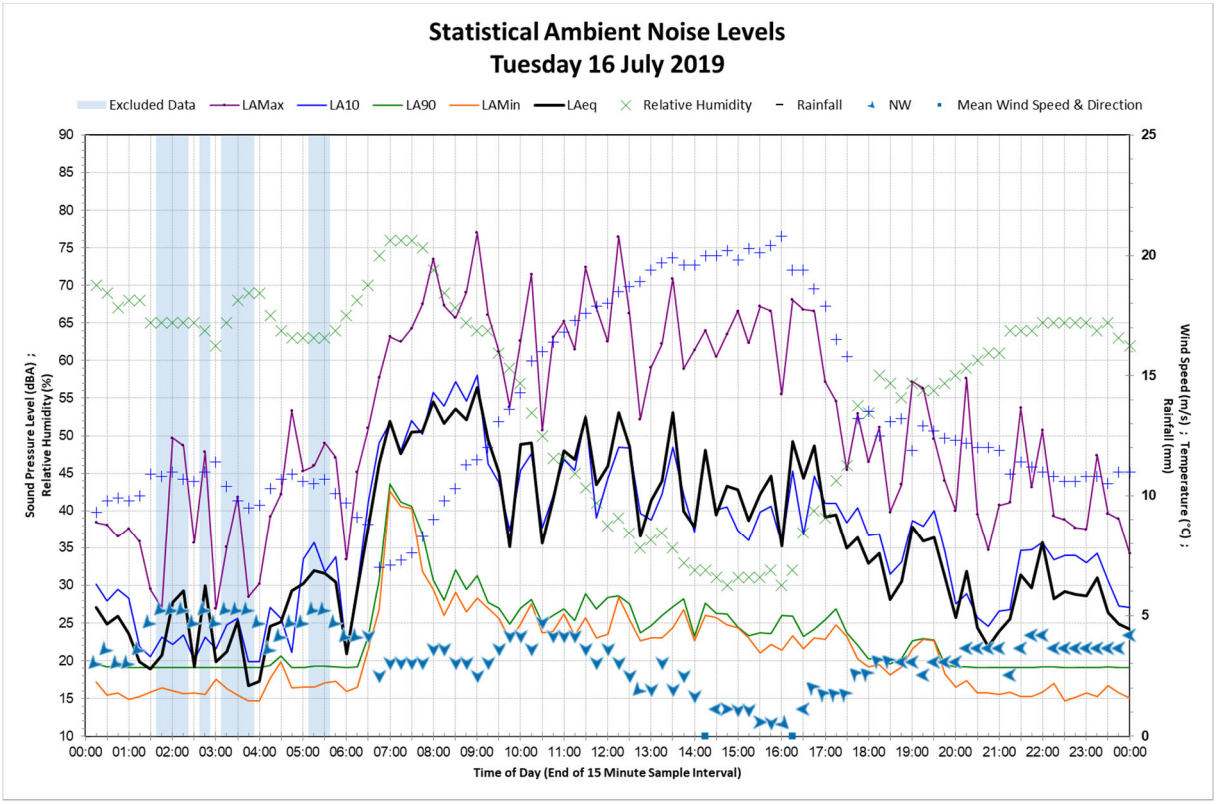
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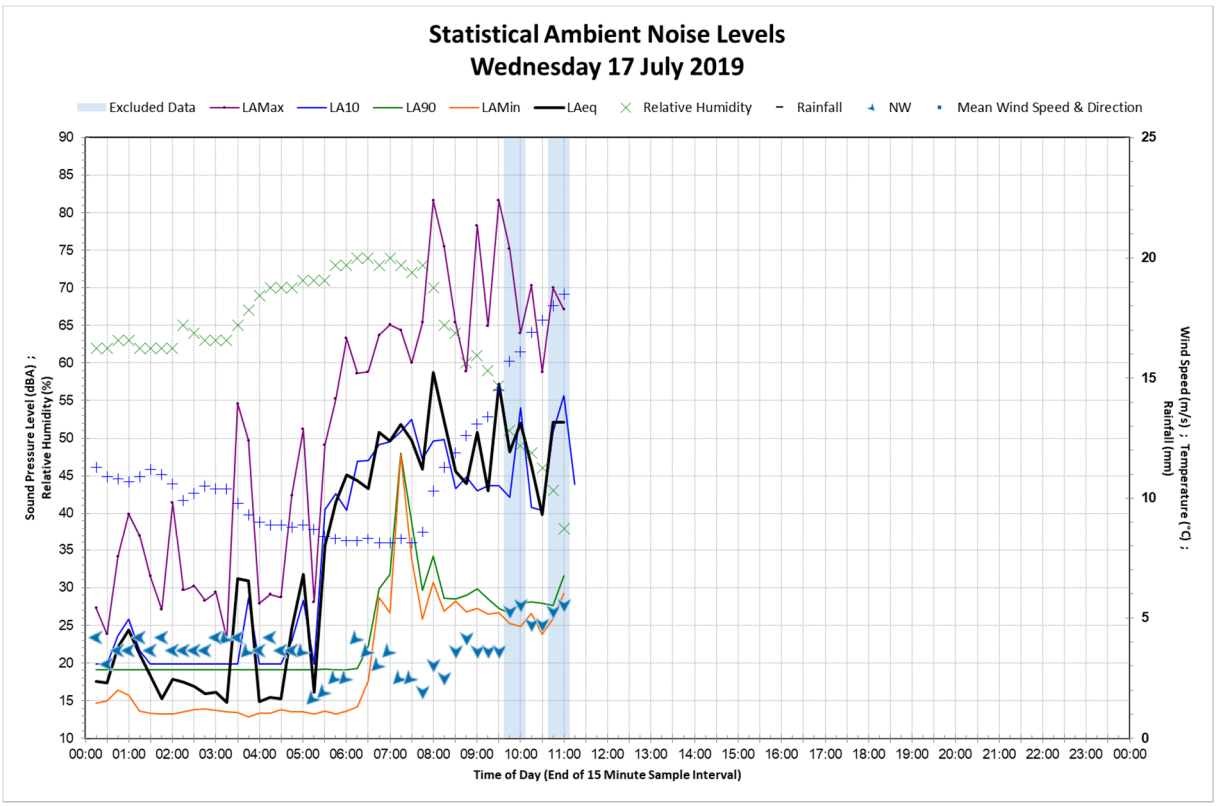
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Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

SITE A

GHD

SOUND LEVEL RECORDING FORM

Project No: 61374550 4 | Date 10.07.19

Project Name: SIMCOA NTH KIAKA APPS & SUPPORTING DOCS | Page 1 of 1

Client: SIMCOA | Performed by GF

Site: 180 KIAKA RD, MOORA (R02) | Monitoring Position FRONT OF HOUSE

SLM Make: SVAN /Model: 955 /Serial N°: 27622

CAL Make: LD /Model: 10469 /Serial N°: CAL200 Level: 94 (dB) /Frequency: 1000 (Hz)

SLM=Sound Level Meter *CAL=Calibrator (pistonphone)*

1. Monitoring Interval: 15 (mins)
2. Start Time: 1038 AM (0812 on log) Finish Time: 11.15 AM 17.07.19
3. Calibration performed before monitoring: (Y)/N factor= 94.5 dBA
4. Calibration performed after monitoring: (Y)/N factor= 94.2 dBA

L_{eq}= L1= Lpeak=

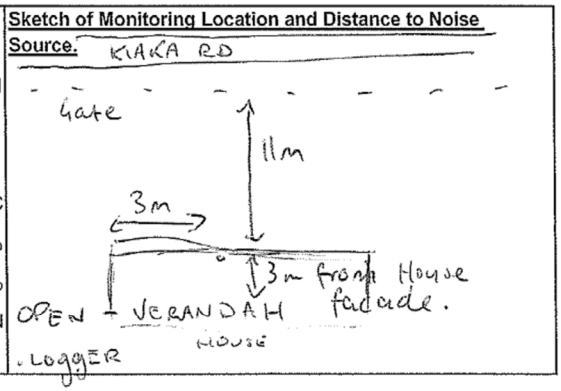
L_{10}= Lmax= L90=

Lmin= Height of meter 1.5m *(1.2m minimum)*

Weather Conditions at time of Monitoring

Wind Speed	m/second
(note: max allowable = 5m/sec)	
Approximate Direction =	
Ambient Temperature =	°C
Relative Humidity	%
Cloud Cover	%
Inversion Layer	Y/N
Others (fog, drizzle)	

Sketch of Monitoring Location and Distance to Noise Source.



DISTINCTIVE NOISE SOURCES Dominant noise source

Birds are dominant noise sources 55dB, 49dB, 47dB, 44dB

Bees / Flys ~~dominant~~.

Aircraft Flying nearby (or on Kiaka Rd. 57.4dB

* Resident noted no blasting or other sounds from Simcoa existing mine during noise logger deploy.

Lowest noise level ~ 29 dB

NOISE CHARACTER (broad band , impulsive, tonal)

METER SETTINGS (Linear, exponential:, weightings; a, b, c,: fast, slow, impulsive) A, SLOW

Start at File 2 (File 1 is calibration).

lock No. (A)

Finish File 672.

SITE B

GHD

SOUND LEVEL RECORDING FORM

Project No: 613745504 Date 10.07.19

Project Name: SIMCOA NTH KWALA APPS & SUPPORTING DOCS Page 1 of 1

Client: SIMCOA Performed by GG

Site: 4034 THE MIDLANDS ROAD Monitoring Position Front of house

SLM Make: NOISE /Model: 955 /Serial N°: 27623

CAL Make: LD /Model: CAL200 /Serial N°: 10496 /Level: 94 (dB) /Frequency: 1000 (Hz)

SLM=Sound Level Meter CAL=Calibrator (pistonphone)

1. Monitoring Interval: 15 (mins)

2. Start Time: 11.36am (13.34 on log) Finish Time: ~~11.55am~~ 11.55 am 17.07.19

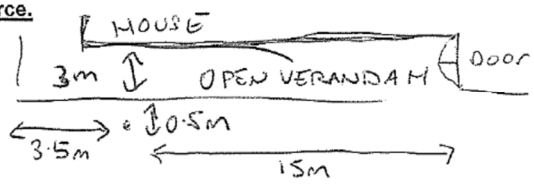
3. Calibration performed before monitoring: (Y/N factor= 94.3 dBA

4. Calibration performed after monitoring: (Y/N factor= 94.4 dBA

L_{eq}= L1= Lpeak=

L_{10}= Lmax= L90=

Lmin= Height of meter *(1.2m minimum)*

Weather Conditions at time of Monitoring		**Sketch of Monitoring Location and Distance to Noise Source.**
Wind Speed	m/second	
(note: max allowable = 5m/sec)		
Approximate Direction =		
Ambient Temperature =	°C	
Relative Humidity	%	
Cloud Cover	%	
Inversion Layer	Y/N	
Others (fog, drizzle)		• Noise logger

DISTINCTIVE NOISE SOURCES Dominant noise source

Birds are dominant noise source 45.3dB, 38.5dB, 36.6dB, 47dB

Sheep in distance 35.2 dB, 38.3 dB

Bees / flys

Car / ute at front of property 37.6 dB, 41 dB

Lowest noise level 30.4 dB

NOISE CHARACTER (broad band , impulsive, tonal)

METER SETTINGS (Linear, exponential:, weightings; a, b, c,: fast, slow, impulsive) A slow.

Start at File 3 (File 1 is N/A, File 2 is calibration)

lock No. (B)

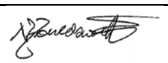
Finish file 672.

GHD

Level 10
999 Hay Street
T: 61 8 6222 8222 F: 61 8 9463 6012 E: permail@ghd.com

6137455-51422/\\ghdnet\ghd\AU\Perth\Projects\61\12518217\Tech\Air and Noise\Noise Assessment\12518127-REP_Simcoa Noise Assessment.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Rev 0	B Elder	J Forrest		N. Houldsworth		27/8/2020

Appendix Q2: Moora Minesite Noise Control Plan SIMCOA 2021

SIMCOA

Silicon Metal Company of Australia

MOORA MINESITE NOISE CONTROL PLAN 2021

Noise Officer
Mary Noble
01309

Revision History

Revision	Date	Prepared/Reviewed by	Comments
0	17/6/2021	Mary Noble Kees Visser	Prepared by Reviewed by

Approval

This document is approved by:

17 June 2021

Kees Visser
Mining and Raw Materials Manager
SIMCOA OPERATIONS PTY LTD

Date

Table of Contents

1 OBJECTIVE

The noise survey forms the basis of the risk assessment used to devise the risk management action plan for noise. The survey provides direction on the ranking of noise problems and an evaluation of available noise control treatments. The resultant noise control plan is a written document listing the noise control treatments that have been decided upon, and a timetable for their implementation.

The noise control plan includes:

- a brief description of the mine, or part of the mine, and the workers to whom the plan relates
- a statement of noise objectives in terms of levels and exposure for the operators
- a brief description of the engineering and administrative noise control measures proposed by the noise officer
- a detailed description of the site's agreed engineering and administrative noise control measures, timeframes for their completion and persons responsible for implementation
- the expected reduction in noise and exposure levels resulting from implementation of engineering and administrative noise control measures

2 COMPANY ENDORSEMENT

This noise control plan has been endorsed by:

Kees Visser
Mining and Raw Materials Manager
SIMCOA OPERATIONS PTY LTD
Please refer to the approval section at the beginning of the report.

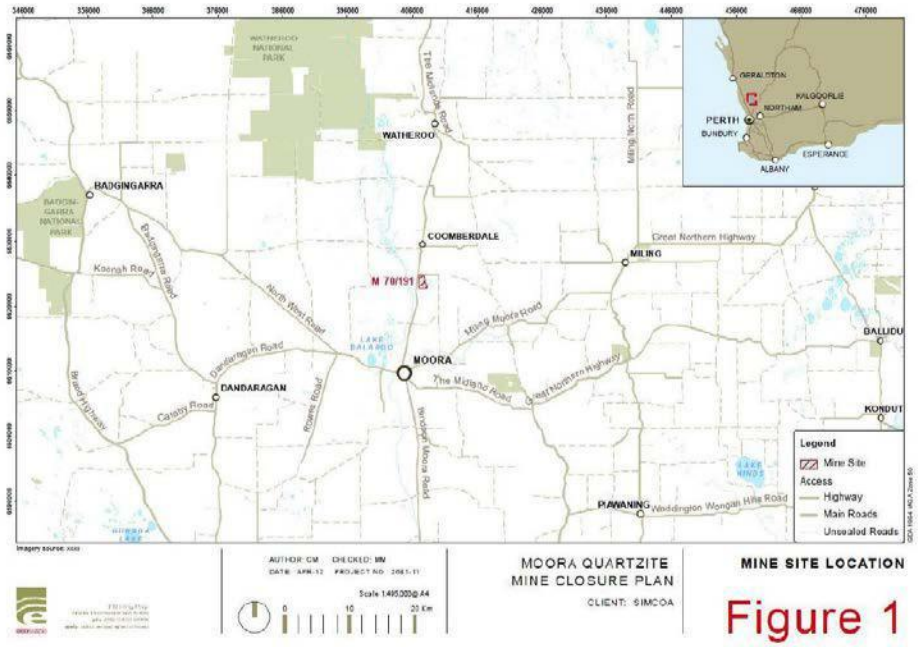
3 DESCRIPTION OF WORKPLACE

A brief description of the workplace and work processes is provided in this Section.

3.1 Location

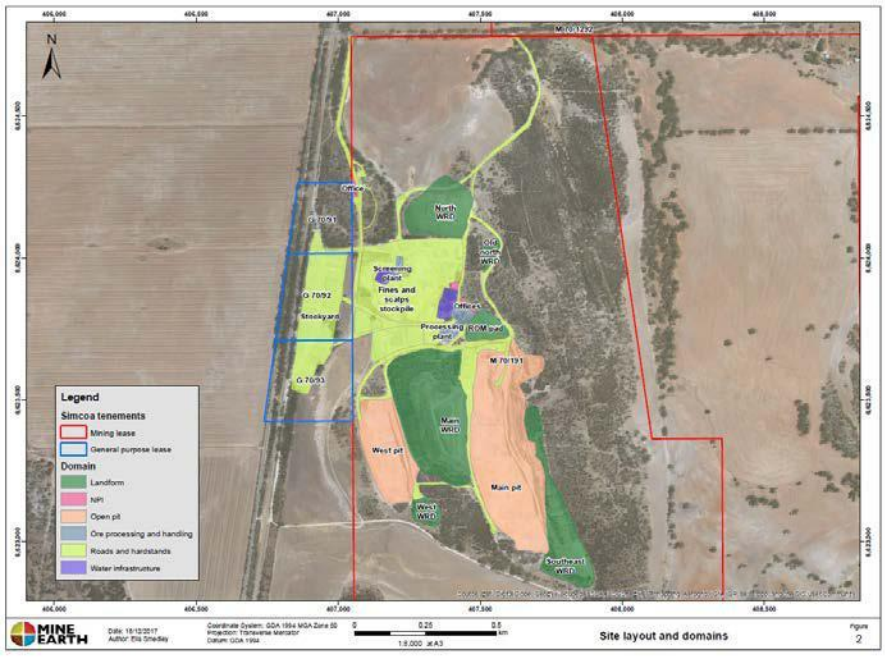
The Moora Mine is located 15 km north of Moora, in the Wheatbelt region of Western Australia (Refer Figure 1). The Project is operated by Simcoa Mines Pty Ltd (Simcoa) and is mined for high purity quartzite which is transported offsite for smelting.

Figure 1 Moora mine location map



Quartzite ore is mined from Main and West open pits and is processed through an onsite crushing and screening plant at a rate of approximately 160,000 t per annum. Processed ore is trucked offsite to the Kemerton silica smelter. Waste rock is deposited in onsite Waste Rock Deposits (WRDs). The total area of Project disturbance is estimated to be 60 ha (Refer Figure 2)

Figure 2 Moora mine overview



3.2 Workforce

There are approximately 8.6 workers based full time at the Moora Mine Site in 2021. The majority of staff live in nearby Moora.

The main roster patterns worked have been described as follows:

- Mine manager, 10.5hr/day 5/2 roster
- Simcoa operators, 10.5hr/day 5/2 roster;
- Drilling contractors 10hr/day 5/2 roster when on site (site attendance is ~50% of Full time).
- Drill and Blast, on site as required

The Simcoa mine runs a 10.5 hours a day, 5 day per week all year operation.

The number of personnel in each of the similar exposure groups (SEGs) relevant to the site, along with the typical roster worked by personnel within each of the SEGs; are indicated in Table 2.1.

Table 2.1 SEG personnel numbers

SEG no.	Name	DMIRS Codes	# workers – 2021	Roster
1	Management, Administration & Technical	130000 to 150000	2	10.5hr/day 5/2 roster
2	Simcoa Operators, (Excavator Operator, Haul Truck Operator, loader operator, Sampling) Operators preform all the above tasks	340000, 361000, 350000, 440000	5.6	10.5hr/day 5/2 roster
3	Drill and Blast Crew	321000 320000		On Site as required
4	Crusher/Dry Plant Personnel	411000 421000	1	10.5hr/day 5/2 roster

4 NOISE OBJECTIVES

Under the general and specific provision for duty of care under the Mines Safety and Inspection Act 1994 – Section 9, it is the responsibility of the employers to provide safe working conditions and work practices. This includes the hazard of noise and the prevention of noise induced hearing loss. In addition, employers and self-employed persons have a duty under Section 12 of the Act to take reasonable care to ensure their own safety and health at work.

Specific regulatory requirements for noise control are listed under Part 7 of the Mines Safety and Inspection Regulations 1995. The Regulations place primary emphasis on the introduction of engineering controls to reduce noise levels.

Under Regulation 7.3, specific action must be taken when persons are exposed to:

a) an average noise level over an eight-hour day (LAeq, 8 hour) of more than 85 dB(A); or

b) a peak noise level (Lpeak) in excess of 140 dB(lin).

The above levels are measured at the position of a person's ear without taking into consideration the effects of personal hearing protection. If it is not practicable to avoid exposing a person at a workplace to noise above the action level, then a person who, at the workplace, is an employer, the main contractor or a self-employed person must ensure that the first-mentioned person is provided with personal hearing protectors that have been selected in accordance with the procedures specified in AS/NZS 1269.3.

5 SUMMARY OF ACTIONS RECOMMENDED

- A site noise control policy, management plan and noise control plan should be developed and implemented where these do not exist. These should comply with legislation, codes of practice, guidance and best practice and be kept current. An audit of the implementation of these documents should also be undertaken.

- A hearing conservation training programme should be developed, implemented, reviewed and audited where this does not exist.

- An ear plug fit testing programme should be developed, implemented, reviewed and audited where this does not exist.

- The audiometric testing programme should be reviewed for adequacy and implemented.

- An alternative to those hand and power tools generating noise at the operator ear in exceedance of 82 dB(A) should be sought or else retrofitted to minimise noise emissions.

- Noise control solutions for the crushers and screens should be investigated. Exposures for plant operators can be reduced by investigating the causes of spillage in these areas and remediating which would negate the need for lengthy clean up activities and thus reducing noise exposure time for all personnel that work in these areas.

- Hearing protection signage should be installed at the mobile and fixed plant maintenance workshops (mandatory or else cautionary). Signage and labelling must comply with AS 1319 Safety signs for the occupational environment.

- Mobile plant and hand/power tools that generate an LAeq,T in excess of 82 dB(A) should be labelled for the mandatory requirement to wear hearing protection. Signage and labelling must comply with AS 1319 Safety signs for the occupational environment.

- Consider limiting noise from two-way radios within mobile plant items or else encourage workers to set radios to just-audible levels. Noise indicates may assist in alerting mobile plant operators of at-risk noise levels.

- Consider reducing the number of personnel exposed to noise by segregation (physically and/or over time) and/or reducing noise exposure times.

- Communicate the noise results and findings to all site personnel.

6 NOISE CONTROL AGREED ACTIONS

The list of noise actions recommended were reviewed and agreed noise control actions with descriptions of agreed engineering and administrative controls have been detailed for each section area of site. Timeframes and assigning of responsibility are included. Where quantifiable the expected reduction in noise and exposure levels is included.

Recommended Action	Agreed Action	Responsibility	Completion Date
A site noise control policy, management plan and noise control plan should be developed and implemented where these do not exist. These should comply with legislation, codes of practice, guidance and best practice and be kept current. An audit of the implementation of these documents should also be undertaken.	Create NCP, NMP	MN	1/03/2021
A hearing conservation training programme should be developed, implemented, reviewed and audited where this does not exist.	Induction to be implemented that includes noise and HPD	MN	1/09/2021
	Implement Simcoa HP Toolbox talk	MN	1/09/2021
An ear plug fit testing programme should be developed, implemented, reviewed and audited where this does not exist.	Completed by OHMS - no action required	Completed OHMS 2020	
The audiometric testing programme should be reviewed for adequacy and implemented.	Biannual audiometric testing included in site medical	CW	1/04/2021
An alternative to those hand and power tools generating noise at the operator ear in exceedance of 82 dB(A) should be sought or else retrofitted to minimise noise emissions.	Will consider Buy Quiet policy when hand and power tools require replacement	MG	Ongoing
Noise control solutions for the crushers and screens should be investigated. Exposures for plant operators can be reduced by investigating the causes of spillage in these areas and remediating which would negate the need for lengthy clean up activities and thus reducing noise exposure time for all personnel that work in these areas.	Investigate noise control solutions for crushers	Engineering department	Review 1/09/2021
Hearing protection signage should be installed at the mobile and fixed plant maintenance workshops (mandatory or else cautionary). Signage and labelling must comply with AS 1319 *Safety signs for the occupational environment*.	Inspect plant and areas for adequate signage. Identify and arrange for installation where required.	MN	1/07/2021
Mobile plant and hand/power tools that generate an LAeq,T in excess of 82 dB(A) should be labelled for the mandatory requirement to wear hearing protection. Signage and labelling must comply with AS 1319 *Safety signs for the occupational environment*.	Organise HP required stickers for plant and power tools	MN	1/07/2021
Consider limiting noise from two-way radios within mobile plant items or else encourage workers to set radios to just-audible levels. Noise indicates may assist in alerting mobile plant operators of at-risk noise levels.	Include in Toolbox talk	MN	1/07/2021
Consider reducing the number of personnel exposed to noise by segregation (physically and/or over time) and/or reducing noise exposure times.	Review exposure times for SEG's	MN	1/07/2021
Communicate the noise results and findings to all site personnel.	Communicate quarterly Personal Dosimetry results at NSO quarterly visit	MN	1/07/2021

Appendix Q3: Moora Noise Survey OHMS Hygiene 2018

OHMS HYGIENE

Simcoa Operations
Moora Mine
Noise Survey Report

2018

16th May 2018

Mick Geary
Registered Mine Manager
Moora Quartzite Mine
Simcoa Operations Pty Ltd

Dear Mick,

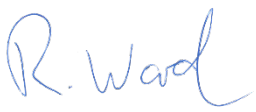
Re: Moora Mine Noise Survey Report, February 2018.

Please find enclosed the report detailing the results from the Simcoa Operations Pty Ltd, Moora Mine Noise Survey conducted on the 20th of February 2018.

The noise survey was conducted as part of the *Mines Safety and Inspection Regulations* requirement to conduct a 5-yearly site-wide noise survey, with subsequent preparation of a report and notification to the State Mining Engineer.

If you can provide advice or comments on the report please do so by contacting me on 0427 609 688. If there are no further clarifications, it can be re-issued as final.

Yours sincerely,



Ruairi Ward
Principal Occupational Hygienist
OHMS Hygiene Pty Limited

Contents

Moora Mine Noise Survey 2018

Glossary

Term	Definition
Action Limit / Action Level / Exposure Standard / Exposure Criteria	An exposure level as prescribed by the relevant regulatory body. Where these are not prescribed and with reference to noise, an 8-hour equivalent noise exposure limit of 85 dB(A) and a peak noise limit of 140 dB(C) shall apply.
AS/NZS	Australian New Zealand Standards
A-weighted	Refers to a standardised frequency response used in sound measuring instruments. It corresponds approximately to the human ear response at low sound levels. Sound pressure levels measured using this response, are expressed in units of dB (A).
A-weighted noise exposure ($E_{A,T}$)	In Pascal-squared-hours (Pa^2h) means the time integral of the squared, instantaneous A-weighted sound pressure level over a particular time period 'T'. $E_{A,T}$ is a linear measure of noise exposure which takes into account the sound energy received over a given time. For practical purposes a noise exposure of 1 Pa^2h corresponds to L_{Aeq}, 8h of 85 dB(A).
Audiometry or audiometric testing	The process of assessing a person's hearing ability.
CNO	Could not obtain
C-weighted	Refers to a standardised frequency response used in sound measuring instruments. It corresponds approximately to the human ear response at high sound levels. Sound pressure levels measured using this response, are expressed in units of dB(C).
dB	Abbreviation for decibel.
dB(A)	A-weighted decibel.
dB(C)	C-weighted decibel.
dB(lin)	Unweighted decibel.
Decibel	Used to indicate the relative magnitude of sound pressure level and other acoustical quantities. The range of sound pressures commonly encountered is very large so a logarithmic scale is used. The decibel is the unit used on this scale and is abbreviated to 'dB'. On the decibel scale, the threshold of hearing occurs at a sound pressure level of about 0 dB and the threshold of pain occurs at about 120 dB. As the decibel is also used to describe the level of other quantities, such as sound power and vibration acceleration, it is always necessary to refer to the specific quantity being measured, for example, L_{Aeq}, 8h or Lpeak.
Effective level (of a sound for people wearing hearing protectors) L(eff)	Effective level is a quantity derived by subtracting the attenuation of a hearing protector from the level of the sound in which it is worn.
Hazardous or excessive noise	In relation to hearing loss means noise that exceeds the exposure standard for noise in the workplace.
Hearing protection area or prescribed work area or restricted area	Areas where noise levels have the potential to exceed a noise Action Limit.
$L_{Aeq,T}$	A-weighted Leq measured over a time T.
$L_{Aeq,8h}$	Eight-hour equivalent continuous A-weighted sound pressure level in dB(A) referenced to 20 micropascals) means that steady noise level which would, in the course of an eight-hour period, caused by the same A-weighted sound energy as that due to the actual noise over an actual working day. $L_{Aeq,8h}$ is to be determined in accordance with Part 1 of Australian/New Zealand Standard AS/NZS 1269.1.
$L_{Z,peak}$	Peak noise level; means linear-weighted peak sound pressure level in decibels measured by a sound level meter with a peak detector-indicator characteristic complying with Australian Standard AS 1259.1.
L_{eq}	Represents an average value based on the sound energy received over some known time. The Leq is the continuous or constant sound pressure level necessary to give the same energy as the actual fluctuating sound pressure level (during the same measurement time).
L_{peak}	Peak noise level.
MEM	Mobile equipment maintenance
Noise	Any unwanted or damaging sound.
Noise emission	Radiation of sound from a sound source
Noise exposure	Amount of sound energy the unprotected ear of a person is exposed to.
Noise immission	Influx of sound at a point.
Octave band analysis	Analysis of the frequency content of noise into octave bands.
Octave band filter	A filter that attenuates all noise except that falling between two frequencies an octave apart. Octave band filters are used to measure which frequencies are present in a given noise.
Ototoxic agents	Chemical substances that have detrimental effect on an individual's hearing.

Term	Definition
Over protection	The selection and wearing of a hearing protector with unnecessarily high attenuation.
Partial noise exposure	The exposure of a person to noise over a specified time interval, typically the time spent at a specified workstation, or while performing a specified task.
Personal Sound Exposure Meter (PSEM) or noise dosimeter	An instrument for measuring noise exposure by automatically integrating sound energy over a measurement period and provides a measure of its magnitude.
PPE	Personal protective equipment.
Prescribed workplace	As per Western Australia *Workers' Compensation and Injury Management Regulations* 1982, a workplace or part of a workplace where a worker is receiving, or is likely to receive, noise above the action level. In this context action level means- - an L peak of 140 dB(lin); or - a representative LAeq,8h of 90 dB(A)
Protected noise exposure	The presence of a person wearing hearing protectors at a point of immission.
Risk	The probability of harm occurring to the hearing of a person.
SEG	Similar exposure group.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance, and designed to measure a frequency—weighted and time-weighted value of the sound pressure level.
Sound pressure	The alternating component of the pressure at a point in a sound field.
Sound pressure level (SPL)	The relative magnitude of sound pressure, customarily expressed in decibels referenced to 20 micropascals.
T_i	Time interval.
Total daily noise exposure	Total of a person's partial noise exposures over a working day.
Unweighted (or linear weighted)	Sound pressure levels or similar quantities that are measured using an instrument that responds equally to all frequencies, that is, it has a flat or linear frequency response. Sound pressure levels measured using this response are expressed in units of dB (lin).

1. Executive summary

OHMS Hygiene was requested by Simcoa Operations Pty Ltd Limited to undertake a noise survey for their Moora Mine, located 15 km north of Moora, in the Wheatbelt region of Western Australia. The Project is operated by Simcoa Operations Pty Ltd (Simcoa) and is mined for high purity quartzite which is transported offsite for smelting.

The noise survey was conducted by Principal Occupational Hygiene Consultant Ruairi Ward of OHMS Hygiene, with the assistance of various site personnel. The survey was conducted on the 20th of Feb 2018.

The purpose of the assessment was to:

- evaluate noise exposures for all personnel working at Moora Mine, and associated infrastructure including workshops
- identify those at risk from excessive noise exposure;
- provide information and advice on noise control measures including hearing protectors available on site;
- identify equipment, activities and processes having the potential to cause excessive noise exposure;
- determine, at least in part, compliance with statutory requirements; and
- allow, as far as practicable, for the delineation of areas in which noise exposure standards and/or action levels are exceeded.

1.1.1 Operation Description

The mining method is open pit mining with conventional drill and blast / load and haul techniques utilising a typical diesel fuelled mining fleet.

Quartzite ore is mined from Main and West open pits and is processed through an onsite crushing and screening plant at a rate of approximately 160,000 t per annum. Processed ore is trucked offsite to the Kemerton silica smelter. Waste rock is deposited in onsite Waste Rock Deposits (WRDs). The total area of Project disturbance is estimated to be 60 ha.

1.1.2 Methodology

Noise measurements were evaluated against the action levels for noise prescribed in the Western Australian *Mines Safety and Inspections Regulations* 1995:

- $L_{Aeq,8h}$ of 85 dB(A)
- L_{peak} 140 dB (lin)

Additionally, background noise level measurements were evaluated against an action level for noise of 82 dB(A). Both legislation and Simcoa policies, plans and procedures require that noise exposures for all personnel on site (including employees, contractors and visitors) be controlled at levels below these exposure standards and action levels and as far as reasonably practicable (ALARP).

This report does not:

- provide specific engineering noise solutions and advice for plant and equipment items identified generating noise in excess of the noise action levels;
- review health surveillance requirements; or
- provide an in-depth review of noise management policies, plans and procedures on site.

1.1.3 Results

Table 1.1 indicates the calculated exposures for the similar exposure groups (SEGs) relevant to Moora Mine. Indicated in red are those found to have excessive noise exposures. The noise sources contributing most to calculated noise exposures are also indicated.

Calibration certificates for equipment used are provided in Appendix 1, noise measurement results can be found in Appendix 2, and calculated normalised total daily noise exposure levels can be found in Appendix 3. The hearing protection assessments are provided in Appendix 4.

Table 1.1 Calculated 8hr equivalent continuous noise exposure level, $L_{Aeq,8hr}$ dB(A), for SEGs at Moora Mine

SEG	Occupations	No. in SEG	$L_{Aeq,8h}$ dB(A)	Predominant source(s)
SEG 1 Management, Administration & Technical	130000 to 150000 Professional and related occupations Management or administration services Mine management occupations	1	Majority office based <85 dB(A) Potential exposure to other noise sources as part of walkthrough and inspections	• N/A
SEG 2 Simcoa Operators	Simcoa Operators, Excavator Operator, 340000 Haul Truck Operator, 361000 Loader operator, 350000 Sampling, 440000 Operators are reported to rotate in all the above tasks, depending on the activities on any given day	7	88	• Plant machinery, walkthrough in processing areas
SEG 3 Drill and Blast	Blast Hole Drilling Surface 310000 Blast Hole Drill Operator 311000 Blast Hole Drill Ops Assistant 312000	1	Could Not Obtain	• Could not obtain, not present on the day of the survey
SEG 4 Crusher/Dry Plant Personnel	411000 Processing plant operator 412000 Processing plant serviceman	1	94	• Primary and Secondary Crushers
	TOTAL	10 (~8 > action limit)		

1.1.4 Summary of actions

The below is recommended.

- A site noise control policy, management plan and noise control plan should be developed and implemented where these do not exist. These should comply with legislation, codes of practice, guidance and best practice and be kept current. An audit of the implementation of these documents should also be undertaken.
- A hearing conservation training programme should be developed, implemented, reviewed and audited where this does not exist.
- An ear plug fit testing programme should be developed, implemented, reviewed and audited where this does not exist.
- The audiometric testing programme should be reviewed for adequacy and implemented.
- An alternative to those hand and power tools generating noise at the operator ear in exceedance of 82 dB(A) should be sought or else retrofitted to minimise noise emissions.
- Noise control solutions for the crushers and screens should be investigated. Exposures for plant operators can be reduced by investigating the causes of spillage in these areas and remediating which would negate the need for lengthy clean up activities and thus reducing noise exposure time for all personnel that work in these areas.
- Hearing protection signage should be installed at the mobile and fixed plant maintenance workshops (mandatory or else cautionary). Signage and labelling must comply with AS 1319 *Safety signs for the occupational environment*.

- Mobile plant and hand/power tools that generate an $L_{Aeq,T}$ in excess of 82 dB(A) should be labelled for the mandatory requirement to wear hearing protection. Signage and labelling must comply with AS 1319 *Safety signs for the occupational environment*.
- Consider limiting noise from two-way radios within mobile plant items or else encourage workers to set radios to just-audible levels. Noise indicates may assist in alerting mobile plant operators of at-risk noise levels.
- Consider reducing the number of personnel exposed to noise by segregation (physically and/or over time) and/or reducing noise exposure times.
- Provide hearing conservation and protection training and fit testing.
- Communicate the noise results and findings to all site personnel.

The complete list of recommendations can be found in Section 10.

1.1.5 Duties after receipt of noise survey report

The following duties should be undertaken on receipt of this report.

- The State Mines Engineer must be notified of the noise survey report via the Department of Mines, Industry Regulation and Safety form provided in Appendix 5: DMP Notification of a Noise Report Form.
- The report should be made available to managers and health and safety representatives.
- The manager of the mine should communicate the contents of the report to all persons at the workplace and to any other persons that the manager considers to be at risk.
- Within six months of receipt of this report, a written action plan should be prepared and implemented.
- If requested, the report should be made available to any person employed at the mine who may be exposed to noise in the workplace.
- This and all previous reports must be retained at the workplace if practicable, or else at another readily accessible place.

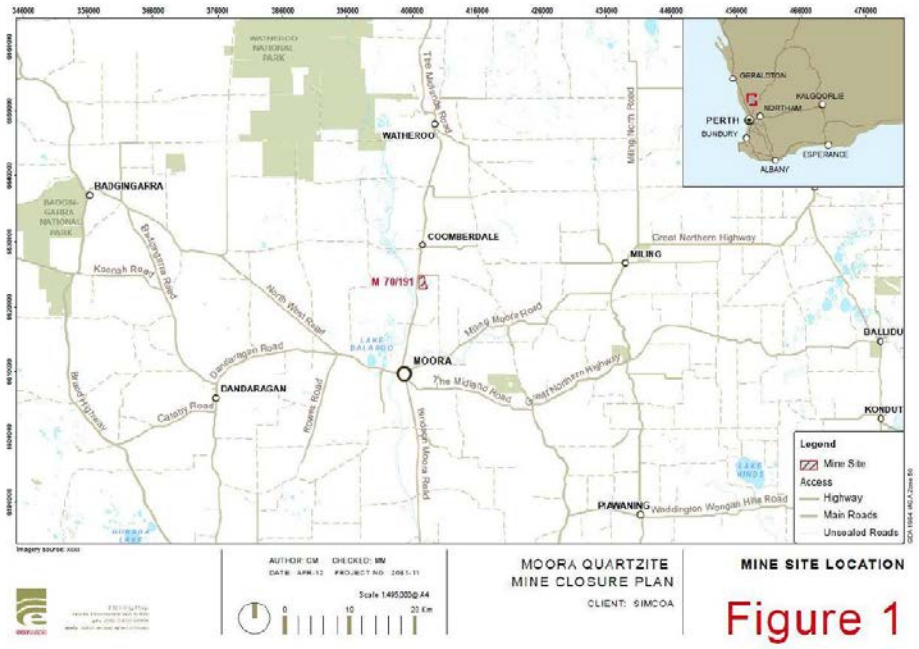
2. Background

A brief description of the workplace and work processes is provided in this Section.

2.1.1 Workplace

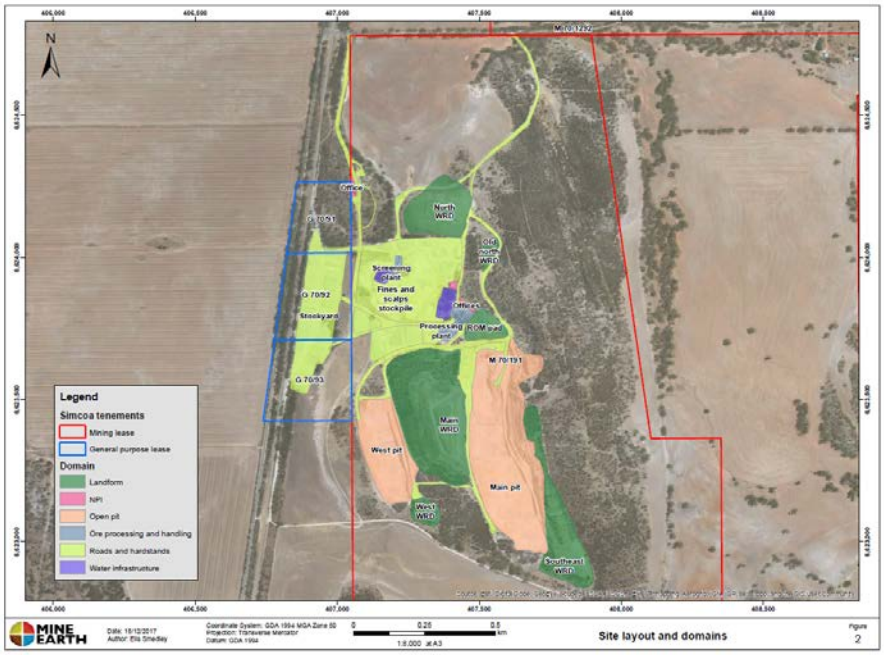
The Moora Mine is located 15 km north of Moora, in the Wheatbelt region of Western Australia (Refer Figure 1). The Project is operated by Simcoa Operations Pty Ltd (Simcoa) and is mined for high purity quartzite which is transported offsite for smelting.

Figure 1 Moora mine location map



Quartzite ore is mined from Main and West open pits and is processed through an onsite crushing and screening plant at a rate of approximately 160,000 t per annum. Processed ore is trucked offsite to the Kemerton silica smelter. Waste rock is deposited in onsite Waste Rock Deposits (WRDs). The total area of Project disturbance is estimated to be 60 ha (Refer Figure 2)

Figure 2 Moora mine overview



2.1.2 Workforce

There are approximately 11 workers based full time at the Moora Mine Site in February 2018. The majority of staff live in nearby Moora.

The main roster patterns worked have been described as follows:

- Mine manager, 11hr/day 5/2 roster with 2 Saturdays worked/month
- Simcoa operators, 11hr/day 5/2 roster with 2 Saturdays worked/month;
- JJ Hawkins Crushing and Screening, 11hr/day 5/2 roster with 2 Saturdays worked/month;
- Drill and Blast, on site as required,

The Moora Operations runs 12 hours a day, 365 days a year.

The number of personnel in each of the similar exposure groups (SEGs) relevant to the site, along with the typical roster worked by personnel within each of the SEGs; are indicated in Table 2.1.

Table 2.1 SEG personnel numbers

SEG no.	Name	DMIRS Codes	# workers – 2017/18	Roster
1	Management, Administration & Technical	130000 to 150000	1	11hr/day 5/2 roster with 2 Saturdays worked/month,
2	Simcoa Operators, (Excavator Operator, Haul Truck Operator, loader operator, Sampling) Operators preform all the above tasks	340000, 361000, 350000, 440000	7	11hr/day 5/2 roster with 2 Saturdays worked/month
3	Blast Crew	321000 320000	1	On Site as required
4	Crusher/Dry Plant Personnel	411000 421000	1	11hr/day 5/2 roster with 2 Saturdays worked/month off

2.1.3 Changes Since Previous Noise Survey

This is the first noise survey for Simcoa Moora Mine Site.

2.1.4 Summary of Actions Taken Since Last Report

Not applicable.

3. Methodologies

3.1.1 Noise Officer

Noise monitoring was conducted by Ruairi Ward (OHMS Hygiene Senior Occupational Hygienist). Ruairi is a Western Australia Department of Mines, Industry Regulation and Safety approved Noise Officer (Approval Number 11033).

3.1.2 Measurement Instrumentation

A hand held integrating sound level meter was used for measuring sound pressure levels during this investigation. Details of equipment used are provided in Table 3.1 below.

Table 3.1 Sound level measuring equipment used in the survey

Item	Make	Model	Serial No.
Integrated sound pressure level meter, octave band filter	Bruel & Kjaer	2250 (Type 1)	2506810
Microphone	Bruel & Kjaer	4189	2534249
Acoustic calibrator	Bruel & Kjaer	4231	3011979

The following settings were used for measurements taken in this investigation.

- Time response: Fast
- Frequency weighting: A, lin 1/3 Octave band, lin peak.

Calibration certificates for the above equipment have been provided in Appendix 1: Calibration certificates.

3.1.3 Measurement Procedures

All noise measurement methods and calculations were conducted in accordance with the requirements of AS/NZS 1269.1:2005 *Occupational Noise Management Part 1: Measurement and assessment of noise immission and exposure*, except where otherwise indicated.

All measurements were taken at the position of the person's ear where able without taking into account any protection which may be provided to the person by the wearing of personal hearing protectors. Otherwise, noise measurements were taken at the position where the operator's head would be expected to be, or else at 1.5m from the ground for standing persons and 0.8m above seat height for seated persons. For processing plant areas noise emissions levels from plant/equipment items were also collected (where unaffected by noise from other sources) however in most cases these measurements would be representative of noise immission levels at that point, due to the influx of noise from several noise sources.

Such measurements included the A-weighted average noise level ($L_{Aeq,T}$) and the linear-weighted peak noise level (L_{Zpeak}). These data were used to identify noisy plant, equipment and processes. Octave band linear-weighted average noise levels were also obtained for the purpose of assessing hearing protection. All measurements were taken during what was understood to be normal, representative working conditions unless otherwise indicated.

In addition to assessing noise at the operator ear, an attempt was made to identify all other noisy plant, equipment and processes and assess the noise levels emitted from these. This assessment included obtaining the extent of the affected area which is the maximum distance from the noise source at which the Sound Pressure Level reduced to 82 dB(A).

Plant, equipment and processes which have the potential to cause the action level to be exceeded but which were unable to be assessed at the time of the site survey, are listed in Section 9 Equipment Unable to be Assessed.

3.1.4 Action Level

The action level used for the extended shifts on site is: $L_{Aeq,T}$ 82 dB(A).

4. Noise survey results

All noise measurement data collected during the February 2018 noise survey are provided in Appendix 2: Noise measurement results. Results from individual areas are discussed below.

4.1.1 Mine Truck and Earthmoving Equipment

The results above the action level from monitoring conducted on mine truck and earthmoving equipment are presented in in Table 4.1.

Table 4.1 Mine Truck and Earthmoving Equipment, noise measurement details and results

ID	Noise source	Location	Area	Operating condition	Measurement position	$L_{Aeq,T}$ dB(A)	L_{Zpeak} dB(lin)	Extent of affected area (m)
ID064	CAT 773E Haul Truck DT01	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	91.7	115.6	10m
ID065	CAT 773E Haul Truck DT01	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.1	110.9	10m
ID066	CAT 773E Haul Truck DT01	Rear of Vehicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	86.8	108.3	5m
ID067	CAT 773E Haul Truck DT01	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	90.2	109.7	10m
ID070	CAT 980M FEL	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	84.0	105.7	3m

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ID	Noise source	Location	Area	Operating condition	Measurement position	$L_{Aeq,T}$ dB(A)	L_{Zpeak} dB(lin)	Extent of affected area (m)
ID071	CAT 980M FEL	Rear of Vehicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	82.3	103.6	3m
ID072	CAT 980M FEL	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	83.6	102.4	3m
ID073	CAT 980M FEL	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	87.3	142.7	5m
ID084	CAT 773E Haul Truck DT03	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	95.6	116.4	10m
ID085	CAT 773E Haul Truck DT03	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.2	115.6	10m
ID086	CAT 773E Haul Truck DT03	Rear of Vehicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.9	114.3	10m
ID087	CAT 773E Haul Truck DT03	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	95.5	112.0	10m
ID088	CAT 773E Haul Truck DT03	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	82.0	139.0	3m
ID089	CAT 773E Water Cart WC01	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	92.0	111.0	10m
ID090	CAT 773E Water Cart WC01	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	95.0	112.1	10m
ID091	CAT 773E Water Cart WC01	Rear of Vehicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	91.3	109.5	10m
ID092	CAT 773E Water Cart WC01	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.4	114.2	10m
ID093	CAT 773E Water Cart WC01	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	84.9	123.4	3m
ID095	CAT 988K FEL	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	83.1	104.3	3m
ID096	CAT 988K FEL	Rear of Vehicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	87.4	104.9	10m
ID097	CAT 988K FEL	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	86.5	106.2	5m

- The noise measured at the operator ear in the cab for the CAT 980M FEL, CAT 773E Water Cart WC01 and CAT 773E Haul Truck DT03 exceeded the 82dB(A) action level for noise whilst operating at 80% Revs for demonstration purposes.
- The noise measured at the operator ear in the cab for the CAT 773E Haul Truck DT01, CAT 988K FEL and CAT 385B FEL Excavator EX01 did not indicate a potential to be over exposed to noise; with noise levels measured at the operator ear measuring less than the 82dB(A) action level when operating at 80% Revs for demonstration purposes.

- Noise emission monitoring external to the mobile equipment operating cabin was also undertaken as indicated above. Noise measurements exceeded the noise action level of 82 dB(A) at 1m for all of the equipment items while operating at 80% Revs with the exception of the CAT 385B FEL Excavator EX01.
- The peak noise level of 142.7 recorded for the CAT 980M FEL, was noted not to be a true exceedance. This result was caused by the door of the front end loaded being slammed shut with the resulting pressure change causing a spurious results on the B&K 2250 sound level meter.

4.1.2 Processing and Fixed Plant Areas

The results above the action level from monitoring conducted in the processing and fixed plant area are presented in Table 4.2.

Table 4.2 Processing and fixed plant, noise measurement details and results

ID	Noise source	Location	Operating condition	Measurement position	$L_{Aeq,T}$ dB(A)	L_{Zpeak} dB(lin)	Extent of affected area (m)
ID037	Primary Crusher	Crushing hut door, outside	Crushing in progress	At 1.5 meters	90.6	115.5	Entire area
ID038	Primary Crusher	Crushing hut, Left Hand Side, outside	Crushing in progress	At 1.5 meters	100.8	126.3	Entire area
ID039	Primary Crusher	Crushing hut, Right Hand Side, outside	Crushing in progress	At 1.5 meters	97.7	124.1	Entire area
ID040	Secondary Crusher	Secondary crusher at Pressurizing fan PF02	Crushing in progress	At 1.5 meters	97.3	122.9	Entire area
ID041	Secondary Crusher	Secondary crusher at Right hand side of PF02	Crushing in progress	At 1.5 meters	92.3	115.6	Entire area
ID042	Secondary Crusher	Lube Cooling fan LC02 under secondary crusher	Crushing in progress	At 1.5 meters	95.4	115.2	Entire area
ID043	Primary and Secondary Crusher	Ground Floor	Crushing in progress	At 1.5 meters	90.6	117.5	Entire area
ID044	Primary and Secondary Crusher	Delivery Chute TV01	Chute in operation	At 1.5 meters	85.4	109.9	Entire area
ID045	McCloskey Conveyor	At McCloskey Conveyor	Conveyor running	At 1.5 meters	87.8	111.6	Entire area
ID046	Screen 01	Screen 1 Ground Floor	Screen running	At 1.5 meters	89.3	111.1	Entire area
ID047	Screen 01	Screen 01Centre of stairs	Screen running	At 1.5 meters	97.6	118.4	Entire area
ID048	Screen 01	Screen 01, top of stairs at confined space entry sign	Screen running	At 1.5 meters	92.0	114.9	Entire area
ID049	Screen 01	Screen 01, at emergency stop	Screen running	At 1.5 meters	95.9	116.0	Entire area
ID050	Under conveyors 4 & 8	Screen 01, at emergency stop	Screen running	At 1.5 meters	84.9	112.2	Entire area
ID051	Tertiary Crusher	Tertiary Crusher, Ground Floor	Crushing in progress	At 1.5 meters	91.2	111.8	Entire area
ID052	Tertiary Crusher	Tertiary Crusher	Crushing in progress	At 1.5 meters	91.3	110.8	Entire area
ID053	Tertiary Crusher	Tertiary Crusher, level 2 at stairs	Crushing in progress	At 1.5 meters	95.0	113.8	Entire area
ID054	Tertiary Crusher	Tertiary Crusher, top of Crusher	Crushing in progress	At 1.5 meters	98.3	116.1	Entire area
ID055	Screen 02	Screen 02, bottom at fire extinguisher	Screen running	At 1.5 meters	88.2	109.3	Entire area
ID056	Screen 02	Screen 02, at stairs	Screen running	At 1.5 meters	89.7	111.9	Entire area
ID057	Screen 02	Screen 02, at emergency stop	Screen running	At 1.5 meters	91.9	113.4	Entire area

ID	Noise source	Location	Operating condition	Measurement position	$L_{Aeq,T}$ dB(A)	L_{Zpeak} dB(lin)	Extent of affected area (m)
ID059	Red Genset Geo 01	Between Red Genset Geo 01 and MCC01	Genset Running	At 1.5 meters	82.1	112.0	8m
ID060	Screen 03	Bottom of Screen 03	Screen running	At 1.5 meters	83.9	115.6	5m
ID061	Screen 03	Screen 03, top of stairs	Screen running	At 1.5 meters	88.9	113.7	Entire area
ID062	Screen 03	Screen 03 at Emergency Stop	Screen running	At 1.5 meters	93.4	115.3	10m

- The majority of noise levels measured throughout the processing plant measured in excess of the 82 dB(A) action limit for noise and thus have the potential to contribute to excessive noise exposures for the processing plant operators and also maintenance personnel.
- The Crusher Operators have the potential to be exposed to noise above 100 dB(A) on the CR01 at the primary crusher. However the levels inside the crushing hut were measured to be 74.5 dB(A) which is well below the 82dB(A) noise action limit
- Many of the areas where the processing plant operators and maintainers perform work duties within the screening plant had noise levels measuring in exceedance of the 82 dB(A) action limit.
- The extent of the areas affected by noise generated from the relevant noise sources are as indicated in the table above. In general the entire crushing and screening plant operations exceeded the 82 dB(A) action limit. Mandatory HP signage was observed in at the 3 entry points to the crushing and screening plant.
- None of the peak noise levels recorded exceeded the 140 dB(lin) action level for peak noise.

4.1.3 Sample Preparation

The results above the action level from monitoring conducted at the processing plant sample prep area are presented in Table 4.3.

Table 4.3 Sample Preparation noise measurement details and results

ID	Noise source	Location	Operating condition	Measurement position	$L_{Aeq,T}$ dB(A)	L_{Zpeak} dB(lin)	Extent of affected area (m)
ID076	Sieve Shaker	Sample Prep	Operating for Demonstration purposes	At operators ear	89.2	109.9	10m

- Sample Technicians have the potential to be exposed to noise above the 82 dB(A) action limit at the sieve shaker with 89.2 dB(A) measured for this operation. Operators spend approximately an hour, once per week operating the sieve shaker.
- No hearing protection signage was observed to be present in the room with the sieve shaker. Hearing protection signage was observed to be present above the ring mill, in the adjacent room. However no hearing protection is required for tasks in this room.
- None of the peak noise levels recorded exceeded the 140 dB(lin) action level for peak noise.

4.1.4 Mobile and Fixed Plant Workshops – (no fitter or boilermakers present)

The results above the action level from monitoring conducted in the mobile and fixed plant Workshops are presented in Table 4.4. It is important to bear in mind also that only the item of equipment assessed was operating when noise measurements were taken – no other noisy plant/equipment items were running (unless otherwise indicated).

Table 4.4 Plant Maintenance Workshop noise measurement details and results

ID	Noise source	Location	Operating condition	Measurement position	$L_{Aeq,T}$ dB(A)	L_{Zpeak} dB(lin)	Extent of affected area (m)
ID075	Trade master GR1203 Grinder	Fixed Plant Workshop	Operating for Demonstration purposes	At operators ear	92.5	109.4	10m

- As no fitters or boilermakers were present on the day of the survey, a limited amount of equipment could be monitored. It is likely that the majority of the hand and powered tools used by the plant maintenance personnel will result in noise at the operator ear above the 82 dB(A) action level and thus have the potential to contribute to excessive daily noise exposure.
- The Trade master GR1203 Grinder resulted in noise levels at the operator ear measuring 92.5 dB(A), which exceeds the 82 dB(A) action level for noise and thus have the potential to contribute to excessive daily noise exposure for the fitters or boilermakers.
- Where the extent of the affected areas for each of the noisy plant and equipment items could not be obtained, this was either because they extended well beyond the workshop or the tooling was not operated for long enough to be able to check sound pressure levels extending out from the noise source.
- None of the peak noise levels measured in the workshop recorded exceeded the 140 dB(lin) action level for peak noise.

5. Noise Exposure Evaluations

In this Section noise exposure evaluations have been determined for each relevant similar exposure group (SEG) from the work activities and work locations, noise survey measurement data, worker reported approximations of exposure times, and using the methodology described in AS/NZS 1269.1:2005 *Occupational Noise Management Part 1: Measurement and assessment of noise immission and exposure*.

The 8-hour equivalent continuous noise exposures calculated for each SEG applicable to is provided in Table 5.1 below, along with the plant, equipment and/or processes that contributed significantly to these exposures.

The noise data used and calculations performed in determining daily noise exposures for each SEG can be found in Appendix 3: Evaluation of normalised total daily noise exposure level.

Table 5.1 Evaluated noise exposures for similar exposure groups (SEGs) at Moora Mine

SEG	Occupations	No. in SEG	$L_{Aeq,8h}$ dB(A)	Predominant source(s)
SEG 1 Management, Administration & Technical	130000 to 150000 Professional and related occupations Management or administration services Mine management occupations	1	Majority office based <85 dB(A) Potential exposure to other noise sources as part of walkthrough and inspections	• N/A
SEG 2 Simcoa Operators	Simcoa Operators, Excavator Operator, 340000 Haul Truck Operator, 361000 Loader operator, 350000 Sampling, 440000 Operators are reported to rotate in all the above tasks, depending on the activities on any given day	7	88	• Plant machinery, walkthrough in processing areas
SEG 3 Drill and Blast	Blast Hole Drilling Surface 310000 Blast Hole Drill Operator 311000 Blast Hole Drill Ops Assistant 312000	1	Could Not Obtain	• Could not obtain, not present on the day of the survey
SEG 4 Crusher/Dry Plant Personnel	411000 Processing plant operator 412000 Processing plant serviceman	1	94	• Primary and Secondary Crushers
	TOTAL	10 (~8 > action limit)		

6. Hearing protection assessments

6.1.1 Observations

Several different types of hearing protectors were available to site personnel:

- A, 3M E-A-R™ FX™ Earplugs;
- B , 3M E-A-R™ Classic™ Platinum Earplugs;

6.1.2 Results

The AS/NZS 1269.3:2005 octave band analysis method was used to evaluate the effectiveness of these hearing protectors for measured $L_{Aeq,T}$ sound pressure levels. All of the attenuated noise levels for all of the hearing protectors can be found in Appendix 4: Hearing protection assessments.

There were no situations encountered where available hearing protectors failed to provide sufficient protection.

Error! Reference source not found. outlines the attenuation provided for the 5 loudest noise sources for the Simcoa Moora operations.

Table 6.1 Noise exposures where all of the available hearing protectors provide insufficient protection

Measurement Id.	Noise Sources	Hearing Protector dB(A)	
		A	B
ID038	Primary Crusher Crushing in progress At 1.5 meters	78.0	81.5
ID039	Primary Crusher Crushing in progress At 1.5 meters	74.3	77.5
ID040	Secondary Crusher Crushing in progress At 1.5 meters	74.3	77.7
ID047	Screen 01 Screen running At 1.5 meters	73.7	77.4
ID054	Tertiary Crusher Crushing in progress At 1.5 meters	74.7	77.9

6.1.3 Findings

- If worn correctly, both earplugs will adequately attenuate noise at the operator ear (or at 1 m from the plant/equipment) to below the 82 dB(A) action limit for noise over a 12-hour period.
- The closest the exposure got to the 82dB(A) limit was at the primary crusher wearing the 3M E-A-R™ Classic™ Platinum Earplugs (highlighted in amber in Table 6.1). In this instance, the attenuation came to within 0.5 dB(A) of the 82dB(A) limit.
- Available hearing protectors over-protect for many of the measured noise levels, as can be seen in Appendix 4: Hearing protection assessments. AS/NZS 1269.3:2005 states that where attenuation results in an effective L_{Aeq}8hr of less than or equal to 70 dB(A), over-protection can result; which subsequently affects the ability of the wearer to sufficiently hear warning signals or critical communications.
- When reviewing new hearing protection in the light of findings it should be noted that one of the key deciding factors when selecting hearing protection is comfort. Workers will not wear hearing protection, or will not wear it for the entire period exposed when it is uncomfortable. Hence, comfort is key.
- When utilising double hearing protection (i.e. ear plugs worn in combination with ear muffs); priority should be given to selecting an ear plug of the highest attenuation. When worn in combination with an ear muff, an additional 3 dB of attenuation is provided.
- Note that Class 5-only hearing protectors must be used to protect against peak exceedences.

7. General - Noise Management

A review Moora Operations management of noise in terms of development and implementation of noise control policies, noise management and control plans and procedures was not undertaken as part of this noise survey report. Moora Mine should assess whether the following have been prepared, meet the requirements of legislation and best practice guidance, have been implemented effectively and are continuously monitored and reviewed:

- Ω a noise control policy;
- Ω a noise management plan and/or hearing protection management plan;
- Ω a noise control action plan;
- Ω a formal noise management/hearing protection training programme; and
- Ω pre-employment and ongoing audiometric testing programmes.

8. Hearing protection signage

A review of Moora Mine mandatory hearing protection areas was undertaken. This was undertaken by measuring sound pressure levels using the sound level meter around fixed plant areas at Moora during the site visit. For the most part, signposting of mandatory hearing protection wearing areas was adequate. A summary of the findings is presented below.

- Ω Hearing protection (HP) signage was observed to be present at all three entrances to the crushing and screening circuits.
- Ω A small hearing protection sign was observed to be present at the mobile plant workshop (Refer Photo 1).
- Ω Hearing protection signage was observed to be present at the mobile plant workshop (Refer Photo 2).
- Ω Additional safety signage was observed to be present, but not in use in the fixed plant workshop (Refer Photo 3).
- Ω Safety signage was observed to be present on the Screen Primary Scalping (Refer Photo 4).
- Ω No HP signage was on the interior of the water cart, and on the CAT 980M FEL. The sound levels in the cab of these pieces of equipment exceed 82dB(A) and hearing protection signage is required.

Photo 1: HP signage in mobile Plant Fitters Workshop

Photo 2: HP signage at the fixed plant workshop

Photo 3: HP signage at vehicle access to fixed plant

Photo 4: Mandatory HP sign at single lane access to sample area

9. Equipment Unable to be Assessed

The following items were unable to be assessed at the time of the noise survey:

- CAT 773E Haul Truck DT02 (expected to be similar to DT01 and DT03);
- Multiple pieces of equipment in the fixed and mobile workshop as there were no fitters available on the day of the survey to allow the noise levels from these area to be assessed
- RSW10 and MC1050, temporary radial stackers which were not in use on the day of the survey
- Auxiliary Genset, not in use on the day of the survey;

10. Recommendations

Please note the determination of specific engineering controls, apart from general suggestions, was not an outcome. A reputable noise engineer is required for such advice and specifics.

10.1.1 Engineering

- Available noise control solutions should be investigated with a team of appropriate stakeholders (e.g. persons from operations, maintenance, design, health and safety). Where possible, the services of an acoustic engineer should be procured for assistance. Appropriate noise control solutions should be decided on and implemented and noise levels re-tested to confirm effectiveness.
- Noise control methodologies should be investigated for the following items of fixed plant:
  - Crushers;
  - Screens.

  Consideration may be given to:
  - increasing the preventative maintenance frequency and/or improving procedures;
  - installing baffles or other impact-absorbing materials;
  - installing silencers;
  - reducing the speed and/or power of the motors;
  - confirming connections;

- identifying any vibrating components and isolate, stiffen or dampen these to reduce vibration and subsequently noise.

Ω Causes of spillage within the screen area should be investigated and remedial measures identified and implemented. Reduced spillage would minimise the requirement for significant time periods spent hosing/cleaning up spillage.

Ω An alternative to those hand and power tools generating noise at the operator ear in exceedance of 82 dB(A) should be sought or else retrofitted to minimise noise emissions and in the interim hearing protection be mandated and exposure durations minimised. A review of the inspection and preventative maintenance regimes should also be conducted.

Ω Consider limiting noise from two-way radios within mobile plant items.

Ω When replacing noisy plant and equipment use quieter alternatives.

10.1.2 Administrative

Ω A site-specific noise control policy and management plan should be developed. This plan should include a "Buy/Hire/Design Quiet" Policy and be communicated to all persons responsible for design and also purchasing/hiring new or replacement equipment and/or parts. A programme for the continual review and improvement of the noise management programmes and procedures should also be developed and implemented. The implementation of the noise control policy and management programmes/procedures should also be audited. The policy and plan should fulfil the requirements of:

- Part 7, Division 1 of the Mines Safety and Inspection Regulations 1995;
- Department of Mines, Industry Regulation and Safety (2014) Guideline - Management of noise in Western Australian mining operations;
- AS/NZS 1269 Occupational noise management;
- National Occupational Health and Safety Commission (2000) National standard for occupational noise [NOHSC:1007(2000)] 2nd Edition; and
- Safe Work Australia (2011) Code of Practice - Managing noise and preventing hearing loss at work.

Ω A programme for pre-employment and regular audiometric tests subsequent to the baseline audiometric test should be established. AS/NZS 1269 Occupational noise management Part 4: Auditory assessment recommends that audiometric testing be conducted at least 12-monthly.

Ω A programme for training on noise and the wearing of hearing protection should be established and implemented. Hearing conservation training should meet the requirements of:

- Section 5.5 of Department of Mines, Industry Regulation and Safety, 2014, Management of noise in Western Australian mining operations — guideline;
- Section 5 of Safe Work Australia, 2011, Managing Noise and Preventing Hearing Loss at Work Code of Practice;
- Section 3.3.4, 2005, AS/NZS 1269.2:2005 Occupational Noise Management Part 2: Noise Control Management.

Ω Consider relocating noise sources and increasing the distance between noise sources and workers. Noise sources ideally also would be operational in open-air environments rather than enclosed spaces and/or those having hard, reflective surfaces which allows noise to reverberate.

Ω Consider altering work schedules/staggering work activities such that noisy work is only conducted when there are no/minimal personnel in the vicinity. An example is blast hole drilling – ensure all drilling has ceased before the blast crew access the drill pad. When increasing the distance between noise sources and workers – consideration should be given to the extent of the affected area for the noise source(s) of concern.

Ω Consider the development and implementation of job rotation programmes for sources contributing/potentially contributing to excess noise exposure or other means to reduce exposure time.

Ω Replace noisy power/hand tools with quieter alternatives or else substitute for a quieter process.

- Cautionary signage, as a minimum, should be erected at all entrances to plant and mobile equipment workshops: because the noise levels generated within the workshops are from the use of tools, plant and equipment that are transient in nature. Note that mandatory signage should be considered (where not already in place) because workers may not always advise all other personnel in the area that noisy plant/equipment will be operated and most items have "extent of the affected areas" beyond the work area boundary. Signage and labelling must comply with AS 1319 *Safety signs for the occupational environment*. Placement of the signage should consider the greatest extent of the affected area measured for tooling relevant to that area.
- Consideration could be given to installation of environmental sound level devices as quick indicators as to when hazardous noise levels are being approached and hearing protection required to be worn.
- Consider encouraging workers to set 2-way radios and stereos at reasonable (i.e. just audible) volume levels, this volume will need to be determined.
- All mobile plant, tooling and other equipment items that generate an $L_{Aeq,T}$ at the operator ear in excess of 82 dB(A) should be labelled for the mandatory requirement to wear hearing protection. Signage and labelling must comply with AS 1319 *Safety signs for the occupational environment*.
- Ensure that SWPs for operating all plant/equipment that generate an $L_{Aeq}T$ in excess of 82 dB(A) are updated to reflect the mandatory requirement to wear hearing protection. This requirement should be communicated to all relevant parties and incorporated in training, risk assessments and standard work procedures.
- Compare personal noise dosimetry measurements for mobile equipment operators with internal cabin measurements conducted at the time of the survey to assess noise contributed by two-way and AM/FM radios where used.
- When planning daily work activities, consider consulting the UK Health and Safety Executive (HSE) Daily Noise Exposure Calculator (found at: http://www.hse.gov.uk/noise/calculator.htm). Enter in the $L_{Aeq,T}$ dB(A) noise level for the task(s) conducted or plant/equipment items to be used and the estimated task duration(s) to assess whether the 8-hour noise action limit of 85dB(A) will be reached and whether exposure times need to be reduced to ensure exposures are less than noise action limits.
- Solvents are known to be used on site. Appendix A of the Safe Work Australia Code of Practice for *Managing Noise and Preventing Hearing Loss at Work*, outlines common ototoxic substances that are found in Australian Workplaces. A review of the SDSs for materials used on site is appropriate and where ototoxic substances are found to be present, a robust risk assessment to reduce the risk to as low as reasonably practicable should be carried out.

10.1.3 PPE

- An ear plug fit testing programme should be developed, implemented, reviewed and audited.
- The use of electronic filtering hearing protectors should be assessed where background noise levels are excessive and communication required e.g. Sensear ear muffs may be used to reduce background noise (including input to the hearing protector from 2-way radio communications) to below 82 dB(A). These types of protectors work through amplifying the frequencies of noise at which people speak and reducing the remaining frequencies to allow for more effective communication.
- Develop, implement and communicate procedures to mitigate the inadvertent use of hearing protectors that do provide too much attenuation (refer section 0).

10.1.4 Duties After Receipt of Noise Survey Report

- Within 6 months of receipt of this report, prepare a noise control action plan in accordance with Section 4 of the 2016 Department of Mines, Industry Regulation and Safety Management of noise in Western Australian mining operations — guideline, incorporating these recommendations.
- Notify the State Mines Engineer of the noise survey report via the Department of Mines, Industry Regulation and Safety form provided in Appendix 5: DMP Notification of a Noise Report Form.
- The report should be made available to managers and health and safety representatives.

- The manager of the mine should communicate the contents of the report to all persons at the workplace and to any other persons that the manager considers to be at risk.
- Within six months of receipt of this report, a written action plan should be prepared and implemented.
- If requested, the report should be made available to any person employed at the mine who may be exposed to noise in the workplace.
- This report must be retained at the workplace if practicable, or else at another readily accessible place.
- Ensure a further noise survey of the site is undertaken within 5 years of this survey and that supplementary assessments are carried out for plant/equipment/processes listed in Section 9 and whenever new plant/equipment items are introduced to site.

11. Amendment details

Revision	Details	Date	Author	Reviewer
Draft	Draft issue	02/03/2018	Ruairi Ward	Giovanni Sessarego
Final	Amendments made in line with RBHMP rosters	16/05/2018	Ruairi Ward	Ruairi Ward

12. Approval

Signed	Date	By
	16/05/2018	Ruairi Ward

Moora Mine Noise Survey 2018

Appendix 1: Calibration certificates

NVMS Measurement Systems

Certificate of Calibration – Sound Level Meter

Report Reference: SLM/16/11/010 **Date of calibration:** 11/11/2016

Client: OHMS Hygiene
Address: PO Box 160, Cloverdale WA 6985

Sound Level Meter:	Brüel & Kjær 2250	**Microphone:**	Brüel & Kjær 4189
Meter Serial No:	2506810	**Microphone Serial No:**	2534249
Meter Class:	1	**Preamplifier:**	Brüel & Kjær ZC 0032
Hardware Version:	1.1	**Preamplifier Serial No:**	4645
Software Version:	4.5.2	**Filters:**	Integral Octave & 1/3 Octave Band
Channel/s tested:	N/A		

Procedures from IEC 61672-3:2006 were used to perform periodic tests.

Clause 9	Indication at the calibration check frequency	**Complied**
Clause 10	Self-generated noise	**Complied**
Clause 11	Acoustical tests of frequency weighting	**Complied**
Clause 12	Electrical tests of frequency weightings	**Complied**
Clause 13	Frequency and time weighting at 1kHz	**Complied**
Clause 14	Level linearity on the reference level range	**Complied**
Clause 15	Level linearity including level range control	**N/A**
Clause 16	Toneburst response	**Complied**
Clause 17	Peak C sound level	**Complied**
Clause 18	Overload indication	**Complied**

Where the instrument includes an Octave Band or 1/3 Octave Band Filter Set, performance characteristics were checked against the requirements of the following clauses of AS/NZS4476:1997:

Clause 4.4, 5.3	Relative Attenuation	**Complied**

Primary test equipment:
Bruel & Kjaer type 4226 multifunction calibrator S/N 2831080
Agilent Technologies HP33120A Waveform generator S/N US36006913
Agilent Technologies HP8903E Distortion Analyser S/N 2818A00472

Environmental conditions – start of test 25.5 deg C, 101.6 kPa, 42 %RH
Environmental conditions – end of test: 25.5 deg C, 101.6 kPa, 43 %RH

The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 [AS IEC 61672.1-2004], the sound level meter submitted for testing conforms to the Class 1 requirements of IEC 61672-1:2002 [AS IEC 61672.1-2004].

The calibration procedures followed are in accordance with the terms of the NATA accreditation of this laboratory.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Calibration.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accreditation No. 12604

Authorised Signatory

11/11/16
Date of Issue

Noise & Vibration Measurement Systems Pty Ltd
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NVMS Solutions

Certificate of Calibration

Certificate No:	CAL/17/02/012	**Calibration Date:**	24/02/2017
Client:	OHMS Hygiene		
Address:	30 Churchill Avenue, Subiaco WA 6008		
Description:	Acoustic Calibrator	**Specified Sound**	
Manufacturer:	Brüel & Kjær	**Pressure Levels:**	94 dB, 114 dB
Model:	4231		
Serial No:	3011979	**Specified Frequencies:**	1000 Hz
Adaptors:	½ inch		

Tests performed The sound pressure level(s), frequency(ies) and total distortion of the calibrator have been checked against the requirements of AS IEC 60942 - 2004 Annex B

Test Results

Parameter	**Measured Value**	**Expanded Measurement Uncertainty** †	
Sound Pressure Level 1	**94.09 dB**	0.14 dB	**Complied Class 1**
Sound Pressure Level 2	**114.07 dB**	0.14 dB	**Complied Class 1**
Frequency	**1000 Hz**	0.01 Hz	**Complied Class 1**
Distortion @ SPL 1	**0.3 %**	0.07 %	**Complied Class 1**
Distortion @ SPL 2	**0.4 %**	0.07 %	**Complied Class 1**

(Sound Pressure Levels are referred to a pressure of 20 micro-pascals)

† Measurement uncertainties are stated at the 95% confidence level, and have been calculated in accordance with the principles in the ISO Guide to the Expression of Uncertainty in Measurement. A coverage factor of 2 applies.

Ambient Conditions

Temperature	**25.8** °C
Relative Humidity	**36** %
Atmospheric Pressure	**1015** mbar

Authorised Signatory

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Calibration.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Accreditation No. 12604.

Checked by

24/2/17
Date of issue

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Phone: (08) 9380 6933
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Primary Test Equipment

Reference Sound Calibrator: Brüel & Kjær Type 4226 s/n 2831080

Test Microphone: Brüel & Kjær Type 4192 s/n 2670896
Test Preamplifier: Type 2669 s/n 2222221
Configuration: IEC 1094-4 Type WS2P

Calibrated Frequency Counter: HP 53131A s/n 3546A13054

Calibrated Measuring Amplifier: Brüel & Kjær Type 2610 s/n 1894797

Calibrated Distortion Analyser: HP 8903E s/n 2818A00472

Test Methods

a) **Sound Pressure Level (AS IEC 60942-2004 Clause B3.4)**
The sound pressure level(s) of the calibrator under test was measured by comparison with the sound pressure level(s) generated by the reference sound calibrator using the test microphone. The result(s) provided on the previous page is the mean of the set(s) of three measurements.

b) **Frequency (AS IEC 60942-2004 Clause B3.5)**
The frequency of the calibrator under test was measured with the test microphone using the calibrated frequency counter.

c) **Total Distortion (AS IEC 60942-2004 Clause B3.6)**
The total Distortion of the calibrator under test was measured with the test microphone using the calibrated distortion analyser.

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Appendix 2: Noise measurement results

Notes

* Area where the $L_{Aeq,T}$ exceeds 82 dB(A), given as a radius in metres.

CNO = Could not obtain.

NA = Not applicable

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID036	Primary Crusher	Crushing Hut	Processing and Fixed Plant	Crushing in progress	At operators ear	74.5	105.8	N/A	85.99	79.08	74.89	76.95	72.08	72.05	68.84	67.03	62.81	50.03	36.86
ID037	Primary Crusher	Crushing hut door, outside	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	90.6	115.5	Entire area	86.71	87.68	89.46	90.94	89.56	88.43	85.39	82.52	76.86	68.12	55.47
ID038	Primary Crusher	Crushing hut, Left Hand Side, outside	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	100.8	126.3	Entire area	88.02	91.95	100.44	97.89	97.20	98.70	96.55	92.06	87.01	79.77	68.98
ID039	Primary Crusher	Crushing hut, Right Hand Side, outside	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	97.7	124.1	Entire area	88.16	90.03	92.20	93.52	92.15	93.89	93.61	90.76	86.00	77.86	68.02
ID040	Secondary Crusher	Secondary crusher at Pressurizing fan PF02	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	97.3	122.9	Entire area	83.01	91.18	95.97	93.57	93.34	94.41	93.32	89.37	83.39	74.62	62.66

Moora Mine Noise Survey 2018

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID041	Secondary Crusher	Secondary crusher at Right hand side of PF02	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	92.3	115.6	Entire area	87.67	83.33	88.41	89.86	89.13	88.95	88.10	85.03	79.59	71.75	60.52
ID042	Secondary Crusher	Lube Cooling fan LC02 under secondary crusher	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	95.4	115.2	Entire area	85.72	86.05	90.75	90.86	92.96	94.69	90.42	86.41	82.31	73.09	60.97
ID043	Primary and Secondary Crusher	Ground Floor	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	90.6	117.5	Entire area	92.63	85.58	90.18	89.00	89.23	88.32	86.09	82.56	77.55	68.63	55.50
ID044	Primary and Secondary Crusher	Delivery Chute TV01	Processing and Fixed Plant	Chute in operation	At 1.5 meters	85.4	109.9	Entire area	85.95	86.16	87.52	82.87	81.16	80.61	80.25	79.76	75.00	66.49	57.04
ID045	McCloskey Conveyor	At McCloskey Conveyor	Processing and Fixed Plant	Conveyor running	At 1.5 meters	87.8	111.6	Entire area	100.31	85.68	81.47	82.56	83.74	82.64	83.01	81.80	77.82	69.76	59.30
ID046	Screen 01	Screen 1 Ground Floor	Processing and Fixed Plant	Screen running	At 1.5 meters	89.3	111.1	Entire area	98.45	86.60	82.92	83.59	86.52	83.48	83.23	83.74	80.79	72.84	61.39
ID047	Screen 01	Screen 01Centre of stairs	Processing and Fixed Plant	Screen running	At 1.5 meters	97.6	118.4	Entire area	102.37	87.92	91.81	89.34	93.14	93.97	92.45	91.64	86.13	78.67	68.90

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID048	Screen 01	Screen 01, top of stairs at confined space entry sign	Processing and Fixed Plant	Screen running	At 1.5 meters	92.0	114.9	Entire area	96.16	86.15	86.70	86.55	86.49	86.03	85.62	86.98	83.19	75.09	63.21
ID049	Screen 01	Screen 01, at emergency stop	Processing and Fixed Plant	Screen running	At 1.5 meters	95.9	116.0	Entire area	99.16	87.39	87.31	89.34	92.95	92.88	89.93	89.22	86.03	80.34	71.89
ID050	Under conveyors 4 & 8	Screen 01, at emergency stop	Processing and Fixed Plant	Screen running	At 1.5 meters	84.9	112.2	Entire area	100.57	87.43	85.64	83.86	83.04	81.54	79.13	77.52	75.00	71.55	63.19
ID051	Tertiary Crusher	Tertiary Crusher, Ground Floor	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	91.2	111.8	Entire area	85.91	86.97	83.08	94.19	91.15	88.10	86.24	82.27	77.86	72.63	62.23
ID052	Tertiary Crusher	Tertiary Crusher	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	91.3	110.8	Entire area	85.13	86.57	85.25	92.72	93.97	88.36	85.39	81.52	76.87	71.15	59.01
ID053	Tertiary Crusher	Tertiary Crusher, level 2 at stairs	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	95.0	113.8	Entire area	87.88	90.24	89.55	92.98	92.84	93.43	94.37	91.61	86.95	79.79	69.96
ID054	Tertiary Crusher	Tertiary Crusher, top of Crusher	Processing and Fixed Plant	Crushing in progress	At 1.5 meters	98.3	116.1	Entire area	91.29	85.69	87.19	87.82	83.52	82.79	81.43	81.82	80.20	78.31	73.73
ID055	Screen 02	Screen 02, bottom at fire extinguisher	Processing and Fixed Plant	Screen running	At 1.5 meters	88.2	109.3	Entire area	98.61	86.12	84.32	89.20	86.81	84.75	82.49	82.85	82.03	79.82	73.18

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID056	Screen 02	Screen 02, at stairs	Processing and Fixed Plant	Screen running	At 1.5 meters	89.7	111.9	Entire area	100.13	92.34	86.51	91.03	87.34	85.27	85.79	85.13	84.59	81.25	73.28
ID057	Screen 02	Screen 02, at emergency stop	Processing and Fixed Plant	Screen running	At 1.5 meters	91.9	113.4	Entire area	88.56	84.86	85.02	85.00	79.33	73.84	73.39	71.99	69.23	65.07	56.34
ID058	Red Genset Geo 01	Red Genset Geo 01, centre	Processing and Fixed Plant	Genset Running	At 1.5 meters	79.3	108.2	N/A	89.09	86.80	92.56	91.29	82.16	75.77	74.58	74.03	72.45	68.98	59.80
ID059	Red Genset Geo 01	Between Red Genset Geo 01 and MCC01	Processing and Fixed Plant	Genset Running	At 1.5 meters	82.1	112.0	8m	109.10	90.93	88.22	83.49	84.55	81.15	77.01	75.68	73.91	71.39	65.37
ID060	Screen 03	Bottom of Screen 03	Processing and Fixed Plant	Screen running	At 1.5 meters	83.9	115.6	5m	103.95	88.27	87.38	82.36	88.88	85.13	82.48	81.25	80.44	77.07	69.70
ID061	Screen 03	Screen 03, top of stairs	Processing and Fixed Plant	Screen running	At 1.5 meters	88.9	113.7	Entire area	100.33	87.33	88.81	84.66	93.31	89.45	87.98	84.56	84.29	82.04	74.70
ID062	Screen 03	Screen 03 at Emergency Stop	Processing and Fixed Plant	Screen running	At 1.5 meters	93.4	115.3	10m	97.59	84.11	80.93	79.75	76.75	72.92	70.25	67.19	64.00	59.52	53.97
ID063	MCC02	In front of MCC02	Processing and Fixed Plant	Screen running	At 1.5 meters	75.9	106.1	N/A	83.72	84.52	87.35	96.56	93.17	87.25	84.65	85.32	77.37	69.64	57.98

Moora Mine Noise Survey 2018

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID064	CAT 773E Haul Truck DT01	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	91.7	115.6	10m	83.46	79.56	78.92	93.34	88.40	87.86	89.52	88.56	81.43	76.58	68.61
ID065	CAT 773E Haul Truck DT01	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.1	110.9	10m	82.83	77.29	77.32	91.27	93.05	79.46	79.68	78.68	69.08	64.31	56.22
ID066	CAT 773E Haul Truck DT01	Rear of Vehicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	86.8	108.3	5m	81.89	80.90	78.22	90.53	88.63	85.35	86.12	82.77	77.59	71.92	62.10
ID067	CAT 773E Haul Truck DT01	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	90.2	109.7	10m	85.28	91.34	83.59	79.65	74.25	76.04	74.41	73.00	67.76	62.79	51.30
ID068	CAT 773E Haul Truck DT01	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	79.5	104.2	N/A	81.70	80.03	88.63	83.73	74.80	76.45	76.60	73.09	66.75	61.45	52.19
ID069	CAT 980M FEL	At Front	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	80.5	103.9	N/A	82.05	83.22	90.43	87.10	80.54	80.04	80.05	76.19	69.42	63.39	52.12
ID070	CAT 980M FEL	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	84.0	105.7	3m	79.52	81.67	88.02	86.24	80.27	79.88	78.29	72.21	66.24	59.65	46.99

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ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID071	CAT 980M FEL	Rear of Vechicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	82.3	103.6	3m	78.22	82.85	80.30	83.89	81.90	81.01	79.63	74.69	68.93	62.92	52.14
ID072	CAT 980M FEL	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	83.6	102.4	3m	107.21	100.82	85.61	85.36	78.14	83.58	82.79	81.58	74.33	64.83	57.69
ID073	CAT 980M FEL	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	87.3	142.7	5m	76.93	69.98	72.95	68.68	66.81	71.89	74.45	69.47	60.01	50.25	43.22
ID074	Compressor FP1001-RMD	Mobile Workshop	Workshop	Operating for Demonstration purposes	At operators ear	77.1	100.3	N/A	68.14	72.40	71.51	76.75	77.69	84.18	83.53	86.38	87.43	82.05	72.57
ID075	Trade master GR1203 Grinder	Fixed Plant Workshop	Workshop	Operating for Demonstration purposes	At operators ear	92.5	109.4	10m	74.78	73.95	74.71	83.67	83.39	78.01	82.11	78.23	83.12	84.79	79.58
ID076	Sieve Shaker	Sample Prep	Sample Prep Area	Operating for Demonstration purposes	At operators ear	89.2	109.9	10m	82.83	70.16	71.17	68.15	70.51	72.96	75.99	70.39	70.61	68.61	60.48
ID077	Ring Mill	Sample Prep	Sample Prep Area	Operating for Demonstration purposes	At operators ear	79.2	99.3	N/A	76.60	72.08	70.04	69.68	73.32	74.90	70.77	67.33	61.47	53.94	43.97
ID078	Sample Prep Crusher	Sample Prep	Sample Prep Area	Operating for Demonstration purposes	At operators ear	75.8	99.4	N/A	90.96	90.60	83.65	82.14	72.61	63.72	60.44	57.06	52.48	45.13	35.42

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID079	Holden Ute, Registration 1GAM946	Driving	Mine Truck and Earthmoving Equipment	Driving on Road	At operators ear	69.7	110.2	N/A	74.15	76.32	84.87	77.90	80.59	80.56	73.01	75.15	66.81	56.65	43.70
ID080	All Terrain Telehandler	In front at workshops	Processing Area, Mobile Plant	Operating for Demonstration purposes	In front of cab	81.6	107.8	N/A	75.17	78.91	92.30	77.34	81.80	77.48	67.29	65.12	59.20	51.76	45.07
ID081	All Terrain Telehandler	In Cab	Processing Area, Mobile Plant	Operating for Demonstration purposes	At operators ear	78.2	103.8	N/A	73.68	71.28	84.19	76.68	74.35	75.22	70.56	67.14	64.38	53.99	42.47
ID082	CAT 236D Bobcat	In front at workshops	Processing Area, Mobile Plant	Operating at 80% Revs, demonstration purpose	At 1.5 meters	76.5	97.5	N/A	109.05	97.81	91.53	81.65	72.23	73.95	70.17	70.03	69.75	65.21	60.42
ID083	CAT 236D Bobcat	In Cab	Processing Area, Mobile Plant	Operating at 80% Revs, demonstration purpose	At 1.5 meters	78.0	141.6	N/A	73.57	77.61	82.87	93.89	96.04	90.98	91.05	88.43	82.82	78.34	65.01
ID084	CAT 773E Haul Truck DT03	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	95.6	116.4	10m	74.24	80.23	79.84	90.91	93.47	88.78	89.16	88.11	82.03	79.56	65.75
ID085	CAT 773E Haul Truck DT03	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.2	115.6	10m	74.83	79.75	82.85	98.49	101.46	85.96	87.73	87.03	80.50	79.43	64.23

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ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID086	CAT 773E Haul Truck DT03	Rear of Vechicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.9	114.3	10m	75.07	79.70	80.52	92.53	91.68	90.24	90.68	89.44	83.34	80.02	66.69
ID087	CAT 773E Haul Truck DT03	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	95.5	112.0	10m	104.81	98.62	85.82	88.66	81.03	78.46	76.44	73.63	68.22	66.84	49.38
ID088	CAT 773E Haul Truck DT03	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	82.0	139.0	3m	75.60	79.62	87.30	92.39	87.66	88.32	87.84	85.22	77.41	71.98	62.45
ID089	CAT 773E Water Cart WC01	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	92.0	111.0	10m	77.82	81.59	90.09	90.85	91.54	88.69	91.26	89.05	81.59	76.25	64.78
ID090	CAT 773E Water Cart WC01	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	95.0	112.1	10m	74.68	81.87	81.41	90.41	90.37	85.36	88.03	83.99	75.85	71.52	62.57
ID091	CAT 773E Water Cart WC01	Rear of Vechicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	91.3	109.5	10m	82.61	86.72	91.94	96.26	91.98	87.31	90.17	88.12	81.16	76.85	67.27
ID092	CAT 773E Water Cart WC01	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	94.4	114.2	10m	91.44	92.67	86.82	88.29	83.06	81.58	80.11	76.99	70.60	58.49	46.66

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID093	CAT 773E Water Cart WC01	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	84.9	123.4	3m	76.29	80.79	84.07	79.97	72.91	68.00	66.60	62.51	53.75	46.66	31.97
ID094	CAT 988K FEL	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	71.5	103.9	N/A	72.42	87.32	82.58	81.79	78.62	79.06	79.72	75.27	68.43	63.32	53.03
ID095	CAT 988K FEL	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	83.1	104.3	3m	70.87	80.11	83.84	84.96	86.04	84.05	83.70	77.81	74.70	68.51	57.19
ID096	CAT 988K FEL	Rear of Vechicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	87.4	104.9	10m	72.69	80.71	83.20	87.52	86.92	83.05	82.31	78.57	70.93	64.21	50.39
ID097	CAT 988K FEL	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	86.5	106.2	5m	105.16	94.54	83.69	82.09	79.30	76.74	73.99	70.90	69.49	62.44	54.05
ID098	CAT 988K FEL	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	79.6	136.2	N/A	69.62	75.21	97.57	84.58	74.68	69.97	66.15	65.49	54.22	47.52	42.31
ID099	CAT 385B FEL Excavator EX01	At Front Radiator	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	76.1	106.4	N/A	80.27	77.13	93.62	82.94	79.28	72.03	71.59	68.83	61.86	53.84	43.65

Moora Mine Noise Survey 2018

ID	Noise Source (Description, Make, Model, Serial No.)	Measurement Location	Measurement Position	Operating Conditions & Process	Measurement Position	LAeq,T dB(A)	Peak noise dB(lin)	Extent of affected area (m)	LZeq 16Hz	LZeq 31.5Hz	LZeq 63Hz	LZeq 125Hz	LZeq 250Hz	LZeq 500Hz	LZeq 1kHz	LZeq 2kHz	LZeq 4kHz	LZeq 8kHz	LZeq 16kHz
ID100	CAT 385B FEL Excavator EX01	Drivers Left Hand Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	77.4	107.2	N/A	79.56	77.81	92.09	86.70	80.77	73.43	73.46	71.96	63.34	53.68	42.98
ID101	CAT 385B FEL Excavator EX01	Rear of Vechicle	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	79.3	109.2	N/A	73.60	78.85	93.21	85.08	77.42	71.81	69.15	71.83	60.97	52.53	39.60
ID102	CAT 385B FEL Excavator EX01	Drivers Right Side	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At 1.5 meters	77.7	105.4	N/A	80.61	77.73	101.71	78.91	76.32	68.40	65.25	60.59	58.24	52.23	41.91
ID103	CAT 385B FEL Excavator EX01	Drivers Cab	Mine Truck and Earthmoving Equipment	Operating at 80% Revs, demonstration purpose	At operators ear	77.4	106.6	N/A	68.84	74.63	97.87	88.33	70.88	64.38	67.78	58.35	49.57	44.76	38.01
ID104	Geo 3 Generator	Admin area	Admin Area	Genset Running	At 1.5 meters	74.0	105.6	N/A	85.99	79.08	74.89	76.95	72.08	72.05	68.84	67.03	62.81	50.03	36.86

Appendix 3: Evaluation of normalised total daily noise exposure level

Item	Location/Task	Measured noise level L_{Aeq},Ti dB(A)	Duration of exposure Ti (h)	Partial noise exposure $E_{A,Ti}$ Pa^2h	Total daily noise exposure $E_{A,T}$ Pa^2H	Normalised noise exposure level L_{Aeq}, 8h dB(A)	Adjustments to L_{Aeq}, 8h (if applicable)	Adjusted L_{Aeq},8h dB(A)
Evaluation of normalised total daily noise exposure level for Moora Operators (Example 1)								
N/A	Admin in Office, Crib, lunchbreak	65	1.00	0.001				
ID088	CAT 773E Water Cart WC01	91	2.00	0.919				
ID050	Tertiary Crusher	85	2.00	0.247				
ID068	CAT 773E Haul Truck DT01	80	3.00	0.107				
ID073	Compressor FP1001-RMD	87	3.00	0.644				
ID093	CAT 988K FEL	85	1.00	0.124				
		Overall	12.0	**2.042**	2.042	88	1	89
Evaluation of normalised total daily noise exposure level for Moora Operators (Example 2)								
N/A	Admin in Office, Crib, lunchbreak	65	1.00	0.001				
ID036	Crushing Hut	75	6.00	0.068				
ID038	Crushing hut, Left Hand Side, outside	101	1.00	4.842				
ID039	Crushing hut, Right Hand Side, outside	98	1.00	2.372				
ID044	Delivery Chute TV01	85	1.00	0.140				
ID051	Tertiary Crusher, Ground Floor	91	1.00	0.522				
ID052	Tertiary Crusher, Level 1 at Fan	91	1.00	0.535				
		Overall	**12.0**	7.676	7.676	94	1	95

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Appendix 4: Hearing protection assessments

Reference	Hearing protection type	Mean – SD data						
		125	250	500	1000	2000	4000	8000
A	3M E-A-R soft FX ear plugs	13.5	13.9	18.2	20.6	23.8	32.6	35.3
B	3M Classic Platinum ear plugs	22.0	22.0	21.6	21.7	31.2	38.7	40.3

Measurement Id.	Noise Source, Operating Condition, Measurement Position	Hearing Protector Attenuation Calcs dB(A)	
		A	B
ID036	Primary Crusher Crushing in progress At operators ear	51.2	55.6
ID037	Primary Crusher Crushing in progress At 1.5 meters	67.7	71.9
ID038	Primary Crusher Crushing in progress At 1.5 meters	78.0	81.5
ID039	Primary Crusher Crushing in progress At 1.5 meters	74.3	77.5
ID040	Secondary Crusher Crushing in progress At 1.5 meters	74.3	77.7
ID041	Secondary Crusher Crushing in progress At 1.5 meters	69.1	72.8
ID042	Secondary Crusher Crushing in progress At 1.5 meters	72.9	76.6
ID043	Primary and Secondary Crusher Crushing in progress At 1.5 meters	67.8	71.8
ID044	Primary and Secondary Crusher Chute in operation At 1.5 meters	61.3	65.2
ID045	McCloskey Conveyor Conveyor running At 1.5 meters	63.7	67.4
ID046	Screen 01 Screen running At 1.5 meters	64.5	68.8
ID047	Screen 01 Screen running At 1.5 meters	73.7	77.4
ID048	Screen 01 Screen running At 1.5 meters	66.8	70.8
ID049	Screen 01 Screen running At 1.5 meters	72.0	76.0

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Measurement Id.	Noise Source, Operating Condition, Measurement Position	Hearing Protector Attenuation Calcs dB(A)	
		A	B
ID050	Under conveyors 4 & 8 Screen running At 1.5 meters	61.2	65.5
ID051	Tertiary Crusher Crushing in progress At 1.5 meters	68.3	72.9
ID052	Tertiary Crusher Crushing in progress At 1.5 meters	68.6	74.0
ID053	Tertiary Crusher Crushing in progress At 1.5 meters	74.6	77.8
ID054	Tertiary Crusher Crushing in progress At 1.5 meters	74.7	77.9
ID055	Screen 02 Screen running At 1.5 meters	63.1	67.4
ID056	Screen 02 Screen running At 1.5 meters	64.7	69.3
ID057	Screen 02 Screen running At 1.5 meters	66.8	70.9
ID058	Red Genset Geo 01 Genset Running At 1.5 meters	55.7	61.2
ID059	Red Genset Geo 01 Genset Running At 1.5 meters	58.6	65.2
ID060	Screen 03 Screen running At 1.5 meters	60.4	65.5
ID061	Screen 03 Screen running At 1.5 meters	65.0	69.7
ID062	Screen 03 Screen running At 1.5 meters	69.7	74.2
ID063	MCC02 Screen running At 1.5 meters	53.0	58.1
ID064	CAT 773E Haul Truck DT01 Operating at 80% Revs, demonstration purpose At 1.5 meters	68.2	74.0
ID065	CAT 773E Haul Truck DT01 Operating at 80% Revs, demonstration purpose At 1.5 meters	69.9	73.5
ID066	CAT 773E Haul Truck DT01 Operating at 80% Revs, demonstration purpose At 1.5 meters	64.7	71.7
ID067	CAT 773E Haul Truck DT01 Operating at 80% Revs, demonstration purpose At 1.5 meters	66.9	71.0
ID068	CAT 773E Haul Truck DT01 Operating at 80% Revs, demonstration purpose At operators ear	55.8	59.7
ID069	CAT 980M FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	57.4	61.3
ID070	CAT 980M FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	61.0	65.0

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Measurement Id.	Noise Source, Operating Condition, Measurement Position	Hearing Protector Attenuation Calcs dB(A)	
		A	B
ID071	CAT 980M FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	59.8	64.0
ID072	CAT 980M FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	61.0	64.8
ID073	CAT 980M FEL Operating at 80% Revs, demonstration purpose At operators ear	63.6	67.0
ID074	Compressor FP1001-RMD Operating for Demonstration purposes At operators ear	54.0	56.4
ID075	Trade master GR1203 Grinder Operating for Demonstration purposes At operators ear	64.8	68.5
ID076	Sieve Shaker Operating for Demonstration purposes At operators ear	62.2	66.0
ID077	Ring Mill Operating for Demonstration purposes At operators ear	55.5	58.0
ID078	Sample Prep Crusher Operating for Demonstration purposes At operators ear	53.2	56.9
ID079	Holden Ute, Registration 1GAM946 Driving on Road At operators ear	47.9	55.3
ID080	All Terrain Telehandler Operating for Demonstration purposes In front of cab	58.2	62.8
ID081	All Terrain Telehandler Operating for Demonstration purposes At operators ear	55.9	61.9
ID082	CAT 236D Bobcat Operating at 80% Revs, demonstration purpose At 1.5 meters	53.6	57.8
ID083	CAT 236D Bobcat Operating at 80% Revs, demonstration purpose At 1.5 meters	53.6	58.9
ID084	CAT 773E Haul Truck DT03 Operating at 80% Revs, demonstration purpose At 1.5 meters	72.4	76.9
ID085	CAT 773E Haul Truck DT03 Operating at 80% Revs, demonstration purpose At 1.5 meters	70.4	74.8
ID086	CAT 773E Haul Truck DT03 Operating at 80% Revs, demonstration purpose At 1.5 meters	72.8	79.9
ID087	CAT 773E Haul Truck DT03 Operating at 80% Revs, demonstration purpose At 1.5 meters	71.4	75.2
ID088	CAT 773E Haul Truck DT03 Operating at 80% Revs, demonstration purpose At operators ear	59.0	64.2
ID089	CAT 773E Water Cart WC01 Operating at 80% Revs, demonstration purpose At 1.5 meters	68.7	72.4
ID090	CAT 773E Water Cart WC01 Operating at 80% Revs, demonstration purpose At 1.5 meters	71.4	74.9
ID091	CAT 773E Water Cart WC01 Operating at 80% Revs, demonstration purpose At 1.5 meters	68.3	72.2

Moora Mine Noise Survey 2018

Measurement Id.	Noise Source, Operating Condition, Measurement Position	Hearing Protector Attenuation Calcs dB(A)	
		A	B
ID092	CAT 773E Water Cart WC01 Operating at 80% Revs, demonstration purpose At 1.5 meters	70.6	74.8
ID093	CAT 773E Water Cart WC01 Operating at 80% Revs, demonstration purpose At operators ear	61.8	66.2
ID094	CAT 988K FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	49.5	55.3
ID095	CAT 988K FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	60.1	63.4
ID096	CAT 988K FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	64.6	68.4
ID097	CAT 988K FEL Operating at 80% Revs, demonstration purpose At 1.5 meters	63.8	68.3
ID098	CAT 988K FEL Operating at 80% Revs, demonstration purpose At operators ear	56.5	61.2
ID099	CAT 385B FEL Excavator EX01 Operating at 80% Revs, demonstration purpose At 1.5 meters	51.3	57.8
ID100	CAT 385B FEL Excavator EX01 Operating at 80% Revs, demonstration purpose At 1.5 meters	54.2	59.9
ID101	CAT 385B FEL Excavator EX01 Operating at 80% Revs, demonstration purpose At 1.5 meters	56.2	62.1
ID102	CAT 385B FEL Excavator EX01 Operating at 80% Revs, demonstration purpose At 1.5 meters	53.4	59.7
ID103	CAT 385B FEL Excavator EX01 Operating at 80% Revs, demonstration purpose At operators ear	49.8	56.2
ID104	Geo 3 Generator Genset Running At 1.5 meters	52.2	59.5

Appendix 5: DMP Notification of a Noise Report Form

From: http://www.dmp.wa.gov.au/documents/Forms/MSH_Occ_F_NotificationOfANoiseReport.pdf

Government of Western Australia
Department of Mines and Petroleum
Resources Safety

Notification of a noise report

100 Plain Street, East Perth WA 6004
contammanager@dmp.wa.gov.au
www.dmp.wa.gov.au/ResourcesSafety

Mines Safety and Inspection Regulations 1995 — Regulation 7.11(1)

Form to be returned to the State Mining Engineer, Resources Safety

Part A — Company details

Company _____ Site name _____

Part B — Noise report details

	Number of persons exposed to:	
	Noise above action level	Noise below action level
Management and supervisory (including administration services)		
Surface mining work areas (production and services)		
Underground workings (production and services)		
Ore treatment processing plants		
Workshops (mechanical, electrical, etc)		
Railway operations		
Material handling (stores/warehouses)		
Other		
Total		

Have contractors been included in noise report? ☐ Yes ☐ No

If yes, name of contractor _____

Date of completion of noise report ☐☐/☐☐/☐☐

Part C — Noise officer details

Name and initials _____ Approval no. ☐☐☐☐☐

Part D — Responsible person details

Name _____ Position _____

Signature _____

Appendix 6: Limitation of Liability

A site survey was undertaken to assess the noise hazards present on site. It should be noted that assessing noise exposure using a sound level meter provides a snap shot of the risk on site at a given time and cannot be regarded as absolute because routine and non-routine operations may change and not be reflective of the conditions during the survey. As such there may be noise sources that were either not working at the time of testing or not working in a routine or worst case scenario, in these cases the results supplied in this report may not always represent the risks within the workplace.

The document review applies only to any documents as received. In preparing this report OHMS Hygiene may have relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations. Except as otherwise stated in the report, OHMS Hygiene has not verified the accuracy or completeness of the data or information. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this report ("conclusions") are based in whole or part on the data and information provided, those conclusions are contingent upon the accuracy and completeness of the data and information provided. The scope of work and time frame for the review did not allow for an in-depth gap analysis of the documentation against any standards or guidance materials. Nor is there an allowance for a comprehensive review of implementation of the documentation provided. The scope only allows for a cursory review for broad content only. OHMS Hygiene will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented, altered, change of process or otherwise not fully disclosed to OHMS Hygiene.

Within the limitations imposed by the scope of services, the assessment of the site and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other guarantee or warranty, expressed or implied, is made.

The conclusions are based upon the data collected on the day of the survey, information provided and visual observations and are therefore merely indicative of the condition of the site at the time of the survey. It needs to be understood that these results may not accurately represent the noise risks under conditions and activities other than those occurring at the time of review.

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End of Report