Cracow TSF2 Stage 3B-5 Lift

Environmental Authority Amendment - Noise and Vibration Impact Assessment

Lion Mining Pty Ltd (a subsidiary of Aeris Resources Ltd)

Cracow Gold Mine, Theodore Road, Cracow,
Queensland, 4719

Prepared by:

SLR Consulting Australia

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Revision Record

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Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Aeris Resources (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

Introduction

Cracow Gold Mine and Processing Operations (CRO) is owned by Aeris Resources Limited. CRO are proposing to construct an embankment raise to Tailings Storage Facility No 2 (here referred to as TSF2 Stage 3B, 4 and 5 Lifts) to provide additional storage to support ongoing operations.

The construction and operation of TSF2 Stage 3B, 4 and 5 Lifts requires an amendment to the Environment Authority EPML00770913.

CRO operations are located in Central Queensland, northwest of the township Cracow in the Banana Shire. The gold mine lies approximately 40 km southeast of Theodore and approximately 500 km northwest of Brisbane.

The project is proposed to include construction and associated crushing of mine waste or hard rock (quarry) to provide the required construction material. Activities will include drilling and quarry blasting, earthworks construction, articulated trucks transporting rock and clay internally within the site, and clay borrow pit extraction. At project completion, this assessment also covers the end of life capping of TSF2 Stage 5.

The applicable noise and vibration criteria are described in the Environmental authority EPML00770913, which took effect on 1 August 2025.

These are the same criteria discussed in detail within SLR's Cracow Gold Mine Updated Noise and Vibration Criteria Report (dated 16 June 2022), with the exception that the assessment time period is 15 minutes rather than the 1 hour period used in EMPL00770913. There is no material impact associated with this change. The proposed criteria consider the relative impact on specific receptors, including cumulative noise from the existing Cracow Gold Mining operations and the expected change in received noise and perception of receptors.

The assessment of potential operational noise from the Project identified the following:

- Project noise levels for receptors R2 & R3 under both neutral and adverse weather conditions are predicted to be no greater than the proposed external construction noise limit of 50 dB L_{Aeq}.
- Project noise levels for receptor R1 (CRO camp) and Cracow town site under both neutral and adverse weather conditions are predicted to below the proposed 42 dB L_{Aeq} noise limit.

The assessment has considered the potential for cumulative mine noise impacts. The assessment has determined that, with the introduction of the Project, cumulative noise impacts would not be anticipated.

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1.0 Introduction

1.1 Project Background

Cracow Gold Operations (CRO) is an active underground gold mine owned by Lion Mining Propriety Limited (a subsidiary of Aeris Resources Ltd)[1]. The mine is located on the traditional lands of the *Wulli Wulli People*, directly adjacent to the township of Cracow, approximately 40 km southeast of Theodore and 500 km north-west of Brisbane, in the Banana Shire, Central Queensland (see **Figure 1** and **Figure 2**).

Tailings from the CRO processing plant are pumped to the Tailings Storage Facility 2 (TSF2), which began operation in August 2021 and is the only active tailings facility at the mine site. TSF2 was originally planned with five development stages. Stage 2 constructed and is currently in use and expected to reach capacity by October 2025. Stage 3A is under construction and will be operational by then, providing an additional year of capacity until October 2026.

CRO plans to amend its Environmental Authority (EA) - EPML00770913 to allow further lifts. Stage 3B (1.5 m), Stage 4 (3.0 m), and Stage 5 (2.5 m) to extend TSF2's capacity by about five more years.

The Project is proposed to include the following activities during TSF2 Stage 3B, 4 and 5 construction, and at project completion for capping of TSF2.

- Site preparation including topsoil removal / stockpile.
- Stage 3B will utilise some waste dump material from the Cracow mine, similar to Stage 3A.
- Associated hard rock blasting, extraction and crushing within the existing hard rock quarry to provide the required material for the construction.
- Borrow pit development for TSF2 capping, utilising scrapers, dozers and excavators.
- Transportation of material between existing waste rock dump, hard rock quarry, clay borrow pit and TSF2 using articulated dump trucks.
- Capping will involve quarry rock, clay extraction and TSF2 compaction.

The Project will be integrated into CRO activities, making the most efficient use of existing infrastructure and services.

The TSF2 Stage 3B, 4 and 5 development will be less intensive in terms of equipment fleet numbers and works scope compared to the previous TSF2 Stage 1. During initial TSF2 development (November 2020 to August 2021) there were no noise impacts or complaints reported from the nearest sensitive receptor (R1 shown in **Figure 3**).

[1] Whilst Lion Mining Pty Ltd is the holder of the EA EPML00770913, Lion Mining Pty Ltd (a subsidiary of Aeris Resources) is also used within this document.

Figure 1 Project Location

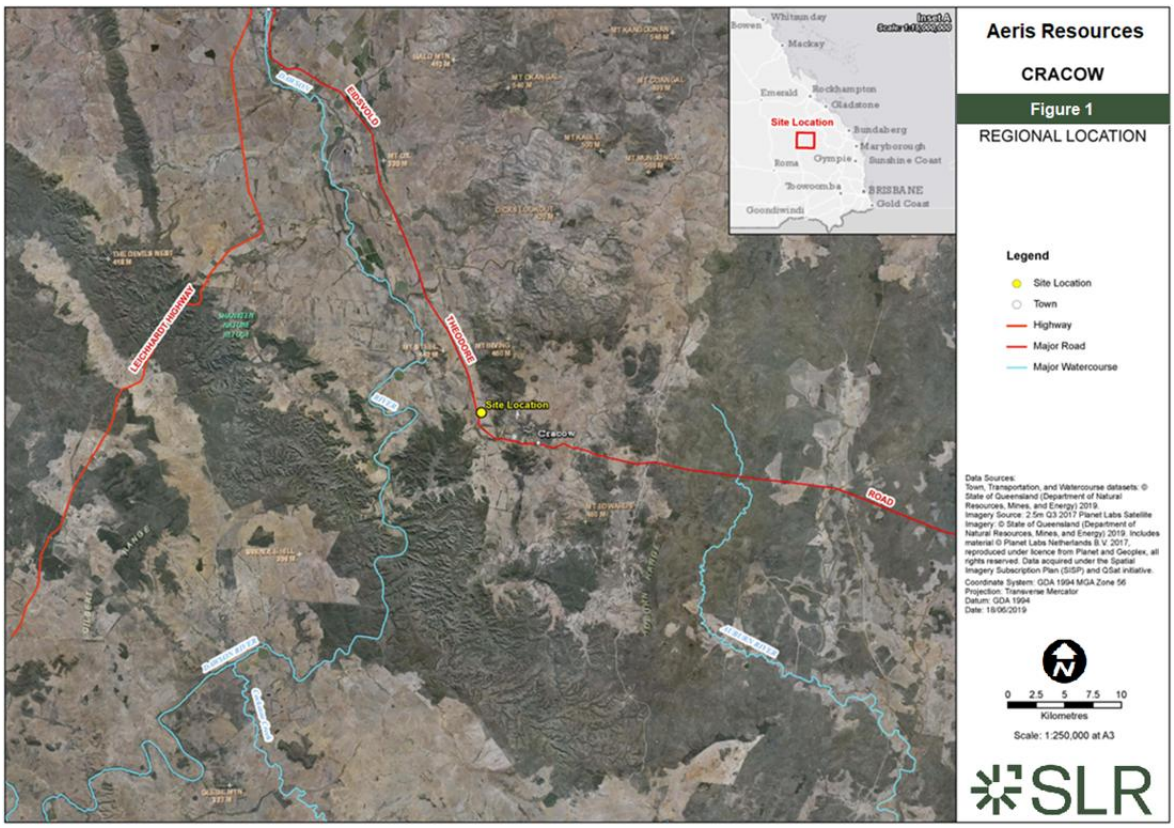
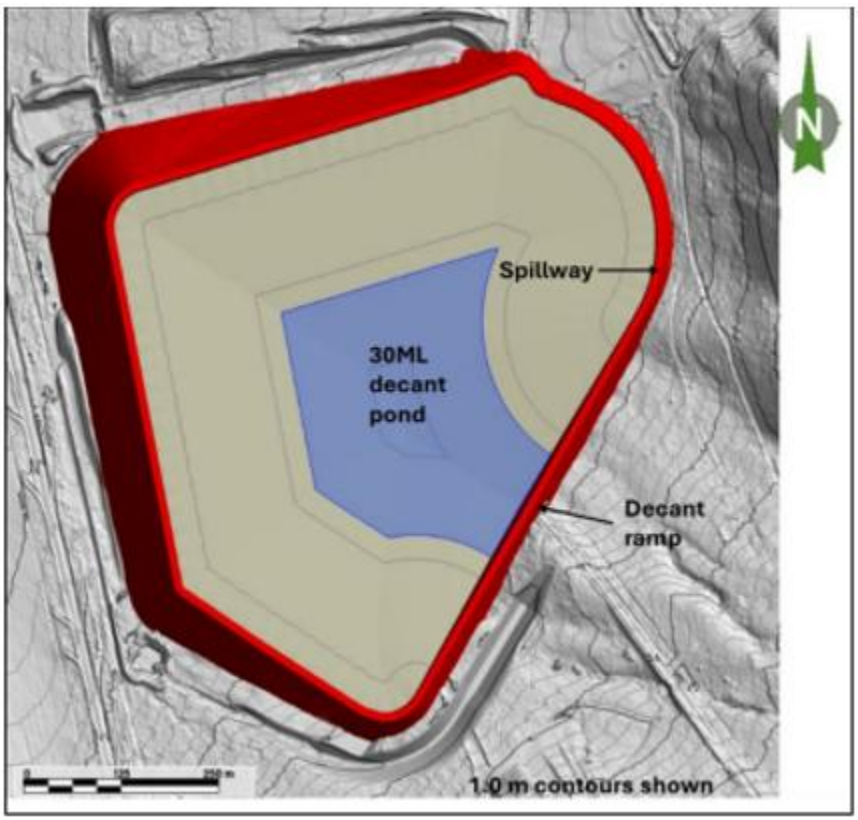


Figure 2 Project Overview – Muk3D representation of TSF2 Stage 5 at Capacity



1.2 Purpose

This Noise and Vibration Impact Assessment Technical Report has been prepared by SLR Consulting Australia Pty Ltd (SLR) on behalf of Aeris Resources to provide supporting information to the EA Amendment Application under *Section 226* of the EP Act. Acoustic terminology used through this report is explained in further detail in **Appendix A**.

2.0 Existing Environment

2.1 Existing Sensitive Receptors

The CROEA (EPML00982113/ EPML00770913) provides the following definitions regarding sensitive places :

a) *a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or*

b) *a motel, hotel or hostel; or*

c) *an educational institution; or*

d) *a medical centre or hospital; or*

e) *a protected area; or*

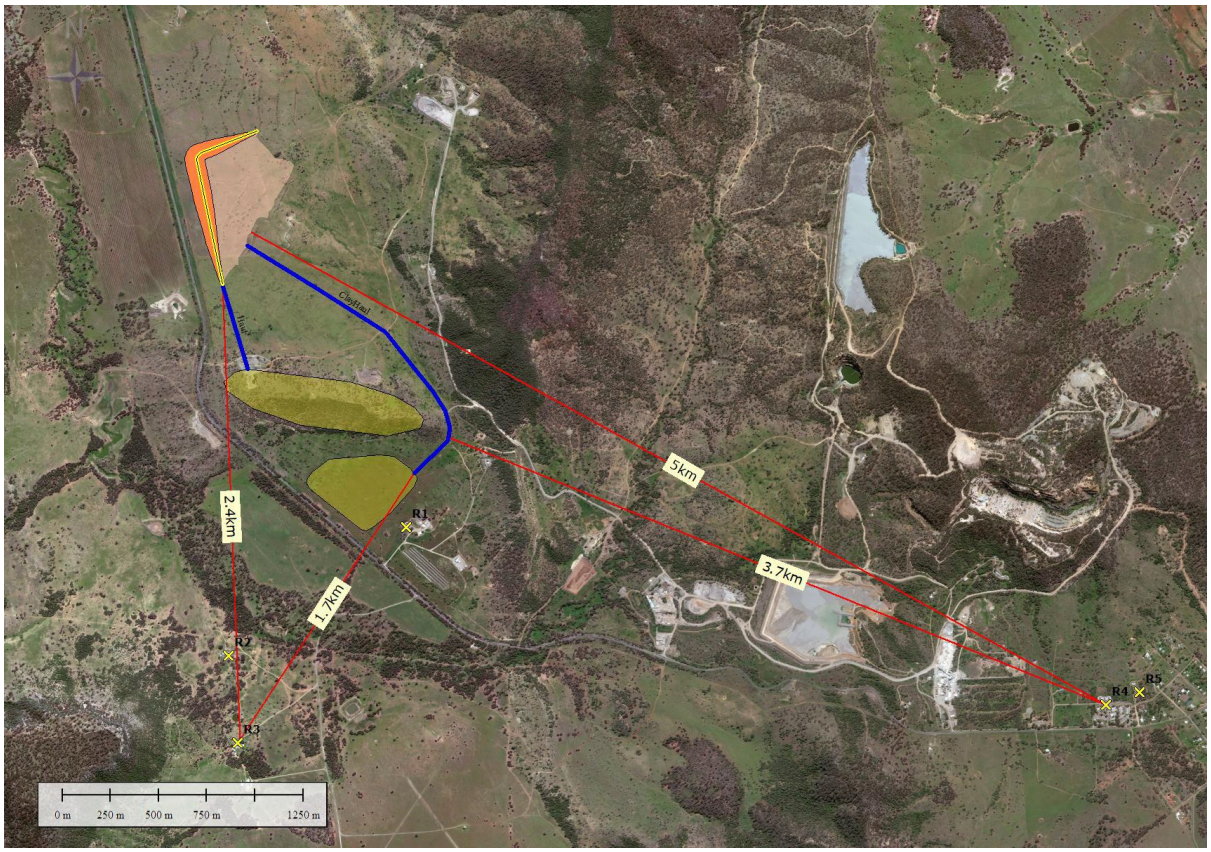
f) *a public park or gardens*.

Based on the above definition, noise and vibration sensitive receptors surrounding and potentially impacted by the Project are listed in **Table 1** and identified on **Figure 3**. The location, direction and separation distance of the closest sensitive receptors relative to CROthe TSF2 Stage 3B to 5 Project are provided in **Table 1**.

Table 1 Sensitive receptors adjacent to the proposed TSF

Receptor	Distance from TSF (m)	Direction from TSF	Distance from Quarry (m)	Direction from Quarry	Comment
R1	5000	South East	4000	South-East	Dwellings in Cracow – Mine Accommodation Village. Dwellings in Cracow are at an acoustically similar distance from TSF2.
R2	1900	South	1285	South	Closest possible dwelling
R3	2400	South	1740	South	Same owner as R2

Figure 3 Key receptors in relation to TSF2 construction area



Source: SE Group 2019 – Cracow Proposed New TSF: Noise Assessment – Construction Phase

2.2 Background noise levels

The area surrounding the proposed TSF2 Stage 3B, 4 and 5 Lift project is the operating CRO minesite, with farmland and reserves surrounding the mine. The main noise producing sources near the sensitive receptors are from the mine, road traffic and Cracow township.

The estimated background noise levels are taken from a background noise monitoring report prepared by Air Noise Environment on behalf of the mine site (Evolution Mining, July 2015, 4197report03, Appendix C) for the area surrounding the CRO processing plant and Cracow town site.

The monitoring period of seven days included a scheduled shut down of the gold mine processing plant, permitting measurement of background noise in the absence of significant mining operational noise.

The Air Noise Environmental derived residual background noise (RBL) levels adopted from Table 4.11 of that report are shown in **Table 2.**

Table 2 Adopted RBL for Deriving Noise Criteria

Period	Adopted RBL (Lowest across all measurement locations), dB
Day	30
Evening	25
Night	25

2.3 Wind characteristics

Wind rose data has been generated for the TSF2 Project based on site-specific data.

It was noted that the predominant wind direction throughout the year is from the north-east through to the south-east. Given the predominant wind directions during the proposed construction period, impacts to identified sensitive receptors (located to the south and south-east of the project area) from project generated noise emissions would be lessened, with the potential for 'adverse' winds towards receptors only expected for receptors R2 and R3, predominantly during the winter season.

3.0 Criteria

The applicable noise and vibration criteria are described in the EA EPML00770913, taken effect on 1 August 2025.

These are the same criteria discussed in detail within SLR's Cracow Gold Mine Updated Noise and Vibration Criteria Report (dated 16 June 2022), with the exception that the assessment time period is 15 minutes rather than the 1 hour in EMPL00770913. There is no material impact associated with this change. The proposed criteria consider the relative impact on specific receptors, including cumulative noise from the existing Cracow Gold Mining operations and the expected change in received noise and perception of receptors.

In summary, receptors can be separated into two groups with different noise impact effects. These are:

Construction Activity – Receptors R2 and R3

Receptors R2 and R3 (co-owned premises) located nearest the proposed TSF2 Stage 3B, 4 and 5 construction project, and some distance from current CRO operations. Some of the proposed construction activities are within 1.3km of these receptors, to the south-west of the TSF2 area. Noise and vibration impacts for these receptors is expected to be dominated by the TSF2 construction project for the duration of the project, with an impact similar to any other construction project.

Mining Activity – Receptors R1 & Cracow Town Site

Receptor R1 (CRO camp) and the Cracow town site further to the south-east experience existing noise from the CRO mining and processing operations. TSF2 Stage 3B, 4 and 5 construction noise will be similar in nature to this noise. It is proposed to consider the TSF2 construction noise in conjunction with the CRO noise emissions in terms of potential impact, as to these residents, the construction noise is likely to be perceived as 'part of' the CRO operations. It is proposed to assess the TSF2 construction noise emissions cumulatively with the CRO emissions to receptor R1 (mining camp) and Cracow town site.

3.1 Construction Airborne Noise

Current Queensland legislation, policies or guidelines do not prescribe numerical noise limits or noise criteria for construction activities.

Noise impacts are usually minimised by limiting the hours of operation and, in particular circumstances, scheduling the noisiest activities to occur at times when they would generate least disruption. For construction work occurring during normal daytime hours, which SLR have been informed will be the case for the TSF Stage 3B, 4 and 5 construction activities, provided all mechanical powered plant is fitted with mufflers as per manufacturers specifications, specific noise limits are generally not warranted.

In accordance with the *Environmental Protection Act 1994* (EP Act), where construction noise may affect adjacent sensitive receptors, it is recommended to limit the hours of construction activities from Monday to Saturday 6.30 am to 6.30 pm. For construction works outside these hours, particular noise limits should be applied to prevent disturbances at any adjacent sensitive receptors.

Construction noise will be the significant noise emission for the nearest receptors, R2 and R3 during the construction and capping phases. Operational noise will be similar to existing, being one or more pumps and some minor maintenance works over time. The operational noise emissions will not be significant and will be similar to the operation of the existing TSF2.

It is recognised that both construction and operational noise will be covered by the one set of criteria (i.e. there will be no distinction in the EA criteria between construction and operational activities within the mine). However, the construction and associated crushing activities associated with the TSF2 uplift are located away from the main operational mining areas. As a result, the neighbouring properties to the south-west (identified as Residences R2 and R3 in SLR's *Environmental Authority Amendment Noise and Vibration Impact Assessment* dated 16 June 2022 for the previous TSF2 Stage 2 lift) would likely be able to distinguish between construction and (typical) mining operations.

It is therefore recommended that the EPP(Noise) external acoustic quality objectives of 50 dBA L_{Aeq} and 65 dBA L_{A1} between 6:30am and 6:30pm Monday to Saturday be conditioned for these two (2) properties during construction of the TSF2 Stage 3B, 4 and 5 uplift only (returning to the **Table 1** noise criteria once construction of the TSF2 uplift is complete).

3.2 Operational Airborne Noise

The applicable noise and vibration criteria are described in the Environmental authority EPML00770913, taken effect on 1 August 2025.

The noise criteria nominated in **Table 3** below (extracted from EPML00770913) have been applied to this assessment.

Table 3 Recommended Noise Criteria 'Noise Sensitive Place'

Reference Assessment Criteria	Noise Criteria, Assessable at a Residential Noise Sensitive Receptor, dB		
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
$L_{Aeq,adj,1hr}$	42	42	35
$L_{A1,adj,1hr}$	52	52	47

Noise criteria for commercial places are contained in Schedule D (Noise) of EPML00770913 and summarised in **Table 4**.

Table 4 Recommended Noise Criteria 'Commercial Place'

Reference Assessment Criteria	Noise Criteria, Assessable at a Commercial Place, dB		
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
$L_{Aeq,adj,1hr}$	47	47	42

3.3 Blasting

Airblast overpressure limits are not included in the Aeris Resources Pty Ltd (Cracow) permit EPML00770913 however ground vibration limits are included. It is proposed to adopt the blasting criteria recommended in the Model Mine Condition (MMC) limits in Schedule D, Table D2. Accordingly, the blasting limits applied to the assessment of the Project, as per MMC Table D2, are summarised in **Table 5**.

Table 5 Recommended Blasting Criteria

Blasting Parameter	Criteria at a Sensitive or Commercial Blasting Place
	7.00 am to 6.00 pm
Airblast overpressure	115 dB (Linear) peak for 9 out of 10 consecutive blasts initiated; and not greater than 120 dB (Linear) peak at any time.
Ground vibration peak particle velocity	5 mm/s peak particle velocity for 9 out of 10 consecutive blasts initiated; and not greater than 10 mm/s peak particle velocity at any time.

It is recommended that these blasting criteria be adopted for construction, quarrying and operational mining.

4.0 Methodology

4.1 Construction Activities and Assumptions

The selection of noise assessment scenarios was based on construction operations with the greatest potential to result in noise at the sensitive receptors, such as:

- when plant (noise sources) would be at the closest proximity to receptors, and
- where there would be limited screening of noise from terrain features (e.g. for clay borrow pit operations at or near the original ground surface level).

With consideration to the proposed Project schedule, the assessment scenarios in **Table 6** were developed to assess potential ‘typical worse-case’ noise levels which accounted for TSF2 Stage 3B, 4 and 5 construction and quarrying operations, and general movement of other mobile equipment on haul roads.

Table 6 Assessed Operational Scenarios and Associated Mining Activities

Scenario/ Year of Operation	Summary of Mining Operations
Scenario 1 – TSF2 Stage 3B Lift Construction	Scenario modelled to assess loading of mine waste at the foot of the mine waste dump, hard rock quarry crushing, clay extraction from areas around TSF2 using loader and excavator, and from the clay borrow pit, TSF2 Stage 3B Lift construction including track dozers, excavators, vibrating roller, and operation of articulated dump trucks from waste dump, hard rock quarry and clay borrow pit to TSF2 construction areas.
Scenario 2 - TSF2 Stage 4/5 Lift Construction	Scenario modelled to assess hard rock quarry drilling, blasting, crushing and extraction, clay extraction from the clay borrow pit, TSF2 Stage 4/5 Lift construction including track dozers, excavators, vibrating roller, and operation of articulated dump trucks from hard rock quarry and clay borrow pit to TSF2 construction areas.
Scenario 3 – TSF2 Stage 5 capping (closure)	Scenario similar to construction (Scenario 2), but activity in the clay borrow pit and at the finish surface level of the TSF2 Stage 5, including scrapers, track dozers and vibrating compactors. .

The operational noise assessment was based on the key assumptions outlined below.

- To model mobile articulated dump trucks, this has been completed via line sources calculating a noise emission level for a typical path travelled. To account for the total number of trucks proposed for each pit/activity, an assumption has been made that one (1) idle haul truck (i.e. with relatively insignificant noise emissions) would be located next to an active excavator and the remaining number of trucks are moving on defined routes in a way that can be represented over time as line sources.
- The grader and watercart have been modelled as line sources representing typical path travelled.
- All remaining equipment has been modelled as point sources in a typical location for the pit/activity.
- All operations will be continuous during the day period. As such, no allowance was made for periods when plant was temporarily idle or not in use.
- Noise emission levels have been predicted based on the energy average (L_{Aeq}) noise descriptor. To assess L_{A1} noise levels (in accordance with the nominated MMC noise criteria), the following relationship is applied:
    - a +8 dB relationship between the L_{Aeq} and L_{A1} has been applied to the highest individual L_{Aeq} noise level (i.e. source of mine noise) where the noise source is identified to be non-steady state in nature such as mobile equipment (e.g. haul trucks and dozers).

4.2 Noise Prediction Modelling

4.2.1 Modelling Software and Algorithm

A SoundPLAN (Version 8.2) computer noise model was developed to predict mine noise levels at the identified noise sensitive receptors. SoundPLAN is a computer model software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The model can calculate noise levels taking into account such factors as the sound power levels and locations of noise sources, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

The *Conservation of Clean Air and Water Europe* (CONCAWE 1981) prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specifically designed for large industrial facilities and incorporates the influence of wind effects and the stability of the atmosphere.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 – 1982). Marsh concluded that CONCAWE was accurate to ±2 dB in any one octave band between 63 Hertz (Hz) and 4 kHz and ± 1 dB overall under specific weather conditions.

In relation to the modelling of atmospheric conditions, the Department of Environment and Science (DES)[2] (now DETSI) Ecoaccess Guideline '*Planning for Noise Control'* (PNC), provides guidance with respect to assessing the potential for noise enhancements due to prevailing atmospheric conditions. This is discussed in Section 4.2.2.

4.2.2 Meteorological Effects

The default weather parameters recommended in the PNC have been adopted to determine the effects of meteorology on noise emissions from the Project. The weather parameters applied to this study are summarised in **Table 7**.

Table 7 Modelled Meteorological Conditions

Parameter	Neutral Weather	Adverse Weather
Temperature	10°C	10°C
Humidity	70%	90%
Pasqual stability class	D	F (representative of temperature inversion)
Wind speed	0 m/s	2 m/s [1]

Note 1: Sensitive receptors located at a lower altitude than mine, therefore a 2 m/s drainage-flow wind component assumed.

4.2.3 Mobile Mining Equipment, Sound Power Levels and Location Allocation

With guidance from Aeris Resources and reference to the modelled mine scenarios (refer to **Table 6**), **Table 8** and **Table 9** summarise the following model inputs:

- Mobile mining equipment make, model and numbers.
- Assumed overall sound power level (SWL or denoted by subscript 'w') data and source emission heights for each equipment item developed by SLR based on details from similar recently assessed mining projects.
- Mining equipment assigned locations for each of the assessed operational scenarios and associated mining activities tabled in section 4.1 (Table 6).

[2] Now Department of Environment, Tourism, Science and Innovation (DETSI)

Table 8 Mobile Mining Equipment Sound Power Levels and Locations

Equipment Item (make / model)	L_{wA}, dB	Height, m	Scenario 1 Construction Stage 3B		Scenario 2 Construction Stage 4/5		Scenario 3 Capping Stage 5	
			Qty.	Location	Qty.		Qty.	Location
Articulated Truck / Water Cart	106	2.5	6	Roads (line source)	6		6	Roads (line source)
Blast Drill	118	1.5	-	Mine waste rock used	2	Hard rock quarry (natural ground level)	2	Hard rock quarry (natural ground level)
CAT 330B Excavator	105	3	2	2 x TSF2	3	2 x TSF2, 1 x Borrow	3	2 x TSF2, 1 x Borrow
CAT 375 Excavator	111	3	1	1 x mobile crusher.	1	1 x mobile crusher.	1	1 x mobile crusher.
CAT D10 dozer	116	2.5	2	TSF2	1	TSF2	1	TSF2
Crushing Circuit	124	3	1	Hard rock quarry, processing mine waste rock	1	Hard rock quarry	1	Hard rock quarry
Grader (CAT 16M)	113	2.5	3	Roads (line source)	3	Roads (line source)	3	Roads (line source)
Loader	111	2.5	1	TSF2	1	TSF2	1	TSF2
Roller	111	2	4	TSF2	4	TSF2	4	TSF2
Scraper	116	2.5	4	3 x TSF2, 1 x Borrow	4	3 x TSF2, 1 x Borrow	4	3 x TSF2, 1 x Borrow

Table 9 Octave Band sound power levels for Modelled Mobile Mining Equipment

Source	L_w, dB by octave band centre frequency, Hz									
	Overall (A-wt)	31	63	125	250	500	1k	2k	4k	8k
Articulated Truck	106	107	117	115	102	102	100	96	91	83
Blast Drill	118	97	114	103	104	106	110	113	111	110
CAT 330B Excavator	105	94	106	105	99	99	100	99	91	89
CAT 375 Excavator	111	105	105	115	111	109	107	103	96	90
CAT 980G loader	113	74	82	101	105	107	107	105	100	93
CAT D10 dozer	116	78	89	104	106	110	113	107	101	94
CAT D9 dozer	113	75	86	101	103	107	110	104	98	91
Crushing Circuit	124	87	100	110	116	119	119	117	111	99
Grader (CAT 16M)	113	71	94	100	106	103	109	106	102	90
Loader	111	74	82	101	105	107	107	105	100	93
Roller	111	111	117	117	106	105	107	104	100	100
Scraper	116	107	109	117	115	113	110	108	105	103

4.3 Blasting

No blasting particulars were available at the time of preparing this assessment, therefore the following has been prepared based on similar previous hard rock quarry assessments by SLR. Detailed blast design will need to be undertaken when Aeris Resources engages a blast contractor for the TSF2 Lift project.

Blasting parameters for the Project have been assumed to be consistent with best practise blast management, including:

- Drilling of 89 mm to 127mm blast holes and pre-split holes for final walls in fresh rock.

All production holes will be stemmed using a combination of drill cuttings and crushed/sized stemming to minimise air blast and maximise fragmentation.

- Powder factors will be restricted to minimise vibration potential.

Based on previous blasting assessments completed by SLR, the assessment of airblast overpressure and ground vibration proposed for the Project has been conservatively based on:

the attenuation formula in Australian Standard AS 2187.2 – 2006 *Explosives- Storage, Transport and Use – Part 2 Use of Explosives* (AS 2187) and ICI Explosives (now Orica) Blasting Guide 1995, and

- an MIC range of 50 to 500 kg which is typical for a quarries of this size and deposit type.

Section 5.2 includes assessment of airblast overpressure and ground vibration impacts from the Project.

5.0 Noise and Vibration Impact Assessment

5.1 TSF2 Construction Noise

5.1.1 Predicted Construction Noise Levels – Stage 3B

The predicted noise levels from the modelled scenarios (specifically Scenario 1) listed in Section 4.1 are summarised in **Table 10** for neutral weather and **Table 11** for adverse weather conditions. Noise level contour maps for all scenarios are presented in **Appendix B**.

Table 10 Predicted Project Noise Levels – Neutral Weather

Noise Sensitive Receptor	Predicted Project Noise Level (dB)	
	Scenario 1 – Lift Construction	
	$L_{Aeq,adj,1hr}$	$L_{A1,adj,1hr}$
R1	10	21
R2:	43	47
R3:	39	43

Table 11 Predicted Project Noise Levels – Adverse Weather

Noise Sensitive Receptor	Predicted Project Noise Level (dB)	
	Scenario 1 – Lift Construction	
	$L_{Aeq,adj,1hr}$	$L_{A1,adj,1hr}$
R1	15	26
R2:	48	52
R3:	45	48

From the modelling results summarised in **Table 10** and **Table 11**, the following is noted:

- Project noise levels for receptors R2 & R3 under both neutral and adverse weather conditions are predicted to be no greater than the proposed external construction noise limit of 50 dB L_{Aeq}.
- Project noise levels for receptor R1 (CRO camp) and the Cracow town site under both neutral and adverse modelled weather conditions are predicted to be no greater than 20 dB L_{Aeq} from the TSF2 Stage 3B construction activities. This predicted noise emission contribution is significantly below the proposed L_{Aeq} 42 dB noise limit and will have a negligible impact in combination with existing CRO noise emissions at these receptor locations.

5.1.2 Predicted Construction Noise Levels – Stage 4/5

The predicted noise levels from the modelled scenarios listed in Section 4.1 (specifically Scenario 2 and 3) are summarised in **Table 12** for neutral weather and **Table 13** for adverse weather conditions. Noise level contour maps for all scenarios are presented in **Appendix B**.

Table 12 Predicted Project Noise Levels – Neutral Weather

Noise Sensitive Receptor	Predicted Project Noise Level (dB)			
	Scenario 2 – Lift Construction		Scenario 3 – TSF2 Closure Capping	
	$L_{Aeq,adj,1hr}$	$L_{A1,adj,1hr}$	$L_{Aeq,adj,1hr}$	$L_{A1,adj,1hr}$
R1	8	14	10	14
R2:	43	47	43	47
R3:	39	43	39	43

Table 13 Predicted Project Noise Levels – Adverse Weather

Noise Sensitive Receptor	Predicted Project Noise Level (dB)			
	Scenario 2 – Lift Construction		Scenario 3 – TSF2 Closure Capping	
	$L_{Aeq,adj,1hr}$	$L_{A1,adj,1hr}$	$L_{Aeq,adj,1hr}$	$L_{A1,adj,1hr}$
R1	13	18	15	19
R2:	48	52	48	52
R3:	45	48	45	48

From the modelling results summarised in **Table 12** and **Table 13** , the following is noted:

- Project noise levels for receptors R2 & R3 under both neutral and adverse weather conditions are predicted to be no greater than the proposed external construction noise limit of 50 dB L_{Aeq}.
- Project noise levels for receptor R1 (CROCROcamp) and the Cracow town site under both neutral and adverse modelled weather conditions are predicted to be no greater than 20 dB L_{Aeq} from the TSF2 construction activities. This predicted noise emission contribution is significantly below the proposed L_{Aeq} 42 dB noise limit and will have a negligible impact in combination with existing CRO noise emissions at these receptor locations.

5.1.3 Assessment of Noise Characteristics

The potential impacts from mine noise experienced at the sensitive receptors are not solely a function of the overall level of noise, but also the characteristics of the noise. Consideration for the potential presence of tonal and impulsive noise characteristics has been investigated and detailed in the following subsections.

5.1.3.1 Tonality

To complete a true tonal assessment, the inclusion of one-third octave data is required. As per **Table 9**, the spectrum data used for this assessment has been simplified at octave band data (which is widely accepted for an assessment of this nature). Consistent with the description of tonal noise in the DES (now DETSI) Ecoaccess Guideline '*Planning for Noise Control'* (PNC) guideline and SLR's experience of noise from mine sites, there may be a distinguishable "hum" associated with diesel powered equipment. However, the presence of tonal characteristics can often be attributed to mining plant with mechanical faults. For this assessment, no specific tonal correction has been considered on the assumption that all mining plant is operating in good working order.

5.1.3.2 Impulsivity

There is potential for impulsive noise from track slap associated with the dozers. Measures to mitigate such noise events from the operation of the dozer, and mitigate impulsive noise, are provided in **Section 7.0**.

5.1.3.3 Low Frequency Noise

In the absence of specific low frequency noise assessment requirements in the existing CRO EA, the following two (2) documents and associated criteria[3] are referenced to provide consideration of potential low frequency noise impact[4] from the Project onto the assessed receptors:

- DES's former Ecoaccess guideline Assessment of Low Frequency Noise contains an initial screening test at noise sensitive receptors, whereby
  - the overall noise level should not exceed L_{eq} 50 dB (internal), and
  - the difference between the overall Z-weighted (unweighted) and A-weighted (internal) noise levels should not exceed 15 dB.
- For this assessment, a (conservative) 5 dB façade reduction has been applied to convert the 50 dB internal level to an external level (i.e. 55 dB L_{eq} external), given that building facades generally do not attenuate low frequency noise as well as broader spectrum noise.
- DES's Streamlined Model Conditions for Petroleum Activities Guideline, which is relevant to operations of industrial noise sources operating in rural Queensland, contains the following external and internal criteria that must not be exceeded (Leq unless noted otherwise). It is noted the internal criteria are generally consistent with the former Ecoaccess Assessment of Low Frequency Noise Guideline noted above:
  - L_{Ceq} 60 dB measured outside the sensitive receptor; and
  - the difference between the external A-weighted and C-weighted noise levels is no greater than 20 dB or 50 dB measured inside the sensitive receptor; and
  - the difference between the internal A-weighted and Z-weighted (Max $L_{pZ,15\ min}$) noise levels is no greater than 15 dB.

Due to the transient nature of construction noise, it is not normally assessed for low frequency noise impact. For information, the highest external noise levels of L_{Ceq} 54/55 dB and L_{Zeq} 55 dB are predicted to occur at R2 for construction and capping scenarios respectively, only under adverse weather conditions. Therefore, low frequency noise is predicted to comply with the DES low frequency noise criteria under all conditions and scenarios. The predicted noise emissions at receptor R3 are predicted to be compliant with the above low frequency noise criteria.

Predicted levels of low frequency noise emissions at receptor R1 and the Cracow town site are L_{Zeq} 32 dB and L_{Ceq} 31 dB, which are not significant to this receptor location.

For Neutral or favourable weather conditions, the low frequency criteria will be complied with.

[3] The subscript Z or no capitalised subscript (e.g. L_{Zeq}, L_{eq}) refers to 'unweighted' results (i.e. linear or zero-weight). The subscript A, e.g. L_{Aeq}, refers to 'A-weighted' results. The subscript C likewise refers to 'C-weighted' results. All are common frequency 'weightings' (or lack thereof) for assessing low frequency noise.

[4] With reference to DES *Noise Measurement Manual* and the former Ecoaccess *Assessment of Low Frequency Noise Guideline*, low frequency noise is defined as noise from the 10 Hz to 200 Hz frequency range).

5.1.4 Cumulative Noise

The assessment has considered the potential for cumulative mine noise impacts, in the context of the Environmental Protection Policy (EPP) (Noise) Acoustic Quality Objectives which apply to all (man-made) noise sources excluding road and rail transport noise, for sensitive receptors located between the Project and CRO mine and processing plant to the south. The assessment has determined that, with the introduction of the Project, cumulative noise impacts would not be anticipated based on the following observations:

- Of the three (3) sensitive receptors assessed for the Project, receptor R1 is significantly closer to existing mining operations and processing plant than TSF2 and therefore the predicted noise contribution from the TSF2 Lift (in **Table 10** and **Table 11**) would be negligible overall.
- Of the other two (2) sensitive receptors (R2 and R3), these receptors are located much closer to the TSF2 construction area and quarry / borrow pit than the CRO mining operations. The CRO processing plant is shielded by a hill in the direction or receptors R2 and R3, and the nearest mining is an underground portal, with noise emissions typically from travelling mobile equipment.
- Noise levels from existing CRO operations is expected to be below TSF2 construction noise at receptors R2 and R3. Due to the distances and relative locations, when there are adverse wind conditions for the TSF2 construction operations, noise from the CRO mining and processing operations would be propagated away from the receptors. Conversely, when adverse wind conditions may result in increased propagation of noise from existing CRO mining and processing operations, noise from the TSF2 construction activities would not have increased propagation towards the receptors R2 and R3.

5.2 Blasting Assessment

5.2.1 Airblast Overpressure

As noted in **Section 3.3**, the airblast overpressure limits prescribed in the Model Mine Condition limits in Table D2 cater for the inherent variation in emission levels from a given blast design by allowing a 10% (i.e. nine (9) out of ten (10) blasts) exceedance of the 115 dBL criterion up to a 120 dBL maximum (assumed at 1% exceedance to facilitate predictions through the below formula). Correspondingly, ‘1% exceedance’ and ‘10% exceedance’ airblast overpressure prediction formula was generated for the airblast site law.

The blast emissions formula utilised for this assessment is as follows:

$$SPL = K_a - 24(\log_{10} R - 0.33 \log_{10} Q)$$

Where,

SPL = Peak airblast level (dB_{Linear})

K_a = Site constant (discussed below)

R = Distance between charge and receiver (m)

Q = Charge mass per delay (kg)

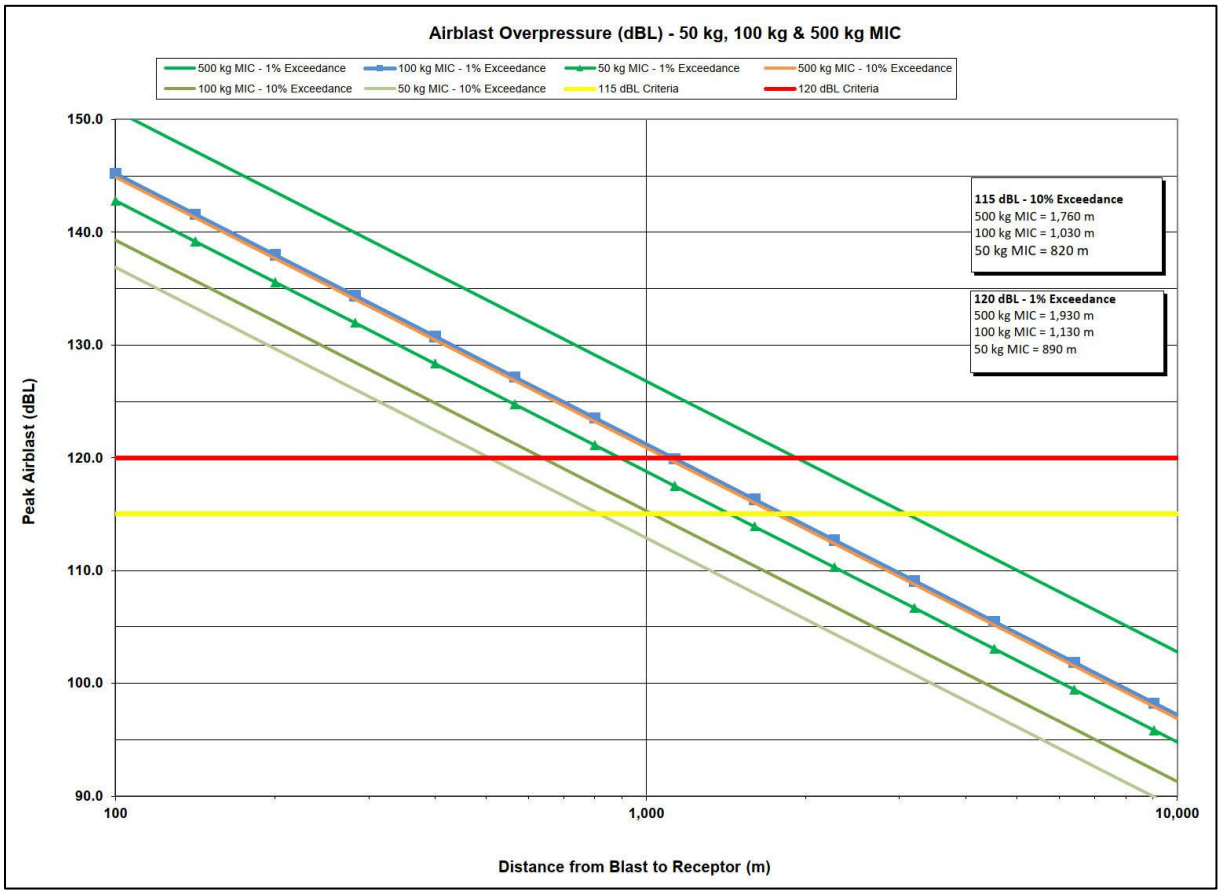
The site constant (K_a) in the above equation is an assumed constant, with the following constants derived from the percentage of exceedance and blast parameters applicable free-face blasting in hard rock conditions:

- 171.3 – for assessment against the 115 dBL criterion for nine (9) out of ten (10) consecutive blasts 10% exceedance.

- 177.2 – for assessment against the maximum limit of 120 dBL at any time.

SPL represent the level of airblast overpressure (dB_{Linear} or dBL), above which 1% or 10% of the total population (of data points) will lie respectively, assuming that the population has the same statistical distribution as the underlying measured sample. The relationship between distance and peak airblast overpressure (1% or 10% exceedances) from the proposed blasting site are presented in **Figure 4** for MICs of 50 kg, 100 kg and 500 kg.

Figure 4 Peak Airblast Overpressure Versus Distance Relationship for MICs of 50 kg, 100 kg and 500 kg



Applying the above scaling formula and the distance between the project blasting areas and closest sensitive receptors, airblast overpressure levels have been predicted for the range of MICs and assessed against the 115 dBL 10% exceedance criterion and 120 dBL maximum criterion. The predicted airblast overpressure levels are summarised in **Table 14**.

Table 14 Predicted Airblast Overpressure Levels at the Closest Sensitive Receptors

Source	Distance to Receptor (m)	Airblast Overpressure (dBL)							
		115 dBL Criterion (with 10% Exceedance Allowance)				120 dBL Criterion (Maximum)			
		50 kg	100 kg	150 kg	500 kg	50 kg	100 kg	150 kg	500 kg
R1	4,000	98	101	102	106	104	107	108	112
R2	1,285	110	113	114	118	116	119	120	124
R3	1,740	107	110	111	115	113	115	117	121

The predicted airblast overpressure levels presented in **Table 14** indicate that both the 115 dBL (10% exceedance) and 120 dBL (maximum) airblast overpressure criteria can be achieved for Project blasting providing the Maximum Instantaneous Charge is limited to 150 Kg for blasting events during adverse weather conditions.

5.2.2 Ground Vibration

Similar to the above airblast assessment, AS 2187 provides the following formula to conservatively estimate ground vibration:

$$V = K_g \left(\frac{R}{Q^{1/2}} \right)^{-B}$$

where

V = ground vibration vector peak particle velocity (mm/s)

R = distance from charge (m)

Q = MIC per delay (Kg)

K_g , B = Constants related to site and rock properties for estimation purposes

According to AS 2187, when blasting is to be carried out to a free face in hard rock conditions, the following equation may be used to estimate the mean (50% probability of exceedance) vector Peak Particle Velocity (PPV):

$$V = 500 \left(\frac{R}{Q^{1/2}} \right)^{-1.6}$$

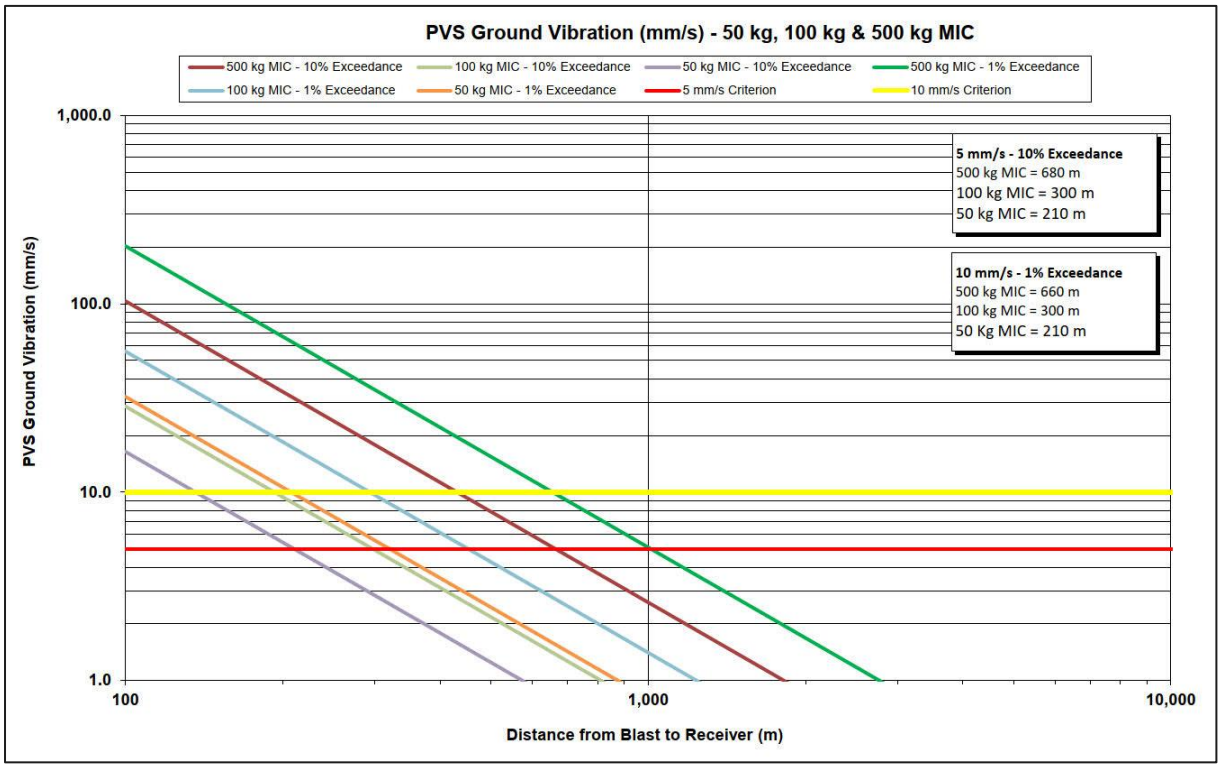
The ‘500’ ground response factor has been scaled up for the assessment of ground vibration against the following criteria:

- ‘1,136’ for assessment against the 5 mm/s peak particle velocity for nine (9) out of ten (10) consecutive blasts.
- ‘2,227’ for assessment against the maximum limit of 10 mm/s peak particle velocity at any time.

The relationship between distance and ground vibration from the proposed blasting site are presented in

Figure 5 for MICs of 50 kg, 100 kg and 500 kg.

Figure 5 Ground Vibration Versus Distance Relationship for MICs of 50 kg, 100 kg and 500 kg



Applying the above scaling formula and the distance between the project blasting areas and closest sensitive receptors, ground vibration levels have been predicted for the range of MICs and assessed against the 5 mm/s and 10 mm/s PPV vibration limits. The predicted ground vibration levels are summarised in **Table 15**.

Table 15 Predicted Ground Vibration Levels at the Closest Sensitive Receptors MICs Calculated to Comply with the 5 mm/s and 10 mm/s PPV Limits

Source	Distance to Receptor (m)	Peak Particle Velocity Ground Vibration (mm/s)							
		5 mm/s Criterion (with 10% Exceedance Allowance)				10 mm/s Criterion (Maximum)			
		50 kg	100 kg	150 kg	500 kg	50 kg	100 kg	150 kg	500 kg
R1	4,000	<0.1	0.1	0.1	0.3	0.1	0.2	0.2	0.6
R2	1,285	0.3	0.5	0.7	1.7	0.5	0.9	1.3	3.4
R3	1,740	0.2	0.3	0.4	1.1	0.3	0.6	0.8	2.1

The predicted peak particle velocity ground vibration levels presented in **Table 15**

Table 15 indicate that both the 5 mm/s (10% exceedance) and 10 mm/s (maximum) ground vibration criteria can be achieved for all Project blasting.

Notwithstanding the above, it is anticipated that routine blasting noise and vibration mitigation measures applied at Cracow Aeris Resources would also be employed for the Project.

6.0 Noise Mitigation

Noise mitigation measures are not required based on the findings of the assessment. However, should noise monitoring show noise mitigation is required, the following mitigation measures should be considered.

Noise related preventative and mitigation controls include:

- Managed reduction of larger equipment fleets during periods of adverse wind conditions;
- Planning to carry out the required works during seasons where prevailing climatic conditions minimise impact to key receptors;
- Alternate methods for some required activities during critical time periods or adverse wind conditions – For example, paddock dumping as an alternative to edge tipping of ore or waste;
- Additional noise control of project dedicated equipment, or selection of equipment manufacturer noise mitigated equipment. Measures include elements such as high performance engine silencers, large cooling radiators with low speed fans, track equipment guides, limiting track equipment travel speeds; and
- Construction of acoustic noise barrier bunds close to the operating equipment such as quarry crusher where practical; and

Implementation of some or all of the above noise mitigation methods can significantly reduce noise emissions. In some cases, such as reduced operating equipment fleets, the operation will then occur over a longer time period, so there can be a trade-off between noise emission level and the period of noise impact (for specific construction tasks where there is a defined scope of work). Some measures can impose restriction or cost on a project, thus are typically implemented on critical projects where potential or monitored noise impacts are considered significant.

It is noted that for the TSF2 construction project, the nature of some required operations do not facilitate effective application of some of the above mitigation measures. For example, providing acoustic barriers for the clay borrow pit which is typically a shallow deposit over a wider area are not conducive to effective use of acoustic barriers.

Excessive noise can be generated by use of equipment in poor condition, or methods which are not good practise.

It is recommended that the following good practice noise and/or vibration mitigation and management measures are employed where practicable:

- Dumping of material can include engineering controls to minimise the distance the material falls.
- Equipment should be shut down when not in use.
- All equipment should be operated and maintained in accordance with the manufacturer’s instruction and in order to minimise noise impact events.
- Broadband “buzzer”, not tonal “beeper”, reversing alarms should be utilised on all mobile plant.
- In the event of a complaint regarding potential impulsive noise disturbance such as dozer track slap, this could be minimised through idle wheel modification, use of track slides and grousers, and management controls such as gear limitation (forward and reverse in 1st gear only).

7.0 Summary

The technical assessment has modelled proposed TSF2 project noise emission levels from two (2) scenarios representing the TSF2 Stage 3B and Stage 4/5 construction, and at end of life the Capping of TSF2 Stage 5. Through a review of Project information supplied by Aeris Resources as part of the assessment, these three (3) modelled scenarios were selected to represent various stages of operational intensity with consideration to noise sensitive receptors surrounding the Project.

Receptors R2 and R3, within 1.3km of the TSF2 project area and with minimal noise contribution from existing CRO operations to be assessed on the basis of day time TSF2 construction, with a recommended outdoor receptor criteria of $L_{Aeq,1hr}$ 50 dB.

Receptor R1 (CRO camp) and Cracow town site to be assessed on the basis of cumulative noise impact from existing CRO operations and TSF2 construction activity. This reflects the likely scenario that any noise generated by TSF2 construction activity will be perceived as part of the CRO operational noise emission.

The assessment of potential operational noise from the Project identified the following:

- Project noise levels for receptors R2 & R3 under both neutral and adverse weather conditions are predicted to be no greater than the proposed external construction noise limit of L_{Aeq} 50 dB.
- Project noise levels for receptor R1 (CRO camp) and Cracow town site under both neutral and adverse weather conditions are predicted to be no greater than L_{Aeq} 20 dB from the TSF2 Stage 3A construction activities. This predicted noise emission contribution is significantly below the proposed L_{Aeq} 42 dB noise limit.
- Previous construction of the TSF2 has been reported as not resulting in complaints regarding noise and vibration at nearby receptors. The scale of the TSF2 construction and capping phases is similar or of lesser scale. With good practice construction methods, no significant impacts to nearby receptors are predicted, particularly as the works are proposed during the day period.

The assessment has considered the potential for cumulative mine and TSF2 construction noise impacts for sensitive receptors in surrounding areas.

The assessment has determined that with the introduction of the TSF2 Stage 3B, 4 and 5 Lifts, no significant cumulative noise impacts are predicted.

8.0 References

Legislation (Queensland)

Queensland Environmental Protection Act 1994.

Queensland Environmental Protection (Noise) Policy 2019.

Guidelines, Standards, EAs etc

Queensland Department of Environment and Science's Environmental Authority EPML00982113 dated 25 March 2022.

Queensland Department of Environment and Science's Model Mining Conditions Guideline 2017.

Queensland Department of Environment and Science's Noise guideline: assessment of low frequency noise 2005 (Draft). Unpublished.

Queensland Department of Environment and Science's Planning for Noise Control Guideline 2004 (under review by DES – not currently an approved DES guideline).

Queensland Department of Environment and Science's Streamlined Model Conditions for Petroleum Activities Guideline 2016.

Standards Association of Australia, 2006. Explosives – Storage and use Part 2: Use of explosives AS 2187.2-2006.

ICI Explosives (now Orica) Blasting Guide 1995.

Appendix A Acoustic Terminology

Cracow TSF2 Stage 3B-5 Lift

Environmental Authority Amendment - Noise and Vibration Impact Assessment

Lion Mining Pty Ltd (a subsidiary of Aeris Resources Ltd)

SLR Project No.: 623.030484.00004

27 October 2025

Sound Level (or Noise Level)

The terms sound and noise are almost interchangeable, except that in common usage noise is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear (and those of other species) responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (dB or dBZ) scale reduces this ratio to a more manageable size by the use of logarithms.

A-weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dB, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to human hearing.

Sound Power Level

The sound power of a source is the rate at which it emits acoustic energy. As with sound pressure, sound power levels (SWL) are expressed in dB units, but are identified by the symbols SWL.

The relationship between sound power and sound pressure may be likened to an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

Change in Sound Pressure Levels

For human perception, a change of 1 dB or 2 dB in the level of a sound is considered to be indiscernible, while a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness.

Typical Sound Pressure Levels

The table below lists examples of typical sound pressure levels.

Table A1 Examples of Typical Sound Pressure Levels

Sound pressure level (dB)	Typical example	Subjective (human) evaluation
130	Threshold of pain	Intolerable
120	Metal hammering	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 metres (m)	Very noisy
90	Dog bark at 1 m	
80	Cicadas at 1 m	Loud
70	Noise level directly adjacent to a busy main road	
60	Ambient noise level in urban area close to main roads	

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Sound pressure level (dB)	Typical example	Subjective (human) evaluation
50	Typical rural environment with high insect noise or close to a main road	Moderate to quiet
40	Ambient noise level in a rural environment with light breezes and some noise from insects, birds and distant traffic	Quiet to very quiet
30	Ambient noise level in a typical rural noise environment in the absence of insect noise and wind	
20	Ambient noise level in remote and quiet rural environment away from main roads with no wind and no insect noise	Almost silent

Noise Propagation

Provided the receptor is in the far-field of the noise source, noise levels will reduce as a receptor moves further away from the source. This is due to spreading of the noise source energy over distance. For a simple point source (for example, a motor) the theoretical reduction in noise levels is 6 dB per doubling of distance. For a line source (for example, a busy road) the theoretical reduction is 3 dB per doubling of distance. In reality however other factors affect noise propagation. These include ground absorption, air absorption, acoustic screening and meteorological effects.

Meteorological Effects

At distances over 500 m, meteorological affects (for example, local weather and atmospheric conditions) can substantially enhance or impair noise propagation. The most influential meteorological conditions on noise propagation are wind speed and direction and the occurrence of temperature inversions. Ambient air temperature and humidity and atmospheric pressure also affect noise propagation although to a lesser extent than wind and temperature inversions.

Wind Conditions

Wind conditions enhance noise propagation when the wind is blowing from a noise source towards a receptor and therefore noise levels at the receptor will be higher under these conditions. The wind can be thought to carry the noise in the direction it is heading. Where winds blow from the receptor towards the source, the propagation of noise is impaired and therefore lower noise levels will be experienced at the receptor.

It is important to consider the effect of prevailing wind conditions when assessing noise propagation over larger distances. Wind roses, which graph long term variations in wind speed and direction, are a useful tool for analysing prevailing wind conditions where available.

Temperature Inversions

Temperature inversions are a meteorological phenomenon where a layer of cold air is trapped at the ground surface under a layer of warmer air. Temperature inversions enhance noise propagation because sound travelling away from the ground is reflected back down from where the colder air meets the warmer air due to the change in pressure between the two layers.

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Conditions that favour the development of a strong surface inversion are nights with calm winds and clear skies. Calm winds prevent warmer air above the surface from mixing down to the ground, and clear skies increase the rate of cooling at the Earth's surface. It is therefore important to consider the effect of temperature inversions when assessing noise propagation over larger distances and during night-time periods.

Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of “peak” velocity or “rms” velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as “peak particle velocity”, or PPV. The latter incorporates “root mean squared” averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

Over-Pressure

The term “over-pressure” is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (i.e. unweighted), at frequencies both in and below the audible range.

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Appendix B Predicted Construction Noise Level Contour Maps

Cracow TSF2 Stage 3B-5 Lift

Environmental Authority Amendment - Noise and Vibration Impact Assessment

Lion Mining Pty Ltd (a subsidiary of Aeris Resources Ltd)

SLR Project No.: 623.030484.00004

27 October 2025

Figure 6 Noise Contours – Construction Stage 3B – Neutral Day

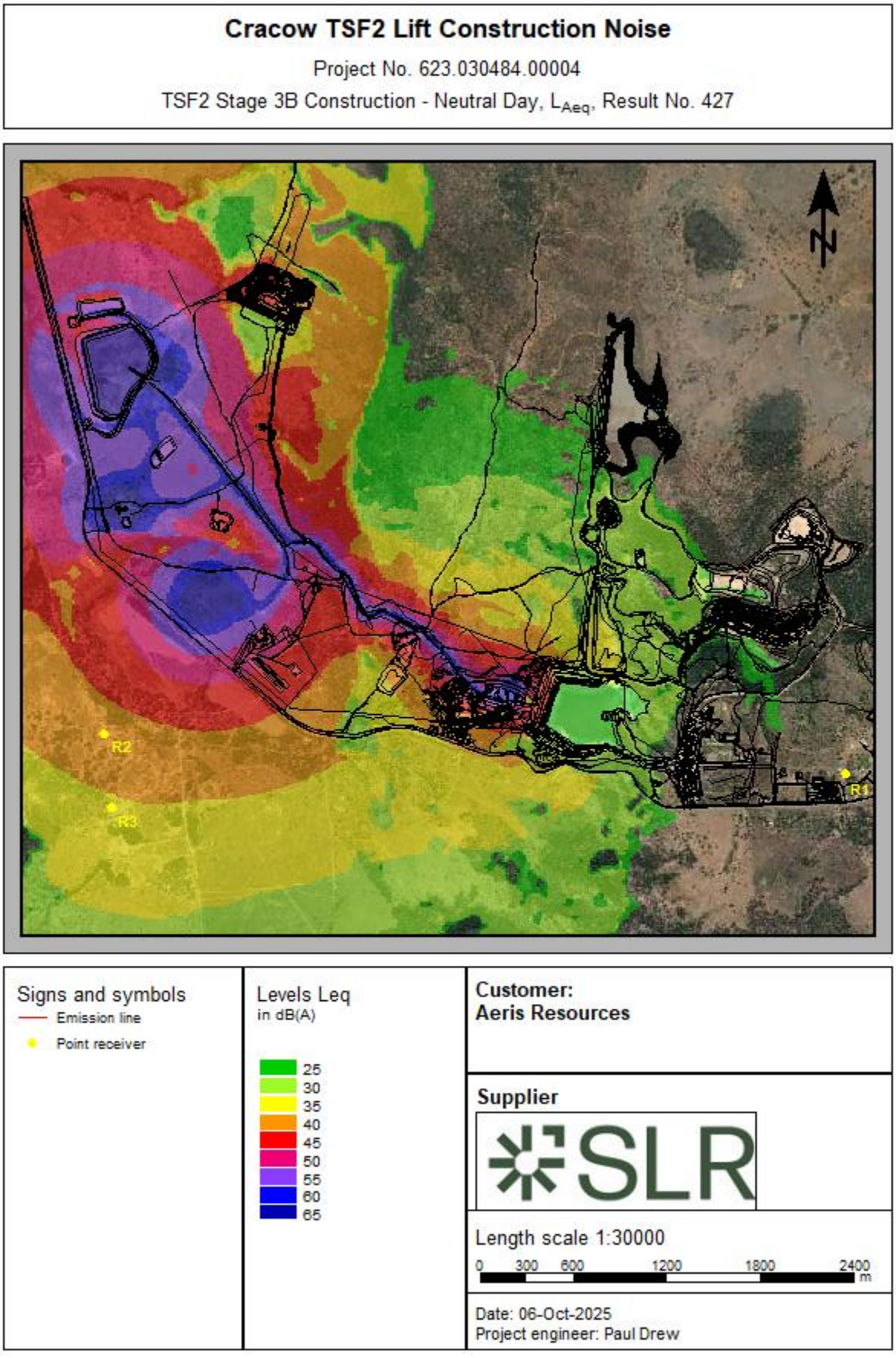

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Figure 7 Noise Contours – Construction Stage 3B – Adverse Day

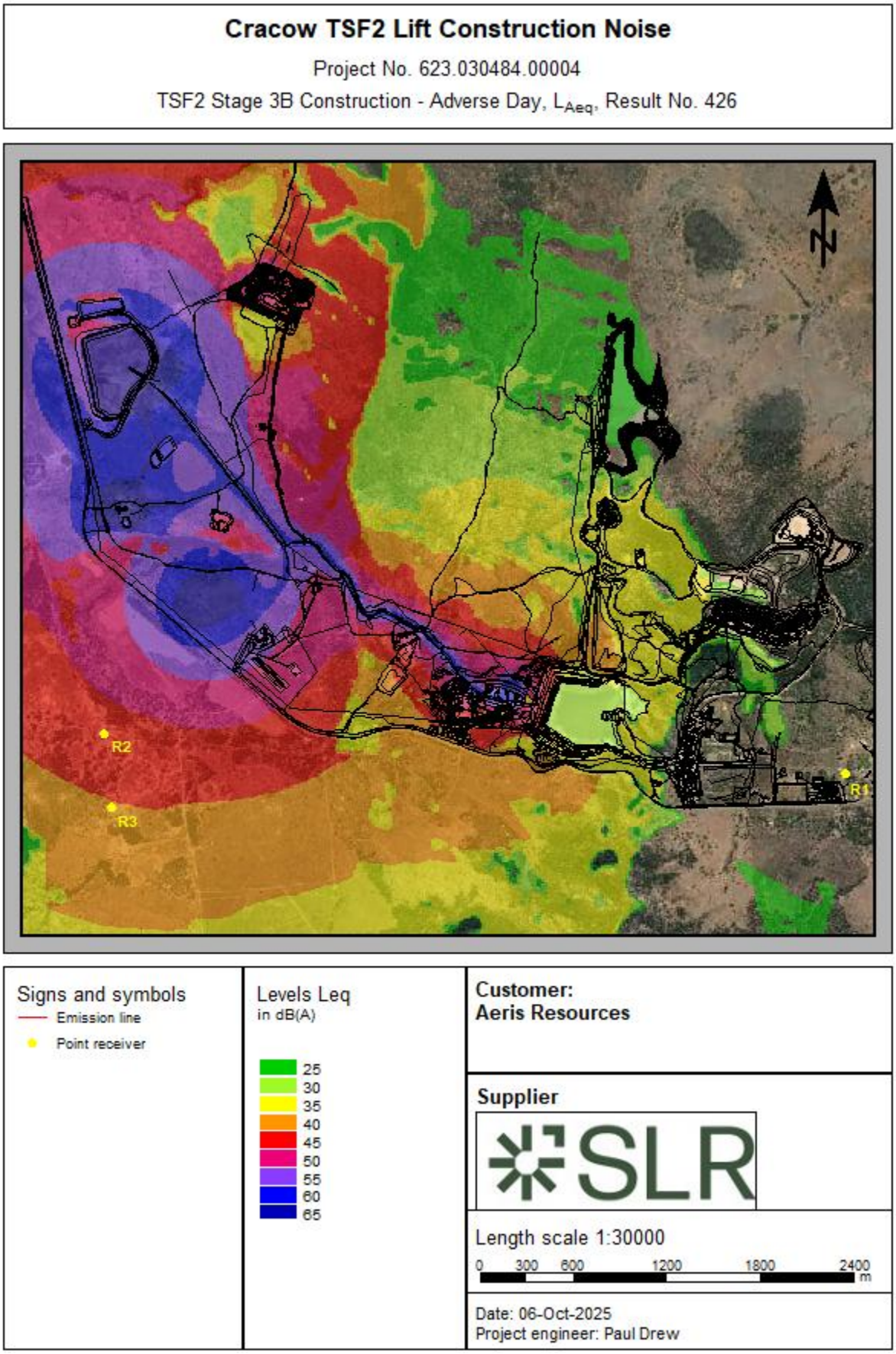

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Figure 8 Noise Contours – Construction Stages 4/5 – Neutral Day

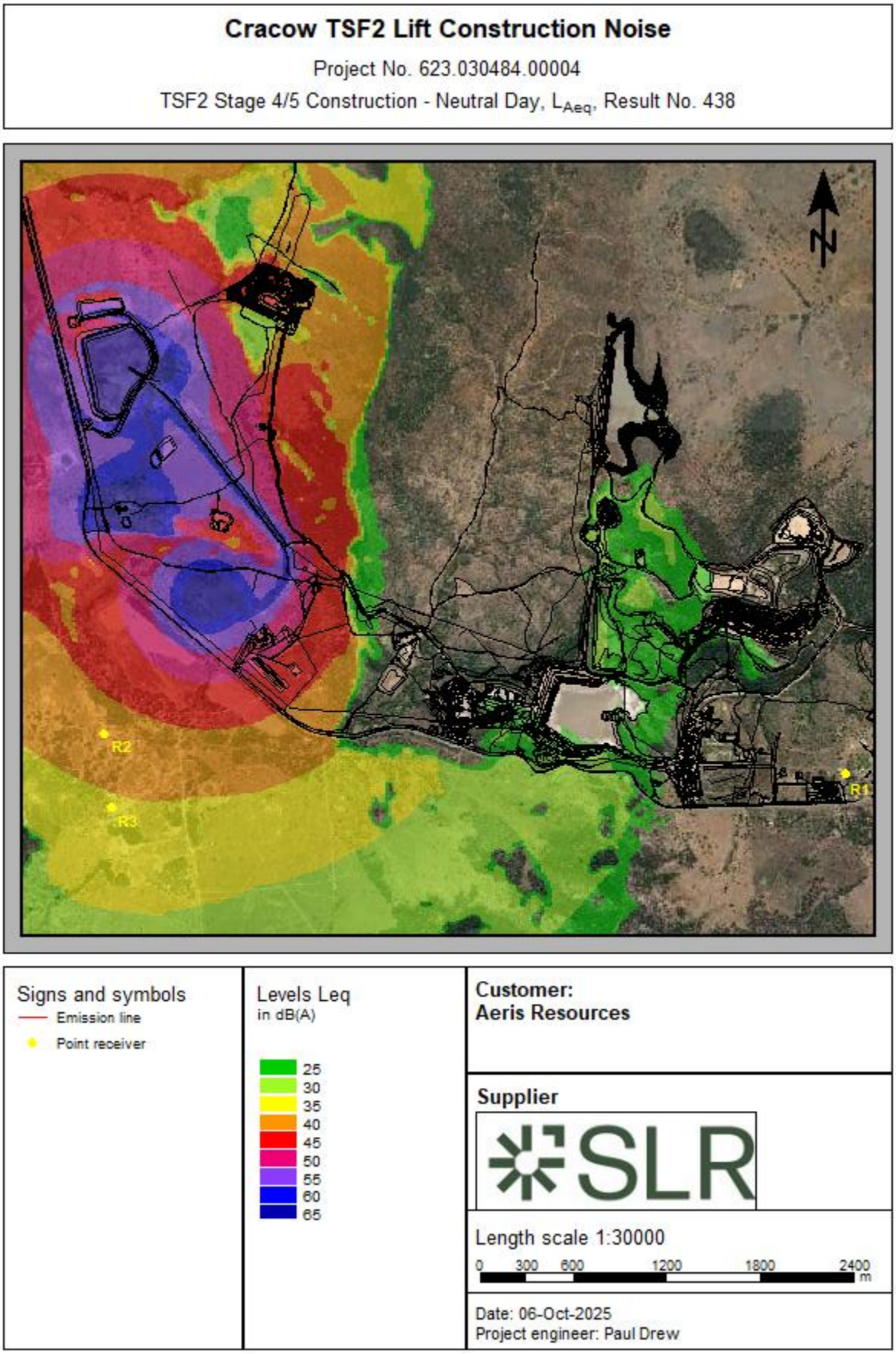

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Figure 9 Noise Contours – Construction Stage 3B – Adverse Day

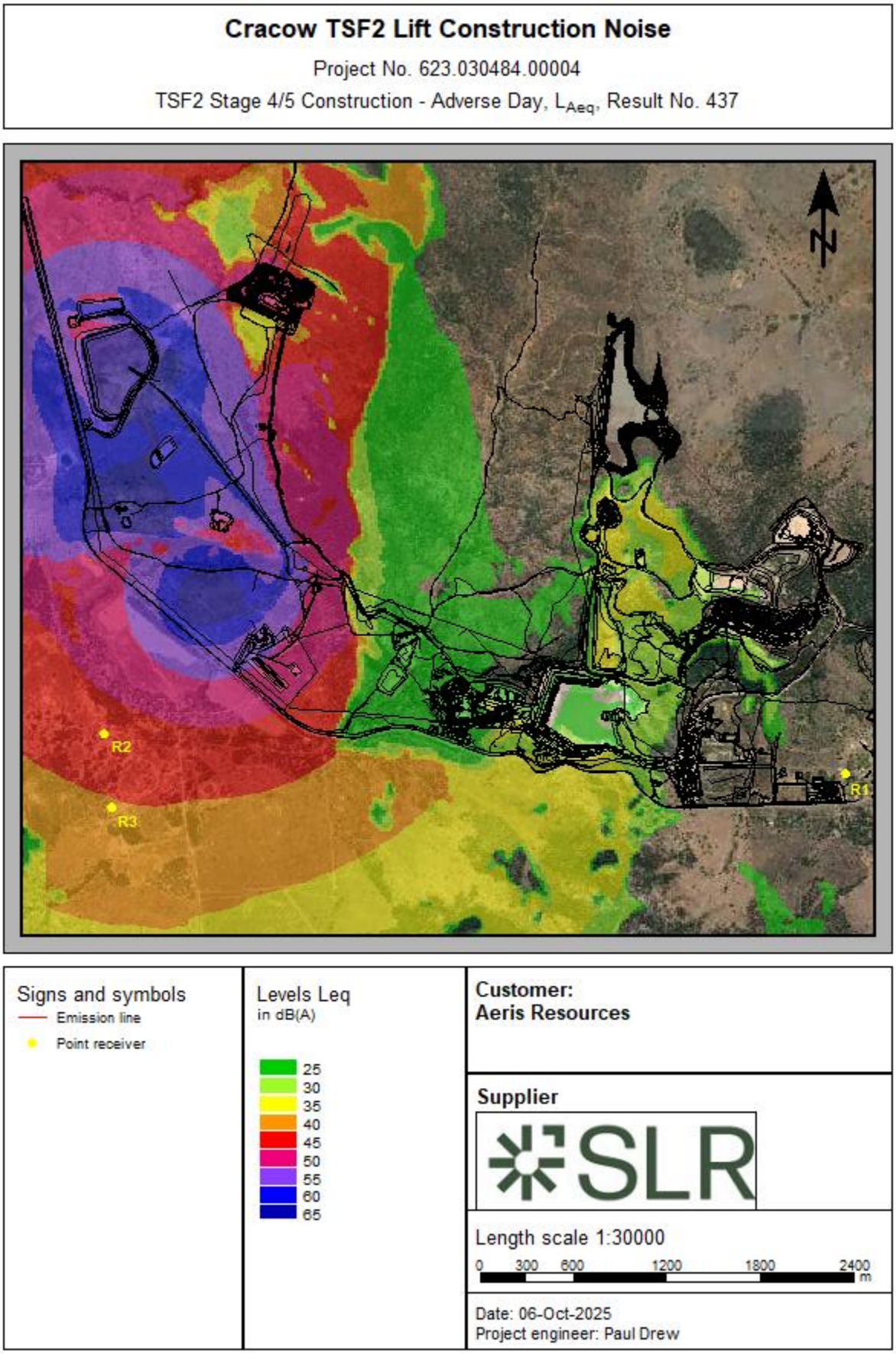


Figure 10 Noise Contours – Capping – Neutral Day

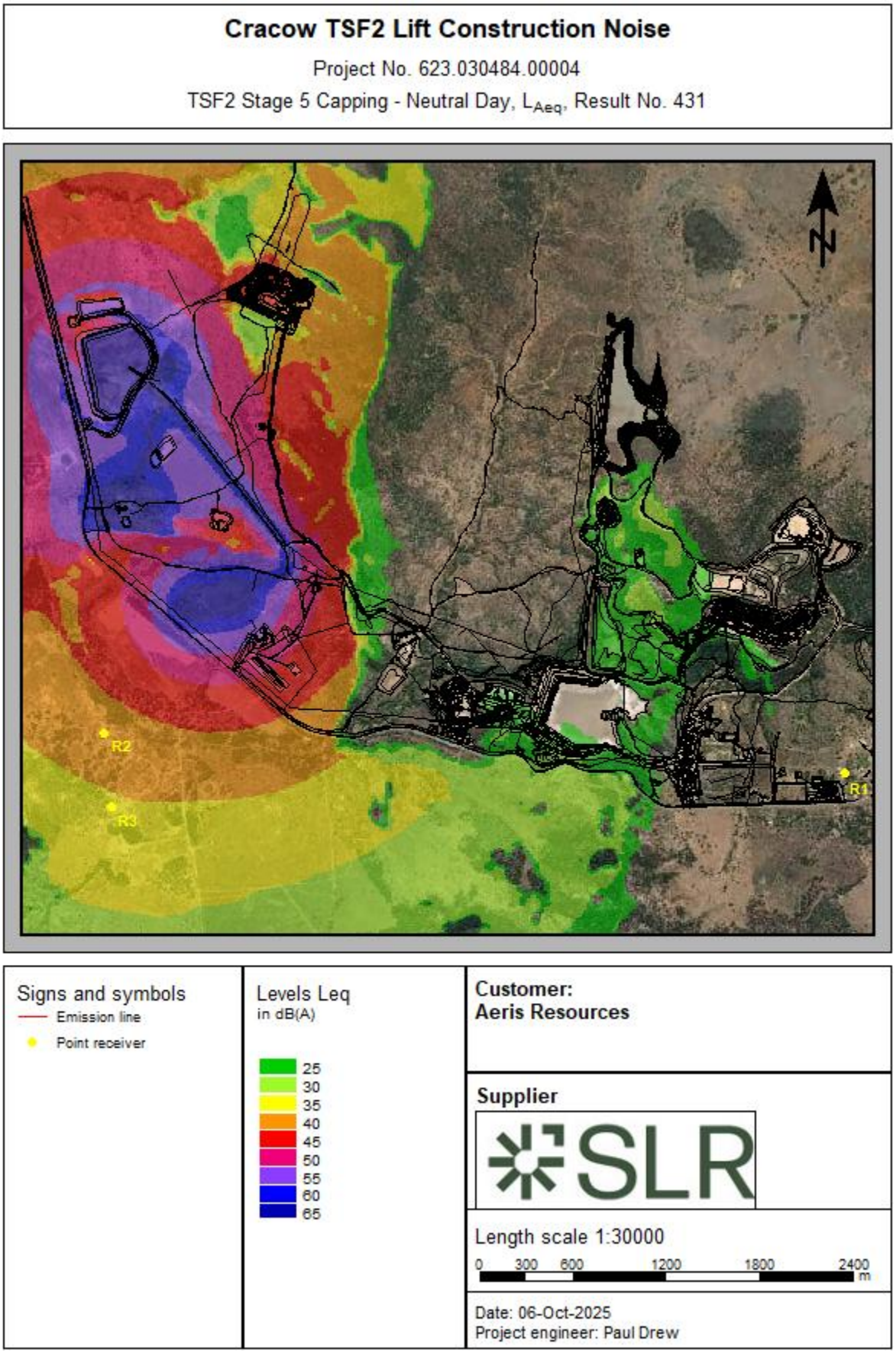
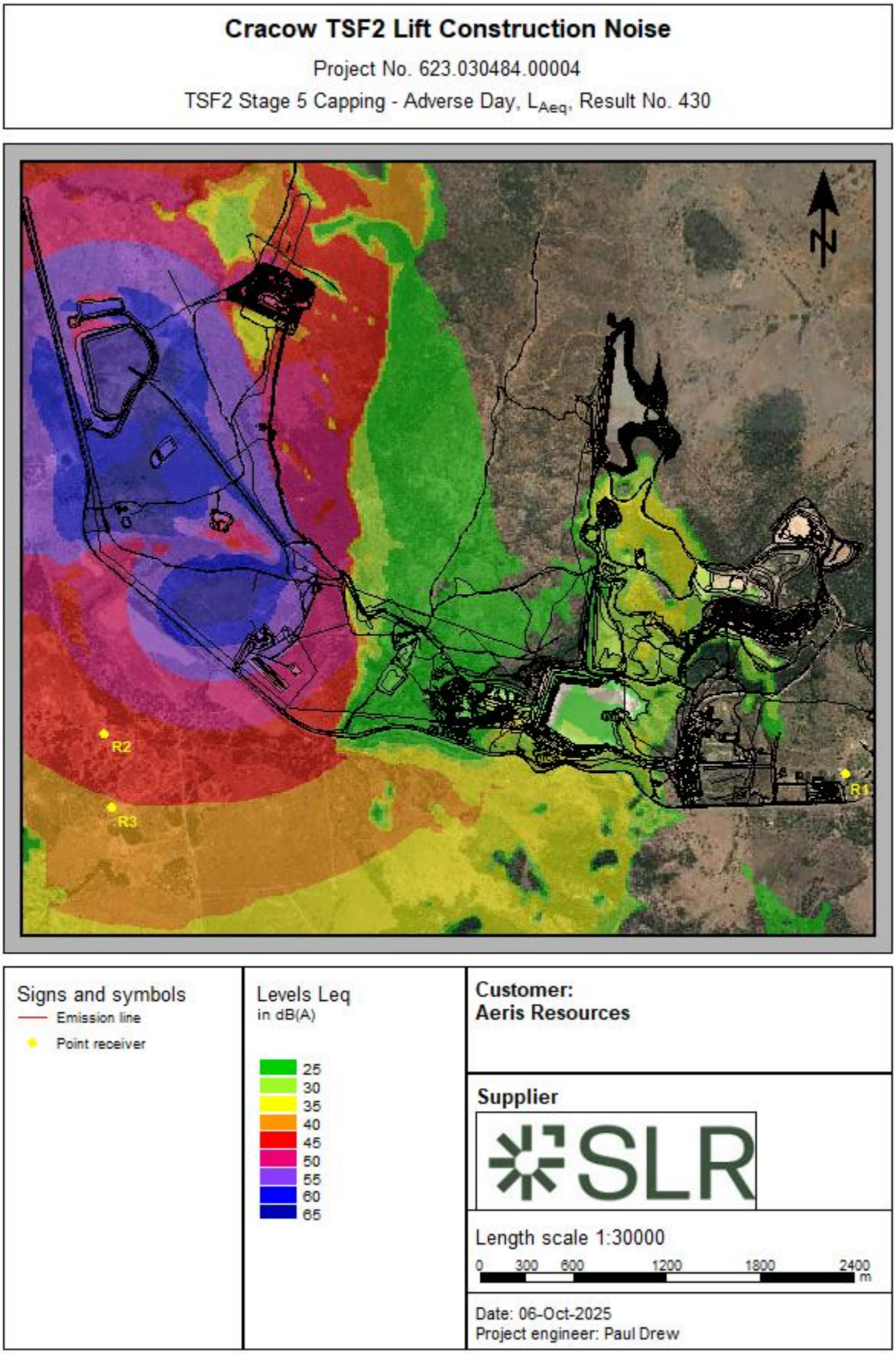


Figure 11 Noise Contours – Capping – Adverse Day



Appendix C Noise Monitoring Cracow Gold Mine July 2015 Air Noise Environment - Document 4197report03

Cracow TSF2 Stage 3B-5 Lift

Environmental Authority Amendment - Noise and Vibration Impact Assessment

Lion Mining Pty Ltd (a subsidiary of Aeris Resources Ltd)

SLR Project No.: 623.030484.00004

27 October 2025

SLR

Air Noise Environment
Environmental Monitoring and Assessment

Noise Monitoring - Cracow Gold Mine - FINAL

Evolution Mining

July 2015

Issued: 17 July 2015

Prepared by:
Air Noise Environment

ABN: 13 081 834 513

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Brisbane Office

A: Unit 3, 4 Tombo Street,

Capalaba, QLD 4157

T: +61 7 3245 7808

E: qld@ane.com.au

Sydney Office

A: Level 6, 69 Reservoir Street

Surry Hills, NSW 2010

T: +61 1300 851 761

E: nsw@ane.com.au

Townsville Office

A: Level 1, 25 Sturt Street

Townsville, QLD 4810

T: +61 07 4722 2724

E: qld@ane.com.au

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04				
05				

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The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Air Noise Environment Pty Ltd for the purposes of this project is both complete and accurate.

Executive Summary

Evolution Mining operates an underground gold mine in Cracow, 45 km south-east of Theodore. The mine site includes a processing plant located along Eidsvold-Theodore Road and to the west of existing residential houses in Cracow. Noise complaints have recently been received by Evolution Mining with regards to the processing plant, which includes the operation of a conveyor, crusher and loader 24 hours a day. To assess whether compliance with the site's noise license conditions are being achieved, noise monitoring has been completed by Air Noise Environment.

The following noise monitoring tasks were undertaken for the assessment:

- *unattended noise monitoring at 5 positions for up to a 7 day period between 9 June and 16 June 2015; and*
- *attended monitoring at the same 5 positions on the night of 15 June 2015.*

The 5 positions included the eastern boundary of the processing plant, three houses to the east of the site (including the complainant house) and an additional position close to the complainant house. The distance to the monitoring positions from the plant boundary to the receptor monitoring positions ranges between 550 m to 950 m (complainant house).

To establish noise criteria for the site, noise data measured during scheduled downtime on 10 June was utilised. The noise levels during this period were typical of an isolated rural area with night time Rating Background Levels (RBL) below 25 dB(A). These low RBL values indicated that the nearest receptors were not affected by noise from the mine site during the scheduled downtime and hence, are appropriate for establishing noise criteria in accordance with the 'RBL Plus' limits in the environmental license conditions.

An analysis of the unattended and attended noise monitoring data has identified the following:

- *the processing plant operated for the majority of the time during the monitoring period, with the exception of scheduled downtime period on 10 June;*
- *attended site observations – noise from processing plant was barely audible at the sensitive receptors (with the exception of alarms for short periods at one position) and other ambient noise sources defined the acoustic environment at the sensitive receptors. Noise sources that were observed at the receptors included constant conveyor noise, reversing beepers and an alarm;*
- *operation of the processing plant made negligible difference to sensitive receptors noise levels (based on average noise levels for the day, evening and night period).*

The results of the monitoring indicate compliance with the noise conditions, which include criteria for L_{A1} and L_{A10} noise parameters. It should be noted compliance was measured under relatively calm winds and normal operating conditions of the processing plant. Should noise levels of plant increase or downwind conditions occur, higher noise levels could be measured at the sensitive receptors.

It is noted that compliance was achieved at the complainant property by a significant margin (5 dB below criteria). However, for the monitoring positions at the GM house and SP house (closer to the

plant), noise levels were at or within 2 dB of the criteria limit. Hence, any slight variations in wind or operating conditions could result in non-compliances.

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1 Introduction

1.1 Scope of Study

Evolution Mining commissioned Air Noise Environment to undertake noise monitoring of the Cracow Gold Mine operations. The purpose of the monitoring is to compare operational noise levels at nearby sensitive receptors with the site's noise license conditions. The monitoring has been completed in response to noise complaints received from a nearby sensitive receptor regarding operation of the processing plant. The processing plant includes the operation of a loader, conveyor and crusher 24 hours a day. To assess the noise levels, both attended and unattended noise monitoring has been completed.

Figure 1.1 identifies the location of the processing plant in relation to the complainant property at 38 Forth Avenue, Cracow.

Figure 1.1 - Processing Plant and Sensitive Receptor Location

1.2 This Report

This report summarises the methodology, results and conclusions of the noise monitoring assessment. A glossary of terms is presented in Appendix A to assist the reader.

2 Noise License Conditions

Table 2.1 presents the noise conditions specified in the site's Environmental Authority. RBL (Rating Background Level) referred to in Table 2.1 is defined as median of the lowest 10th percentile $L_{A90,1\text{-hour}}$ noise level for the relevant period (day, evening or night) over 1-week of monitoring. In addition, time periods referred to in the noise conditions are as follows:

- Day – 7 am to 6 pm;
- Evening – 6 pm to 10 pm; and
- Night – 10 pm to 7 am.

Table 2.1 - Environmental Authority Noise Conditions

Noise Level dB(A)	Monday to Sunday (including Public Holidays)		
	7 am – 6 pm	6 pm – 10 pm	10 pm – 7 am
Noise measured at a nuisance sensitive place			
$L_{A10,adj,10\text{-mins}}$	RBL[a] + 5	RBL+ 5	RBL + 3
$L_{A1,adj,10\text{-mins}}$	RBL + 10	RBL + 10	RBL + 5
Noise measured at a commercial place			
$L_{A10,adj,10\text{-mins}}$	RBL + 10	RBL + 10	RBL + 5
$L_{A1,adj,10\text{-mins}}$	RBL + 15	RBL + 15	RBL + 10

[a] RBL (Rating Background Level) is defined as the median of the lowest 10th percentile $L_{A90,1\text{-hour}}$ noise level for the relevant period (day, evening or night) over 1-week of monitoring. The site's license condition uses the term BG (Background) which is synonymous to RBL.

Based on the noise monitoring completed during the scheduled downtime on 10 June 2015 (as discussed in Section 4.3.2), RBL values of 30 dB(A), 25 dB(A) and 25 dB(A) are applicable for the day, evening and night period. Table 2.2 presents the relevant noise criteria applicable to the assessment.

Table 2.2 - Derived Assessment Criteria

Noise Level dB(A)	Monday to Sunday (including Public Holidays)		
	7 am – 6 pm	6 pm – 10 pm	10 pm – 7 am
Noise measured at a nuisance sensitive place			
$L_{A10,adj,10\text{-mins}}$	35	30	28
$L_{A1,adj,10\text{-mins}}$	40	35	30

Noise Level dB(A)	Monday to Sunday (including Public Holidays)		
	7 am – 6 pm	6 pm – 10 pm	10 pm – 7 am
Noise measured at a commercial place			
$L_{A10,adj,10\text{-}mins}$	40	35	30
$L_{A1,adj,10\text{-}mins}$	45	40	35

3 Noise Monitoring

3.1 Overview

To assess noise levels from the mine operations, both attended and unattended noise monitoring was completed during June 2015. The following sections outline the monitoring locations and methodology.

3.2 Monitoring Locations

Five noise monitoring locations were selected by Evolution Mining for the purpose of the assessment. These monitoring positions include the mine mill site boundary, the complainant property and three other positions near houses (located close to the complainant property). In addition to the noise monitoring, monitoring of wind and rainfall was recorded by the Evolution Mining's on-site weather station located near the entrance to the mill along Eidsvold-Theodore Road.

Table 3.1 and Figure 3.1 presents a summary of the monitoring locations.

Table 3.1 - Noise Monitoring Locations

No.	Location	Distance from Mine Mill
1	Cracow Gold Mine – Mill boundary	-
2	GM House	550 m east
3	SP House	650 m east
4	Bushland near complainant's House	870 m east
5	Complainant's House	950 m east

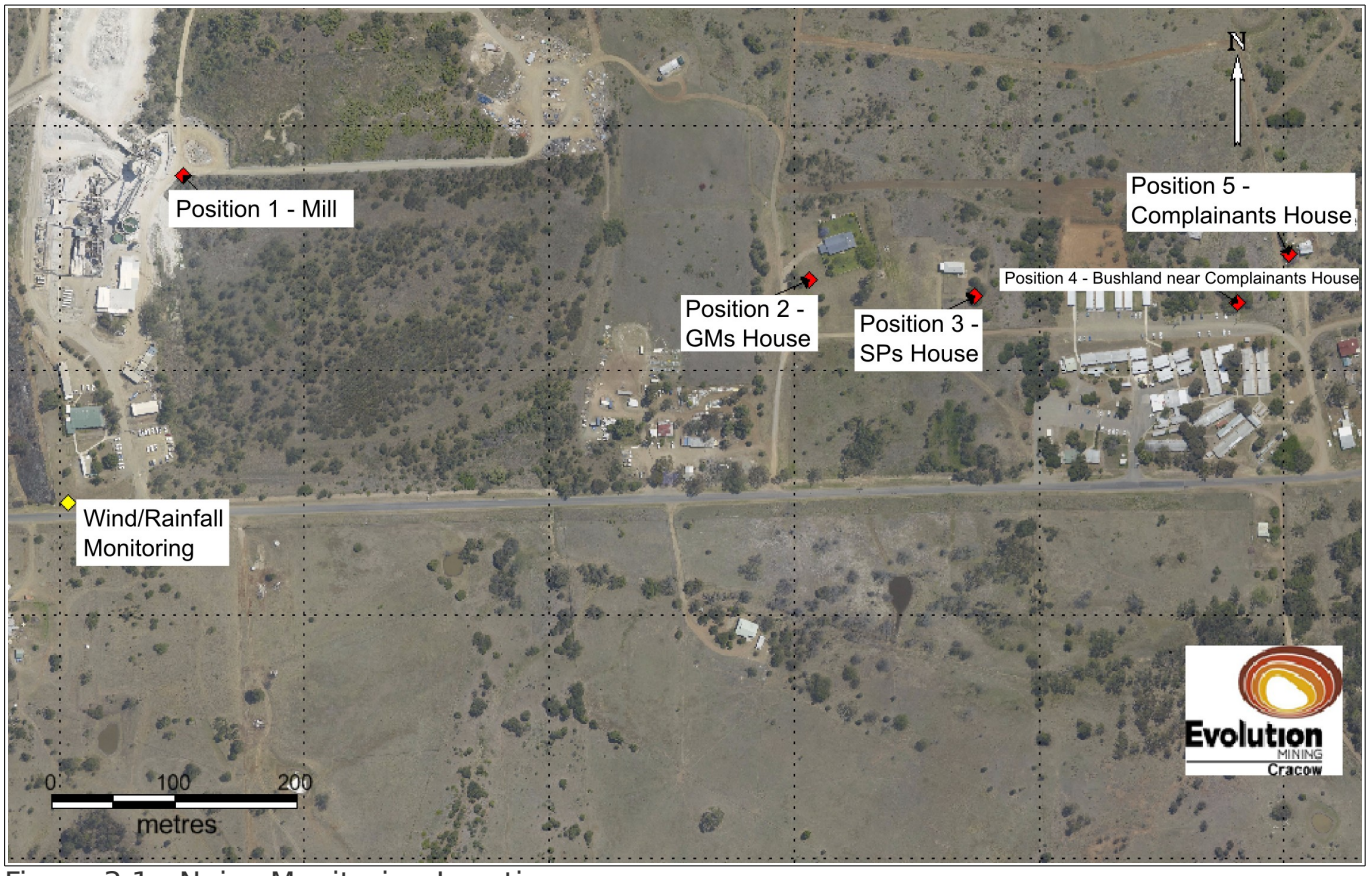


Figure 3.1 - Noise Monitoring Locations

3.3 Monitoring Methodology

At each location, the following noise monitoring tasks were completed:

- up to 7 days of continuous unattended noise monitoring between 9 to 16 June 2015; and
- 2 x 10-minute attended noise measurements on the night of 15 June 2015.

Noise measurements were undertaken in accordance with the requirements of the EHP Noise Measurement Manual (2013). The instruments were situated in free-field positions at a height of 1.2 metres above ground level and fitted with windshields throughout the measurements. An averaging time of 10 minutes was adopted for both unattended and attended measurements. The serial numbers and calibration information for the instruments are presented in Table 3.2.

Table 3.2 - Noise Instrument Calibration Information

No.	Instrument/ Serial No.	Monitoring Dates	NATA Calibration Current to:	Pre-Calibration	Post-Calibration
Unattended Monitoring					
1	Nor140 (1405257)	9/6/15 – 16/6/15	1/10/16	93.9	93.9

No.	Instrument/ Serial No.	Monitoring Dates	NATA Calibration Current to:	Pre-Calibration	Post-Calibration
2	Nor140 (1405261)	9/6/15 – 16/6/15	7/5/17	93.4	94.0
3	Nor140 (1404664)	9/6/15 – 16/6/15	20/8/15	93.5	93.8
4	Nor140 (1405258)	9/6/15 – 16/6/15	7/11/16	94.4	94.2
5	Ngara (8780D6)	10/6/15 – 16/6/15	30/5/16	93.8	93.6
-	Rion NC-73 (1127965)	Field calibrator	30/10/15	-	-
Attended Monitoring					
All	B&K2250 Lite (274110	15/6/15	22/01/17	94.0	94.0
-	Rion NC-73 (11248297)	Field calibrator	5/11/15	-	-

3.4 Meteorological Conditions

The EHP Noise Measurement Manual specifies that noise monitoring should not generally be conducted when winds are higher than 5 m/s or during periods of rain. During the monitoring, all measured wind speeds (based on hourly on-site data) were below 5 m/s. 0.2 mm rainfall was measured at the following times:

- 9:58 pm on 11 June 2015;
- 0:59 am, 1:17 am, 3:20 am, 4:42 am and 5:56 am on 12 June 2015; and
- 2:52 am, 3:15 am on 13 June 2015.

10-minute measurements potentially affected by rainfall during the above times have been omitted from the analysis to avoid weather-related bias.

During the monitoring, wind speeds ranged from calm to 4 m/s and were generally from an easterly to south-easterly direction. It is noted that calm conditions occurred for a large proportion of the monitoring period (40%). Compliance against the license conditions has been assessed during a period of calm conditions (as discussed in Section 5).

3.5 Operational Conditions

The processing plant was operating under standard conditions for the majority of the monitoring period. A scheduled downtime period occurred from midnight to 8:45 pm on Tuesday 10 June 2015.

4 Monitoring Results

4.1 Attended Noise Measurements

Tables 4.1 to 4.5 present a summary of the attended noise monitoring results completed on the night of 15 June 2015.

Table 4.1 – Position 1 (Plant Boundary) – Attended Noise Monitoring Results

Time	Measured Noise Levels dB(A)					Description
	L_{Aeq}	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	
22:21	75.2	79.3	76.8	76.0	74.3	Meteorology: -light to moderate winds, clear skies Audible Noises: • conveyor motor – 76 dB(A) – constant. • ROM feed – material falling/moving around inside hopper (rumbling type noise). Unable to distinguish noise level over conveyor motor. • Loader – observed loading material into hopper. Conveyor motor dominant. Some material falling into hopper just audible. Unable to distinguish levels above conveyor. • Compressed air source also audible from nearby, however, unable to distinguish noise levels. Summary – conveyor noise was dominant.
22:32	73.2	84.0	79.6	72.7	69.3	Audible noise sources: • High pressure water hose intermittent – clearly audible, however cannot distinguish over conveyor (approximately 71 dB(A)). • Reversing beeper just audible on one occasion . • Compressed air “hiss” - constant. • Industrial forklift observed moving pallet ('bang' noise) was audible. • Forklift pass by level 84 dB(A).

Table 4.2 – Position 2 (GM House) – Attended Noise Monitoring Results

Time	Measured Noise Levels dB(A)					Description
	L_{Aeq}	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	
22:54	35.0	60.0	44.0	36.1	30.1	• Light-moderate winds, clear skies • Background noise included vegetation noise, leaves rustling, insects, crickets • Conveyor noise from mill was just audible however, noise levels could not be distinguished above background levels. • One light vehicle pass by event along nearby road.
23:05	34.2	63.1	39.7	32.7	29.4	• Background noise including insects and vegetation was dominant. • Conveyor noise from mill was just audible

Table 4.3 – Position 3 (SP House) – Attended Noise Monitoring Results

Time	Measured Noise Levels dB(A)					Description
	L_{Aeq}	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	

23:20	32.7	56.4	40.2	35.1	28.6	• Light to moderate winds, clear skies
						• Noise from mill site included:
						  ◦ Alarm – 38-39 dB(A) (sounded for 1-minute). Alarm was audible again at 23:27 (10 seconds) and 23:28 (30 seconds).
						  ◦ Conveyor was only just audible.
						  ◦ Occasional 'bang' from site.

23:30	34.3	60.6	44.1	32.8	28.4	• Noise from site included:
						  ◦ Conveyor noise constant, just audible.
						  ◦ Alarm audible for 2 seconds (35 dB(A)).
						  ◦ A reversing beeper was barely audible on one occasion.
						• Background noise including insects and vegetation was dominant

Table 4.4 – Position 4 (Bushland Area Near Complainant) – Attended Noise Monitoring Results

Time	Measured Noise Levels dB(A)					Description
	L_{Aeq}	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	
23:47	34.1	64.5	41.8	32.9	29.8	• Constant fixed plant noise from mine camp was dominant. Other background sources included insects and vegetation. • Site mill noise included occasional reversing beeper and an alarm was audible for 2 seconds on one occasion.
23:56	32.6	54.2	39.1	32.7	29.1	• Site mill noise included occasional reversing beeper (audible but levels could not be distinguished above background sources). No conveyor noise was audible at the position. • Fixed plant noise from mine camp was dominant.

Table 4.5 – Position 5 (Complainant House) – Attended Noise Monitoring Results

Time	Measured Noise Levels dB(A)					Description
	L_{Aeq}	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	

00:11	32.9	56.6	40.9	33.1	30.1	• Clear skies, light winds.
						• The dominant noise source was fixed plant from the nearby mining camp.
						• Noise from mill site included:
						  ◦ Occasional 'bang' from site.
						  ◦ Reversing beeper just audible, but levels could not be distinguished above fixed plant from mining camp.
						  ◦ Material being dropped 33 dB(A).

00:22	36.3	58.2	47.6	35.5	31.2	• Noise from mill site included a reverse beeper, but no other noise sources audible from mill site. • Fixed plant from the mining camp was clearly audible and defining levels. Other sources include a vehicle in the distance (off-site) and insects and vegetation.

4.2 Unattended Noise Measurements

Tables 4.6 to 4.10 presents a summary of the noise monitoring results at unattended monitoring locations. The Rating Background Level (RBL) value is defined as the median of the lowest 10th percentile $L_{A90,1\text{-hour}}$ noise level for the relevant period (day, evening or night) across 1-week of monitoring. The RBL is used to derive noise criteria as referred to in Table 2.1 in Section 2. Appendix B presents daily averages of noise levels for each monitoring position. Time periods referred to in the results tables are as follows:

- Day – 7 am to 6 pm;
- Evening – 6 pm to 10 pm; and
- Night – 10 pm to 7 am.

Measured L_{A1} and L_{A10} noise levels at the sensitive receptor locations (Positions 2, 3 and 5) are above the noise criteria values presented in Table 2.2 of Section 2. However, a comparison of noise levels during the mill operation with noise levels during the scheduled downtime (10 June midnight to 9 pm) is also presented. This indicates that average day, evening and night noise levels are similar with and without the operation of the processing plant, highlighting that ambient noise sources (as opposed to mill noise sources) are defining the measured L_{A1} and L_{A10} noise levels at the sensitive receptor monitoring positions. Given this, more detailed analysis of the monitoring data is required to determine the compliance status of the site (this analysis is provided in Section 5).

Table 4.6 - Position 1 – Plant Boundary – Noise Monitoring Summary

	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	RBL
Operational	Day	81	77	75	71	76	65
	Evening	82	78	77	73	76	71
	Night	82	79	77	74	76	72
Ambient Background (No Operations)	Day	73	66	61	55	60	55
	Evening	75	70	66	58	66	59
	Night	67	62	58	57	58	55
Difference	Day	8	11	14	16	16	10
	Evening	7	8	11	15	10	12
	Night	15	17	19	17	19	17

Table 4.7 - Position 2 – GM House – Noise Monitoring Summary

	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	RBL
Operational	Day	61	52	45	34	44	32
	Evening	50	44	39	33	38	31
	Night	49	40	35	29	38	27
Ambient Background (No Operations)	Day	60	51	44	35	47	32
	Evening	53	49	44	39	43	36
	Night	47	41	37	31	40	24
Difference	Day	1	1	0	-1	-3	0
	Evening	-3	-5	-6	-5	-5	-5
	Night	2	-1	-2	-2	-2	3

Table 4.8 - Position 3 – SP House – Noise Monitoring Summary

	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	RBL
Operational	Day	57	49	43	33	45	30
	Evening	55	51	47	32	46	31
	Night	48	40	34	28	37	27
Ambient Background (No Operations)	Day	56	48	41	33	41	30
	Evening	57	55	54	36	49	35
	Night	47	41	36	31	38	27
Difference	Day	2	1	1	0	4	0
	Evening	-2	-4	-7	-4	-3	-4
	Night	1	-1	-2	-2	-1	0

Table 4.9 - Position 4 – Bushland Near Complainant House – Noise Monitoring Summary

	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	RBL
Operational	Day	57	50	43	35	42	33
	Evening	48	43	40	34	39	32
	Night	46	39	35	31	36	30
Ambient Background (No Operations)	Day	57	49	42	34	41	32
	Evening	54	47	41	35	40	34
	Night	45	41	37	33	39	32
Difference	Day	0	0	1	1	1	1
	Evening	-6	-3	-2	-1	-1	-2
	Night	0	-2	-2	-1	-3	-2

Table 4.10 - Position 5 – Complainant House – Noise Monitoring Summary

	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	RBL
Operational	Day	57	48	41	34	42	32
	Evening	47	41	39	34	38	32
	Night	45	38	34	31	35	30
Ambient Background (No Operations)[a]	Day	57	49	42	34	41	32
	Evening	50	46	44	39	42	38
	Night	45	41	37	33	39	32
Difference	Day	0	-1	-1	0	1	0
	Evening	-3	-4	-5	-5	-4	-6
	Night	0	-4	-3	-2	-4	-2

[a] Noise monitoring at Position 5 did not occur until 3 pm on 10 June 2015 (towards the end of the scheduled downtime period), therefore, scheduled down time data for the day and night period has been based on Position 4 data.

4.3 Discussion of Results

4.3.1 Attended Measurements

Observations made during the attended monitoring indicated that processing plant noise (mostly defined by the conveyor operation) was only just audible at the GM and SP houses. At the SP house, an alarm was clearly audible on three occasions (10 second to 1-minute period) with levels ranging from 35 to 39 dB(A). The operation of the alarm did not appear to influence the L_{A10} and L_{A1} noise measurements (33/35 dB(A) and 40/44 dB(A)), which were similar to ambient background (scheduled downtime) night noise levels at the SP house of L_{A10} 36 dB(A) and L_{A1} 41 dB(A). At the GM house, which is closer to the mill by 100 metres, intermittent sources such as reversing beepers or alarms were not audible and therefore, it is likely that these sources were not in operation during the two 10-minute measurements.

At Positions 4 and 5 (complainant property), continuous noise from the mill was not audible. These positions are an additional 300-400 metres from the mill and it is noted that fixed plant from the nearby mine camp defined noise levels. Intermittent noise sources from the mill (such as reversing beepers and an alarm) were just audible on occasions however, noise levels were not distinguishable against the ambient noise.

Overall, based on the attended observations, noise from the mill was barely audible at the sensitive receptors and other ambient noise sources defined the acoustic environment at the sensitive receptors.

4.3.2 Noise Levels During Scheduled Downtime

As indicated in Table 4.1, during the schedule down time from midnight to 8.45 pm pm on 10 June, L_{A90} noise levels at Position 1 (Mill Boundary) decreased by up to 15-17 dB (to less than 60 dB(A)). The L_{A90} noise levels during the down time were higher than typical ambient noise levels for a rural area (25-30 dB(A)) indicating the there was still some quieter plant in operation during the downtime. Nevertheless, given the low measured level of less than 60 dB(A), it is unlikely that noise from the site would have had any influence on noise levels at the other four monitoring positions which are between 550 m to 950 metres away. Analysis of the data at the nearest Position 2 (GM House) indicates L_{A90} noise levels dropped to as low as 23 dB(A) – this is typical of an isolated rural area and confirms noise from the site did not influence noise levels at sensitive receptors during this period.

For the purpose of deriving noise criteria in accordance with Table 2.1 of Section 2, it is necessary to define a Rating Background Level (RBL) for the day, evening and night period. For the assessment, the lowest RBL value across Positions 2 to 5 have been adopted, as presented in Table 4.11.

Table 4.11 - Adopted RBL for Deriving Noise Criteria

Period	Measured RBL during Scheduled Downtime				Adopted RBL (lowest across positions)
	Position 2	Position 3	Position 4	Position 5	
Day	32	30	32	32	30
Evening	36	35	34	38	25[a]
Night	24	27	32	32	25[b]

[a] The lowest evening RBL was 34 dB(A), which is higher than the day RBL values. Other sources may have influenced the evening noise levels and as a conservative approach the night-time RBL has been adopted.

[b] The lowest night RBL was 24 dB(A), however, in accordance with the EHP Noise Measurement Manual 2013, the minimum 25 dB(A) level has been adopted

4.3.3 Comparison of Noise Levels (Operational Period vs Ambient Background)

A comparison of average day, evening and night noise levels with and without operation of the mine mill indicates that, on average, operation of the mine mill has minimal impact on noise levels at sensitive receptors as indicated by the minimal differences identified through the comparison:

- Position 2 (GM House) – L_{A1} and L_{A10} differences in noise levels varied by 1 dB or less (down to a -6 difference);
- Position 3 (SP House) – L_{A1} and L_{A10} differences in noise levels varied by 1 dB or less (down to a -5 difference);
- Position 5 (Complainant House) – L_{A1} and L_{A10} differences in noise levels were less than 0 dB.

It is noted the average measured L_{A1} and L_{A10} noise levels at the sensitive receptors are above the noise criteria values for the site. However, the above comparison of the operational and ambient background levels highlights that ambient noise sources (as opposed to mill noise sources) are defining the measured L_{A1} and L_{A10} noise levels at the sensitive receptor monitoring positions.

Based on the above comparison, it is likely that average noise levels from the mill operations are 10 dB or lower than background levels[1]. It is noted the comparison does not demonstrate compliance with the noise criteria, as there is still a potential for individual 10-minute periods to exceed the 10-minute L_{A1} and L_{A10} criteria. Section 5 provides an assessment of compliance based on a more detailed analysis of the monitoring data.

1 See Table 4 and preceding text of the EHP Noise Measurement Manual (2013) for further information regarding this matter.

4.3.4 Tonality/Impulsiveness

The noise license conditions require a correction for tonal and impulsive noise sources to account for the degree of nuisance associated with these types of sources. Analysis of the 1/3 octave band data in accordance with the EHP Noise Measurement Manual did not identify any tonal components associated with the processing plant. During the attended measurements, reversing beepers and short duration bangs/clangs were just audible at times. However, these sources were relatively infrequent and for short periods of time, hence, were not significant contributors to noise levels over a 10-minute averaging period.

5 Assessment of Compliance

5.1 L_{A10} Criteria

For the majority of the monitoring period, determining source L_{A10} noise levels from the processing plant (and whether or not compliance is achieved) directly from the measured data is problematic for the following reasons:

- L_{A10} noise levels at sensitive receptors are similar with and without operating of the mine mill, indicating operational noise levels are 10 dB or more below L_{A10} ambient background levels at the receptors (as discussed in Section 4.3.3); and
- the evening/night assessment criteria of L_{A10} 28-30 dB(A) are more than 10 dB below the ambient background L_{A10} noise levels.

Nevertheless, between 3 am and 4 am on Monday 15 June, there was a period when operations at the processing plant reduced in activity (possibly lower number of equipment operating) and this corresponded with a decrease in L_{A10} and L_{A90} noise levels at the GM House and SP House for the same period. The following noise levels were measured:

- prior to 3 am (2 am to 3 am) – L_{A10} noise levels were 29-30 dB(A) and 28-30 dB(A) at the GM and SP House, respectively; and
- Between 3 am and 4 am – L_{A10} noise levels dropped to 26 dB(A) and 27 dB(A) at the GM and SP House. It is also noted that L_{A90} noise levels at sensitive receptors dropped to 23 dB(A) and 25 dB(A) at the GM and SP House, respectively (similar to receptor noise levels during the scheduled downtime), indicating any plant noise is unlikely to have been audible at the nearest receptors during this period.

Accounting for the contribution from measured background noise levels, component noise levels from the mine mill are calculated to be up to 28 dB(A) and 26 dB(A) at the GM and SP House[2]. These noise levels are compliant with the day, evening and night L_{A10} noise limits (35 dB(A), 30 dB(A) and 28 dB(A)). It is noted that the processing plant was operating at standard operating levels during this period (L_{A10} 79 dB(A) at Position 1).

Noise levels from the processing plant cannot be identified from the monitoring data at the complainant house due to other extraneous noise sources in the vicinity[3]. Based on distance propagation of a point source, noise levels at the complainant property are predicted to be 23 dB(A), which is also compliant with the L_{A10} noise criteria.

2 For calculating component noise levels, see Page 15 of the EHP Noise Measurement Manual (2013), section 'Calculation of component noise levels'.

3 Noise levels were higher at the complainant position compared to at the GM and SP houses, despite being significantly further from the mine mill (950 metres compared to 550-650 m). The attended noise measurements also identified fixed plant from the nearby mining camp were influencing noise levels at the complainant house.

5.2 L_{A1} Criteria

As with the L_{A10} noise parameter, determining source L_{A1} noise levels from the processing plant at the nearest receptors (and whether or not compliance is achieved) directly from the measured data is problematic for the following reasons:

- L_{A1} noise levels at sensitive receptors are similar with and without operating of the mine mill (indicating operational noise levels are 10 dB or more below L_{A1} ambient background levels); and
- the evening/night assessment criteria of L_{A1} 30-35 dB(A) are more than 10 dB below background L_{A1} noise levels.

In addition to the above, there were no short periods during the monitoring period where L_{A1} noise levels from processing plant defined receptor noise levels. However, a comparison of L_{A1} and L_{A10} noise levels at Position 1 (Mine Mill Boundary) indicates that L_{A1} noise levels from the mill are 2 dB above L_{A10} noise levels on average. Therefore, the following L_{A1} noise levels at the nearest receptors are predicted as follows:

- GM House – 30 dB(A) (ie. L_{A10} 28 dB(A) + 2);
- SP House – 28 dB(A) (ie. L_{A10} 26 dB(A) + 2); and
- Complainant house – 25 dB(A) (ie. L_{A10} 23 dB(A) + 2).

The above noise levels are compliant with the day (35 dB(A), evening (35 dB(A)) and night (30 dB(A) L_{A1} criteria.

5.3 Comments on Meteorology and Operating Conditions

The above compliant noise levels are based on the following monitoring conditions:

- calm conditions with wind speeds reaching only 0.67 m/s at 2 am and 0.07 m/s at 3 am (south-easterly); and
- the processing plant was operating at an L_{A10} noise level of 79 dB(A) (measured at Position 1 (Plant Boundary)).

There is a potential for noise levels to be higher if downwind conditions were to occur (westerly winds). It is noted that noise levels at the GM and SP houses were close to (within 2 dB) or at the criteria for the following:

- L_{A10} – evening and night criteria;
- L_{A1} – night criteria.

Noise levels at the complainant property were well below the L_{A10} night criteria (5 dB lower) and L_{A1} criteria (7 dB lower). Overall, the potential for higher receptor noise levels due to meteorology is dependent on a number of factors including wind speed and whether or not temperature inversions were occurring at the time of the monitoring. In any case, as night-time L_{A10} and L_{A1} noise levels at the GM house were equivalent to the noise criteria, it is expected that downwind conditions would

push noise levels above the criteria for this particular receptor.

Analysis of Position 1 data indicates the mill generally operates at an L_{A10} 79 dB(A) or below, which resulted in compliance at the receptors. However, slight increases in noise levels from the mill would also increase noise levels at the receptors.

6 Conclusion

The findings of the unattended and attended noise monitoring can be summarised as follows:

- The processing plant operated for the majority of the time during the monitoring period, with the exception of scheduled downtime period on 10 June;
- Noise measurements completed during the scheduled downtime were representative of an isolated rural area with noise levels less than 25 dB(A) during the night period. Noise criteria has been derived from monitoring data obtained during this period;
- During the attended noise measurements, noise from processing plant was barely audible at the sensitive receptors for the majority of noise sources and other ambient noise sources defined the acoustic environment at the sensitive receptors. Noise sources that were observed at the receptors included constant conveyor noise, occasional reversing beepers and an alarm;
- operation of the processing plant made negligible difference to noise levels at sensitive receptors (based on average noise levels for the day, evening and night period).
- Assessment of compliance:
    - The results of the monitoring indicate compliance with the noise conditions (day, evening and night). It should be noted compliance was measured under relatively calm conditions and normal operating conditions of the processing plant. Should noise levels of plant increase or downwind conditions occur, higher noise levels could be measured at the sensitive receptors.
    - Compliance was achieved at the complainant property by a significant margin (5 dB below criteria). However, for the monitoring positions at the GM house and SP house (closer to the plant), noise levels were at or within 2 dB of the evening and/or night criteria limit. Hence, any slight variations in wind or operating conditions could result in non-compliances.

Appendix A - Acoustic Glossary

APPENDIX A: GLOSSARY OF ACOUSTIC TERMINOLOGY	
A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure ($0.00002 N/m^2$).
dB(A)	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Facade Noise Level	Refers to a sound pressure level determined at a point close to an acoustically reflective surface (in addition to the ground). Typically a distance of 1 metre is used.
Free Field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally as measured outside and away from buildings.
Hertz (Hz)	A measure of the frequency of sound. It measures the number of pressure peaks per second passing a point when a pure tone is present.
L_{Aeq} Equivalent Continuous Sound Level	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. For a steady sound with small fluctuations, its value is close to the average sound pressure level.
$L_{A90,T}$	This is the dB(A) level exceeded 90% of the time, T.
$L_{A10,T}$	This is the dB(A) level exceeded 10% of the time, T.
$L_{A50,T}$	This is the dB(A) level exceeded 50% of the time, T.
L_{WA}	The A-weighted sound power level in dB.

Appendix B – Additional Noise Monitoring Data

Appendix B – Additional Noise Monitoring Data

Tables B1 to B5 present average noise levels for the L_{AMax}, L_{Aeq}, L_{A1}, L_{A10} and L_{A90} noise levels for each period of the day. The day, evening and night periods in the results tables are defined as follows:

- day – 7 am to 6 pm;
- evening – 6 pm to 10 pm; and
- night – 10 pm to 7 am.

Table B1 – Position 1 (Plant Boundary) - Unattended Noise Monitoring Results

Date	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	Lowest 10th Percentile $L_{A90,1\text{-hour}}$
09/06/15	Day	81.2	77.7	76.5	73.0	75.4	71.5
	Evening	81.6	77.7	76.5	72.9	75.5	71.2
	Night	70.3	65.4	61.9	59.6	67.9	55.2
10/06/15	Day	73.0	66.1	60.8	55.4	59.8	54.7
	Evening	76.2	72.4	69.0	62.1	71.3	55.8
	Night	81.6	77.7	76.2	72.5	75.3	70.0
11/06/15	Day	81.0	76.6	74.0	70.1	76.4	62.9
	Evening	81.7	78.7	77.7	73.8	76.7	72.5
	Night	83.3	79.6	78.4	74.3	77.0	71.8
12/06/15	Day	80.2	77.0	75.2	72.3	75.9	64.9
	Evening	82.7	78.4	77.1	73.6	76.7	70.8
	Night	83.1	79.6	78.4	74.7	77.1	73.4
13/06/15	Day	80.3	76.7	75.0	71.2	75.4	67.0
	Evening	81.1	78.4	77.0	73.2	76.5	69.7
	Night	82.5	78.8	77.6	74.3	76.7	72.3
14/06/15	Day	81.2	78.4	76.4	72.4	75.8	67.9
	Evening	81.7	78.4	77.2	73.4	76.5	70.7
	Night	81.1	77.7	75.5	71.5	75.6	67.7
15/06/15	Day	80.2	76.6	73.9	69.5	74.3	63.6
	Evening	81.1	78.1	75.9	73.2	75.7	71.3
	Night	81.2	78.5	77.3	75.1	76.5	74.4
16/06/15	Day	75.2	71.2	68.7	66.7	69.9	65.1

Table B2 – Position 2 (GM House) - Unattended Noise Monitoring Results

Date	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	Lowest 10th Percentile $L_{A90,1\text{-hour}}$
09/06/15	Day	57.8	50.7	43.3	32.5	41.6	29.6
	Evening	50.4	47.0	42.5	35.6	41.0	32.8
	Night	47.8	41.9	37.6	30.7	39.5	24.1
10/06/15	Day	60.1	51.4	44.3	35.3	47.3	31.7
	Evening	51.4	47.4	43.9	37.2	42.7	33.8
	Night	46.7	41.6	37.6	28.9	38.3	26.6
11/06/15	Day	60.3	52.6	46.0	36.3	45.2	34.5
	Evening	52.3	46.4	42.2	35.1	40.8	33.0
	Night	54.1	41.9	35.4	29.2	36.8	27.1
12/06/15	Day	60.1	51.9	44.7	35.1	43.8	33.1
	Evening	48.2	40.2	34.7	29.7	35.4	28.0
	Night	48.2	38.2	33.5	28.8	35.6	27.6
13/06/15	Day	59.3	50.9	43.1	32.3	41.3	29.9
	Evening	48.9	41.6	37.6	33.2	37.6	30.0
	Night	48.5	39.5	33.8	28.2	41.7	26.9
14/06/15	Day	60.4	52.2	44.2	34.9	43.8	32.0
	Evening	50.1	44.2	39.4	34.5	39.0	31.3
	Night	48.4	38.6	33.0	27.3	37.9	24.7
15/06/15	Day	62.9	54.4	44.6	33.2	45.5	30.7
	Evening	47.8	41.8	35.9	31.3	36.6	29.3
	Night	46.1	39.7	34.5	29.1	35.7	27.4
16/06/15	Day	64.4	56.0	45.8	32.3	45.5	31.6

Table B3 – Position 3 (SP House) - Unattended Noise Monitoring Results

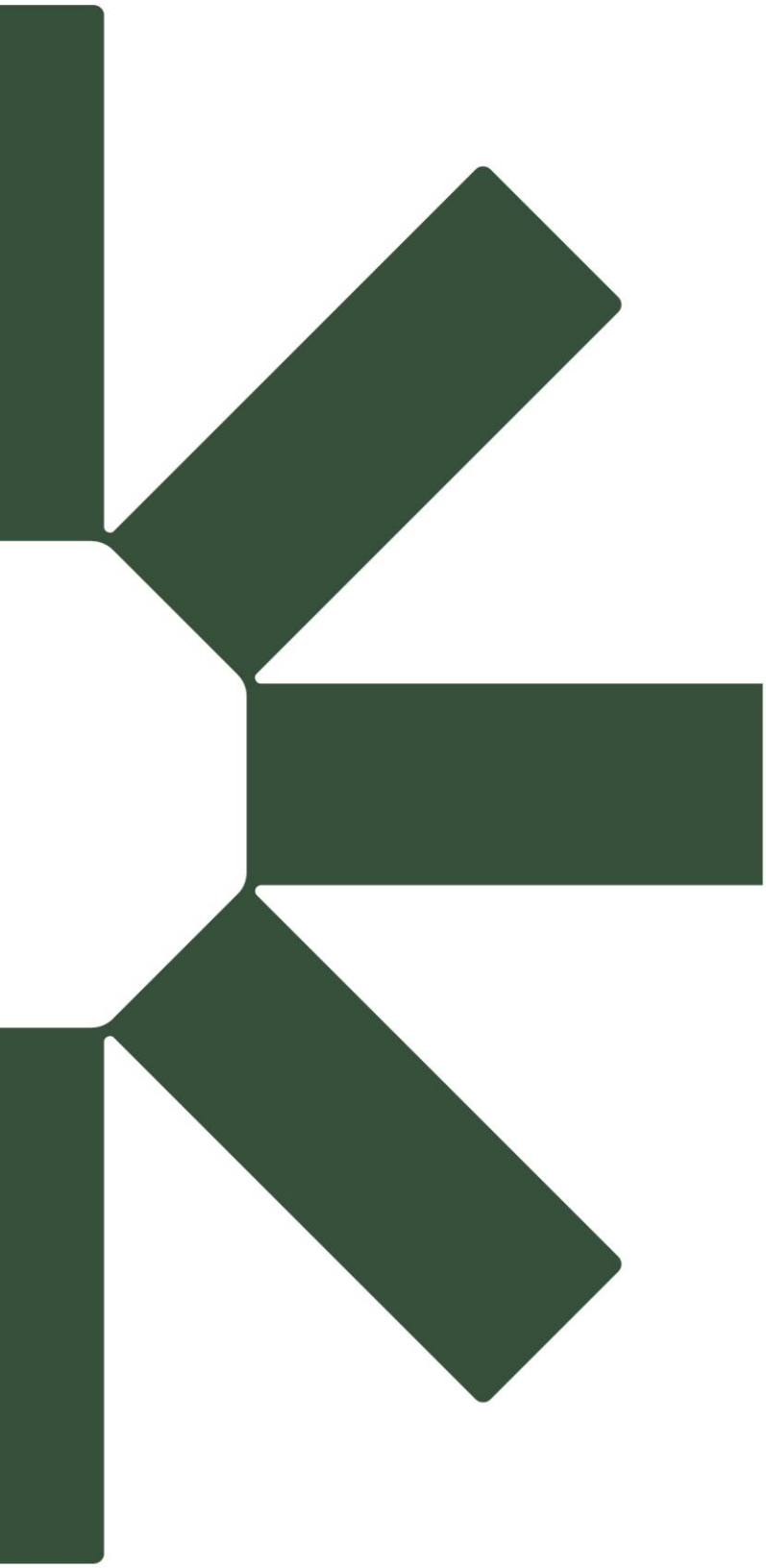
Date	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	Lowest 10th Percentile $L_{A90,1\text{-hour}}$
09/06/15	Day	55.6	46.9	39.8	29.7	38.6	28.8
	Evening	50.8	47.6	43.6	33.5	42.6	31.1
	Night	47.4	40.9	35.6	30.5	37.3	26.9
10/06/15	Day	55.7	48.2	41.4	33.2	41.2	29.9
	Evening	55.3	53.4	51.2	35.4	48.2	33.2
	Night	45.6	38.4	33.3	28.5	35.0	27.0
11/06/15	Day	58.2	51.1	45.3	34.9	56.0	31.5
	Evening	58.1	56.2	54.9	34.1	50.7	33.4
	Night	47.7	39.5	33.6	29.2	37.9	27.1
12/06/15	Day	57.3	49.1	42.5	33.9	41.7	30.9
	Evening	51.6	40.8	33.4	27.8	36.0	27.2
	Night	47.3	37.5	32.9	28.1	33.2	27.3
13/06/15	Day	56.7	48.4	41.3	30.6	41.4	28.6
	Evening	56.3	55.4	52.9	34.4	50.1	32.1
	Night	49.6	41.4	34.9	28.0	38.2	26.4
14/06/15	Day	57.5	49.8	43.0	33.4	42.5	30.0
	Evening	55.7	50.7	46.5	32.6	49.0	30.2
	Night	51.5	42.4	34.8	27.8	39.7	26.0
15/06/15	Day	57.4	48.8	41.8	31.4	43.0	29.1
	Evening	55.5	53.4	49.7	32.7	48.9	30.0
	Night	47.6	40.5	34.8	28.6	37.3	27.1
16/06/15	Day	55.7	49.5	41.5	30.7	42.0	30.3

Table B4 – Position 4 (Bushland near Complainant House) - Unattended Noise Monitoring Results

Date	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	Lowest 10th Percentile $L_{A90,1\text{-hour}}$
09/06/15	Day	56.0	48.2	40.3	33.0	39.6	32.4
	Evening	48.8	43.9	39.6	33.4	39.0	31.4
	Night	44.4	40.5	36.9	32.7	38.3	31.8
10/06/15	Day	57.1	49.1	41.8	33.9	41.3	32.1
	Evening	51.0	44.9	40.4	34.6	39.1	33.7
	Night	43.6	39.0	35.7	32.1	35.9	31.3
11/06/15	Day	59.4	51.4	44.7	36.7	44.2	33.4
	Evening	50.7	45.1	39.8	34.6	38.5	34.0
	Night	48.4	40.0	35.2	31.6	36.7	29.4
12/06/15	Day	57.5	50.2	43.9	36.0	42.8	33.5
	Evening	44.3	39.0	34.4	31.2	34.6	30.3
	Night	44.5	37.7	33.9	30.6	34.2	30.1
13/06/15	Day	56.1	48.1	41.0	33.2	40.0	31.8
	Evening	49.1	44.5	41.3	34.7	40.2	32.4
	Night	45.2	38.5	35.1	31.1	35.9	30.0
14/06/15	Day	56.6	49.3	44.1	35.7	44.1	33.6
	Evening	47.0	43.0	39.5	33.7	38.0	32.0
	Night	47.6	39.8	35.8	31.7	36.4	31.0
15/06/15	Day	56.7	48.8	42.3	34.5	41.2	32.7
	Evening	48.3	44.9	42.4	34.6	40.9	32.0
	Night	44.8	39.8	35.3	31.6	36.0	30.7
16/06/15	Day	60.3	51.7	44.0	34.6	43.9	34.2

Table B5 – Position 5 (Complainant Property) - Unattended Noise Monitoring Results

Date	Period	L_{AMax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	Lowest 10th Percentile $L_{A90,1\text{-hour}}$
10/06/15	Day	58.8	50.2	41.5	32.6	52.1	32.0
	Evening	48.6	45.1	43.2	38.2	41.4	36.4
	Night	42.5	37.4	34.1	30.6	34.5	29.9
11/06/15	Day	57.4	48.9	43.1	35.5	43.9	32.8
	Evening	49.6	47.4	45.7	38.3	43.9	36.9
	Night	50.7	39.7	34.7	30.5	35.0	29.1
12/06/15	Day	56.4	48.0	41.9	34.8	42.1	32.1
	Evening	45.4	37.2	32.8	29.9	32.1	29.3
	Night	43.0	36.0	32.7	29.4	32.3	29.0
13/06/15	Day	56.9	47.6	39.7	31.8	45.0	30.0
	Evening	46.6	41.9	39.8	36.8	39.5	34.0
	Night	44.4	37.7	34.7	30.8	39.7	30.1
14/06/15	Day	56.8	47.3	41.3	34.2	41.3	32.2
	Evening	45.9	40.0	37.5	32.7	36.7	30.7
	Night	43.9	37.5	35.0	31.8	34.3	31.0
15/06/15	Day	55.9	46.9	40.3	32.9	39.6	31.5
	Evening	46.5	40.7	38.4	34.7	37.8	32.4
	Night	46.2	37.9	34.3	30.8	34.2	30.0
16/06/15	Day	57.2	48.1	41.4	32.6	40.2	31.6



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