APPENDIX O
Noise and vibration impact assessment

Evolution MINING

EMM creating opportunities

Cowal Gold Operations Open Pit Continuation Project

Noise and vibration impact assessment

Prepared for Evolution Mining (Cowal) Pty Limited

April 2023

Cowal Gold Operations Open Pit Continuation Project

Noise and vibration impact assessment

Evolution Mining (Cowal) Pty Limited

J190417 RP38

April 2023

Version	Date	Prepared by	Approved by	Comments
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Executive Summary

ES1 Introduction

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of Cowal Gold Operations (CGO), an existing open pit and underground gold mine approximately 38 kilometres (km) north-east of West Wyalong, in the central west region of New South Wales (NSW).

Evolution is seeking approval for further open pit mining operations at CGO through the Open Pit Continuation Project (the Project). The Project primarily seeks to continue the open pit operations by approximately 10 years to 2036 and extend the total mine life by approximately two years to 2042.

The Project will involve further development of the existing 'E42' pit and the development of open pit mining in three adjacent orebodies, known as 'E46', 'GR' and 'E41'. It is noted that the three adjacent ore bodies are within the existing mining lease (ML 1535). No change to the approved ore processing rate of 9.8 Mt per annum is proposed.

Other than the changes to existing approved activities as set out above, all activities that are currently approved under the existing Ministerial development consents are intended to continue.

This noise and vibration impact assessment (NVIA) report forms part of the EIS. It documents the assessment methods, results and the initiatives built into the project design to avoid and minimise noise and vibration impacts, and the additional mitigation and management measures proposed to address residual impacts which cannot be avoided.

ES2 Existing environment and CGO noise performance

Land-uses surrounding the Project are largely dominated by agricultural activities; primarily for sheep and cattle grazing or dry land cropping; bird-watching and other recreational activities relating to Lake Cowal when it is holding water. The CGO and surrounding areas are zoned RU1 Primary Production under the *Bland Local Environmental Plan 2011* (Bland LEP).

The area surrounding the Project includes a number of privately-owned properties with the closest residence located approximately 1.2 km to the west of CGO.

The nearest representative noise and vibration residential assessment locations to CGO have been identified for the purpose of assessing potential noise and vibration impacts.

CGO has been operating since 2005 and has been through several operational modifications. Throughout the life of operations, an extensive suite of management and mitigation measures have been implemented on-site.

Quarterly attended noise monitoring is completed for CGO at monitoring locations representative of the most affected residential receivers (refer to Figure 2.1). A review of attended noise monitoring data between quarter 1 of 2017 and quarter 3 of 2022 identified that site noise contributions during monitoring have in all cases satisfied the relevant noise limits. A complaints history review identified that there have been four noise complaints in the last seven years. Records show that these complaints were handled swiftly and resolved under CGO's established complaints management process.

ES3 Operational noise

Operational noise has been assessed in accordance with the Noise Policy for Industry (EPA 2016). All reasonable and feasible mitigation controls were applied to the Project and predicted exceedances of project trigger noise levels (PTNLs) are considered residual noise impact.

The findings of the operational noise modelling for the Project are as follows:

- Seven assessment locations (i.e. 22a, 22b, 24, 38, 49a, 62 and 89) where a negligible exceedance (1–2 dB) is predicted in accordance with the NPfI and VLAMP. Evolution currently has a noise agreement with the landowner of assessment location 38 which will continue.

- Five assessment locations (i.e. 15, 20, 22c, 36a and 49b) where a marginal exceedance (3–5 dB and below the RANL) is predicted in accordance with the NPfI and VLAMP. Evolution currently has a noise agreement with the landowner of assessment location 15 and the landowner of assessment location 22c currently holds existing noise mitigation rights; both will continue.

- One assessment location (i.e. 21) where a moderate exceedance (up to 8 dB and satisfies the RANL) is predicted in accordance with the NPfI. In accordance with the VLAMP, this predicted exceedance (>5 dB above PNTL during the night period) is considered to be significant, meaning that voluntary acquisition rights are triggered at this location. The landowner of this location currently holds land acquisition rights which will continue.

Some of the predicted negligible exceedances of the PNTL discussed above would not exceed the site existing operational noise limits provided in the development consent or EPL. This is true for assessment locations 22a and 22c where future operational $L_{Aeq,15minute}$ noise levels are predicted to achieve the relevant existing limits. Furthermore, existing limits are higher than the evening and night PNTL at assessment locations 22a, 22c, 36a and 49b, and hence the predicted exceedances discussed above would be less when compared to existing limits at these locations.

Noise emissions will continue to be managed in accordance with the approved NMP (Evolution Mining 2022) which will be revised following approval of the Project.

ES4 Construction noise

Noise levels during lake protection bund (LPB) and up catchment diversion system (UCDS) construction (combined with the relevant operational scenario) were assessed against the Interim Construction Noise Guideline (ICNG) noise management levels (NMLs) for standard hours and out-of-hours periods during noise-enhancing meteorological conditions:

- Site noise levels during standard hours LPB construction will be less than the relevant NMLs at all assessment locations.

- Site noise levels during out of hours (OOH) LPB construction would satisfy the relevant NMLs at most assessment locations. The exceptions are at:

    - six assessment locations where a negligible exceedance is predicted

    - four assessment locations where an exceedance of 3 to 5 dB is predicted

    - one assessment location where an exceedance of up to 6 dB is predicted.

Most of the exceedances are associated with operations and not due to proposed construction activities alone.

Site noise levels during standard hours UCDS construction will be less than relevant NMLs at most assessment locations. The exception is at one assessment location where a 5 dB exceedance is predicted. Operational noise also contributes to this exceedance and it is not due to proposed construction activities alone.

Site noise levels during OOH UCDS construction will satisfy the relevant NMLs at most assessment locations. The exceptions are at:

- six assessment locations where a negligible is predicted
- six assessment locations where an exceedance of 3 to 5 dB is predicted
- five assessment locations where an exceedances of more than 5 dB is predicted.

Some of the exceedances are associated with operations and not due to proposed construction activities alone.

Construction noise will be managed through the existing NMP which will be revised following Project approval.

ES5 Blasting

A blasting assessment was completed for the proposed continuation of open-pit mining operations. By maintaining the current approach to blast design and blast emission management, it is anticipated that the blasting emission limits will continue to be met throughout the life of the Project. Blasting activities will continue to be managed through the existing Blast Management Plan which will be revised following Project approval.

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1 Introduction

1.1 Background

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of Cowal Gold Operations (CGO), an existing open pit and underground gold mine approximately 38 kilometres (km) north-east of West Wyalong, in the central west region of New South Wales (NSW).

The CGO is located on the traditional lands of the Wiradjuri People and is immediately adjacent to the western foreshore of Lake Cowal, which is an ephemeral waterbody. The existing CGO mine is shown at a regional scale in Figure 1.1 and in its local setting in Figure 1.2.

CGO was first approved in 1999, and open pit mining operations commenced in 2005. Underground mining operations were approved in 2021 and development works to enable underground mining are underway.

This noise and vibration impact assessment (NVIA) report forms part of the EIS. It documents the assessment methods, results and the initiatives built into the project design to avoid and minimise noise and vibration impacts, and the additional mitigation and management measures proposed to address residual impacts which cannot be avoided.

1.2 Project overview

Evolution is seeking approval for further open pit mining operations at CGO through the Open Pit Continuation Project (the Project). The Project primarily seeks to continue the open pit operations by approximately 10 years to 2036 and extend the total mine life by approximately two years to 2042.

This will involve further development of the existing E42 Pit and the development of open pit mining in three adjacent orebodies, known as 'E46', 'GR' and 'E41'. It is noted that the three adjacent ore bodies are within the existing mining lease (ML 1535). No change to the approved ore processing rate of 9.8 Mt per annum is proposed.

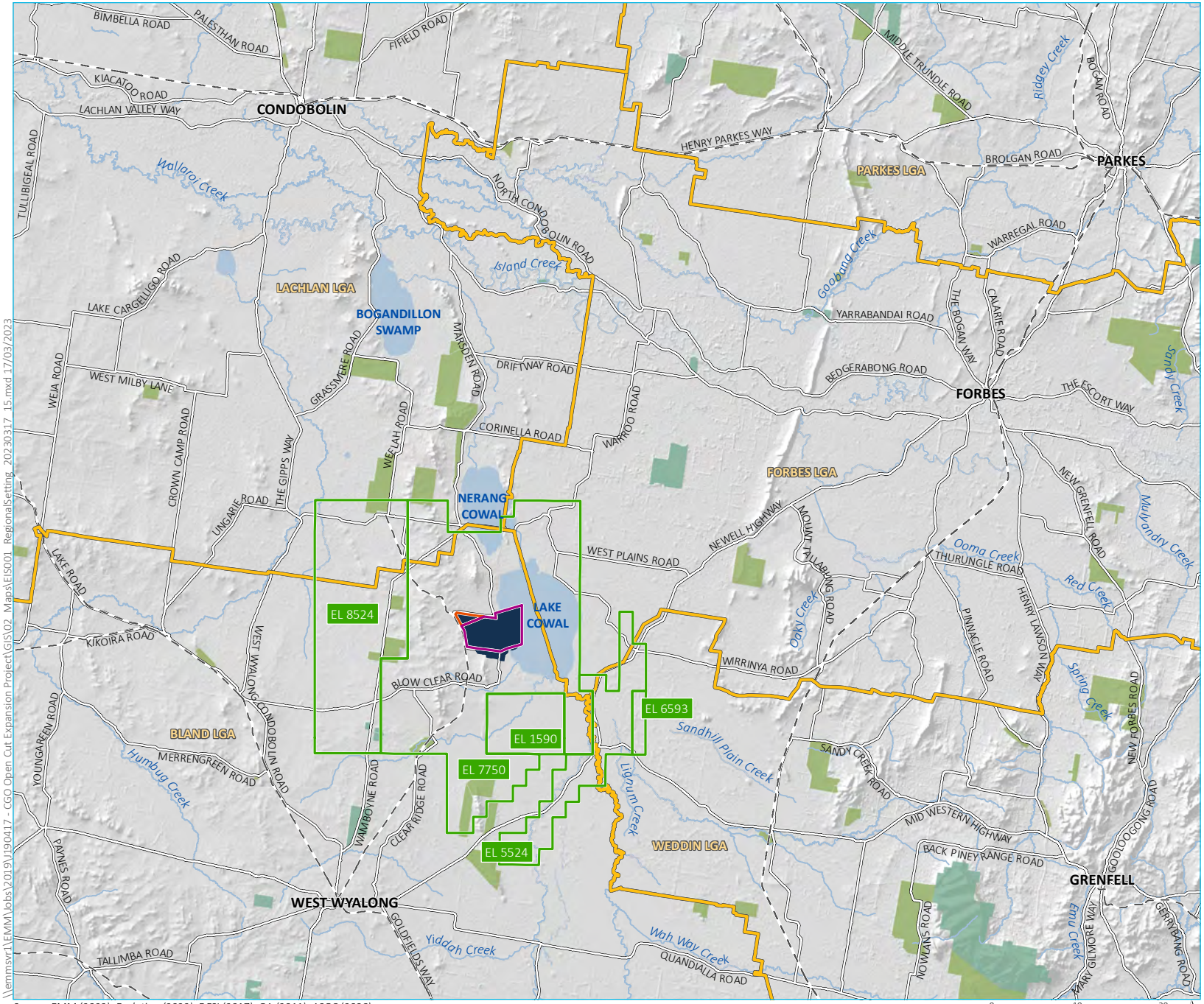
A detailed description of the Project is contained in Chapter 4 of EIS and a conceptual Project layout is shown in Figure 1.3. The Project comprises the following key components:

- continued operation of activities as approved under DA 14/98 and SSD 10367
- development of three new open satellite pits (the 'E46', 'GR' and 'E41' pits) to the north and south of the existing open pit (E42 pit), within the current approved mining lease
- extending the existing E42 Pit to the east and south via a 'cutback' within the current approved mine lease
- extending open pit mining operations by approximately 10 years to 2036 and total mine life by approximately 2 years to 2042
- expansion of the existing Integrated Waste Landform (IWL) to accommodate life of mine tailings
- extension of the lake protection bund system to provide continued separation and mutual protection between Lake Cowal and CGO
- backfilling of one of the new open satellite pits (E46 pit) post-mining with waste rock and establishment of a new waste rock emplacement on the backfilled pit to minimise the additional area required for waste rock disposal
- expansion of the footprint of the existing waste rock emplacement (WRE) areas to accommodate additional waste rock

- development of additional topsoil and subsoil stockpiles to accommodate materials from pre-stripping, with materials to be reused during progressive mine rehabilitation
- upgrades to existing surface water drainage system, to assist with on-site water management and maximise on-site water conservation
- modification of internal site access and haul roads
- development of new water storages and relocation of some components of the surface water drainage system
- modification and relocation of some existing ancillary mining infrastructure.

The Project will not change existing ore processing rates or methods, tailings disposal methods, main site access, water supply sources, offsite transport volumes and routes or hours of operation. The Project will also retain the existing open pit mining workforce.

Other than the changes to existing approved activities as set out above, all activities currently approved under the existing Ministerial development consents are intended to continue. The existing activities approved under the consents for the open pit (DA 14/98) and underground (SSD 10367) operations are described in Chapter 3 of the EIS.



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Source: EMM (2023); Evolution (2023); DFSI (2017); GA (2011); ASGC (2006)

Regional setting

Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Noise and Vibration Impact Assessment
Figure 1.1

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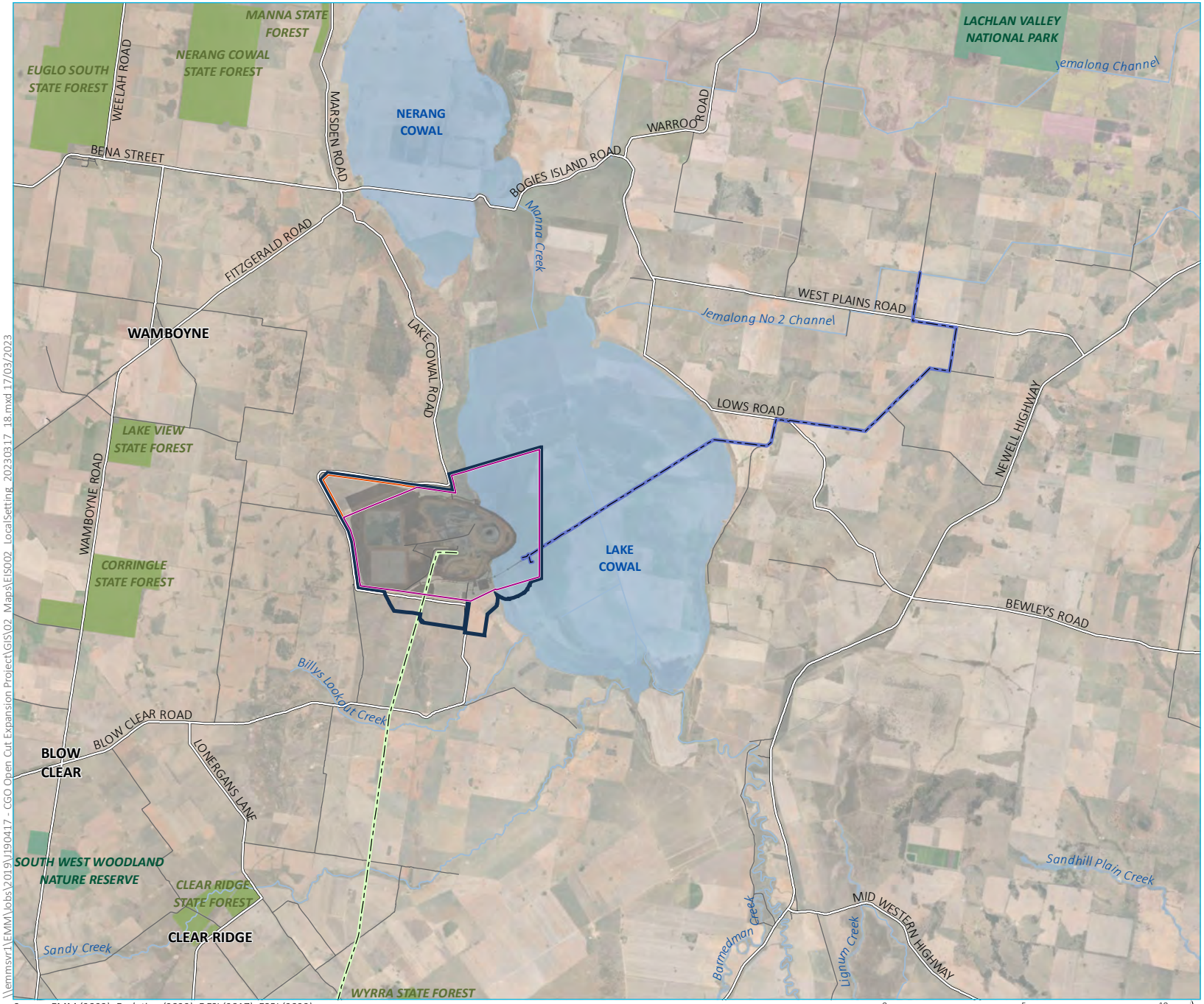

KEY

- Project area
- DA14/98 approved surface disturbance
- Mining lease (ML1535)
- Mining lease (ML1791)
- Water supply pipeline
- Electricity transmission line
- Major road
- Minor road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

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Source: EMM (2023); Evolution (2023); DFSI (2017); ESRI (2023)

0 5 10 km

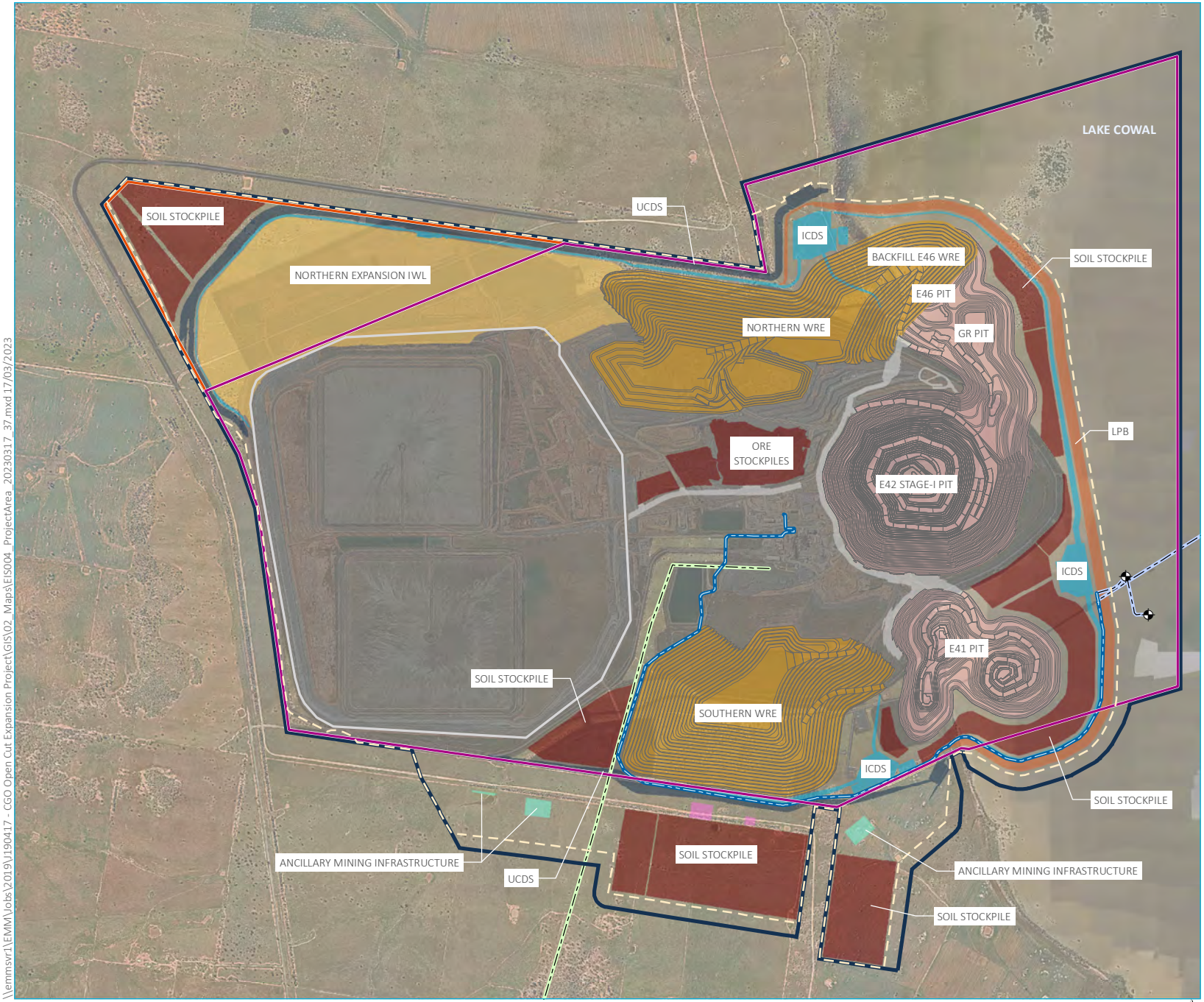
GDA 1994 MGA Zone 55

N

Local setting

Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Noise and Vibration Impact Assessment
Figure 1.2

EMM creating opportunities



KEY

- Project area
- Proposed disturbance footprint
- DA14/98 approved surface disturbance
- Approved IWL footprint
- Mining lease (ML1535) (offset for clarity)
- Mining lease (ML1791) (offset for clarity)
- Saline groundwater supply bore
- Water supply pipeline
- Electricity transmission line

Conceptual project infrastructure

- Open cut pit footprint
- Northern expansion IWL
- Waste rock emplacement (WRE)
- Lake protection bund (LPB)
- Stockpile
- Up catchment diversion system (UCDS)
- Internal Catchment Drainage System (ICDS)
- Ancillary mining infrastructure
- Magazine
- Road
- Water supply pipeline realignment

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Source: EMM (2023); Evolution (2023); DFSI (2017); Nearmap (2021)

0 1 2 km

GDA 1994 MGA Zone 55

N

Project overview

Evolution Mining
Cowal Gold Operations
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Noise and Vibration Impact Assessment
Figure 1.3

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1.3 Assessment requirements

This NVIA has been prepared following the appropriate guidelines, policies and industry requirements, and following consultation with stakeholders including community members and relevant government agencies.

Guidelines and policies referenced are as follows:

- NSW Department of Environment Climate Change and Water (DECCW) *Road Noise Policy* (RNP) (2011).
- NSW Department of Environment and Climate Change (DECC) *The Interim Construction Noise Guideline* (ICNG) (2009).
- NSW Department of Environment and Conservation (DEC) *Assessing Vibration: a technical guideline* (2006).
- NSW Environment Protection Authority (EPA) *Noise Policy for Industry* (NPfI) (2017).
- NSW Government *Voluntary Land Acquisition and Mitigation Policy – For State Significant Mining, Petroleum and Extractive Industry Developments* (VLAMP) (2018).
- Australian and New Zealand Environment Conservation Council (ANZECC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (1990).

A number of technical terms are required for the discussion of noise and vibration. These are explained in Attachment A.

1.3.1 Secretary's Environmental Assessment Requirements

This assessment has been prepared in accordance with requirements set out in the NSW Department of Planning and Environment (DPE) Secretary's Environmental Assessment Requirements (SEARs) for the Project. The SEARs identify matters which must be addressed in the EIS. The EPA has also provided details of key issues requiring assessment for the Project. Individual requirements relevant to this NVIA and the sections in this report where the requirements are addressed are presented in Table 1.1.

Table 1.1 NVIA technical assessment related SEARs and Agency Requirements

Requirement	Section addressed
SEARs	
Noise and Blasting – including:	
• An assessment of the likely noise impacts of the development in accordance with the *Noise Policy for Industry* and the *Voluntary Land Acquisition and Mitigation Policy* (2018).	Chapter 5
• If a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities in accordance with the *Interim Construction Noise Guideline*.	Section 5.1.2
• An assessment of the likely road noise impacts of the development in accordance with the *NSW Road Noise Policy*.	Section 5.4
• An assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZECC guidelines.	Section 5.2 and Section 5.3

Table 1.1 NVIA technical assessment related SEARs and Agency Requirements

Requirement	Section addressed
EPA requirements	
B.2. Description of the proposal – Noise and vibration	
• Identify all noise sources or potential sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.	Section 5.1
• Specify the times of operation for all phases of the development and for all noise producing activities.	Chapter 4
• For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks.	N/A
C.3. Noise and vibration	
Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically, the location of any noise sensitive locations in relation to the site should be included on a map of the locality.	Section 2.1
Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.	Section 2.1
E.5. Noise and vibration	
Describe baseline conditions:	
• Determine the existing background (LA90) and ambient (LAeq) noise levels, as relevant, in accordance with the *NSW Noise Policy for Industry.*	Section 2.2.2
• Determine the existing road traffic noise levels in accordance with the *NSW Road Noise Policy*, where road traffic noise impacts may occur.	Section 4.2
• The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:	
a) details of equipment used for the measurements	Section 2.2.2
b) a brief description of where the equipment was positioned	Section 2.2.2
c) a statement justifying the choice of monitoring site(s), including the procedure used to choose the site(s), having regards to Fact Sheets A and B of the *NSW Noise Policy for Industry*	Section 2.2.2
d) details of the exact location of the monitoring site and a description of land uses in surrounding areas	Section 2.2.2
e) a description of the dominant and background noise sources at the site	Section 2.2.2
f) day, evening and night assessment background levels for each day of the monitoring period	Section 2.2.2
g) the final Rating Background Level (RBL) value	Section 2.2.2
h) graphs of the measured noise levels for each day should be provided	Section 2.2.2 Attachment B
i) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring.	Section 2.2.2 Attachment B

Table 1.1 NVIA technical assessment related SEARs and Agency Requirements

Requirement	Section addressed
Assess impacts:	
• Determine the project noise trigger levels for the site. For each identified potentially affected receiver, this should include:	Section 3.1
a) determination of the project intrusive noise level for each identified potentially affected receiver	Section 3.1.2
b) selection and justification of the appropriate amenity category for each identified potentially affected receiver	Section 3.1.3
c) determination of the project amenity noise level for each receiver	Section 3.1.3
d) determination of the appropriate maximum noise level event assessment (sleep disturbance) trigger level.	Section 3.1.5
• Maximum noise levels during night-time period (10:00 pm–7:00 am) should be assessed to analyse possible effects on sleep. Determine expected noise level and noise character likely to be generated from noise sources during:	Section 5.1.2
a) site establishment	
b) construction	
c) operational phases	
d) transport including traffic noise generated by the proposal	
e) other services.	
Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).	
• Determine the noise levels likely to be received at the reasonably most affected location(s) (these may vary for different activities at each phase of the development).	Chapter 5
• The noise impact assessment report should include:	
a) a plan showing the assumed location of each noise source for each prediction scenario	Attachment C
b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site	Section 4.1
c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc	Section 4.1
d) methods used to predict noise impacts including identification of any noise models used	Section 4.1
e) the weather conditions considered for the noise predictions	Section 4.1.6
f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario	Section 5.1
g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived	N/A
h) an assessment of the need to include modification factors as detailed in Fact Sheet C of the *NSW Noise Policy for Industry.*	Section 4.1.3

Table 1.1 NVIA technical assessment related SEARs and Agency Requirements

Requirement	Section addressed
• Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional feasible and reasonable mitigation measures.	Section 5.1 and Section 6.2
• The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.	
a) Where relevant noise/vibration levels cannot be met after application of all feasible and reasonable mitigation measures the residual level of noise impact needs to be quantified.	Section 6.2
• For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.	Section 4.2
• Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment:	
a) bench height, burden spacing, spacing burden ratio	Section 4.3
b) blast hole diameter, inclination and spacing	Section 4.3
c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.	Section 4.3
Describe management and mitigation measures	
• Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.	Chapter 6
• For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:	N/A
a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage	
b) control of traffic (e.g. limiting times of access or speed limitations)	
c) resurfacing of the road using a quiet surface	
d) use of (additional) noise barriers or bunds	
e) treatment of the façade to reduce internal noise levels buildings where the night-time criteria is a major concern	
f) more stringent limits for noise emission from vehicles (i.e. using specially designed 'quite' trucks and/or trucks to use air bag suspension	
g) driver education	
h) appropriate truck routes	
i) limit usage of exhaust brakes	
j) use of premium muffles on trucks	
k) reducing speed limits for trucks	

Table 1.1 NVIA technical assessment related SEARs and Agency Requirements

Requirement	Section addressed
l) ongoing community liaison and monitoring of complaints	
m) phasing in the increased road use.	

2 Existing environment

2.1 Assessment locations

Land-uses surrounding the Project are largely dominated by agricultural activities; primarily for sheep and cattle grazing or dry land cropping; bird-watching and other recreational activities relating to Lake Cowal when it is holding water. The CGO and surrounding areas are zoned RU1 Primary Production under the *Bland Local Environmental Plan 2011* (Bland LEP).

The area surrounding the Project includes a number of privately-owned properties with the closest residence located approximately 1.2 km to the west of CGO.

The nearest representative noise and vibration residential assessment locations to CGO have been identified for the purpose of assessing potential noise and vibration impacts. Details are provided in Table 2.1 and their locations are shown in Figure 2.1.

Table 2.1 Noise and vibration assessment locations

Assessment location ID	Receiver type	Property name	Easting	Northing
1a	Residential	Coniston (Evolution-owned)	535153	6282548
1b	Residential	Lakeside (Evolution-owned)	536424	6283400
1c	Residential	Hillgrove (Evolution-owned)	534407	6272697
1d	Residential	Lake Cowal (Evolution-owned)	541794	6272704
4	Residential	Goodwood	547567	6281001
6	Residential	Boongarry	549989	6276946
15[1]	Residential	Laurel Park	532378	6283364
20	Residential	Bramboyne	530337	6282231
21[2]	Residential	Westella	531013	6278985
22a	Residential	Lakeview	528402	6277761
22b	Residential	Lakeview II	528249	6277583
22c[3]	Residential	Lakeview III	528976	6277626
22d	Residential	Thistleview	527918	6274662
24	Residential	Mangelsdorf	532297	6270665
25	Residential	Mangelsdorf II	531695	6269734
28	Residential	Bristowes	548681	6286710
30a	Residential	Wamboyne	530989	6288345
30b	Residential	Grinter	531171	6289740

Table 2.1 Noise and vibration assessment locations

Assessment location ID	Receiver type	Property name	Easting	Northing
31a	Residential	Koobah	549554	6273711
36a	Residential	The Glen	535625	6284898
36b	Residential	Wamboyne II	530297	6286030
38[1]	Residential	Gumbelah	545613	6276295
42[4]	Residential	Westlea (Evolution-owned)	532383	6274566
43a	Residential	Lake Cowal II	545105	6271379
43b	Residential	Billabong	547179	6268189
49a	Residential	Foxman Downs	531145	6271554
49b	Residential	Foxman Downs II	531386	6272221
56	Residential	Mattiske II	550605	6285032
57	Residential	Harmer	529760	6268071
61a	Residential	Bungabulla	545627	6275893
62	Residential	Cowal North	541979	6286026
79	Residential	Ridley	526342	6286717
89	Residential	Morton	534740	6269452
90	Residential	Caloola	535441	6267131
100	Residential	Blampied	528226	6267940
122	Residential	Fitzgerald	531978	6288396
126	Residential	Noble	526050	6285038

Notes: 1. Evolution has a noise agreement in place with the landowner of this privately-owned property.
2. Subject to acquisition upon request in accordance with the development consent.
3. Subject to mitigation upon request in accordance with the development consent.
4. Property acquired by Evolution on 3 December 2018 in accordance with the land acquisition process defined in Condition 8.3 of the development consent.

Other assessment locations (non-residential) also included in this assessment are provided in Table 2.2. The locations of these non-residential assessment locations are also shown in Figure 2.1.

Table 2.2 Non-residential assessment locations

Assessment location	Description	Easting	Northing
N04 – Bird Breeding Area	Bird Breeding Area North	540025	6285561
N03 – Bird Breeding Area	Bird Breeding Area South	539620	6281131
Lake Cowal Reserve	Relocated Crown Reserve	539978	6273640

2.2 CGO existing noise emissions

2.2.1 Existing operational noise limits

Existing operational noise limits are provided in Condition 6.4 of Schedule 2 of the development consent DA 14/98 and Condition L4 of Environment Protection Licence 11912 (EPL).

Operational noise limits provided in development consent DA 14/98 and EPL are summarised in Table 2.3.

Table 2.3 Development consent (DA 14/98) and EPL noise limits, dB

Assessment location ID	Property name	Operational noise limits			
		$L_{Aeq,15minute}$			L_{Amax}
		Day[1]	Evening[2]	Night[3]	Night[3]
21	Westella[4]	Acquisition upon request in accordance with development consent Condition 6.4(a)			
22c	Lakeview III[5]	38	38	38	52
36a	The Glen	37	37	37	52
22a	Lakeview	36	36	36	52
49b	Foxman Downs II	36	36	36	52
All other locations	All other privately-owned land[6]	35	35	35	52

Notes:
1. Day period: Monday to Saturday: 7:00 am to 6:00 pm, on Sundays and public holidays: 8:00 am to 6:00 pm.
2. Evening period: Monday to Saturday: 6:00 pm to 10:00 pm, on Sundays and public holidays: 6:00 pm to 10:00 pm.
3. Night period: Monday to Saturday: 10:00 pm to 7:00 am, on Sundays and public holidays: 10:00 pm to 8:00 am.
4. Land subject to acquisition upon request in accordance with development consent Condition 6.4(a).
5. Land subject to mitigation upon request in accordance with development consent Condition 6.4(b).
6. Excludes mine-owned properties and privately-owned properties where Evolution has a noise agreement in place with the landowner.

Figure 2.1 Monitoring and assessment locations

Assessment location 21 (Westella) qualifies for acquisition upon request in accordance with the development consent.

It is noted that the noise limits presented in Table 2.3 do not apply if Evolution has an agreement with the owner(s) of the relevant residence or land to generate higher noise levels, and the DPE has been notified in writing of this agreement. This is the case for assessment locations 15 (Laurel Park) and 38 (Gumbelah) where Evolution has a noise agreement in place with the landowners of these privately-owned properties. Nonetheless, this assessment has modelled the noise emissions for the Project at both assessment locations 15 and 38.

2.2.2 Ambient noise environment

A key element in assessing environmental noise impacts from industrial sources is to quantify the existing ambient acoustic environment. Ambient noise monitoring previously completed for CGO identified that background noise levels in the surrounding community are at or below the NPfI minimum Rating Background Level (RBL) of 35 dB(A) for the day period, 30 dB(A) for the evening period and 30 dB(A) for the night period. To verify the ambient noise environment, unattended (logging) and short-term operator-attended noise surveys were conducted at representative monitoring locations in general accordance with the procedures described in Australian Standard 'AS 1055-1997 – Acoustics – *Description and Measurement of Environmental Noise*'. Monitoring results are provided in the following sections.

The locations of background and ambient noise monitoring used in this assessment are shown in Figure 2.1.

Figure 2.2 Ambient noise monitoring and assessment locations

i Unattended noise monitoring

Unattended noise monitoring using noise loggers was completed at representative residential properties potentially affected by noise from the Project. Monitoring locations were selected after a desktop review and inspection of the area surrounding the site, giving due consideration to other noise sources which may influence measured levels (e.g. domestic air conditioning units), the proximity of assessment locations to the Project, security issues for the noise loggers and gaining permission to access properties from residents or landowners. Four noise loggers were deployed as follows:

- Logger 1 (L1) – 'Coniston' (assessment location 1a)
- Logger 2 (L2) – 'Lakeview' (assessment location 22a)
- Logger 3 (L3) – 'Foxman Downs 2' (assessment location 49b)
- Logger 4 (L4) – 'Gumbelah' (assessment location 38).

The logging was done using two Svantek (s/n 59682 and 21095) and two Ngara (s/n 878127 and 878126) noise loggers which were in place during the following periods:

- L1 – Wednesday 4 to Wednesday 18 May 2022 (15 consecutive days)
- L2 – Wednesday 4 to Tuesday 24 May 2022 (21 consecutive days)
- L3 – Wednesday 4 to Wednesday 18 May 2022 (15 consecutive days)
- L4 – Thursday 5 to Saturday 18 May 2022 (23 consecutive days).

The loggers were programmed to record statistical noise level indices continuously in 15 minute intervals, including L_{Amin}, L_{Aeq}, L_{Amax}, L_{A1}, L_{A10}, L_{A50}, and L_{A90}. Calibration of all instrumentation was checked prior to and following measurements. All equipment had appropriate and current NATA calibration certificates at the time of the monitoring.

Meteorological data for the survey period was obtained from the site automatic weather station. Wind speed and rainfall data were used to exclude, in accordance with NPfI methods, noise data during periods when the average wind speed was in excess of 5 m/s and/or during rainfall events.

A summary of existing RBL and ambient L_{Aeq} noise levels is given in Table 2.4. Results for each day are also provided graphically in Attachment B.

Table 2.4 Summary of existing background and ambient noise levels, dB

Unattended monitoring location (assessment location)	Assessment period[1]	RBL[2]	Measured $L_{Aeq,period}$ noise level[3]
L1 – Coniston (1a)	Day	26	47
	Evening	30	47
	Night	29	46
L2 – Lakeview (22a)	Day	29	49
	Evening	28	43
	Night	26	41

Table 2.4 Summary of existing background and ambient noise levels, dB

Unattended monitoring location (assessment location)	Assessment period[1]	RBL[2]	Measured $L_{Aeq,period}$ noise level[3]
L3 – Foxman Downs II (49b)	Day	29	49
	Evening	28	40
	Night	23	42
L4 – Gumbelah (38)	Day	28	46
	Evening	29	44
	Night	22	43

Notes: 1. Day: 7:00 am to 6:00 pm Monday to Saturday; 8:00 am to 6:00 pm Sundays and public holidays; evening: 6:00 pm to 10:00 pm; night: remaining periods.

2. The RBL is an NPfI term which represents the background noise level.

3. The energy averaged noise level over the measurement period and representative of general ambient noise.

ii Attended noise monitoring

EMM completed 15-minute attended noise measurements on 4 and 5 May 2022 at the logger locations (refer to Table 2.4), to identify noise sources contributing to the ambient noise environment.

Operator-attended measurements were made using two Brüel & Kjær (B&K) integrating sound analysers, a 2250 (s/n 3008201) and a 2270 (s/n 3027603), to quantify and qualify the existing noise sources. Field calibration of the instruments was done using a B&K 4230 (s/n 1441415) and a Svantek SV36 (s/n 106879) calibrator. Attended measurements were undertaken in accordance with AS 1055-1997 'Description and Measurement of Environmental Noise'. Meteorological conditions throughout the measurements were relatively calm with no winds above 5 m/s.

A summary of results of the attended noise monitoring is provided in Table 2.5.

Table 2.5 Summary of attended noise measurements

Attended monitoring location (assessment location ID)	Date	Start time (hours)	Measured noise levels (15-minute), dB			Comments
			L_{A90}	L_{Aeq}	L_{Amax}	
L1 – Coniston (1a)	4/5/22	14:56	30	39	64	CGO inaudible. Consistent humming noise from environmental monitoring equipment in the distance audible. Livestock and other natural rural sources (e.g. birds) occasionally audible. Distant traffic occasionally audible.
L2 – Lakeview (22a)	4/5/22	16:44	28	39	65	CGO inaudible. Natural rural sources (e.g. birds and insects) frequently audible. Nearby local traffic briefly audible.
L3 – Foxman Downs II (49b)	4/5/22	17:29	38	50	71	CGO inaudible. Natural rural sources (e.g. birds and insects) frequently audible. Nearby local traffic occasionally audible.
L4 – Gumbelah (38)	5/5/22	12:15	32	43	54	CGO inaudible. Natural rural sources (i.e. birds, insects and wind in foliage) frequently audible. Aircraft noise briefly audible. Water from lake hitting the nearby shore audible.

The ambient noise environment at the logger locations (L1, L2, L3 and L4) was found to be dominated by natural rural sounds (from livestock, birds, insects), noise from local and distant road traffic and aircraft. CGO was inaudible at all monitoring locations during the attended survey.

2.2.3 Noise performance

CGO has been operating since 2005 and has been through several operational modifications. Throughout the life of operations, an extensive suite of management and mitigation measures have been implemented on-site.

Quarterly attended noise monitoring is completed for CGO at monitoring locations representative of the most affected residential receivers (refer to Figure 2.1). A review of attended noise monitoring data between quarter 1 of 2017 and quarter 3 of 2022 identified that site noise contributions during monitoring have in all cases satisfied the relevant noise limits.

A complaints history review identified that there have been four noise complaints in the last seven years. Records show that these complaints were handled swiftly and resolved under CGO's established complaints management process.

2.3 Meteorology

Noise propagation over distance can be significantly affected by meteorological conditions. This includes source-to-receiver winds, the presence of temperature inversions and drainage flow (i.e. katabatic winds), as these conditions can enhance received noise levels. To account for the influence of weather conditions in a noise impact assessment, the NPfI requires assessment of noise under standard and noise-enhancing weather conditions, if found relevant. The NPfI defines these as follows:

- Standard meteorological conditions: defined by stability categories A through to D with wind speeds up to 0.5 m/s at 10 m above ground level (AGL) for day, evening and night periods.

- Noise-enhancing meteorological condition: defined by stability categories A through to D with light winds (up to 3 m/s at 10 m AGL) for the day and evening periods; and stability categories A through to D with light winds (up to 3 m/s at 10 m AGL) and/or stability category F with winds up to 2 m/s at 10 m AGL.

Fact Sheet D of the NPfI specifies two options regarding meteorological data analysis procedures to determine the presence of significant meteorological conditions, as follows:

1. adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night, or

2. determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the NPfI provisions. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.

This NVIA has adopted the first NPfI option above, using the noise-enhancing meteorological conditions for all assessment periods. Nonetheless, for completeness, this assessment also evaluated the significance of noise-enhancing conditions for information purposes. The findings of the meteorological data analysis are summarised in Section 2.3.1.

2.3.1 Meteorological data analysis

i Winds

The NPfI recommends consideration of wind effects if they are 'significant' for the project area. The NPfI defines significant as the presence of source-to-receiver wind speed (measured at 10 m AGL) of 3 m/s or less, occurring for 30% of the time in any assessment period and season. This is further clarified by defining source-to-receiver wind direction as being the directional component of wind. The NPfI states that where wind is identified to be a significant feature of the area, then the assessment of noise impacts should consider the highest wind speed up to 3 m/s that is considered to occur for at least 30% of the time.

An analysis of the vector components of hourly wind data recorded by the CGO onsite weather station was undertaken for the period between November 2017 and November 2022 (5 years). Wind vectors identified to trigger the NPfI 30% threshold of occurrence and hence identified as 'significant' as per the NPfI are shown in Table 2.6.

Table 2.6 Wind vector analysis

Assessment period	Season	Wind direction (degrees)	Percentage of occurrence[1] (%)
Evening	Autumn	180	30
Evening	Autumn	202.5	30
Evening	Autumn	225	31
Evening	Winter	225	33
Evening	Winter	247.5	34

Notes: 1. Wind speed up to 3 m/s.

ii Temperature inversions

Temperature inversions (i.e. where atmospheric temperature increases with altitude) typically occur during the night period in the winter months and can increase site noise levels at surrounding receivers. As per the NPfI, temperature inversions are to be assessed if they are found to occur for 30% of the time (about two nights per week) or greater during the winter months.

Drainage flow winds (katabatic winds i.e. localised cold air flow generated by decreasing altitude) can occur during temperature inversion conditions. The increase of noise levels caused by drainage flow winds need consideration if a development (i.e. noise source) is at a higher altitude to surrounding assessment locations, and where there is no intervening topography. The terrain surrounding CGO and surrounding areas (i.e. between the site and assessment locations) is relatively flat. Further, in some areas, the receivers are at a higher elevation than the site (i.e. the terrain increases in elevation from site to receiver). Given the preceding, the potential for source-to-receiver drainage flow winds to occur is not considered relevant.

The NPfI states that the assessment of noise impact with influence from temperature inversions, defined by atmospheric stability category F (moderate inversion) or G (strong inversion), be confined to the night period when they typically occur.

The frequency of occurrence of temperature inversions was determined based on sigma-theta data obtained from the CGO onsite weather station between November 2017 and November 2022 (5 years). It was found from data analysis that stability category F and G temperature inversion conditions (combined) did not occur for 30% or greater of the night period during the winter months. Therefore, the presence of stability category F or G inversion conditions is not considered 'significant' for the project area as per the NPfI.

2.3.2 Meteorological conditions for modelling

This assessment has adopted the first NPfI option in assessing site noise during noise-enhancing meteorological conditions for all assessment periods as described in the NPfI. Meteorological conditions adopted for noise modelling are discussed in Section 4.1.6.

2.4 CGO existing blast performance

2.4.1 Existing blasting limits

Condition 6.3 of Schedule 2 of the existing development consent and the EPL provides blasting limits the site must meet in relation to airblast overpressure and ground vibration. Airblast overpressure and ground vibration limits in the existing development consent are summarised in Table 2.7. Blasting is managed in accordance with the CGO Blast Management Plan (BMP) (Evolution 2015), which includes monitoring every blast at five locations, one near-field on-site and four off-site.

Table 2.7 Existing development consent and EPL blasting limits

Location and time	Airblast overpressure (L_{pk} dB)	Ground vibration (mm/s)	Allowable exceedance
Residence on privately-owned land – anytime.	120	10	0%
Residence on privately-owned land – Monday to Saturday during day.	115	5	5% of the total number of blasts over a period of 12 months.
Residence on privately-owned land – Monday to Saturday during evening.	105	2	5% of the total number of blasts over a period of 12 months.
Residence on privately-owned land – Monday to Saturday at night, Sundays and public holidays.	95	1	5% of the total number of blasts over a period of 12 months.

2.4.2 Blast performance

Monitoring of airblast overpressure and ground vibration is carried out for each blast at CGO at locations representative of the most affected residential receivers (refer to Figure 2.1). A review of blast monitoring data between 2018 and 2021 identified that blast emissions from site have in all cases satisfied the relevant ground vibration limits. For airblast overpressure, the blast monitoring data showed exceedance of the 115 dB (LinPeak) limit (Monday to Saturday during the day) on one occasion (in 2020) and the 95 dB (LinPeak) limit (Monday to Saturday at night, Sundays and public holidays) on several occasions during the 2018–2021 period. However, airblast overpressure from site satisfied the allowable exceedance threshold of 5% over each 12 month period between 2018 and 2021.

A complaints history review identified six blast related complaints in the last six years (2016–2022). All were related to ground vibration, with the last received in 2019. Records show that monitored blast levels during the relevant events, for both airblast overpressure and ground vibration, satisfied relevant limits at representative monitoring locations. Furthermore, complaints were resolved under the mine's established complaints management process.

3 Criteria

3.1 Operational noise

Noise from industrial sites in NSW is regulated by the EPA and in accordance with an Environmental Protection Licence and/or by a local government authority or DPE (whichever is the relevant consent authority) in accordance with development consent conditions. These instruments stipulate noise limits that are required to be complied with in the day, evening and night periods.

Noise limits are generally derived by either applying project-specific noise trigger levels (PNTL) allowable under government policy or from predicted operational noise levels that can be achieved following the application of all reasonable and feasible noise mitigation.

3.1.1 Applying the NPfI to existing sites

The NPfI provides a method for assessing noise from existing industrial sites. It acknowledges that some industrial sites have been designed to emit noise emissions greater than those allowed under the NPfI as for example they were in existence before neighbouring noise-sensitive developments were developed. In such instances, the range of mitigation options available to mitigate noise to NPfI levels can be limited and/or costly to implement.

The NPfI recognises this, and in Section 6.1 states:

> The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

Where noise emissions from an existing site exceed NPfI PNTL, the relevant regulatory authorities and proponent will determine achievable noise limits (ANL) for it through negotiation and discussion with relevant stakeholders as required.

The process for applying the NPfI to existing sites is outlined in Section 6.1.1 of the NPfI and is summarised as follows, as applicable to the Project:

1. Undertake an initial evaluation, including whether approvals/licences include noise limits and whether they are being met.
2. Establish relevant PNTL in accordance with the NPfI to establish benchmarks to assess the need to consider noise mitigation.
3. Measure/predict noise levels produced by the source in question, having regard to meteorological effects such as wind and temperature inversions.
4. Compare measured/predicted noise level with PNTL.
5. Where PNTL are exceeded, assess feasible and reasonable noise mitigation strategies.
6. Develop and refine ANL that will become long-term noise goals for the site. This may involve interaction between the regulator and proponent as well as consultation with the community. Regulators and operators need to consider the technical practicalities and cost of noise reduction measures, and how long it will take to implement these measures, along with the environmental consequences of exceeding PNTL.
7. Monitor compliance with the agreed noise limits, review and amend site performance as required.

The objectives of PNTL are to protect the community from excessive intrusive noise and preserve amenity for specific land uses. It should be noted that audibility of a noise source does not necessarily equate to disturbance at an assessment location.

To ensure these objectives are met, PNTL are established based on intrusiveness and amenity levels as described in the NPfI.

3.1.2 Intrusiveness noise levels

To limit intrusiveness, the site $L_{Aeq,15minute}$ during relevant operational periods should not exceed the RBL by more than 5 dB.

Day, evening and night period project intrusiveness noise levels (PINL) determined for the project, based on the adopted RBLs (refer to Table 2.4), are presented in Table 3.1. It is noted that intrusiveness noise levels are only applicable at residential assessment locations.

Table 3.1 Project intrusiveness noise levels

Assessment location	Adopted RBL[1], dB(A)			PINL (RBL + 5 dB), $L_{Aeq,15minute}$ dB		
	Day	Evening	Night	Day	Evening	Night
All residential locations	35	30	30	40	35	35

Notes: 1. Based on NPfI minimum RBL for the day, evening and night periods. Evening and night RBL are consistent with those adopted in previous noise assessments.

2. Day: 7:00 am to 6:00 pm Monday to Saturday; 8:00 am to 6:00 pm Sundays and public holidays; evening: 6:00 pm to 10:00 pm; night: 10:00 pm to 7:00 am Monday to Saturday; 10:00 pm to 8:00 am Sundays and public holidays.

3.1.3 Amenity noise levels

Amenity noise levels are specific to land use and relate only to industrial noise, road noise is excluded. Where existing industrial noise approaches the recommended ANL, it needs to be demonstrated that levels from new industry will not contribute to existing such that amenity levels are exceeded.

To ensure that total industrial noise (i.e. existing levels plus new levels) remains within the recommended ANL for an area, the project amenity noise levels for an industrial development are the recommended ANLs (outlined in Table 2.2 of the NPfI) minus 5 dB. This approach is based on a receiver being impacted by several industrial sites at any time. Where no other industries are present or likely to be developed in the area in the future, the recommended ANLs outlined in Table 2.2 of the NPfI should be adopted.

Residential assessment locations surrounding the CGO site have been categorised as being in the NPfI 'rural' amenity category. As per the definition provided in the NPfI, a 'rural' residential area is defined as "an area with an acoustical environment that is dominated by natural sounds, having little to no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse".

No other industrial sites currently exist in the area or are likely to be developed in the area in the future, therefore the recommended ANLs for rural residential receivers and passive recreation areas (outlined in Table 2.2 of the NPfI) were adopted for this assessment without adjustment. The corresponding project ANL are given in Table 3.2.

Table 3.2 Project amenity noise levels

Assessment location	Amenity area	Time period[1]	PANL, $L_{Aeq,period}$ dB
All residential locations[2]	Rural	Day	50
		Evening	45
		Night	40
Lake Cowal Reserve (LCR)	Passive recreation	When in use	50

Source: NPfI (EPA 2017).

Notes: 1. Day: 7:00 am to 6:00 pm Monday to Saturday; 8:00 am to 6:00 pm Sundays and public holidays; evening: 6:00 pm to 10:00 pm; night: 10:00 pm to 7:00 am Monday to Saturday; 10:00 pm to 8:00 am Sundays and public holidays.
2. Excludes mine-owned properties and privately-owned properties where Evolution has a noise agreement in place with the landowner.

3.1.4 Project noise trigger levels

PNTL are the lower of the calculated intrusiveness or amenity noise levels and are provided in Table 3.3 for all assessment locations.

It is commonly acknowledged and accepted amongst regulators and industry that average noise levels are typically 3 dB higher over a 15 minute worst-case assessment period when compared to an entire day (11 hour), evening (4 hour) and night (9 hour) assessment period. To standardise time periods for the intrusiveness and amenity noise levels, the NPfI states that the $L_{Aeq,15minute}$ is equivalent to the $L_{Aeq,period}$ + 3 dB. This approach for converting $L_{Aeq,period}$ to $L_{Aeq,15minute}$ has been adopted for this assessment.

Table 3.3 PNTL, $L_{Aeq,15minute}$ dB

Assessment location	PINL			PANL[1]			PNTL[2]		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
All residential locations[3]	40	35	35	53	48	43	40	35	35
LCR	N/A	N/A	N/A	53	53	53	53	53	53

Notes: 1. Project amenity $L_{Aeq,15minute}$ noise level is the project amenity noise level $L_{Aeq,period}$ + 3 dB as per the NPfI.
2. PNTL are the lower of the calculated PINL or PANL.
3. Excludes mine-owned properties and privately-owned properties where Evolution has a noise agreement in place with the landowner.
4. Day: 7:00 am to 6:00 pm Monday to Saturday; 8:00 am to 6:00 pm Sundays and public holidays; evening: 6:00 pm to 10:00 pm; night: 10:00 pm to 7:00 am Monday to Saturday; 10:00 pm to 8:00 am Sundays and public holidays.

The PNTL in Table 3.3 are largely unchanged from noise limits in development consent DA 14/98. A key difference is a consequence of the NSW EPA policy changes (i.e. from Industrial Noise Policy to NPfI) for the less sensitive day period, where the minimum background level has increased to L_{A90} 35 dB resulting in a PINL of $L_{Aeq,15minute}$ 40 dB. Further, there are five assessment locations which are referenced in DA 14/98 (refer to Table 2.3) where existing noise limits are higher than PNTL shown in Table 3.3 for the evening and night periods. As these noise limits were based on operational noise levels predicted in previous noise assessments (i.e. EMM 2020, Renzo Tonin 2018), inclusive of feasible and reasonable noise mitigation measures, they were also compared to for this assessment at the relevant assessment locations.

3.1.5 Sleep disturbance

The site will continue to operate during the night period and therefore, in accordance with the NPfI, the potential for sleep disturbance has been assessed for the Project.

The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where the development night-time noise levels at a residential location exceed:

- $L_{Aeq,15minute}$ 40 dB or the prevailing RBL plus 5 dB (whichever is greater), and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB (whichever is greater).

The sleep disturbance screening criteria for all residential assessment locations are provided in Table 3.4.

Table 3.4 Maximum noise level event screening criteria (night period only)

Assessment location	Adopted (night) RBL, dB(A)	Maximum noise level event screening criteria, dB	
		RBL +5 dB or standard[1] $L_{Aeq,15minute}$	RBL +15 dB or standard[1] L_{Amax}
All residential locations[2]	30	40	52

Notes: 1. Whichever is greater.

2. Excludes mine-owned properties and privately-owned properties where Evolution has a noise agreement in place with the landowner.

The L_{Amax} noise level event screening criterion in Table 3.3 is consistent with the night period L_{Amax} limit in development consent DA 14/98.

3.1.6 Voluntary land acquisition and mitigation policy

In September 2018, the NSW Government released the revised VLAMP for State Significant Mining, Petroleum and Extractive Industry Developments. The VLAMP describes the voluntary mitigation and land acquisition policy to address dust and noise impacts, and outlines mitigation and acquisition criteria for noise.

Under the VLAMP, if a development cannot comply with relevant impact assessment criteria, or if mitigation or acquisition criteria are likely to be exceeded, the applicant should consider a negotiated agreement with the affected landowner or, acquisition of the land. In doing so, the land is then no longer subject to any impact assessment, mitigation or acquisition criteria, with the exception of provisions that apply under the "Use of acquired land", which is primarily related to informing and protecting existing or prospective tenants.

In relation to noise, the VLAMP states the following about voluntary mitigation and voluntary land acquisition:

> A consent authority can apply voluntary mitigation and voluntary land acquisition rights to reduce:
>
> - operational noise impacts of a development on privately owned land; and
> - rail noise impacts of a development on privately owned land near a non-network rail line (private rail line), that is on, or exclusively servicing and industrial site (see Appendix 3 of the Rail Infrastructure Noise Guideline (RING) (EPA 2013));
>
> But not:
>
> - construction noise impacts, as these impacts are shorter term and can be controlled;
> - noise impacts on the public road or rail network; or

- modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts[13].

[13] Noise issues for existing premises may be addressed through site-specific pollution reduction programs under the *Protection of the Environment Operations Act 1997*.

The characterisation of noise impacts (as outlined in the VLAMP) is generally based on human perception to changes in noise levels as explained in the glossary of the acoustic terms in this report. For example, a change in noise level of 1–2 dB is typically indiscernible to the human ear. The characterisation of a residual noise impact of up to 2 dB above the PNTL is therefore considered negligible.

Voluntary mitigation or voluntary acquisition rights apply when a development contributes to exceedances of criteria set out in Table 1 of the VLAMP.

Voluntary mitigation rights apply to any residence on privately-owned land if, even with the implementation of best practice management at the mine site, in the opinion of the consent authority:

- the noise generated by the development would meet the requirements in Table 3.5, such that the impacts would be characterised as marginal, moderate or significant, at any residence on privately-owned land, or
- the development would increase the total industrial noise level at any residence on privately-owned land by more than 1 dB and noise levels at the residence are already above the recommended ANLs in Table 2.2 of the NPfI, or
- the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended acceptable levels in Table 6 of Appendix 3 of the RING (EPA 2013) by greater than or equal to 3 dB at any residence on privately-owned land.

Voluntary acquisition rights apply to any residence on privately-owned land if, even with the implementation of best practice management at the mine site, in the opinion of the consent authority:

- the noise generated by the development would be characterised as significant, according to Table 3.5, at any residence on privately-owned land, or
- the noise generated by the development would contribute to exceedances of the acceptable noise levels plus 5 dB in Table 2.2 of the NPfI on more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls, or
- the development includes a private rail line and the use of that private rail line would cause exceedances of the recommended maximum criteria in Table 6 of Appendix 3 of the RING (EPA 2013) at any residence on privately-owned land.

The NSW Government's interpretation of the significance of any potential exceedances of the relevant noise assessment criteria and potential treatment for those are shown in Table 1 of the VLAMP, which is reproduced in Table 3.5.

Table 3.5 VLAMP characterisation of noise impacts and potential treatments

If the predicted noise level minus the PNTL is:	And the total cumulative industrial noise level is:	Characterisation of impacts	Potential treatment
All time periods 0–2 dB	Not applicable	Impacts are considered to be **negligible.**	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.

Table 3.5 VLAMP characterisation of noise impacts and potential treatments

If the predicted noise level minus the PNTL is:	And the total cumulative industrial noise level is:	Characterisation of impacts	Potential treatment
All time periods 3–5 dB	< Recommended amenity noise level (RANL). > Recommended amenity noise level (RANL) but the increase in total cumulative industrial noise level resulting from development is <1 dB.	Impacts are considered to be **marginal.**	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
All time periods 3–5 dB	> Recommended amenity noise level (RANL) and the increase in total cumulative industrial noise level resulting from the development is >1 dB.	Impacts are considered to be **moderate.**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening > 5 dB	< Recommended amenity noise level (RANL).	Impacts are considered to be **moderate.**	As for marginal impacts but also upgraded façade elements like windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
Day and evening > 5 dB	> Recommended amenity noise level (RANL).	Impacts are considered to be **significant.**	Provide mitigation as for moderate impacts and refer to voluntary land acquisition provisions.
Night > 5 dB	Not applicable	Impacts are considered to be **significant.**	Provide mitigation as for moderate impacts and refer to voluntary land acquisition provisions.

Source: VLAMP (NSW Government 2018).

It is noted that voluntary mitigation and acquisition rights have been applied for two existing residential properties by the consent authority (i.e. DPE) in the development consent:

- Voluntary mitigation rights have been included in the development consent for one privately-owned residence, location 22c (Lakeview III). The development consent states that CGO shall implement additional noise mitigation measures at the residence upon receiving a written request from the landowner.
- Voluntary acquisition rights have been included in the development consent for one privately-owned residence, location 21 (Westella). The development consent states that CGO shall acquire the land(s) upon receiving a written request from the relevant landowner.

3.2 Construction noise

3.2.1 Guideline

The objectives of the ICNG are to promote a clear understanding of ways to identify and minimise noise from construction and to identify feasible and reasonable work practices. It recommends standard construction hours where noise from construction activities is audible at residential premises (i.e. assessment locations), as follows:

- Monday to Friday 7:00 am to 6:00 pm
- Saturday 8:00 am to 1:00 pm
- no construction work on Sundays or public holidays.

The ICNG acknowledges that works outside standard hours may be necessary; however, justification should be provided to the relevant authorities.

The ICNG provides two methodologies to assess construction noise emissions. The first is a quantitative approach, which is suited to major construction projects with typical durations of more than three weeks. This method requires noise emission predictions from construction activities at the nearest assessment locations and assessment against ICNG recommended noise management levels (NMLs).

The second is a qualitative approach, which is a simplified assessment process that relies more on noise management strategies. This method is adequate for short-term infrastructure and maintenance projects of less than three weeks in duration.

This assessment has adopted a mainly quantitative approach. Some aspects, however, will be qualitative including the identification of assessment locations, description of works involved and proposed noise management measures (e.g. a complaint handling procedure).

i Construction NMLs for residential assessment locations

The ICNG NMLs which apply to residential assessment locations are provided in Table 3.6.

Table 3.6 Construction NMLs for residential assessment locations

Time of day	NML L_{Aeq},15minute	Application
Recommended standard hours: • Monday to Friday 7:00 am to 6:00 pm, Saturday 8:00 am to 1:00 pm, no work on Sundays or public holidays.	Noise-affected RBL + 10 dB	The noise-affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise-affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB	The highly noise-affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise-affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied, and noise is more than 5 dB above the noise-affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Source: ICNG (DECC 2009).

ii Construction NMLs for other land uses

The ICNG NMLs recommended for other land uses relevant to the Project are provided in Table 3.7.

Table 3.7 ICNG construction NMLs for other land uses

Land use	NML, $L_{Aeq,15minute}$ dB
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation).	60 (when in use)

Source: ICNG (DECC 2009).

3.2.2 Assessment approach

The SEARs specifically reference the ICNG for the assessment of noise from proposed construction activities where it is demonstrated to be relevant.

Noise associated with construction activities for mining operations (i.e. progressive construction of the IWL, development of haul roads and the ICDS) have been assessed as operational noise in this assessment, as noise emissions from plant and equipment items associated with construction are similar to those used for operations and these construction activities will occur progressively over the Project life.

However, construction activities associated with the proposed extension of the lake protection bund (LPB) to provide continued separation and mutual protection between Lake Cowal and CGO and the construction of the upper catchment diversion system (UCDS) have been assessed as construction noise under the ICNG. The LPB and UCDS are considered necessary infrastructure to enable and/or support mining operations associated with the Project and will be temporary in nature, with activities generally progressing from one point to another (i.e. in stages). The location of the LPB and UCDS construction activities will also generally be closer to receivers than mining operations.

Given the preceding, the ICNG NMLs presented in the following section have been adopted as the construction noise criteria for the Project.

3.2.3 Construction NMLs for the project

The Project construction NMLs for standard hours are presented in Table 3.8 for all relevant assessment locations.

Table 3.8 Project construction NMLs for standard hours

Assessment locations	Receiver type	Assessment period	Adopted RBL, dB(A)	NML $L_{Aeq,15minute}$ dB
All residential locations	Residential	Standard hours[1]	35[2]	45
LCR	Passive creation	When in use	n/a	60

Notes: 1. Monday to Friday 7:00 am to 6:00 pm; Saturday 8:00 am to 1:00 pm; no construction work on Sundays or public holidays.
2. In accordance with the ICNG and consistent with the operational noise assessment approach (refer to Section 3.1.2), the NPfI minimum RBL of 35 dB for the day period was adopted.

The Project construction NMLs for out-of-hours (OOH) periods are presented in Table 3.9 for all relevant assessment locations.

Table 3.9 Project construction NMLs for OOH periods

Assessment locations	Receiver type	Assessment period	Adopted RBL, dB(A)	NML $L_{Aeq,15minute}$ dB
Residential locations	Residential	Day OOH[1]	35[4]	40
		Evening OOH[2]	30[5]	35
		Night OOH[3]	30[6]	35
LCR	Passive recreation	All OOH periods (when in use)	n/a	60

Notes: 1. Saturday 7:00 am to 8:00 am and 1:00 pm to 6:00 pm; Sunday and public holiday 7:00 am to 6:00 pm.
2. Everyday 6:00 pm to 10:00 pm.
3. Monday to Saturday 10:00 pm to 7:00 am; Sunday and public holiday 10:00 pm to 8:00 am.
4. In accordance with the ICNG and consistent with the operational noise assessment approach (refer to Section 3.1.2), the NPfI minimum RBL of 35 dB(A) for the day period was adopted.
5. In accordance with the ICNG and consistent with the operational noise assessment approach (refer to Section 3.1.2), the NPfI minimum RBL of 30 dB(A) for the evening period was adopted.
6. In accordance with the ICNG and consistent with the operational noise assessment approach (refer to Section 3.1.2), the NPfI minimum RBL of 30 dB(A) for the night period was adopted.

3.3 Road traffic noise

Noise from road traffic during construction has been assessed for potential impact. The principle guidance to assess the impact of road traffic noise at assessment locations is in the RNP.

Table 3.10 presents road traffic noise assessment criteria for residential land uses (i.e. assessment locations), reproduced from Table 3 of the RNP for road categories relevant to the Project. Under the RNP the preferred and alternative transport routes are classified as sub-arterial roads.

Table 3.10 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria – dB	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq,15hour}$ 60 (external)	$L_{Aeq,9hour}$ 55 (external)

Source: RNP (DECCW 2011).

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

In addition to meeting the assessment criteria (Table 3.10), any significant increase in total traffic noise at assessment locations must be considered. Assessment locations experiencing increases in total traffic noise levels above those presented in Table 3.11 should be considered for mitigation. It is noted that the relative increase criteria do not apply to local roads.

Table 3.11 Road traffic relative increase criteria for residential land uses

Road Category	Type of project/development	Total traffic noise level increase - dB	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/ sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{Aeq,15hour}$ + 12 (external)	Existing traffic $L_{Aeq,9hour}$ + 12 (external)

Source: RNP (DECCW 2011).

3.4 Blasting

The limits adopted by regulators for blasting are consistent with those in the ANZECC guideline 'Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration'.

Blasting criteria address two main effects of blasting:

- airblast overpressure
- ground vibration.

Airblast overpressure and ground vibration limits exist for CGO (refer to Table 2.7) as specified in the development consent and EPL. Blasting at CGO is approved to occur 24 hours a day, seven days a week. The CGO airblast overpressure and ground vibration limits in the development consent and EPL are relatively consistent with ANZECC criteria, however, those for the evening and night periods, as well as for Sundays and public holidays are more stringent (refer to Table 2.7).

4 Assessment method

4.1 Noise modelling

4.1.1 Software

Quantitative modelling of construction and operational noise was done using RTA Technology's Environmental Noise Model (ENM), a computer based environmental noise model. ENM is approved by the DPE and EPA as suitable for prediction of industrial noise involving large propagation distances and is currently the industry standard for NIA of this nature.

The model considers geometric spreading, atmospheric absorption, and barrier and ground attenuation. ENM Terrain Category 2, representing a rural land environment, was adopted for model input. Three-dimensional digitised ground contours of the Project and surrounding land were incorporated into the noise model to account for topographic effects.

4.1.2 Noise model establishment and validation

i Noise model establishment

To establish the noise model for this assessment, noise from approved existing CGO operations was modelled, based on the FY2023 mining schedule. The FY2023 operational scenario is considered representative of existing CGO operations.

Noise levels from existing CGO operations were modelled based on noise-enhancing meteorological conditions for the day, evening and night periods in accordance with the NPfI.

ii Noise model validation

For validation purposes, the modelled noise levels were compared to those from the *Cowal Gold Operations Underground Development & Modification 16 Noise and vibration impact assessment* (EMM 2020), which included CGO approved operations (Mod 16) and underground operations and *CGO Underground Development Modification 1 – Noise and vibration impact assessment* (EMM 2022). It is noted that a calibration reduction of 3 dB was adopted in previous CGO assessments, including EMM 2020, EMM 2022 and Renzo Tonin 2018 assessments. The current Project operational noise assessment did not include any modelling calibration factor. Conversely, sound power levels adopted in this assessment for plant and equipment have been updated based on measured site data; some were lower than those adopted in previous CGO assessments, as discussed in the following section. The validation exercise showed that modelled levels from existing CGO operations are relatively comparable to those presented in the EMM 2020 assessment. The noise model established for this assessment is considered to be relatively conservative.

Furthermore, the modelled noise levels from existing CGO operations were found to be similar or higher than the worst-case (i.e. highest) site $L_{Aeq,15minute}$ levels measured during regular compliance attended noise monitoring.

4.1.3 Operational noise modelling

The noise model included operation of plant and equipment for the Project inclusive of existing and approved operations. Two indicative operational scenarios were modelled representing the initial and later stages of the Project, with emphasis on targeting the highest noise impact, including periods when operations will be closest to assessment locations. Accordingly, future operational scenarios Year 2 and Year 7 were modelled for this assessment and are considered relatively worst-case stages of the Project from a potential noise impact perspective, considering the number of significant plant and equipment items and their locations in relation to distance and exposure (or shielding) to surrounding receivers.

Noise levels for existing operations were also modelled to show noise levels from approved CGO operations based on the established model and to show the potential change (e.g. increase) as a result of the Project.

Noise sources modelled for the Project, including sound power levels and quantities for each operational scenario, are summarised in Table 4.1. The sound power levels adopted for this assessment were referenced from the previous CGO assessments (EMM 2020 and EMM 2022) or, where indicated, are based on on-site measurements completed by EMM in May 2022 or EMM's database for similar projects. Single octave or one-third octave (where available) sound power levels are provided in Attachment D. It is noted that plant and equipment items associated with the underground mine are consistent with those in the EMM 2022 assessment.

Table 4.1 Modelled acoustically significant noise sources for the Project

Plant or equipment item – model	Quantity			Sound power level[1], L_{Aeq} dB
	Existing	Future Year 2	Future Year 7	
Processing area				
Process plant	1	1	1	124
Primary crusher	1	1	1	111[2]
Secondary crusher (Sag and Ball mill)	1	1	1	116[2]
Mobile crusher	1	1	1	113
Stockpile conveyors	1	1	1	105[2]
Mining fleet				
Excavator – EX9400	3	3	3	119[2]
Haul truck – CAT 789C	21	17	19	119[2]
Loader TCR652 – 926G	1	1	1	110
Loader TCR653 – IT62G	1	1	1	110
Loader TCR654 – 980G	1	1	1	114
Wheel loader – 992G	3	3	3	108
Track dozer – CAT D10T	4	6	6	120[3]
Wheel dozer – 834H	1	1	1	115
Water truck – CAT 777D	2	2	2	114[2]
Grader – CAT 16H	2	2	2	108
Drill – Epiroc D65	6	6	6	118[2]
Drill – GC Drill	1	1	2	118[2]
Drill – Epiroc/Horizontal	1	1	1	118[2]
Ancillary excavator	2	2	2	118
Roller	1	1	1	106[2]
IWL development support fleet				
Dump truck – CAT 45t Articulated	18	18	18	109[2]

Table 4.1 Modelled acoustically significant noise sources for the Project

Plant or equipment item – model	Quantity			Sound power level[1], L_{Aeq} dB
	Existing	Future Year 2	Future Year 7	
Grader – CAT 14M	1	1	1	108
Water truck – Volvo A40D	1	1	1	108
Excavator – 390FL (90t)	1	1	1	114
Excavator (30t)	1	1	1	110
Track dozer – CAT D8	2	2	2	118
Track dozer – CAT D9	1	1	1	117
Roller	1	1	1	106[2]
Underground mine				
Underground mine trucks – Sandvik TH663	8	12	14	118[4]
Pastefill plant	1	1	1	113[4]
Ventilation fan	1	1	1	122[2]

Notes: 1. Per unit of plant or equipment.
2. Based on on-site measurements completed by EMM in May 2022.
3. Referenced from a noise assessment prepared for a similar project.
4. Referenced from the underground mine noise assessment (EMM 2020).

The application of modifying factors to modelled operational noise was considered in this assessment in accordance with the guideline provided in Fact sheet C of the NPfI. Based on the noise sources modelled for the Project, noting that no additional significant items are proposed, it is unlikely that operational noise sources would generate dominant low frequency noise or contain annoying characteristics such as tonality, intermittency or irregularity. Importantly, attended noise monitoring used for compliance purposes confirms that noise from site does not contain such characteristics. Therefore, no modifying factor corrections were applied to predicted noise levels. This is consistent with the findings published in previous noise assessments and regular compliance monitoring completed for CGO in relation to modifying factors.

The noise modelling of existing and future (Year 2/Year 7) operational scenarios include the application of all existing and proposed reasonable and feasible mitigation controls for the Project. Therefore, any predicted exceedances of PNTL can be considered residual noise impact as defined in the NPfI. Consideration of possible reasonable and feasible mitigation controls to reduce the potential operational noise impacts from the Project is discussed in Section 5.1.1.

4.1.4 Construction noise modelling

Construction noise modelling was based on information provided by Evolution, including locations of proposed works, construction hours and a list of plant and equipment items.

Activities associated with the LPB and UCDS will occur relatively closer to receivers than most mining operations and hence are likely to generate relatively high short-term noise levels at some of the assessment locations depending on work stages. Activities associated with these have been modelled as worst-case construction scenarios for the Project. LPB and UCDS construction have been assumed to occur during approved existing CGO mining operational hours, 24 hours, seven days per week. However, it is expected that noise generating activities associated with LPB and UCDS construction will generally occur during the day period between 6:00 am and 6:00 pm, Monday to Sunday. From time to time, construction activities may extend outside the aforementioned hours (potentially up to 10:00 pm) where necessary for construction to remain on schedule (e.g. due to adverse weather or other construction delays).

Proposed construction works will occur concurrently with mining operations at CGO and hence predicted noise levels for the LPB and UCDS construction have been combined with those for the relevant operational scenario before comparison to ICNG criteria.

The LPB will be constructed in two stages, the northern and southern sections. The northern section will be completed before the southern section, with both stages expected to be constructed during Year 1 and Year 2 of the Project.

The UCDS realignment will be constructed in stages, comprising northern and southern sections. UCDS North Stage 1 and UCDS South Stage 1 (i.e. portions adjacent to the LPB) will occur during the construction of the LPB and will use the same construction fleet as the LPB construction. UCDS North and South stage 2 construction is likely to occur after the completion of the LPB North and LPB South construction, however depending on final mine scheduling this section will either be constructed during the Project's construction phase or as part on ongoing mine development activities (i.e. before the development of the northern IWL embankment in the case of UCDS Stage 2).

Modelled noise sources and sound power levels for LPB and UCDS construction are summarised in Table 4.2. The sound powers were referenced from the EMM 2020 assessment or, where indicated, were supplemented from EMM's database for similar projects or the UK Department for Environment, Food and Rural Affairs (DEFRA) 'Update of Noise Database for Prediction of Noise on Construction and Open Sites' (2005).

Table 4.2 Modelled noise sources for construction

Plant or equipment item	Quantity	Sound power level[1], L_{Aeq} dB
LPB construction		
40 t Excavator	4	107[2]
D10 Dozer	4	120[3]
657 Scraper	12	110[2]
40 kL Water cart	6	105[2]
D8 Dozer	4	118
40 t Articulated Dump Truck	20	108[2]
825 Compactor	4	116[2]
Smooth Drum	4	101[3]
20 t Excavator	4	104[2]
Pulveriser	4	108[3]
20 kL Water cart	4	105[2]

Table 4.2 Modelled noise sources for construction

Plant or equipment item	Quantity	Sound power level[1], L_{Aeq} dB
14 M Grader	4	108
Drill rig	1	115[2]
Backhoe	2	103[2]
UCDS construction		
40 t Excavator	4	107[2]
D10 Dozer	4	120[3]
657 Scraper	12	110[2]
40 kL Water Cart	6	105[2]
D8 Dozer	4	118
40 t Articulated Dump Truck	20	108[2]
825 Compactor	4	116[2]
Smooth Drum	4	101[3]
20 t Excavator	4	104[2]
Pulveriser	4	108[3]
20 kL Water cart	4	105[2]
14 M Grader	4	108
Backhoe	2	103[2]
Crane	2	110[3]

Notes: 1. Per unit of quantity.
2. Referenced from EMM's database.
3. Referenced from 'Update of Noise Database for Prediction of Noise on Construction and Open Sites' (DEFRA 2005).

4.1.5 Sleep disturbance

Noise levels from future night operations with the potential to cause sleep disturbance at nearby residences have been assessed in accordance with the NPfI.

Predicted operational $L_{Aeq,15minute}$ for the night period will be referenced from the operational noise assessment and compared against the $L_{Aeq,15minute}$ sleep disturbance trigger levels.

L_{Amax} from future night operations considered in this assessment included potential maximum noise events from activities such as:

- mobile plant loading material into a haul truck
- mobile plant bucket hitting the ground
- haul truck unloading material at the WRE areas or IWL, or
- haul truck unloading material at the processing area.

A sound power L_{Amax} 125 dB was adopted to cover any of these possible events in the prediction of sleep disturbance impacts at residential assessment locations for the night period during noise-enhancing meteorological conditions.

4.1.6 Modelled meteorological conditions

Winds and temperature inversions were not identified applicable to the Project area in accordance with the NPfI (refer to Section 2.3.2).

As a conservative approach however, the operational and construction noise models established for the Project considers noise-enhancing meteorological conditions for the day, evening and night periods in accordance with the NPfI.

A summary of meteorological conditions for which noise predictions have been provided for construction and operations are shown in Table 4.3.

Table 4.3 Meteorological parameters adopted for the noise modelling

Assessment period[1]	Modelled meteorological conditions
Day	3 m/s wind (source-to-receiver) with stability category D (vertical gradient -0.4°C/100 m)
Evening	3 m/s wind (source-to-receiver) with stability category D (vertical gradient -0.4°C/100 m)
Night	3 m/s wind (source-to-receiver) with stability category D (vertical gradient -0.4°C/100 m)
Night (winter months)	Stability category F (vertical gradient 3.9°C/100 m) with 2 m/s wind (source-to-receiver)

Notes: 1. Day: 7:00 am to 6:00 pm Monday to Saturday; 8:00 am to 6:00 pm Sundays and public holidays; evening: 6:00 pm to 10:00 pm; night: remaining periods.

4.2 Road traffic noise

The Project will not change approved preferred and alternative access routes, primary site access or operational traffic movements.

The potential noise impacts resulting from construction related traffic on public roads have been assessed against criteria defined in the RNP. Road traffic data provided in this section was referenced from the Transport Impact Assessment (TIA) prepared for the Project by EMM (2023b).

The additional daily and peak hourly mine traffic movements that will occur during the construction phase will primarily be related to the construction workforce travel, material deliveries and construction fleet for the Project. The Project will generate light vehicle traffic movements from individual employee cars and minivans, as well as heavy vehicle traffic from coach/ and delivery trucks.

The peak construction workforce for the Project will be a total of approximately 102 persons on-site. It is noted however that the TIA and therefore the road traffic noise assessment for the Project contained in this NVIA has been based on a more conservative peak construction workforce of approximately 114 persons. The construction workforce will predominately travel to site using mini vans which will travel during two peaks, travelling inbound to site between 5:00 am–6:00 am (RNP night period) and travelling outbound from site between 6:00 pm–7:00 pm (RNP day period). It is expected that construction-related traffic will be negligible outside these peak hours.

The Project TIA assumes that during peak construction there would be up to 20 workers travelling per coach/minivan and up to 2 workers per car/ute. It is further assumed that all peak daily construction traffic would travel within the AM and PM peak hours. Based on these assumptions there would be up to 15 light vehicles and 5 coach/minivans per day during peak construction months. Additionally, there would be up to 12 heavy vehicles per day consisting of material and building deliveries and earthmoving fleet. In total, there would be 15 light vehicle and 17 heavy vehicle trips for a combined 32 vehicle trips per day (i.e. 64 movements) during peak construction months. Half of these vehicle movements will occur during the RNP day assessment period (15 hours) and the other half occurring during the RNP night assessment period (9 hours). The total construction period is expected to be approximately 2 years.

The nearest residences potentially affected by an increase in road traffic noise levels are located on Blow Clear Road approximately 230 m (or greater) from the road. The predicted peak hourly construction traffic is estimated to be 12 light and 13 heavy vehicle movements on this route. Existing traffic volumes on this road during the construction-related peak hourly times are 60 light and 12 heavy vehicle movements. Thus, the increase in total volumes because of construction-related traffic is in the order of 35% during the early morning and afternoon peak hours only.

4.3 Blasting

4.3.1 Overview

Blast emissions monitoring data relevant to existing operations was supplied to EMM by Evolution. This data included measured vibration and airblast levels at the near-field monitoring location as well as blast identification information, blast type, maximum instantaneous charge (MIC) and the blast to the monitoring location distance. This data was used to develop prediction site laws for ground vibration and airblast to form the basis of this assessment. Site specific relationships between the level of blast emissions and scaled distances (SD) have been developed and are described in the following sections.

4.3.2 Airblast overpressure

The site law for airblast, together with the measured data used to develop it, are shown in Figure 4.1 and described here:

$$OP(95\%) = 155.2 - 15.5\log(SD_a)$$

Where $SD_a = \frac{D}{\sqrt[3]{MIC}}$

OP(95%) = airblast overpressure level (dB) above which 5% of the total population of data points will lie, assuming that the population has the same statistical distribution as the measured results.

SD_a = scaled distance for airblast

D = distance from blast (m)

MIC = maximum instantaneous charge (kg)

As can be seen from the graph in Figure 4.1 below, there is a low level of correlation between the data and the 95th percentile line of best fit. However, since all the measured data lies below the 95% line, it is likely to provide a conservative estimate of predicted overpressure from blasting.

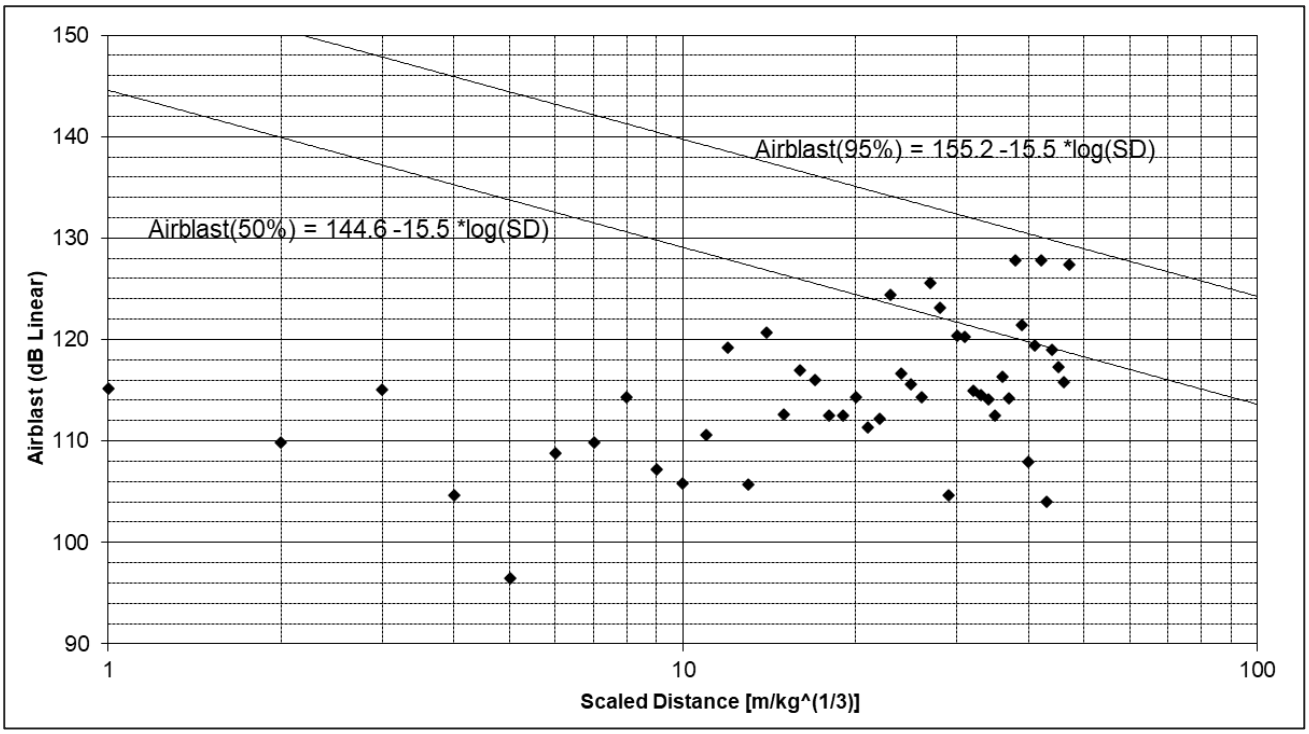

Figure 4.1 Airblast site law

4.3.3 Ground vibration

The site law for vibration, together with the measured data used to develop it, are shown in Figure 4.2 and described here:

$$PVS(95\%) = 319\ (SD_v^{-1.33})$$

Where $SD_v = \frac{D}{\sqrt{MIC}}$

PVS(95%) = ground vibration, peak vector sum (mm/s) above which 5% of the total population of data points will lie, assuming that the population has the same statistical distribution as the measured results.

SD_v = scaled distance for vibration

D = distance from blast (m)

MIC = maximum instantaneous charge (kg)

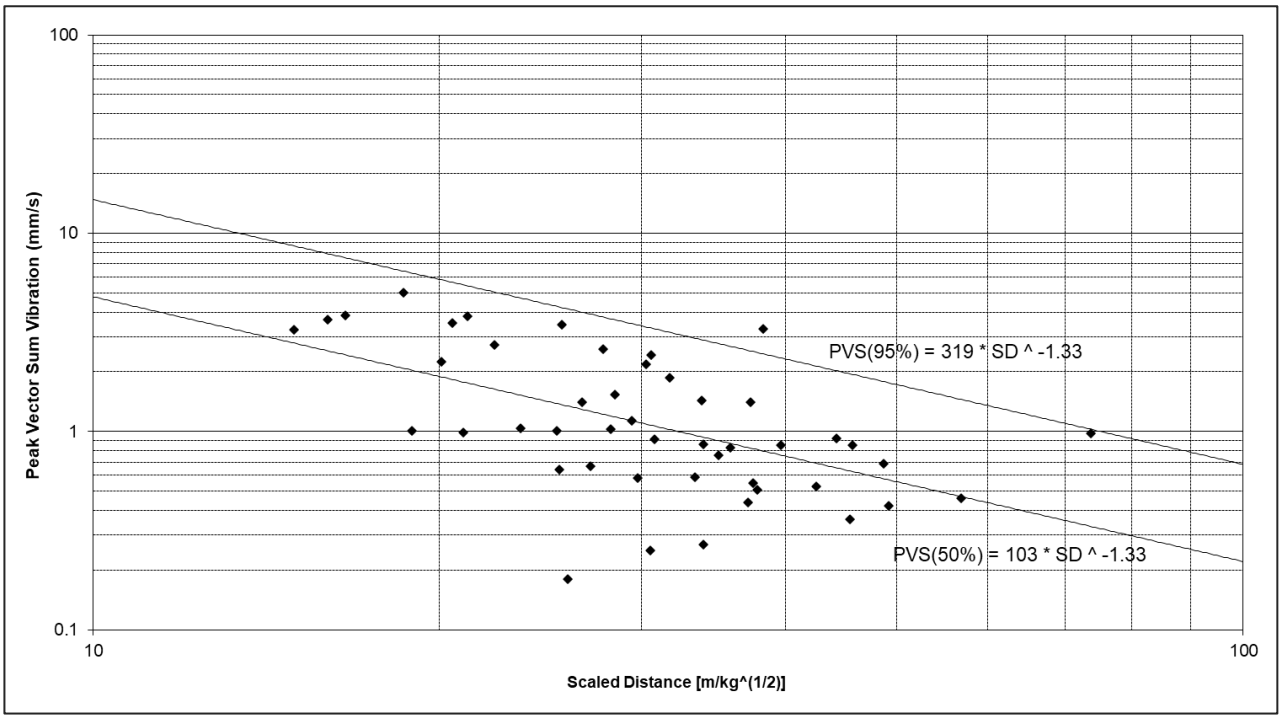

Figure 4.2 Vibration site law

5 Assessment results

5.1 Mine noise

5.1.1 Operational noise

To assess potential noise impacts from the Project, noise levels from proposed mining operations (inclusive of underground mining operations) were modelled for existing, future Year 2 and Year 7 during noise-enhancing meteorological conditions (refer to Table 4.3).

i Operational noise during the day period

Predicted noise levels for the day period during noise-enhancing meteorological conditions are shown in Table 5.1.

Table 5.1 Predicted day period operational noise levels, dB

Assessment location	Existing operations $L_{Aeq,15minute}$	Year 2 $L_{Aeq,15minute}$	Year 7 $L_{Aeq,15minute}$	PNTL $L_{Aeq,15minute}$	PNTL exceedances		
					Existing	Year 2	Year 7
4	<35	<35	<35	40	Nil	Nil	Nil
6	<35	<35	<35	40	Nil	Nil	Nil
15[1]	36	38	38	40	Nil	Nil	Nil
20	<35	35	36	40	Nil	Nil	Nil
21[2]	42	42	42	40	2	2	2
22a	<35	35	36	40	Nil	Nil	Nil
22b	<35	35	35	40	Nil	Nil	Nil
22c[3]	<35	35	37	40	Nil	Nil	Nil
22d	<35	<35	<35	40	Nil	Nil	Nil
24	<35	<35	35	40	Nil	Nil	Nil
25	<35	<35	<35	40	Nil	Nil	Nil
28	<35	<35	<35	40	Nil	Nil	Nil
30a	<35	<35	<35	40	Nil	Nil	Nil
30b	<35	<35	<35	40	Nil	Nil	Nil
31a	<35	<35	<35	40	Nil	Nil	Nil
36a	35	37	37	40	Nil	Nil	Nil
36b	<35	<35	<35	40	Nil	Nil	Nil
38[1]	<35	<35	<35	40	Nil	Nil	Nil
43a	<35	<35	<35	40	Nil	Nil	Nil
43b	<35	<35	<35	40	Nil	Nil	Nil

Table 5.1 Predicted day period operational noise levels, dB

Assessment location	Existing operations $L_{Aeq,15minute}$	Year 2 $L_{Aeq,15minute}$	Year 7 $L_{Aeq,15minute}$	PNTL $L_{Aeq,15minute}$	PNTL exceedances		
					Existing	Year 2	Year 7
49a	<35	<35	35	40	Nil	Nil	Nil
49b	<35	<35	35	40	Nil	Nil	Nil
56	<35	<35	<35	40	Nil	Nil	Nil
57	<35	<35	<35	40	Nil	Nil	Nil
61a	<35	<35	<35	40	Nil	Nil	Nil
62	<35	<35	<35	40	Nil	Nil	Nil
79	<35	<35	<35	40	Nil	Nil	Nil
89	<35	<35	<35	40	Nil	Nil	Nil
90	<35	<35	<35	40	Nil	Nil	Nil
100	<35	<35	<35	40	Nil	Nil	Nil
122	<35	<35	<35	40	Nil	Nil	Nil
126	<35	<35	<35	40	Nil	Nil	Nil
LCR[4]	40	43	44	53	Nil	Nil	Nil
NO3[4]	<35	35	36	N/A	N/A	N/A	N/A
N04[4]	43	45	48	N/A	N/A	N/A	N/A

Notes:
1. Evolution has a noise agreement in place with the landowner of this privately-owned property.
2. Subject to acquisition upon request in accordance with the development consent.
3. Subject to mitigation upon request in accordance with the development consent.
4. Non-residential.
5. Day: 7:00 am to 6:00 pm Monday to Saturday; 8:00 am to 6:00 pm Sundays and public holidays.
6. N/A = not applicable.

Modelling results show that future (Year 2/Year 7) operational noise levels for the day period during noise-enhancing meteorological conditions are predicted to satisfy the relevant PNTL at most assessment locations. The exception is at assessment location 21 where a negligible exceedance (2 dB) is predicted in Year 2 and Year 7 This is consistent with modelled existing operations where a negligible exceedance (2 dB) resulted. It is noted that assessment location 21 is currently subject to acquisition upon request in accordance with the development consent (Refer to Section 2.2.1). An analysis of feasible and reasonable noise mitigation measures undertaken for the Project is summarised in Section 5.1.1.iv.

Furthermore, an increase of up to 3 dB is predicted between existing operations and future Year 2 and Year 7 operational noise levels, however this is inconsequential as future operational noise levels are predicted to satisfy relevant PNTL at all assessment locations where an increase is predicted.

ii Operational noise during the evening period

Predicted noise levels for the evening during noise-enhancing meteorological conditions are shown in Table 5.2. Marginal and moderate exceedances are shown in shaded font.

Table 5.2 Predicted evening period operational noise levels, dB

Assessment location	Existing operations $L_{Aeq,15minute}$	Year 2 $L_{Aeq,15minute}$	Year 7 $L_{Aeq,15minute}$	PNTL $L_{Aeq,15minute}$	PNTL exceedances		
					Existing	Year 2	Year 7
4	<30	<30	30	35	Nil	Nil	Nil
6	<30	<30	<30	35	Nil	Nil	Nil
15[1]	36	39	39	35	1	4	4
20	34	36	36	35	Nil	1	1
21[2]	39	41	41	35	4	6	6
22a	33	35	36	35	Nil	Nil	1
22b	33	35	35	35	Nil	Nil	Nil
22c[3]	33	36	37	35	Nil	1	2
22d	<30	<30	<30	35	Nil	Nil	Nil
24	33	35	36	35	Nil	Nil	1
25	31	33	34	35	Nil	Nil	Nil
28	<30	<30	<30	35	Nil	Nil	Nil
30a	<30	<30	<30	35	Nil	Nil	Nil
30b	<30	<30	<30	35	Nil	Nil	Nil
31a	<30	<30	<30	35	Nil	Nil	Nil
36a	36	38	39	35	1	3	4
36b	<30	31	31	35	Nil	Nil	Nil
38[1]	31	34	35	35	Nil	Nil	Nil
43a	<30	31	32	35	Nil	Nil	Nil
43b	<30	<30	<30	35	Nil	Nil	Nil
49a	33	35	36	35	Nil	Nil	1
49b	34	36	37	35	Nil	1	2
56	<30	<30	<30	35	Nil	Nil	Nil
57	<30	<30	<30	35	Nil	Nil	Nil
61a	30	33	34	35	Nil	Nil	Nil
62	30	33	35	35	Nil	Nil	Nil
79	<30	<30	<30	35	Nil	Nil	Nil
89	30	33	34	35	Nil	Nil	Nil
90	<30	30	31	35	Nil	Nil	Nil
100	<30	<30	<30	35	Nil	Nil	Nil

Table 5.2 Predicted evening period operational noise levels, dB

Assessment location	Existing operations $L_{Aeq,15minute}$	Year 2 $L_{Aeq,15minute}$	Year 7 $L_{Aeq,15minute}$	PNTL $L_{Aeq,15minute}$	PNTL exceedances		
					Existing	Year 2	Year 7
122	<30	<30	<30	35	Nil	Nil	Nil
126	<30	<30	<30	35	Nil	Nil	Nil
LCR[4]	42	45	46	53	Nil	Nil	Nil
NO3[4]	33	36	37	N/A	N/A	N/A	N/A
N04[4]	44	47	50	N/A	N/A	N/A	N/A

Notes:
1. Evolution has a noise agreement in place with the landowner of this privately-owned property.
2. Subject to acquisition upon request in accordance with the development consent.
3. Subject to mitigation upon request in accordance with the development consent.
4. Non-residential.
5. Evening period is between 6:00 pm and 10:00 pm as per the NPfI.
6. N/A = not applicable.

Modelling results show that future (Year 2/Year 7) operational noise levels for the evening period during noise-enhancing meteorological conditions are predicted to satisfy the relevant PNTL at most assessment locations. The exceptions are at:

- six assessment locations (20, 22a, 22c, 24, 49a and 49b) where a negligible exceedance (1–2 dB) is predicted
- two assessment locations (15 and 36a) where a marginal exceedance (3–4 dB but below the RANL) is predicted
- one assessment location (21) where a moderate exceedance (up to 6 dB but below the RANL) is predicted.

It is noted that Evolution currently has a noise agreement with the landowner of assessment location 15, assessment location 22c is currently subject to mitigation upon request and assessment location 21 is currently subject to acquisition upon request in accordance with the development consent (refer to Section 2.2.1). An analysis of feasible and reasonable noise mitigation measures undertaken for the Project is summarised in Section 5.1.1.iv.

Furthermore, an increase of up to 4 dB is predicted between modelled existing operations and future Year 2/Year 7 operational noise levels, however future operational noise levels are predicted to satisfy relevant PNTL at most assessment locations where an increase is predicted. The exceptions are at assessment locations where an exceedance is predicted as listed above.

iii Operational noise during the night period

Predicted noise levels for the night period during noise-enhancing meteorological conditions are shown in Table 5.3. For the night period, noise predictions are provided for both wind and temperature inversion (winter months) noise-enhancing meteorological conditions. Marginal and moderate exceedances are shown in shaded font.

Table 5.3 Predicted night period operational noise levels, dB

Assessment location	Existing Operations $L_{Aeq,15minute}$		Year 2 $L_{Aeq,15minute}$		Year 7 $L_{Aeq,15minute}$		PNTL $L_{Aeq,15minute}$	PNTL exceedances					
								Existing		Year 2		Year 7	
	Wind	T. inv	Wind	T. inv	Wind	T. inv		Wind	T. inv	Wind	T. inv	Wind	T. inv
4	<30	30	<30	30	30	31	35	Nil	Nil	Nil	Nil	Nil	Nil
6	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
15[1]	36	37	39	40	39	40	35	1	2	4	5	4	5
20	34	35	36	38	36	37	35	Nil	Nil	1	3	1	2
21[2]	39	41	41	43	41	42	35	4	6	6	8	6	7
22a	33	34	35	36	36	36	35	Nil	Nil	Nil	1	1	1
22b	33	34	35	36	35	36	35	Nil	Nil	Nil	1	Nil	1
22c[3]	33	34	36	37	37	38	35	Nil	Nil	1	2	2	3
22d	<30	30	<30	31	<30	31	35	Nil	Nil	Nil	Nil	Nil	Nil
24	33	34	35	36	36	37	35	Nil	Nil	Nil	1	1	2
25	31	31	33	34	34	34	35	Nil	Nil	Nil	Nil	Nil	Nil
28	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
30a	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
30b	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
31a	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
36a	36	37	38	40	39	40	35	1	2	3	5	4	5
36b	<30	30	31	32	31	32	35	Nil	Nil	Nil	Nil	Nil	Nil
38[1]	31	32	34	35	35	36	35	Nil	Nil	Nil	Nil	Nil	1
43a	<30	<30	31	31	32	33	35	Nil	Nil	Nil	Nil	Nil	Nil
43b	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
49a	33	33	35	36	36	37	35	Nil	Nil	Nil	1	1	2
49b	34	35	36	37	37	38	35	Nil	Nil	1	2	2	3
56	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
57	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
61a	30	31	33	34	34	35	35	Nil	Nil	Nil	Nil	Nil	Nil
62	30	31	33	34	35	36	35	Nil	Nil	Nil	Nil	Nil	1
79	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
89	30	32	33	35	34	36	35	Nil	Nil	Nil	Nil	Nil	1
90	<30	<30	30	30	31	32	35	Nil	Nil	Nil	Nil	Nil	Nil

Table 5.3 Predicted night period operational noise levels, dB

Assessment location	Existing Operations $L_{Aeq,15minute}$		Year 2 $L_{Aeq,15minute}$		Year 7 $L_{Aeq,15minute}$		PNTL $L_{Aeq,15minute}$	PNTL exceedances					
								Existing		Year 2		Year 7	
	Wind	T. inv	Wind	T. inv	Wind	T. inv		Wind	T. inv	Wind	T. inv	Wind	T. inv
100	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
122	<30	<30	<30	30	<30	30	35	Nil	Nil	Nil	Nil	Nil	Nil
126	<30	<30	<30	<30	<30	<30	35	Nil	Nil	Nil	Nil	Nil	Nil
LCR[4]	42	43	45	47	46	47	53	Nil	Nil	Nil	Nil	Nil	Nil
NO3[4]	33	34	36	37	37	38	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N04[4]	44	46	47	49	50	52	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
1. Evolution has a noise agreement in place with the landowner of this privately-owned property.
2. Subject to acquisition upon request in accordance with the development consent.
3. Subject to mitigation upon request in accordance with the development consent.
4. Non-residential.
5. Night period is between 10 pm and 7 am Monday to Saturday; 10 pm to 8 am Sundays and public holidays.
6. N/A = not applicable.

Modelling results show that future (Year 2/Year 7) operational noise levels for the night period during noise-enhancing meteorological conditions are predicted to satisfy the relevant PNTL at most assessment locations. The exceptions are at:

- seven assessment locations (i.e. 22a, 22b, 24, 38, 49a, 62 and 89) where a negligible exceedance (1–2 dB) is predicted
- five assessment locations (i.e. 15, 20, 22c, 36a and 49b) where a marginal exceedance (3–5 dB but below the RANL) is predicted
- one assessment location (i.e. 21) where a moderate exceedance (up to 8 dB and satisfies the RANL) is predicted. However, in accordance with the VLAMP, this exceedance (i.e. >5 dB above PNTL during the night period) is considered significant.

It is noted that Evolution currently has a noise agreement with the landowner of assessment locations 15 and 38, assessment location 22c is currently subject to mitigation upon request and assessment location 21 is currently subject to acquisition upon request in accordance with the development consent. An analysis of feasible and reasonable noise mitigation measures undertaken for the Project is provided in Section 5.5.1.iv.

Furthermore, an increase of up to 4 dB is predicted between existing and future (Year 2/Year7) operational noise levels, however future operational noise levels are predicted to satisfy the relevant PNTL at most assessment locations where an increase is predicted. The exceptions are at assessment locations where an exceedance is predicted as listed above.

iv Feasible and reasonable noise mitigation measures

Given there are exceedances predicted for the Project, an analysis of feasible and reasonable noise mitigation measures was done. Consideration of the feasibility and reasonableness of additional noise mitigation measures has been undertaken as per Section 3.4 of the NPfI. 'Feasible' and 'reasonable' mitigation is defined in the NPfI as follows:

> A feasible mitigation measure is a noise mitigation measure that can be engineered and is practical to build and/or implement, given project constraints such as safety, maintenance and reliability requirements. It may also include options such as amending operational practices (for example, changing a noisy operation to a less-sensitive period or location) to achieve noise reduction.
>
> Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the mitigation measure.

Several factors were considered in deciding whether an option is reasonable:

1. noise impact extent
2. number of residential receivers affected
3. noise mitigation benefits
4. cost effectiveness of noise mitigation
5. community views.

The NPfI also provides the following guidance on the application of noise mitigation to existing premises:

> The range of noise reduction strategies for existing situations is generally more limited than those available for new development at the planning stage. For example, spatial separation between the source and receiver is not an option for existing situations. The initial focus for existing sites should be operational procedures and prioritising noise-control measures that provide the greatest benefits to residents at least cost.

The main Project noise sources contributing to higher predicted levels at residential receivers, in particular at the assessment locations where exceedances are predicted, are D10 dozers and CAT 789 haul trucks. Noise mitigation options targeting these noise sources have been considered in the following hierarchical approach:

1. control of noise at the source
2. once the feasible and reasonable controls at the source are exhausted, controlling the transmission of noise
3. once source and transmission feasible and reasonable controls are exhausted, considering mitigation measures at the noise-sensitive receivers.

A summary of possible mitigation options considered for the Project, whether these are feasible and/or reasonable and justification as to why each option was adopted or not, is provided in Table 5.4.

Table 5.4 Consideration of possible feasible and reasonable mitigation options

Mitigation option	Feasible	Reasonable	Justification
Control noise at the source			
Best Available Technology Economically Achievable (BATEA)	Yes	Yes	CGO currently implements BATEA, as described in the Noise management plan (NMP). BATEA will continue to be applied at CGO and has been applied where relevant in this assessment.
Best Management Practice (BMP)	Yes	Yes	CGO currently implements BMP, as described in the NMP. BMP will continue to be applied at CGO and has been applied where relevant in this assessment.
Noise suppression kit for D10 dozers	Yes	No	The noise suppression kit is expected to result in a 4 dB reduction to the overall dozer sound power level. This control option would reduce total site noise by 1 dB. Given the negligible reduction and the capital expenditure required to apply this control to all D10 dozers (six units), this option is not considered reasonable.
Restrict D10 dozers operation to 1st gear during the evening and night periods	Yes	No	This option is expected to result in a 4 dB reduction to D10 dozer noise emissions during the evening and night periods. This control option would reduce total site noise by 1 dB. Given the negligible reduction, this option is not considered reasonable.
Noise suppression kit for CAT 789 haul trucks	Yes	No	The noise suppression kit is expected to result in a 4 dB reduction to the overall CAT 789 haul trucks sound power level. This control option would reduce total site noise by 1 dB. Given the negligible reduction and the capital expenditure required to apply this control to the whole truck fleet (19 units), this option is not considered reasonable.
Restrict operation of D10 dozers and CAT 789 haul trucks to the day period only	Yes	No	This would render the Project unviable.
Restrict operation of D10 dozers and CAT 789 haul trucks to lower/shielded parts of the WRE areas during the evening and night periods	Yes	No	This control option would reduce total site noise by 1 dB. Given the negligible reduction, this option is not considered reasonable.
Attenuation to other plant/equipment	Yes	No	Several other noise sources were considered for attenuation (e.g. excavator, watercarts, scrapers etc). Although feasible, this would not significantly decrease total site noise.

Table 5.4 Consideration of possible feasible and reasonable mitigation options

Mitigation option	Feasible	Reasonable	Justification
Control the transmission of noise			
Noise bunds at the top of WRE areas (i.e. north and south of the site)	No	Yes	This is reasonable, however not feasible due to the continuing reduction in the WRE areas' size as they progressively rise in elevation.
Noise bunds in other high impact areas (e.g. new proposed pits to the north-east and south-east of the site)	Yes	No	This is feasible, however not reasonable as it would not provide additional noise reduction to total site noise. This is mainly due to proposed 6-m high LPB extending from the northern to southern pits and the location of plant and equipment within the pits, both of which will provide shielding to closest receivers.
Control noise at the receiver			
Mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity	Yes	Yes	This level of mitigation is feasible and reasonable for receivers where 'marginal' residual noise impact is predicted in accordance with NPfI definitions.
Architectural treatment including upgrading façade elements such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels	Yes	Yes	This level of mitigation is feasible and reasonable for receivers where 'moderate' and/or 'significant' residual noise impacts are predicted in accordance with NPfI definitions.
Voluntary land acquisition	Yes	Yes	Voluntary land acquisition rights is feasible and reasonable for receivers where 'significant' residual noise impact is predicted in accordance with NPfI or VLAMP definitions.

To address the predicted operational noise impacts outlined in the previous sections, an agreement will be negotiated between Evolution and the relevant stakeholders (DPE and landowners of privately-owned residential properties) where a 'marginal' residual noise impact (in accordance with NPfI definitions) has been predicted during the Project noting two of the residential properties already have either a noise agreement under the current NMP or are entitled to mitigation under the existing consent.

Additional mitigation measures including architectural treatment (façade elements upgrade) and/or provision of mechanical ventilation (to enable windows to be closed) will be provided to residences where residual impacts has been verified via attended noise monitoring. This approach is reasonable given the relatively conservative noise model established for the Project (refer to Section 4.1.2). These additional mitigation measures will be directed towards reducing potential noise impacts from the Project at the relevant residences.

In accordance with the VLAMP, voluntary land acquisition rights will be offered to the landowner of a privately-owned property where a 'significant' residual noise impact has been predicted during the Project noting that this landowner is already entitled to voluntary land acquisition under the existing development consent.

A summary of residual impacts from the Project is provided in the following section.

v Summary of residual noise impacts

As mentioned in Section 4.1.3, all reasonable and feasible mitigation controls were applied to the Project and predicted exceedances of PNTL are considered residual noise impact.

The findings of the operational noise modelling for the Project are as follows:

- Seven assessment locations (i.e. 22a, 22b, 24, 38, 49a, 62 and 89) where a negligible exceedance (1–2 dB) is predicted in accordance with the NPfI and VLAMP. Evolution currently has a noise agreement with the landowner of assessment location 38 which will continue.
- Five assessment locations (i.e. 15, 20, 22c, 36a and 49b) where a marginal exceedance (3–5 dB and below the RANL) is predicted in accordance with the NPfI and VLAMP. Evolution currently has a noise agreement with the landowner of assessment location 15 and the landowner of assessment location 22c currently holds existing noise mitigation rights; both will continue.
- One assessment location (i.e. 21) where a moderate exceedance (up to 8 dB and satisfies the RANL) is predicted in accordance with the NPfI. In accordance with the VLAMP, this predicted exceedance (>5 dB above PNTL during the night period) is considered to be significant, meaning that voluntary acquisition rights are triggered at this location. The landowner of this location currently holds land acquisition rights which will continue.

It is important to note that some of the predicted negligible exceedances of the PNTL discussed above would not exceed the site existing operational noise limits provided in the development consent or EPL. This is true for assessment locations 22a and 22c where future operational $L_{Aeq,15minute}$ noise levels are predicted to achieve the relevant existing limits. Furthermore, existing limits are higher than the evening and night PNTL at assessment locations 22a, 22c, 36a and 49b, and hence the predicted exceedances discussed above would be less when compared to existing limits at these locations.

vi Achievable noise limits

The noise predictions presented in Section 5.1.1 are levels that the Project can achieve. Noise predictions represent those from typical worst-case operations, which shows variations in predicted levels across residential assessment locations (i.e. residences). Noise limits for most residences will be the PNTLs, at others, where exceedances were predicted following implementation of feasible and reasonable mitigation measures will require worst-case predictions as noise limits.

Given the preceding, noise predictions in Table 5.1, Table 5.2 and Table 5.3 should be prescribed as approved noise limits where exceedances were predicted above the PNTLs.

5.1.2 Sleep disturbance

Maximum noise levels from future mining operations with the potential to cause sleep disturbance at nearby residences during the night period have been assessed in accordance with the NPfI.

Predicted future operational $L_{Aeq,15minute}$ night period noise levels were taken from Table 5.3 (worst-case prediction) and assessed against relevant sleep disturbance screening criteria.

Further, L_{Amax} noise from future night period mining operations during noise-enhancing meteorological conditions were predicted at residential assessment locations.

Maximum noise levels, for the assessment of sleep disturbance, from future mining operations for the night period during noise-enhancing meteorological conditions are provided in Table 5.5. An exceedance is shown in shaded font.

Table 5.5 Predicted night period worst-case noise levels at residential assessment locations, dB

Residential assessment location	Predicted levels		Screening criteria		Exceedances	
	$L_{Aeq,15minute}$ [1]	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}
4	31	<52	40	52	Nil	Nil
6	<30	<52	40	52	Nil	Nil
15[2]	40	<52	40	52	Nil	Nil
20	38	<52	40	52	Nil	Nil
21[3]	43	52	40	52	3	Nil
22a	36	<52	40	52	Nil	Nil
22b	36	<52	40	52	Nil	Nil
22c[4]	38	<52	40	52	Nil	Nil
22d	31	<52	40	52	Nil	Nil
24	37	<52	40	52	Nil	Nil
25	34	<52	40	52	Nil	Nil
28	<30	<52	40	52	Nil	Nil
30a	<30	<52	40	52	Nil	Nil
30b	<30	<52	40	52	Nil	Nil
31a	<30	<52	40	52	Nil	Nil
36a	40	<52	40	52	Nil	Nil
36b	32	<52	40	52	Nil	Nil
38[2]	36	<52	40	52	Nil	Nil
43a	33	<52	40	52	Nil	Nil
43b	<30	<52	40	52	Nil	Nil
49a	37	<52	40	52	Nil	Nil
49b	38	<52	40	52	Nil	Nil
56	<30	<52	40	52	Nil	Nil
57	<30	<52	40	52	Nil	Nil
61a	35	<52	40	52	Nil	Nil
62	36	<52	40	52	Nil	Nil
79	<30	<52	40	52	Nil	Nil
89	36	<52	40	52	Nil	Nil
90	32	<52	40	52	Nil	Nil
100	<30	<52	40	52	Nil	Nil

Table 5.5 Predicted night period worst-case noise levels at residential assessment locations, dB

Residential assessment location	Predicted levels		Screening criteria		Exceedances	
	$L_{Aeq,15minute}$ [1]	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}
122	30	<52	40	52	Nil	Nil
126	<30	<52	40	52	Nil	Nil

Notes: 1. Worst-case noise-enhancing meteorological conditions prediction during the night period taken from Table 5.3.

2. Evolution has a noise agreement in place with the landowner of this privately-owned property.

3. Subject to acquisition upon request in accordance with the development consent.

4. Subject to mitigation upon request in accordance with the development consent.

5. N/A = not applicable.

5. Night: 10:00 pm to 7:00 am Monday to Saturday, 10:00 pm to 8:00 am Sundays and public holidays.

Worst-case night period $L_{Aeq,15minute}$ are predicted to satisfy the relevant sleep disturbance screening criterion at most residential assessment locations during noise-enhancing meteorological conditions. The exception is at assessment location 21 where a 3 dB exceedance is predicted. Assessment location 21 is currently subject to acquisition upon request in accordance with the development consent. An analysis of feasible and reasonable noise mitigation measures undertaken for the Project is summarised in Section 5.1.1iv.

Noise modelling results show that night period L_{Amax} are predicted to satisfy the relevant sleep disturbance screening criterion at all residential assessment locations during noise-enhancing meteorological conditions.

5.1.3 Construction noise

Noise levels from LPB and UCDS construction activities were predicted for all assessment locations and combined with the relevant operational scenario.

It is noted that most activities associated with construction, especially those generally associated with higher noise emissions, will be undertaken during the day period. For completeness and as a conservative approach, all construction plant and equipment listed in Table 4.2 were modelled as operating concurrently and at full power. Noise predictions for construction presented in the following sections are therefore considered conservative.

i LPB construction

LPB construction was modelled in two different stages being the northern and southern sections (LPB north and LPB south respectively). Noise levels from LPB construction were predicted for noise-enhancing meteorological conditions (refer to Table 4.3) and combined with existing operations predictions for the relevant assessment periods.

The noise predictions for the LPB construction were assessed for the ICNG standard hours and OOH periods as outlined in Section 3.2.3.

a LPB construction during standard hours

Noise predictions for the LPB north and LPB south construction during standard hours are shown in Table 5.6. These are assessed against the standard hours NMLs.

Table 5.6 Predicted LPB construction noise levels during standard hours, $L_{Aeq,15minute}$ dB

Assessment location	Predicted levels[1]		Standard hours NMLs	Exceedances	
	LPB north	LPB south		LPB north	LPB south
4	33	32	45	Nil	Nil
6	29	29	45	Nil	Nil
15[2]	37	37	45	Nil	Nil
20	35	35	45	Nil	Nil
21[3]	42	42	45	Nil	Nil
22a	34	34	45	Nil	Nil
22b	34	34	45	Nil	Nil
22c[4]	35	35	45	Nil	Nil
22d	30	31	45	Nil	Nil
24	34	35	45	Nil	Nil
25	32	33	45	Nil	Nil
28	31	29	45	Nil	Nil
30a	30	29	45	Nil	Nil
30b	29	28	45	Nil	Nil
31a	29	30	45	Nil	Nil
36a	38	36	45	Nil	Nil
36b	31	31	45	Nil	Nil
38[2]	34	35	45	Nil	Nil
43a	34	33	45	Nil	Nil
43b	29	30	45	Nil	Nil
49a	34	35	45	Nil	Nil
49b	35	35	45	Nil	Nil
56	30	28	45	Nil	Nil
57	25	29	45	Nil	Nil
61a	34	34	45	Nil	Nil
62	37	36	45	Nil	Nil
79	25	23	45	Nil	Nil
89	32	36	45	Nil	Nil
90	30	35	45	Nil	Nil
100	27	28	45	Nil	Nil

Table 5.6 Predicted LPB construction noise levels during standard hours, $L_{Aeq,15minute}$ dB

Assessment location	Predicted levels[1]		Standard hours NMLs	Exceedances	
	LPB north	LPB south		LPB north	LPB south
122	31	30	45	Nil	Nil
126	26	26	45	Nil	Nil
LCR[5]	43	49	60	Nil	Nil
NO3[5]	40	36	N/A	Nil	Nil
N04[5]	51	44	N/A	Nil	Nil

Notes:
1. Combined modelled existing operational noise levels and predicted LPB construction noise levels.
2. Evolution has a noise agreement in place with the landowner of this privately-owned property.
3. Subject to acquisition upon request in accordance with the development consent.
4. Subject to mitigation upon request in accordance with the development consent.
5. Non-residential.
6. Standard hours: Monday to Friday 7:00 am to 6:00 pm; Saturday 8:00 am to 1:00 pm; no construction work on Sundays or public holidays.
7. N/A = not applicable.

Modelling results in Table 5.6 show that site noise levels during standard hours LPB construction (i.e. predicted LPB construction noise levels combined with existing operations noise predictions) and noise-enhancing meteorological conditions are less than the relevant NMLs at all assessment locations. Site noise levels are also predicted to be below the ICNG highly affected noise level (75 dB) at all assessment locations.

b LPB construction during OOH periods

Noise predictions for the LPB north and LPB south construction during the OOH periods are shown in Table 5.7. These are assessed against the OOH NMLs. Marginal and moderate exceedances are shown in shaded font.

Table 5.7 Predicted LPB construction noise levels during OOH periods, $L_{Aeq,15minute}$ dB

Assessment location	Predicted levels[1]						OOH NMLs			Exceedances					
	LPB north			LPB south						LPB north			LPB south		
	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH
4	33	33	34	32	32	32	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
6	29	29	30	29	28	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
15[2]	37	37	38	37	37	38	40	35	35	Nil	2	3	Nil	2	3
20	35	35	36	35	35	36	40	35	35	Nil	Nil	1	Nil	Nil	1
21[3]	42	40	41	42	40	41	40	35	35	2	5	6	2	5	6
22a	34	34	35	34	34	35	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
22b	34	34	35	34	34	35	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
22c[4]	35	35	36	35	35	35	40	35	35	Nil	Nil	1	Nil	Nil	Nil
22d	30	30	31	31	31	32	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
24	34	34	35	35	36	36	40	35	35	Nil	Nil	Nil	Nil	1	1
25	32	32	33	33	34	35	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
28	31	31	32	29	29	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
30a	30	30	31	29	29	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
30b	29	29	29	28	28	28	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
31a	29	29	30	30	30	30	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
36a	38	39	40	36	37	38	40	35	35	Nil	4	5	Nil	2	3
36b	31	31	32	31	31	31	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil

Table 5.7 Predicted LPB construction noise levels during OOH periods, $L_{Aeq,15minute}$ dB

Assessment location	Predicted levels[1]						OOH NMLs			Exceedances					
	LPB north			LPB south						LPB north			LPB south		
	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH
38[2]	34	35	36	35	35	36	40	35	35	Nil	Nil	1	Nil	Nil	1
43a	34	34	34	33	33	34	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
43b	29	29	29	30	29	30	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
49a	34	34	35	35	35	36	40	35	35	Nil	Nil	Nil	Nil	Nil	1
49b	35	35	36	35	36	37	40	35	35	Nil	Nil	1	Nil	1	2
56	30	30	30	28	28	28	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
57	25	25	27	29	28	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
61a	34	34	35	34	34	35	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
62	37	37	38	36	36	36	40	35	35	Nil	2	3	Nil	1	1
79	25	24	25	23	23	24	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
89	32	33	34	36	37	38	40	35	35	Nil	Nil	Nil	Nil	2	3
90	30	30	31	35	35	35	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
100	27	26	27	28	28	28	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
122	31	30	31	30	29	30	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
126	26	26	27	26	26	27	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
LCR[5]	43	44	46	49	50	52	60	60	60	Nil	Nil	Nil	Nil	Nil	Nil
NO3[5]	40	40	41	36	36	37	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5.7 Predicted LPB construction noise levels during OOH periods, $L_{Aeq,15minute}$ dB

Assessment location	Predicted levels[1]						OOH NMLs			Exceedances					
	LPB north			LPB south						LPB north			LPB south		
	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH
N04[5]	51	52	54	44	45	47	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
1. Combined modelled existing noise levels and predicted LPB construction noise levels.
2. Evolution has a noise agreement in place with the landowner of this privately-owned property.
3. Subject to acquisition upon request in accordance with the development consent.
4. Subject to mitigation upon request in accordance with the development consent.
5. Non-residential.
6. Day OOH: Saturday 7:00 am to 8:00 am and 1:00 pm to 6:00 pm; Sunday and public holiday 7:00 am to 6:00 pm.
7. Evening OOH: everyday 6:00 pm to 10:00 pm.
8. Night OOH: Monday to Saturday 10:00 pm to 7:00 am; Sunday and public holiday 10:00 pm to 8:00 am.
9. N/A = not applicable.

Results in Table 5.7 show that site noise levels during OOH LPB construction (i.e. predicted LPB construction noise levels combined with existing operations noise predictions) and noise-enhancing meteorological conditions would satisfy the OOH NMLs at most assessment locations. The exceptions are at:

- six assessment locations (i.e. 20, 22c, 24, 38, 49a and 49b) where a negligible 1 to 2 dB exceedance is predicted
- four assessment locations (i.e. 15, 36a, 62 and 89) where an exceedance of 3 to 5 dB is predicted
- one assessment location (i.e. 21) where an exceedance of up to 6 dB is predicted.

It is noted that most of the exceedances are associated with operations and not due to proposed construction activities. The exceptions are at assessment locations 36a, 62 and 89 where negligible 1 to 2 dB exceedances are predicted from proposed construction activities alone.

Evolution currently has a noise agreement with the landowner of assessment locations 15 and 38, and assessment location 21 is currently subject to acquisition upon request in accordance with the development consent, and hence there are no applicable noise limits for these locations. Feasible and reasonable noise mitigation measures for proposed construction works are discussed in Section 6.2.2.

ii UCDS construction

The UCDS construction was modelled in two stages being the northern and southern portions (UCDS north and UCDS south respectively). UCDS construction noise levels were predicted for noise-enhancing meteorological conditions (refer to Table 4.3) and combined with Year 2 operational noise predictions for the relevant assessment periods.

UCDS construction noise predictions were assessed for ICNG standard hours and OOH periods as outlined in Section 3.2.3.

a UCDS construction during standard hours

Noise predictions for UCDS north and south construction during standard hours are shown in Table 5.8. These are assessed against standard hours NMLs. A moderate exceedance is shown in shaded font.

Table 5.8 Predicted UCDS construction noise levels during standard hours, $L_{Aeq,15minute}$ dB

Assessment location	Predicted levels[1]		Standard hours NML	Exceedances	
	UCDS north	UCDS south		UCDS north	UCDS south
4	31	31	45	Nil	Nil
6	32	29	45	Nil	Nil
15[2]	42	38	45	Nil	Nil
20	42	36	45	Nil	Nil
21[3]	50	44	45	5	Nil
22a	39	37	45	Nil	Nil
22b	38	37	45	Nil	Nil
22c[4]	41	38	45	Nil	Nil
22d	34	34	45	Nil	Nil
24	36	38	45	Nil	Nil
25	33	35	45	Nil	Nil
28	29	26	45	Nil	Nil
30a	33	30	45	Nil	Nil
30b	31	29	45	Nil	Nil
31a	27	29	45	Nil	Nil
36a	39	37	45	Nil	Nil
36b	34	31	45	Nil	Nil
38[2]	34	35	45	Nil	Nil
43a	31	33	45	Nil	Nil
43b	27	28	45	Nil	Nil
49a	36	37	45	Nil	Nil
49b	36	38	45	Nil	Nil
56	26	27	45	Nil	Nil
57	27	29	45	Nil	Nil
61a	33	34	45	Nil	Nil
62	35	34	45	Nil	Nil
79	30	23	45	Nil	Nil
89	34	36	45	Nil	Nil
90	31	29	45	Nil	Nil
100	29	30	45	Nil	Nil

Table 5.8 Predicted UCDS construction noise levels during standard hours, $L_{Aeq,15minute}$ dB

Assessment location	Predicted levels[1]		Standard hours NML	Exceedances	
	UCDS north	UCDS south		UCDS north	UCDS south
122	33	26	45	Nil	Nil
126	32	34	45	Nil	Nil
LCR[5]	44	46	60	Nil	Nil
NO3[5]	37	46	N/A	N/A	N/A
N04[5]	47	37	N/A	N/A	N/A

Notes:
1. Combined modelled Year 2 noise levels and predicted UCDS construction noise levels.
2. Evolution has a noise agreement in place with the landowner of this privately-owned property.
3. Subject to acquisition upon request in accordance with the development consent.
4. Subject to mitigation upon request in accordance with the development consent.
5. Non-residential.
6. Standard hours: Monday to Friday 7:00 am to 6:00 pm; Saturday 8:00 am to 1:00 pm; no construction work on Sundays or public holidays.
7. N/A = not applicable.

Modelling results in Table 5.8 show that site noise levels during standard hours UCDS construction (i.e. predicted UCDS construction noise levels combined with Year 2 noise predictions) and noise-enhancing meteorological conditions are less than relevant NMLs at most assessment locations. The exception is at assessment location 21 where a 5 dB exceedance is predicted during UCDS north construction. It is noted that operational noise also contributes (1 dB) to this exceedance and it is not due to proposed construction activities alone. Site noise levels are predicted to be below the ICNG highly affected noise level ($L_{aeq,15minute}$ 75 dB) at all assessment locations.

Assessment location 21 is currently subject to acquisition upon request in accordance with the development consent. Feasible and reasonable noise mitigation measures for proposed construction works are discussed in Section 6.2.2.

b UCDS construction during OOH periods

Noise predictions for UCDS north and south construction during OOH periods are shown in Table 5.9. These are assessed against OOH NMLs. Marginal, moderate and significant exceedances are shown in shaded font.

Table 5.9 Predicted UCDS construction noise levels during OOH periods, $L_{aeq,15minute}$ dB

Assessment location	Predicted levels						OOH NMLs			Exceedances					
	UCDS north			UCDS south						UCDS north			UCDS south		
	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH
4	31	31	32	31	31	31	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
6	32	32	33	29	29	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
15[2]	42	43	45	38	39	41	40	35	35	2	8	10	Nil	4	6
20	42	42	43	36	37	39	40	35	35	2	7	8	Nil	2	4
21[3]	50	50	51	44	44	45	40	35	35	10	15	16	4	9	10
22a	39	39	40	37	38	39	40	35	35	Nil	4	5	Nil	3	4
22b	38	39	40	37	38	39	40	35	35	Nil	4	5	Nil	3	4
22c[4]	41	41	42	38	38	39	40	35	35	1	6	7	Nil	3	4
22d	34	35	36	34	34	35	40	35	35	Nil	Nil	1	Nil	Nil	Nil
24	36	37	38	38	38	39	40	35	35	Nil	2	3	Nil	3	4
25	33	34	35	35	36	37	40	35	35	Nil	Nil	Nil	Nil	1	2
28	29	29	29	26	26	26	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
30a	33	33	33	30	30	30	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
30b	31	30	31	29	29	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
31a	27	27	28	29	29	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
36a	39	40	41	37	39	40	40	35	35	Nil	5	6	Nil	4	5
36b	34	35	36	31	32	33	40	35	35	Nil	Nil	1	Nil	Nil	Nil

Table 5.9 Predicted UCDS construction noise levels during OOH periods, $L_{aeq,15minute}$ dB

Assessment location	Predicted levels						OOH NMLs			Exceedances					
	UCDS north			UCDS south						UCDS north			UCDS south		
	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH
38[2]	34	35	36	35	35	36	40	35	35	Nil	Nil	1	Nil	Nil	1
43a	31	32	32	33	33	34	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
43b	27	26	27	28	28	29	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
49a	36	37	38	37	38	39	40	35	35	Nil	2	3	Nil	3	4
49b	36	37	38	38	39	40	40	35	35	Nil	2	3	Nil	4	5
56	26	26	27	27	26	27	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
57	27	28	28	29	30	31	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
61a	33	34	35	34	35	36	40	35	35	Nil	Nil	Nil	Nil	Nil	1
62	35	35	36	34	34	35	40	35	35	Nil	Nil	1	Nil	Nil	Nil
79	30	30	31	23	23	24	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
89	34	35	36	36	37	38	40	35	35	Nil	Nil	1	Nil	2	3
90	31	31	32	29	30	30	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
100	29	29	29	30	30	31	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
122	33	33	34	26	26	28	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
126	32	32	32	34	34	35	40	35	35	Nil	Nil	Nil	Nil	Nil	Nil
LCR[5]	44	46	47	46	47	48	60	60	60	Nil	Nil	Nil	Nil	Nil	Nil
NO3[5]	37	38	39	46	47	49	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5.9 Predicted UCDS construction noise levels during OOH periods, $L_{aeq,15minute}$ dB

Assessment location	Predicted levels						OOH NMLs			Exceedances					
	UCDS north			UCDS south						UCDS north			UCDS south		
	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH	Day OOH	Evening OOH	Night OOH
N04[5]	47	48	50	37	37	38	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
1. Combined modelled Year 2 noise levels and predicted UCDS construction noise levels.
2. Evolution has a noise agreement in place with the landowner of this privately-owned property.
3. Subject to acquisition upon request in accordance with the development consent.
4. Subject to mitigation upon request in accordance with the development consent.
5. Non-residential.
6. Day OOH: Saturday 7:00 am to 8:00 am and 1:00 pm to 6:00 pm; Sunday and public holiday 7:00 am to 6:00 pm.
7. Evening OOH: everyday 6:00 pm to 10:00 pm.
8. Night OOH: Monday to Saturday 10:00 pm to 7:00 am; Sunday and public holiday 10:00 pm to 8:00 am.
9. N/A = not applicable.

Modelling results in Table 5.9 show that site noise levels during OOH UCDS construction (i.e. predicted UCDS construction noise levels combined with Year 2 noise predictions) and noise-enhancing meteorological conditions would satisfy the OOH NMLs at most assessment locations. The exceptions are at:

- six assessment locations (i.e. 22d, 25, 36b, 38, 61a and 62) where a negligible 1 to 2 dB exceedance is predicted
- six assessment locations (i.e. 22a, 22b, 24, 49a, 49b and 89) where an exceedance of 3 to 5 dB is predicted
- five assessment locations (i.e. 15, 20, 21, 22c and 36a) where an exceedances of more than 5 dB is predicted.

It is noted that some of the exceedances are associated with operations and not due to proposed construction activities alone.

Evolution currently has a noise agreement with the landowner of assessment locations 15 and 38, assessment location 22c is currently subject to mitigation upon request and assessment location 21 is currently subject to acquisition upon request in accordance with the development consent. Feasible and reasonable noise mitigation measures for proposed construction works are discussed in Section 6.2.2.

iii Concurrent construction

As noted in Section 4.1.4, it is likely that the UCDS North stage 1 (north-eastern section) will occur concurrently with parts of the LPB North construction and that UCDS stage 1 (south-eastern section) will occur concurrently with LPB South construction. Plant and equipment (quantity and type) listed for either the UCDS or LPB construction as shown in Table 4.2 will be the used (shared) between the UCDS North and South stage 1 and LPB North and South construction respectively. Therefore, noise levels from the combined UCDS North stage 1 and LPB North construction and UCDS South stage 1 and LPB South construction are expected to be comparable to those presented in either Section 5.1.2.i or Section 5.1.2.ii.

5.2 Blasting results

Calculations of ground vibration and overpressure levels from blasting were conducted using site law equations developed based on measured data. The nearest residence to blasting associated with the Project is approximately 5 km distant. Typical MICs associated with blasting at the mine are in the order of 400 to 600 kg with maximum MICs up to approximately 1,500 kg.

Graphs of predicted blast emissions versus distance from the blast, based on the site law equations provided in Section 4.3.2 and Section 4.3.3, are provided in Figure 5.1 and Figure 5.2 for vibration and overpressure, respectively.

Based on the vibration site law, it is predicted that day, evening and night period vibration criteria would be achieved based on maintaining current blast practices including the typical range of MICs used at the site.

Based on the overpressure site law, it is predicted that the day criterion would be achieved based on maintaining current blast practices including the typical range of MICs used at the site. The evening and night overpressure criteria are predicted to be exceeded at the nearest residential locations based on current blast practices. It is recommended that blasting continues to be conducted during the day period only or blast practices (e.g. MIC) be modified accordingly to reduce blast emissions.

Assuming blasting continues to be conducted during the day period only and maintaining the current approach to blast design and blast emission management, it is anticipated that the blasting emission limits will continue to be met throughout the life of the Project.

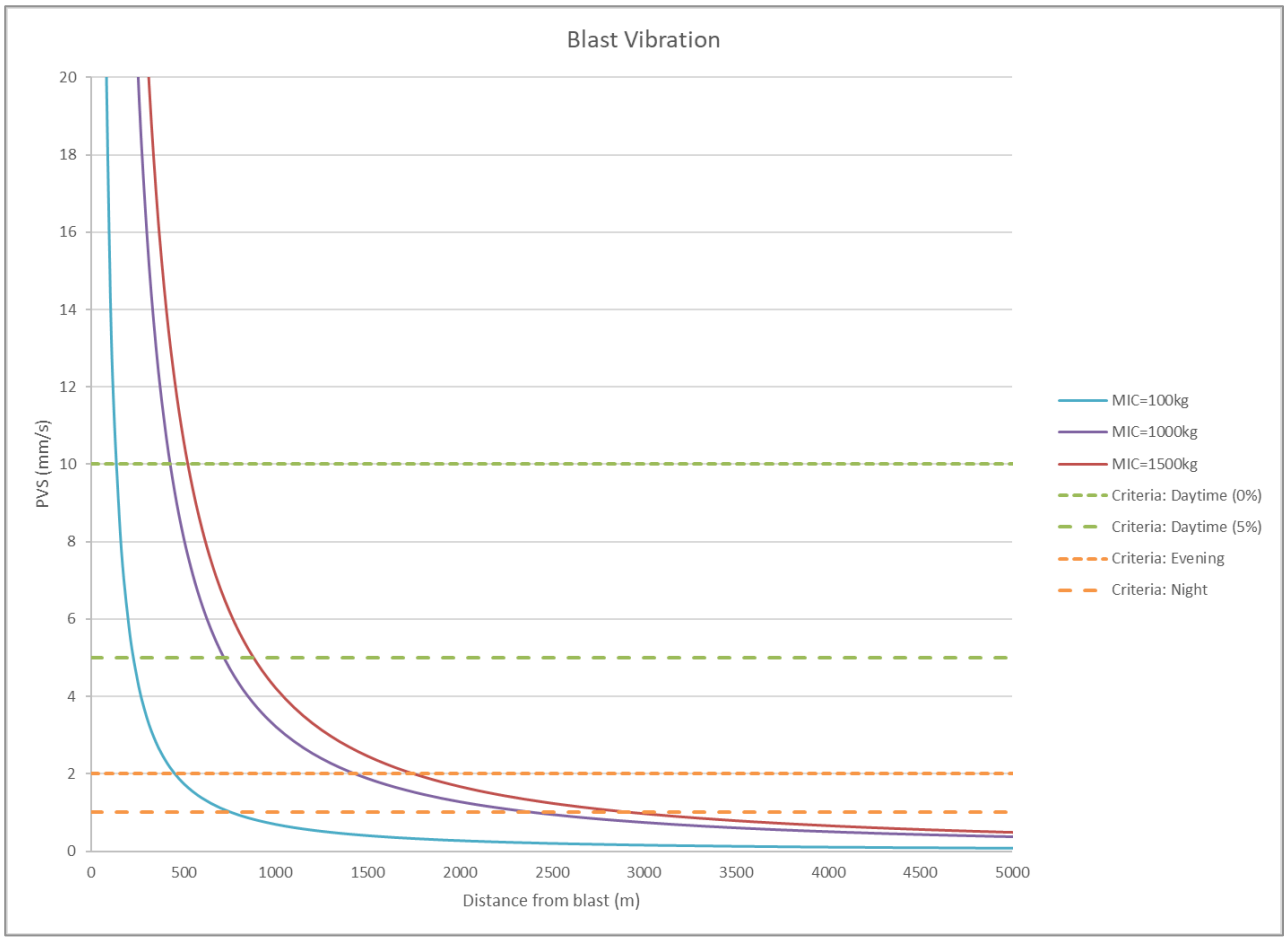

Figure 5.1 Blast vibration predictions

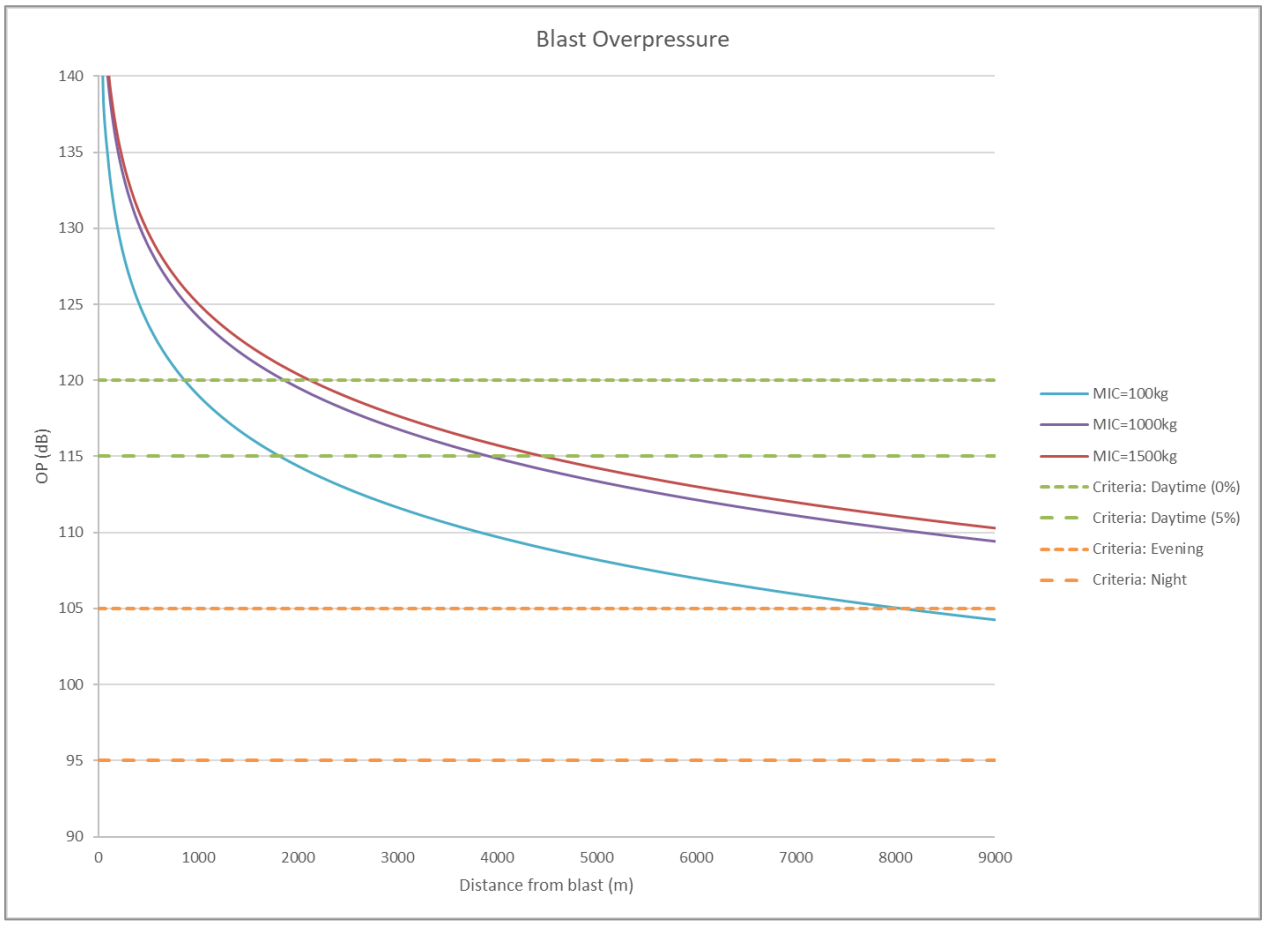

Figure 5.2 Blast overpressure predictions

5.3 Noise and vibration at waterbird breeding areas

5.3.1 Operational noise

For the waterbird breeding areas (assessment locations N03 and N04), the results show that day period Project noise levels are predicted to be between $L_{Aeq,15minute}$ <35 and 48 dB. During the evening period, noise levels are predicted to be between $L_{Aeq,15minute}$ 36 and 50 dB. During the night period, noise levels are predicted to be between $L_{Aeq,15minute}$ 36 and 52 dB.

Maximum instantaneous L_{Amax} levels were also predicted for this assessment for waterbird breeding areas. During operations, these are predicted to be lower than the $L_{Aeq,15minute}$ presented above (i.e. <52 dB).

Noise and bird behaviour monitoring is currently undertaken at the waterbird breeding areas to observe change in behaviour of birds in the area. This monitoring has not found any noticeable bird behaviour change due to CGO noise emissions. The bird behaviour monitoring is expected to continue during the Project in accordance with the CGO Flora and Fauna Management Plan. Potential noise and vibration impacts during the operation of the Project on waterbirds have been assessed in the Biodiversity Development Assessment Report (BDAR) (EMM 2023c, Appendix J of the EIS).

5.3.2 Construction noise

For the waterbird breeding areas (assessment locations N03 and N04), modelling results show that Project construction noise levels during standard hours and OOH LPB construction are predicted up to $L_{Aeq,15minute}$ 51 and 54 dB respectively. During standard hours and OOH UCDS construction, the modelling results show that site noise levels are predicted up to $L_{Aeq,15minute}$ 47 and 50 dB respectively.

Maximum instantaneous L_{Amax} levels were also predicted for this assessment for waterbird breeding areas. During construction, these are predicted to be lower than the $L_{Aeq,15minute}$ presented above (i.e. <54 dB).

Noise and bird behaviour monitoring is currently undertaken at CGO to monitor change in behaviour of birds in the area. The bird behaviour monitoring did not find any noticeable change in the behaviour of birds due to CGO noise or blast emissions. The bird behaviour monitoring is expected to continue during the Project in accordance with the CGO Flora and Fauna Management Plan. Potential noise and vibration impacts during the operation of the Project on waterbirds have been assessed in the Biodiversity Development Assessment Report (BDAR) (EMM 2023c, Appendix J of the EIS).

5.3.3 Blasting

Bird behaviour monitoring is currently undertaken at CGO to monitor change in behaviour of birds in the area. The bird behaviour monitoring has not found any noticeable change in the behaviour of birds due to CGO blast emissions. This monitoring is expected to continue during the Project in accordance with the CGO Flora and Fauna Management Plan.

Bird behaviour monitoring is currently undertaken at CGO to monitor change in behaviour of birds in the area. The bird behaviour monitoring has not found any noticeable change in the behaviour of birds due to CGO blast emissions. This monitoring is expected to continue during the Project in accordance with the CGO Flora and Fauna Management Plan.

Potential impacts from blasting at the waterbird bird breeding areas (assessment locations N03 and N04) has been considered in the BDAR (Appendix J of the EIS).

5.4 Road traffic noise

This traffic volume increase would result in an increase of road traffic noise levels during the peak hours of approximately 1 dB. Road traffic noise criteria are averaged over day (15 hour) or night (9 hour) periods. Hence, the increase in total average road noise levels during each period would be negligible.

Based on the relatively low additional and total traffic volumes and duration of the proposed construction activities, it is anticipated that noise from additional traffic movements will be negligible and therefore unlikely to cause an impact during construction.

6 Management measures

6.1 Management plans

Noise and vibration emissions will continue to be managed in accordance with the approved NMP (Evolution Mining 2022) and BMP (Evolution Mining 2022). Evolution will continue to implement the management measures outlined below.

- Quarterly attended noise monitoring will continue to be conducted at the following monitoring locations:
  - N09 – “Lakeview III” residence
  - N10 – “Bramboyne” residence
  - N11 – “Laurel Park” residence
  - N12 – “The Glen” residence
  - N15 – “Caloola II” residence
  - N16 – “Foxham Downs II” residence
  - N17 – “Lakeview” and “Lakeview II” residences.
- Waterbird behaviour and breeding activity will continue to be monitored during bird breeding periods by a suitably qualified person during operational activities in accordance with the CGO’s Flora and Fauna Management plan.
- Best management practice will continue to be implemented where necessary to reduce CGO noise emissions, and will include, as far as practicable, the following measures:
  - Restricting movement of trucks on ridgelines and exposed haul routes where their noise can propagate over a wide area, especially at night. This means restricting evening and night period movement of material to areas shielded by barriers or mounds and reserving large-scale material movement for the day period. The expanded LPB will provide some shielding, thereby reducing the potential for noise to propagate from the open-cut pits across Lake Cowal.
  - Scheduling the use of any noisy equipment to the day period.
  - Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area, or orienting the equipment so that emissions are directed away from any sensitive areas, to achieve maximum attenuation.
  - Where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently.
  - Keeping equipment well maintained.
  - Employing ‘quiet’ practices when operating equipment (e.g. positioning idling trucks in appropriate areas).
  - Educating staff on the effects of noise and the use of quiet work practices.

- Specify maximum sound power levels when purchasing equipment or include in tender documents and contracts.

- Independent Environmental Audits and Annual Reviews will continue to be conducted.
- A complaints register will continue to be maintained, with a dedicated Community Complaints Line (via telephone or via email) that will be available 24 hours, seven days a week for community members who have enquiries or to lodge complaints.

Where required, the NMP and the BMP will be updated following determination of the Project.

6.2 Noise mitigation

6.2.1 Operational noise

Noise controls and management strategies considered feasible and reasonable described in Section 5.1.1iv were included in operational noise modelling for the purpose of assessing Project noise emissions.

Evolution is committed to implement additional mitigation measures including architectural treatment (façade elements upgrade) and/or provision of mechanical ventilation (to enable windows to be closed) to residences where marginal or moderate residual impacts are identified via attended noise monitoring undertaken during the compliance noise monitoring program (refer to Section 5.1.1iv).

6.2.2 Construction noise

i Overview

The ICNG requires that construction noise levels be assessed against NMLs. Construction noise levels have been predicted above NMLs at several locations outside the ICNG standard hours (i.e. OOH), however, no exceedances were predicted for standard hours. It is not uncommon for construction activities to exceed NMLs. For this reason, they are not considered as noise criteria, but as a trigger for all feasible and reasonable noise mitigation and management to be considered, if exceeded.

It was noted that operational noise levels also contributed to OOH exceedances of the NMLs presented in this assessment, they are not due to proposed construction activities alone. There is limited opportunity to reduce these exceedances when they are contributed to by both construction and proposed operations.

Furthermore, most construction activities, especially those with higher noise emissions, will be undertaken during the day period. Therefore, noise from evening and night period construction will likely be less than presented in this assessment.

Notwithstanding, noise management measures that could be implemented on the Project are provided in the following sections.

ii Work practices

Work practice methods include:

- regular reinforcement (such as at toolbox talks) of the need to minimise noise
- review and implementation of feasible and reasonable mitigation measures to reduce noise
- avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby residents

- where possible, avoid the use of equipment that generates impulsive noise
- notify potentially affected residents prior to the commencement of construction works.

iii Plant and equipment

Additional measures for plant and equipment include:

- where possible, choose quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks
- operate plant and equipment in the quietest and most efficient manner
- regularly inspect and maintain plant and equipment to minimise noise level increases, to ensure that all noise attenuation devices are operating effectively.

7 Conclusion

EMM completed a noise and vibration impact assessment for the proposed Cowal Gold Operations Open-pit Continuation Project. The assessment considered potential impacts from noise and vibration from the Project and has been prepared in accordance with methodologies outlined in the NPfI, VLAMP, ICNG and RNP, as well as other relevant guidelines and standards.

Noise levels for operation and construction of the Project have been established based on ambient levels and methods provided in the NPfI and ICNG.

Operational and construction activities were modelled at all assessment locations for noise-enhancing meteorological conditions. Modelled operational activities included the proposed continuation of open-pit mining operations and underground operations. Modelled construction activities represent the LPB and UCDS construction.

Findings of the noise assessment are summarised as follows:

- Future operational noise levels were assessed against the NPfI PNTLs for the day, evening and night periods during noise-enhancing meteorological conditions:
  - Future operational noise levels for the day period are predicted to satisfy the relevant PNTL at most assessment locations. The exception is at one assessment location where a negligible exceedance is predicted.
  - Future operational noise levels for the evening period are predicted to satisfy the relevant PNTL at most assessment locations. The exceptions are at:
    - six assessment locations where a negligible exceedance is predicted
    - two assessment locations where a marginal exceedance is predicted
    - one assessment location where a moderate exceedance is predicted.
  - Future operational noise levels for the night period are predicted to satisfy the relevant PNTL at most assessment locations. The exceptions are at:
    - seven assessment locations where a negligible exceedance is predicted
    - five assessment locations where a marginal exceedance is predicted
    - one assessment location where a significant exceedance in accordance with the VLAMP is predicted.
  - When compared to existing operational noise limits, some of the exceedances predicted for future evening and night operations, as summarised above, would be less or non-existent for four of these assessment locations.
- Noise levels during LPB and UCDS construction (combined with the relevant operational scenario) were assessed against the ICNG NMLs for standard hours and out-of-hours periods during noise-enhancing meteorological conditions:
  - Site noise levels during standard hours LPB construction will be less than the relevant NMLs at all assessment locations.

- Site noise levels during OOH LPB construction would satisfy the relevant NMLs at most assessment locations. The exceptions are at:
    - six assessment locations where a negligible exceedance is predicted
    - four assessment locations where an exceedance of 3 to 5 dB is predicted
    - one assessment location where an exceedance of up to 6 dB is predicted
    - most of the exceedances are associated with operations and not due to proposed construction activities alone.
- Site noise levels during standard hours UCDS construction will be less than relevant NMLs at most assessment locations. The exception is at one assessment location where a 5 dB exceedance is predicted. Operational noise also contributes to this exceedance and it is not due to proposed construction activities alone.
- Site noise levels during OOH UCDS construction will satisfy the relevant NMLs at most assessment locations. The exceptions are at:
    - six assessment locations where a negligible is predicted
    - six assessment locations where an exceedance of 3 to 5 dB is predicted
    - five assessment locations where an exceedances of more than 5 dB is predicted
    - some of the exceedances are associated with operations and not due to proposed construction activities alone.

- Noise management measures will be implemented on the Project during operation and construction.
- The sleep disturbance assessment showed worst-case $L_{Aeq,15minute}$ and L_{Amax} noise levels should satisfy relevant screening criteria at all residential assessment locations.
- The Project will result in additional road traffic movements during construction, however, the overall increase in road traffic noise at nearest residential facades is predicted to satisfy relevant RNP criteria during both the day and night periods.

A blasting assessment was completed for the proposed continuation of open-pit mining operations. By maintaining the current approach to blast design and blast emission management, it is anticipated that the blasting emission limits will continue to be met throughout the life of the Project.

References

Australian and New Zealand Environment Conservation Council (ANZECC) 1990, *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*.

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British Standard BS 6472-2008 “Evaluation of human exposure to vibration in buildings (1-80Hz)”.

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EMM 2023c, *CGO Open Pit Continuation Project Biodiversity Development Assessment Report,* prepared by EMM Consulting Pty Limited for Evolution Mining (Cowal) Pty Limited.

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NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry*.

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NSW Department of Environment Climate Change and Water (DECCW) 2011, *Road Noise Policy*.

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NSW Department of Environment and Climate Change (DECC) 2009, *The Interim Construction Noise Guideline*.

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Attachment A

Glossary of acoustic terms

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A.1 Glossary of acoustics terms and abbreviations

Several technical terms are required for the discussion of acoustics. Acoustic terms and abbreviations used in this report are explained in Table A.1.

Table A.1 Glossary of acoustic terms and abbreviations

Term	Description
ABL	The assessment background level (ABL) is defined in the NPfI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{A90} statistical noise levels or the measured L_{A90} statistical noise level for each entire monitoring period.
AGL	Above ground level
Amenity noise level (ANL)	The amenity noise levels relate to the overall level of industrial noise subject to land zoning or use.
ANZECC	Australian and New Zealand Environment Conservation Council
A-weighting	There are several different weightings utilised for describing noise, the most common being the 'A-weighting'. This attempts to closely approximate the frequency response of the human ear.
BMP	Blast Management Plan
Day period	Monday – Saturday: 7:00 am to 6:00 pm, on Sundays and public holidays: 8:00 am to 6:00 pm.
dB	Noise is measured in the unit called the decibel (dB).
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	NSW Department of Environment, Climate Change and Water
DPE	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Limited
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental and Planning Assessment Act 1979* (NSW)
Evening period	Monday – Saturday: 6:00 pm to 10:00 pm, on Sundays and public holidays: 6:00 pm to 10:00 pm.
Evolution	Evolution Mining (Cowal) Pty Limited
ICNG	NSW Interim Construction Noise Guideline (DECC 2009)
INP	NSW Industrial Noise Policy (EPA 2000) (superseded)
Intrusiveness noise level	The intrusiveness noise level refers to noise that intrudes above the background level by more than 5 dB. The intrusiveness noise level is described in detail in this report.
IWL	Integrated waste landform
$L_{A1,1minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level exceeded for 10% of the time.

Table A.1 Glossary of acoustic terms and abbreviations

Term	Description
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15min}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
$L_{Aeq,period}$	This descriptor refers to an L_{Aeq} noise level measured over an entire assessment period (day, evening or night period) and is considered equivalent to the $L_{Aeq,15minute}$ minus 3 dB.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
MIC	Maximum instantaneous charge
Night period	Monday – Saturday: 10:00 pm to 7:00 am, on Sundays and public holidays: 10:00 pm to 8:00 am.
NML	Noise management level (in accordance with the ICNG)
NMP	Noise Management Plan
NPfI	NSW Noise Policy for Industry (EPA 2017)
NVIA	Noise and vibration impact assessment
PNTL	The project noise trigger levels (PNTLs) are targets for a particular industrial noise source or industry. The PNTLs are the lower of either the project intrusive noise level or project amenity noise level.
PPV	Peak particle velocity
RBL	The Rating Background Level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period.
RNP	NSW Road Noise Policy (DECCW 2011)
SEARs	Secretary's environmental assessment requirements
Sound power level (L_W)	This is a measure of the total power radiated by a source. The sound power level of a source is a fundamental property of the source and is independent of the surrounding environment.
Standard hours	ICNG recommended standard hours for construction include Monday to Friday 7:00 am to 6:00 pm, Saturday 8:00 am to 1:00 pm, no work on Sundays or public holidays.
SSD	State significant development
Temperature inversion	A positive atmospheric temperature gradient where atmospheric temperature increases with altitude.
WRE	Waste rock emplacement

It is useful to have an appreciation of the decibel (dB), the unit of noise measurement. Table A.2 gives an indication as to how an average person perceives changes of noise level.

Table A.2 Perceived change in noise in the environment

Change in sound pressure level (dB)	Perceived change in noise
1–2	typically indiscernible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

Examples of common noise levels are provided in Figure A.1.

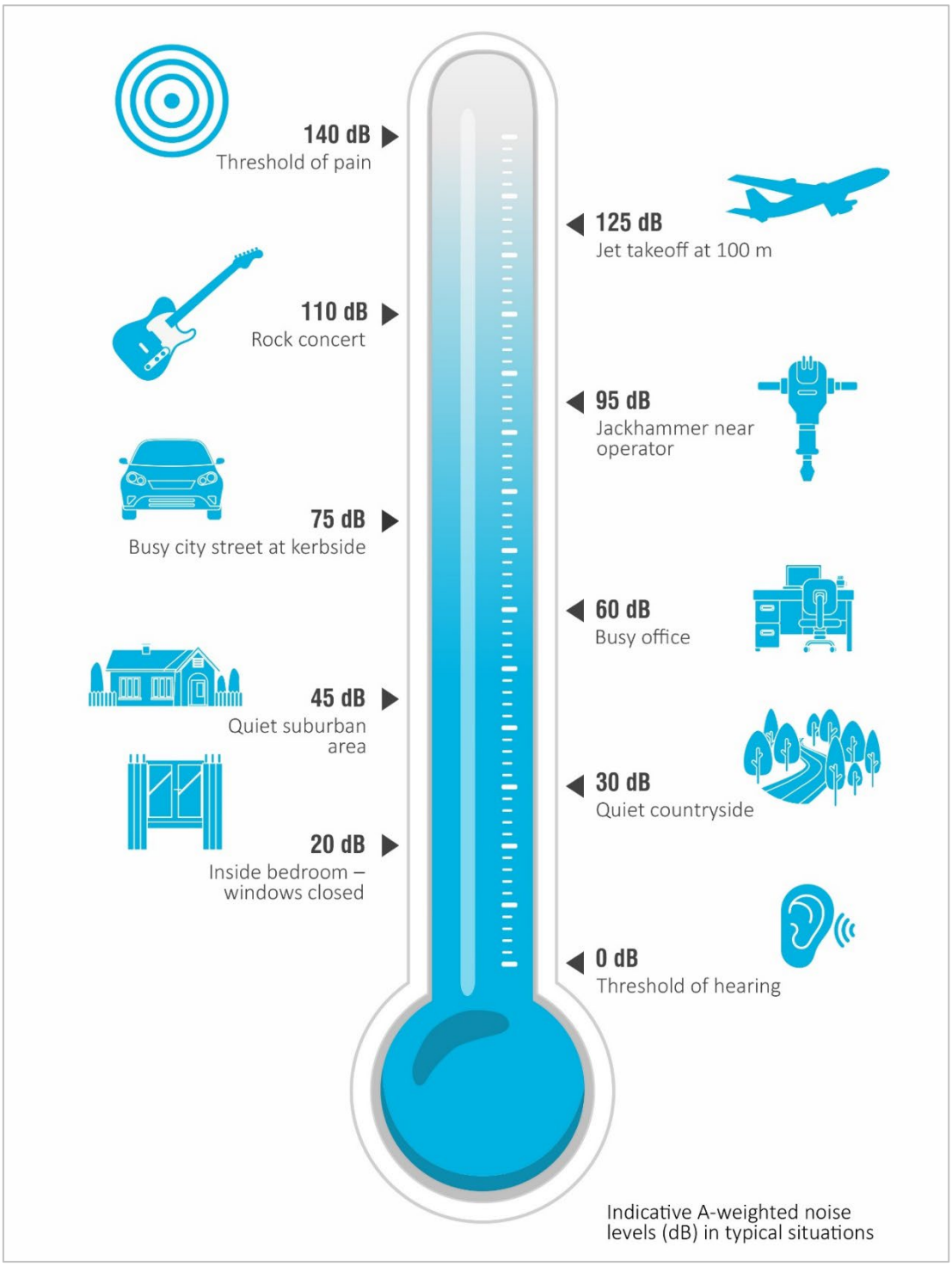

Figure A.1 **Common noise levels**

Attachment B

Unattended noise monitoring data

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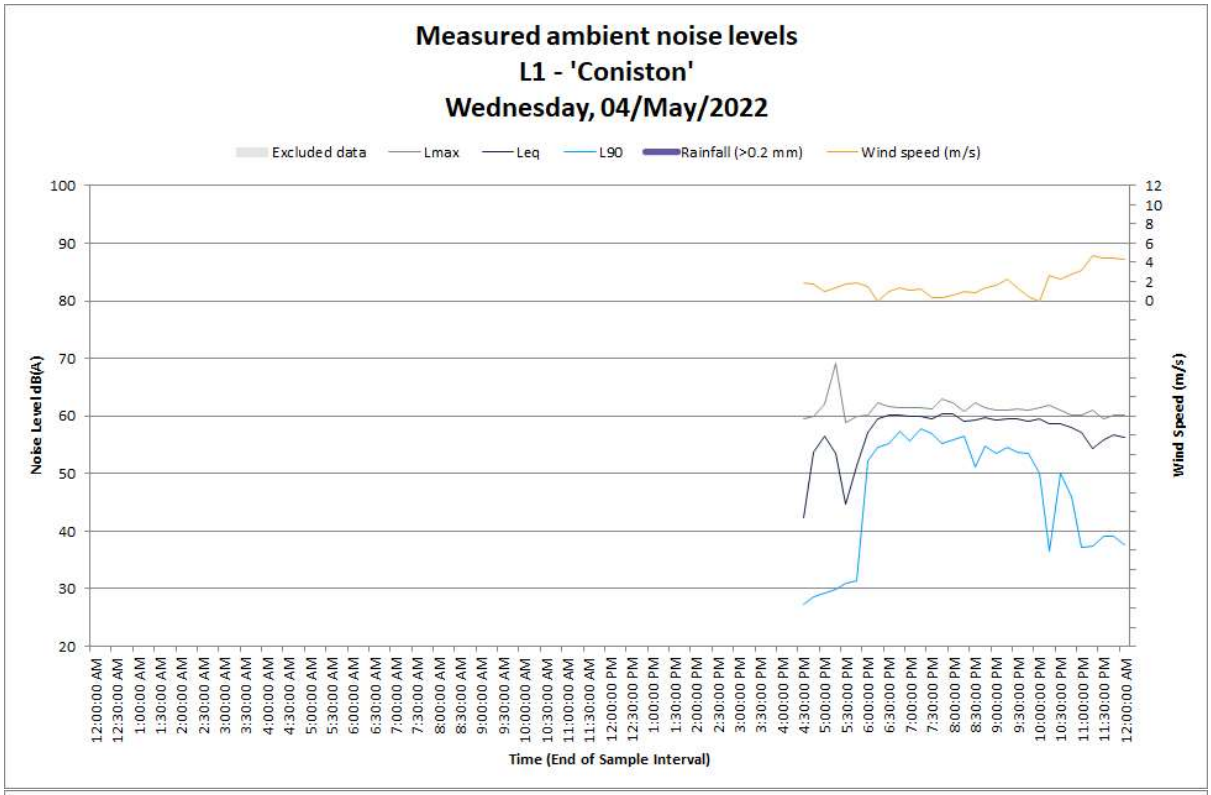
Table B.1 Unattended noise monitoring results – L1 'Coniston' (1a)

Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11hour}$ Day	$L_{Aeq,4hour}$ Evening	$L_{Aeq,9hour}$ Night
Wednesday, 04.05.22	0	0	32	0	0	54
Thursday, 05.05.22	27	30	28	51	39	43
Friday, 06.05.22	24	25	22	48	36	34
Saturday, 07.05.22	0	26	25	0	33	40
Sunday, 08.05.22	25	28	28	45	33	38
Monday, 09.05.22	26	27	27	48	37	37
Tuesday, 10.05.22	28	39	27	49	54	46
Wednesday, 11.05.22	26	0	0	51	0	0
Thursday, 12.05.22	0	37	42	0	42	46
Friday, 13.05.22	35	46	45	46	50	51
Saturday, 14.05.22	27	46	33	45	51	43
Sunday, 15.05.22	24	42	31	42	46	44
Monday, 16.05.22	26	33	30	43	38	39
Tuesday, 17.05.22	25	26	28	42	33	36
Wednesday, 18.05.22	0	28	29	0	32	37
Summary values	**26**	**30**	**29**	**47**	**47**	**46**

Notes: 1. "0" indicates periods with too few valid samples due to weather or logger operation.


Measured ambient noise levels
L1 - 'Coniston'
Wednesday, 04/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)

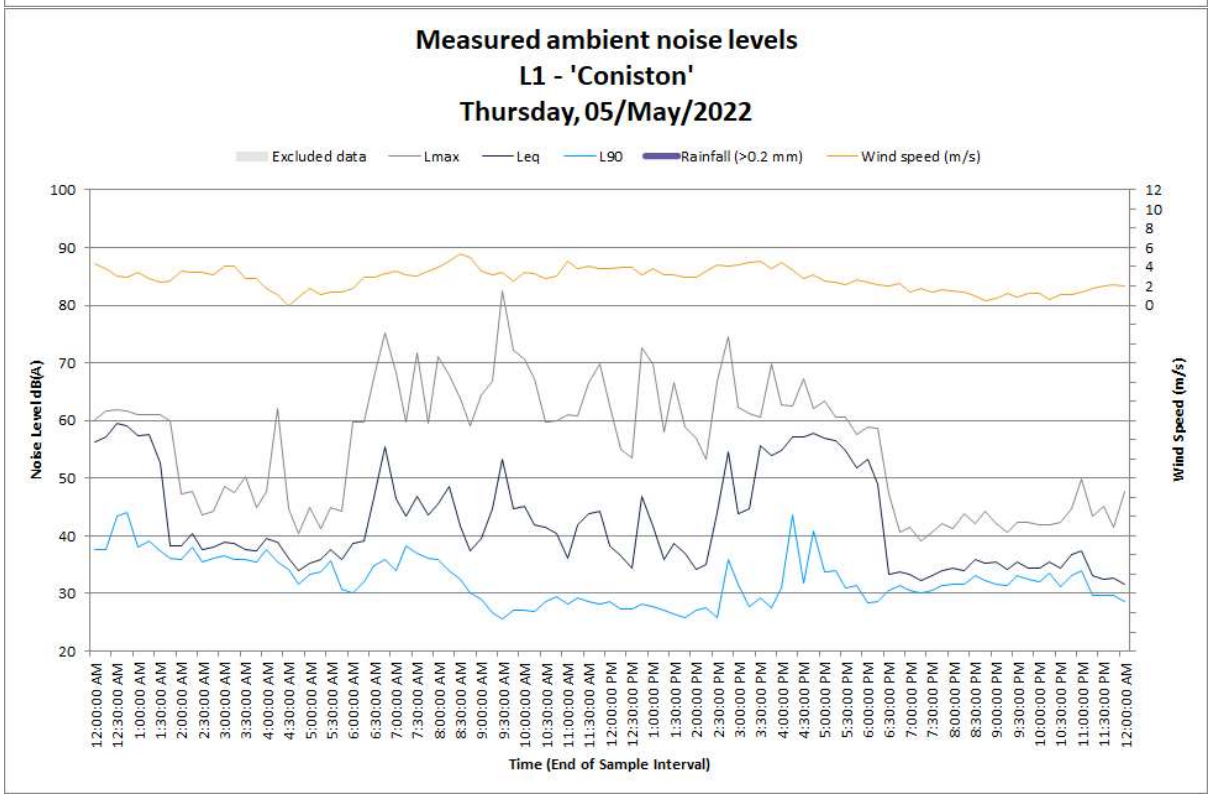
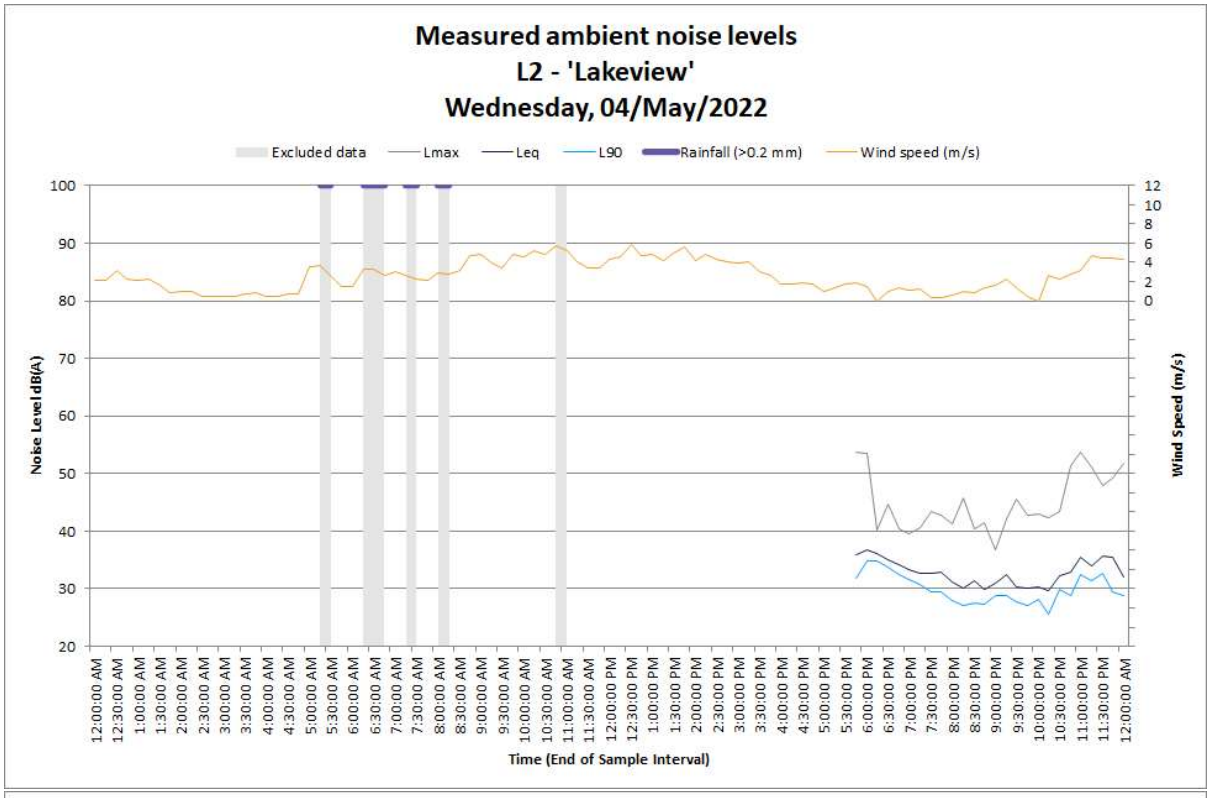

Measured ambient noise levels
L1 - 'Coniston'
Thursday, 05/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)

Table B.2 Unattended noise monitoring results – L2 'Lakeview' (22a)

Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11hour}$ Day	$L_{Aeq,4hour}$ Evening	$L_{Aeq,9hour}$ Night
Wednesday, 04.05.22	0	27	20	0	33	37
Thursday, 05.05.22	25	20	19	42	31	36
Friday, 06.05.22	26	22	18	57	41	34
Saturday, 07.05.22	0	21	20	0	50	33
Sunday, 08.05.22	28	28	25	51	41	37
Monday, 09.05.22	32	26	27	48	35	36
Tuesday, 10.05.22	31	39	32	48	49	43
Wednesday, 11.05.22	32	0	0	46	0	0
Thursday, 12.05.22	0	33	32	0	46	45
Friday, 13.05.22	26	42	35	45	48	47
Saturday, 14.05.22	28	38	28	47	44	42
Sunday, 15.05.22	25	33	23	46	38	36
Monday, 16.05.22	28	32	25	46	45	46
Tuesday, 17.05.22	29	27	21	52	42	37
Wednesday, 18.05.22	0	22	22	0	37	40
Thursday, 19.05.22	25	27	30	53	33	36
Friday, 20.05.22	31	30	29	46	34	38
Saturday, 21.05.22	33	29	27	48	41	36
Sunday, 22.05.22	30	29	29	45	38	37
Monday, 23.05.22	30	28	28	46	35	40
Tuesday, 24.05.22	31	27	25	46	39	36
Summary values	**29**	**28**	**26**	**49**	**43**	**41**

Notes: 1. "0" indicates periods with too few valid samples due to weather or logger operation.


Measured ambient noise levels
L2 - 'Lakeview'
Wednesday, 04/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)

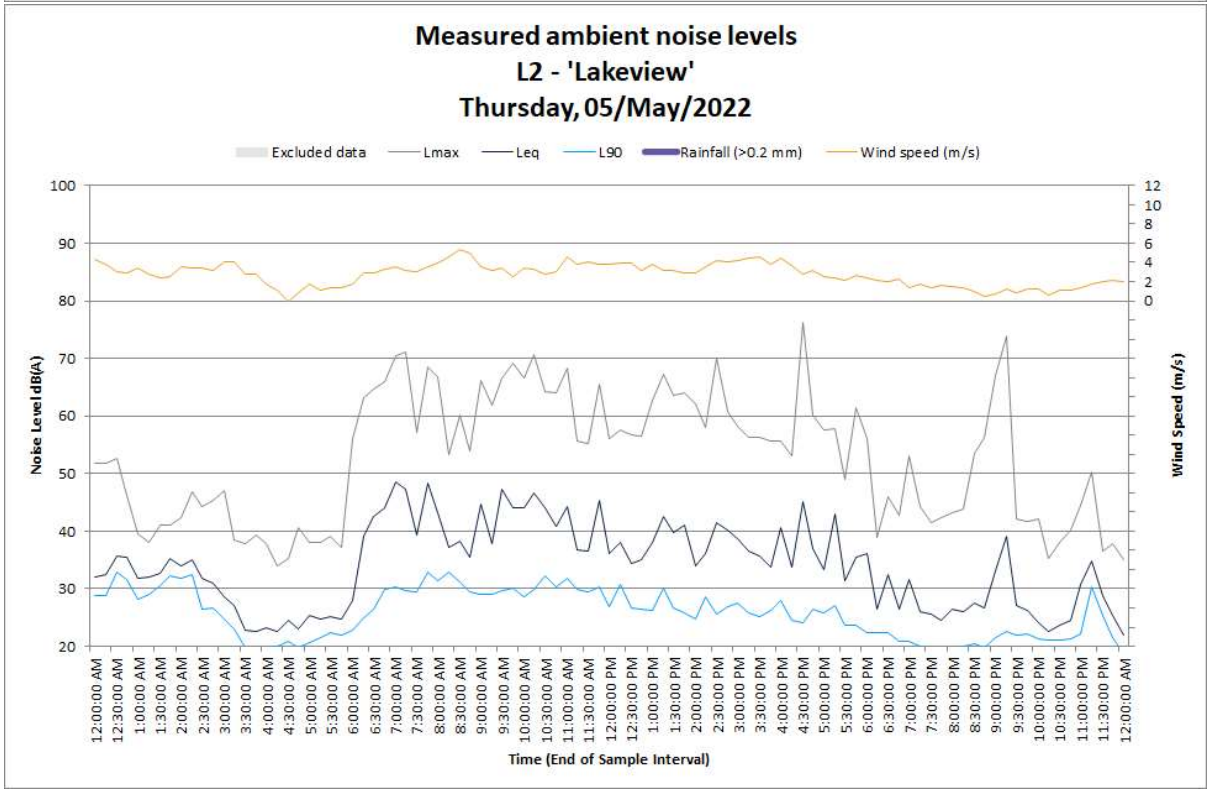
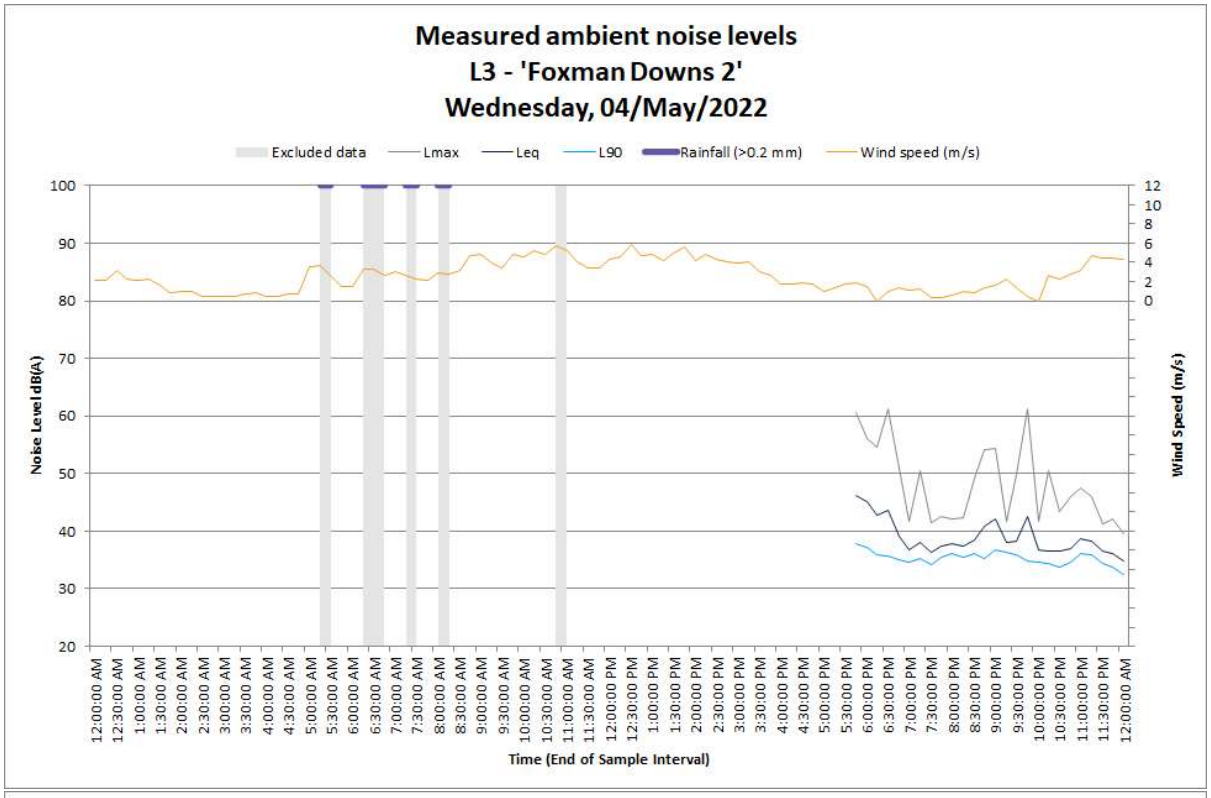

Measured ambient noise levels
L2 - 'Lakeview'
Thursday, 05/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)

Table B.3 Unattended noise monitoring results – L3 'Foxman Downs 2' (49b)

Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11hour}$ Day	$L_{Aeq,4hour}$ Evening	$L_{Aeq,9hour}$ Night
Wednesday, 04.05.22	0	35	25	0	40	42
Thursday, 05.05.22	30	27	23	48	36	42
Friday, 06.05.22	29	19	18	48	39	42
Saturday, 07.05.22	0	19	18	0	38	40
Sunday, 08.05.22	28	19	21	47	37	42
Monday, 09.05.22	29	25	26	46	37	43
Tuesday, 10.05.22	34	36	28	50	45	40
Wednesday, 11.05.22	34	0	0	47	0	0
Thursday, 12.05.22	0	29	29	0	36	38
Friday, 13.05.22	29	36	34	55	39	44
Saturday, 14.05.22	29	37	32	49	41	40
Sunday, 15.05.22	29	35	23	46	42	43
Monday, 16.05.22	31	29	23	48	40	42
Tuesday, 17.05.22	29	21	19	49	39	41
Wednesday, 18.05.22	0	22	20	0	36	42
Summary values	**29**	**28**	**23**	**49**	**40**	**42**

Notes: 1. "0" indicates periods with too few valid samples due to weather or logger operation.


Measured ambient noise levels
L3 - 'Foxman Downs 2'
Wednesday, 04/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)

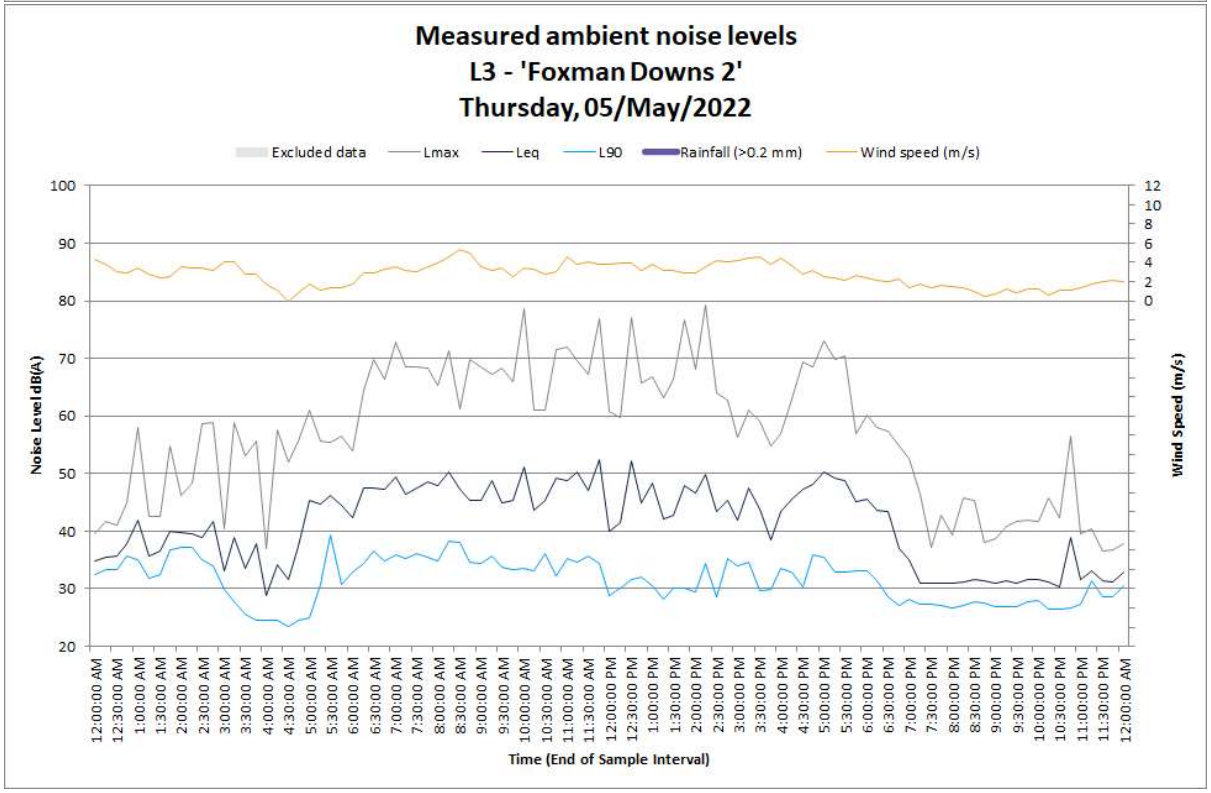
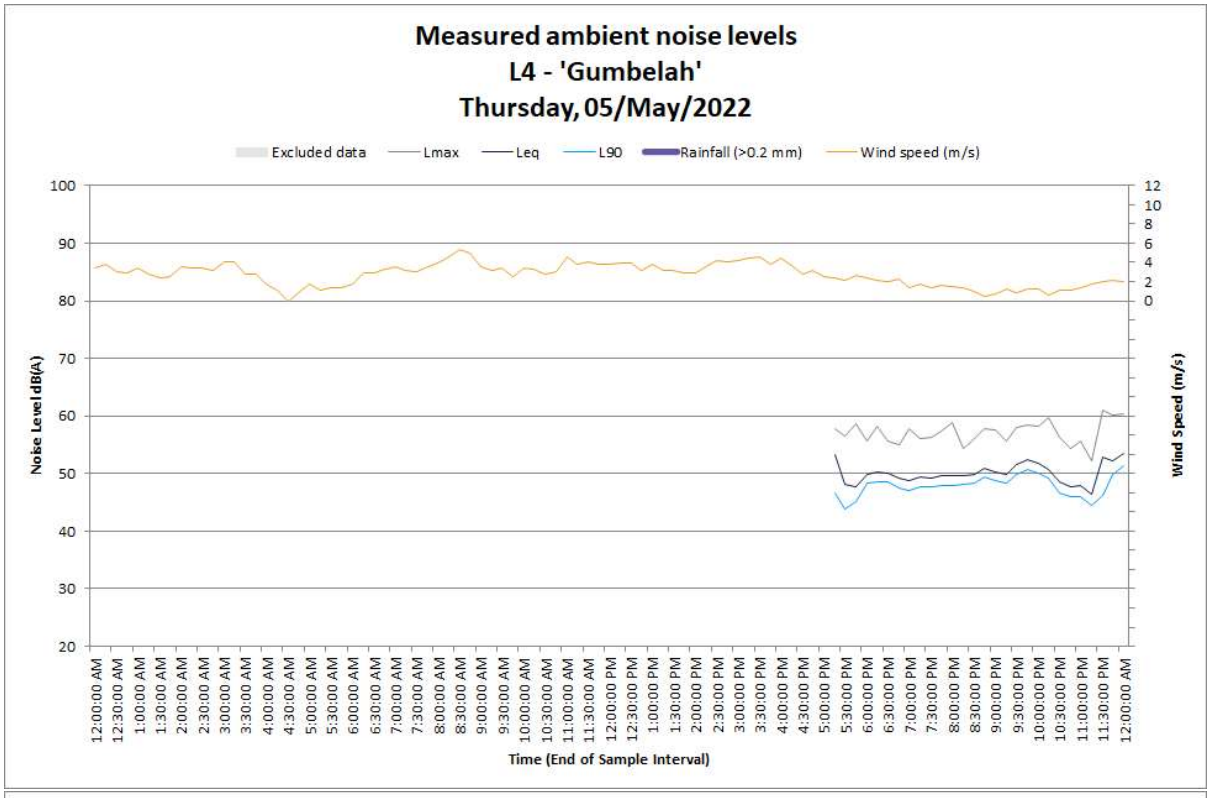
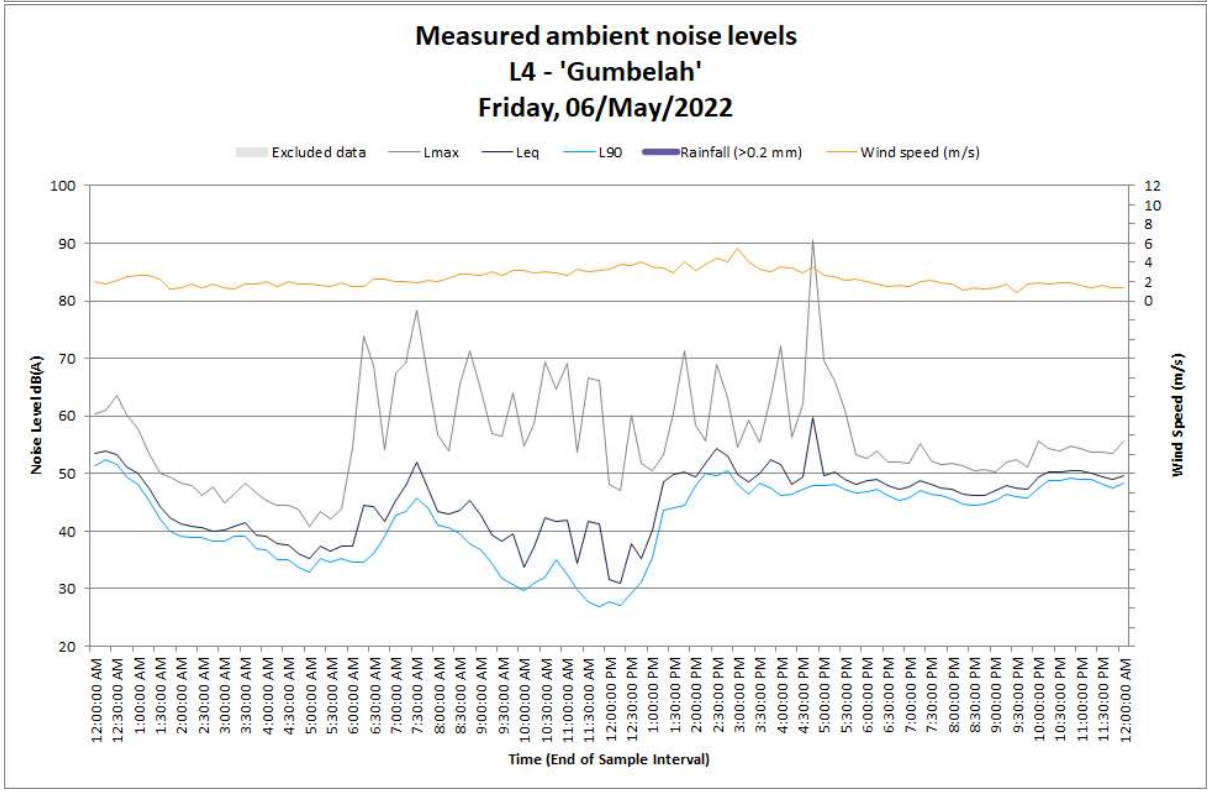

Measured ambient noise levels
L3 - 'Foxman Downs 2'
Thursday, 05/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)

Table B.4 Unattended noise monitoring results – L4 'Gumbelah' (38)

Date	ABL Day	ABL Evening	ABL Night	$L_{Aeq,11hour}$ Day	$L_{Aeq,4hour}$ Evening	$L_{Aeq,9hour}$ Night
Thursday, 05.05.22	0	48	35	0	50	47
Friday, 06.05.22	29	45	30	49	48	45
Saturday, 07.05.22	0	44	32	0	50	42
Sunday, 08.05.22	27	26	21	46	33	32
Monday, 09.05.22	26	26	18	43	37	35
Tuesday, 10.05.22	30	40	23	46	43	34
Wednesday, 11.05.22	28	0	0	49	0	0
Thursday, 12.05.22	0	40	46	0	44	50
Friday, 13.05.22	38	47	46	48	51	51
Saturday, 14.05.22	33	46	40	46	50	45
Sunday, 15.05.22	30	36	31	47	42	40
Monday, 16.05.22	29	32	36	48	39	44
Tuesday, 17.05.22	29	30	32	46	37	43
Wednesday, 18.05.22	0	41	28	0	44	40
Thursday, 19.05.22	28	29	17	43	36	36
Friday, 20.05.22	28	17	21	49	30	35
Saturday, 21.05.22	30	24	18	43	31	34
Sunday, 22.05.22	28	24	20	43	32	33
Monday, 23.05.22	24	25	21	42	36	33
Tuesday, 24.05.22	25	21	19	44	30	33
Wednesday, 25.05.22	28	24	17	39	32	36
Thursday, 26.05.22	27	26	20	45	37	33
Friday, 27.05.22	0	23	19	0	35	39
Summary values	**28**	**29**	**22**	**46**	**44**	**43**

Notes: 1. "0" indicates periods with too few valid samples due to weather or logger operation.


Measured ambient noise levels
L4 - 'Gumbelah'
Thursday, 05/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)


Measured ambient noise levels
L4 - 'Gumbelah'
Friday, 06/May/2022
Excluded data
Lmax
Leq
L90
Rainfall (>0.2 mm)
Wind speed (m/s)
Noise Level dB(A)
Wind Speed (m/s)
Time (End of Sample Interval)

Attachment C

Modelled source locations

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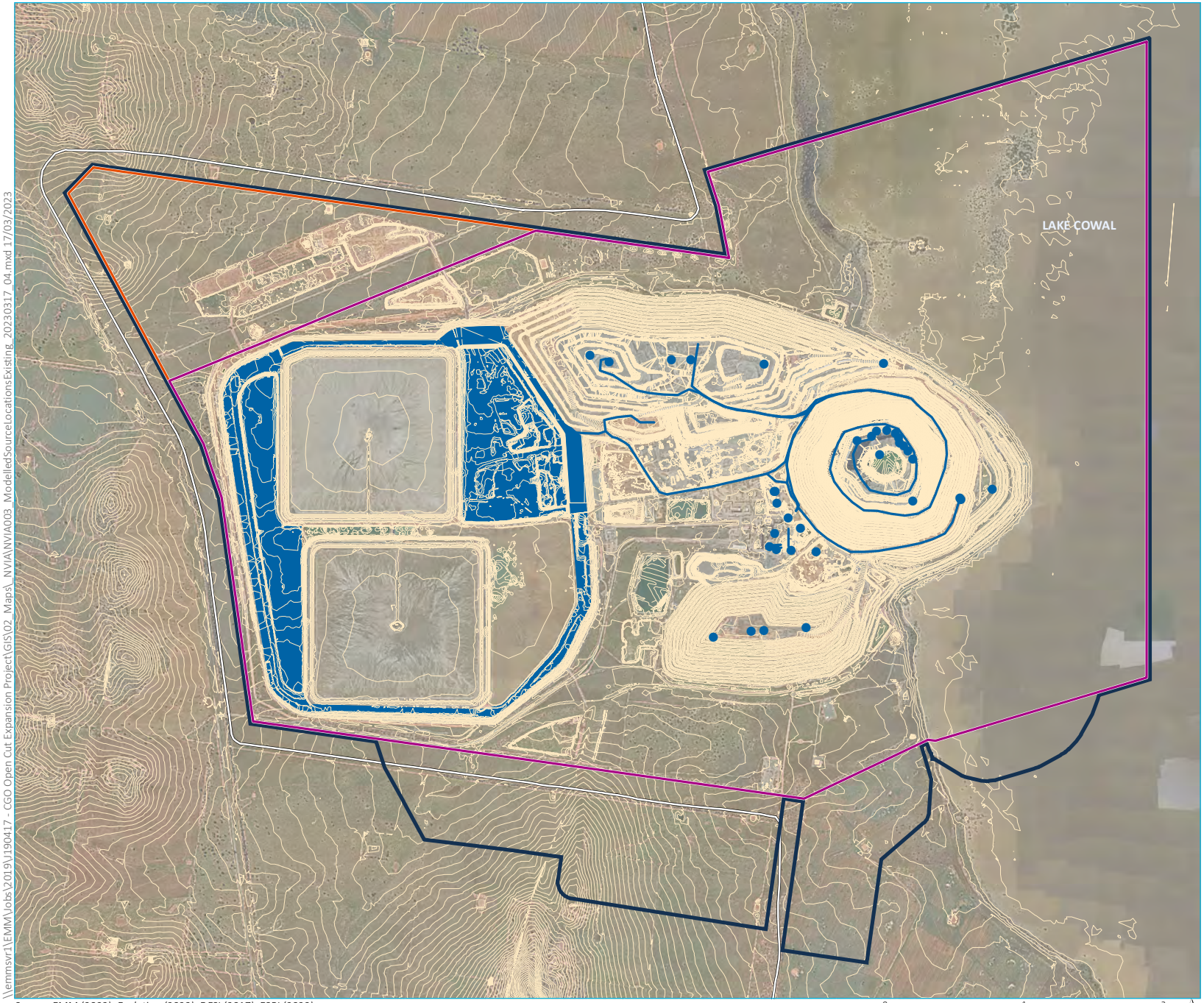

KEY

- Project area
- Mining lease (ML1535)
- Mining lease (ML1791)
- Major road
- Topographic contour (1 m interval)
- Modelled source location

Source: EMM (2023); Evolution (2023); DFSI (2017); ESRI (2023)

0 1 2 km

GDA 1994 MGA Zone 55

N

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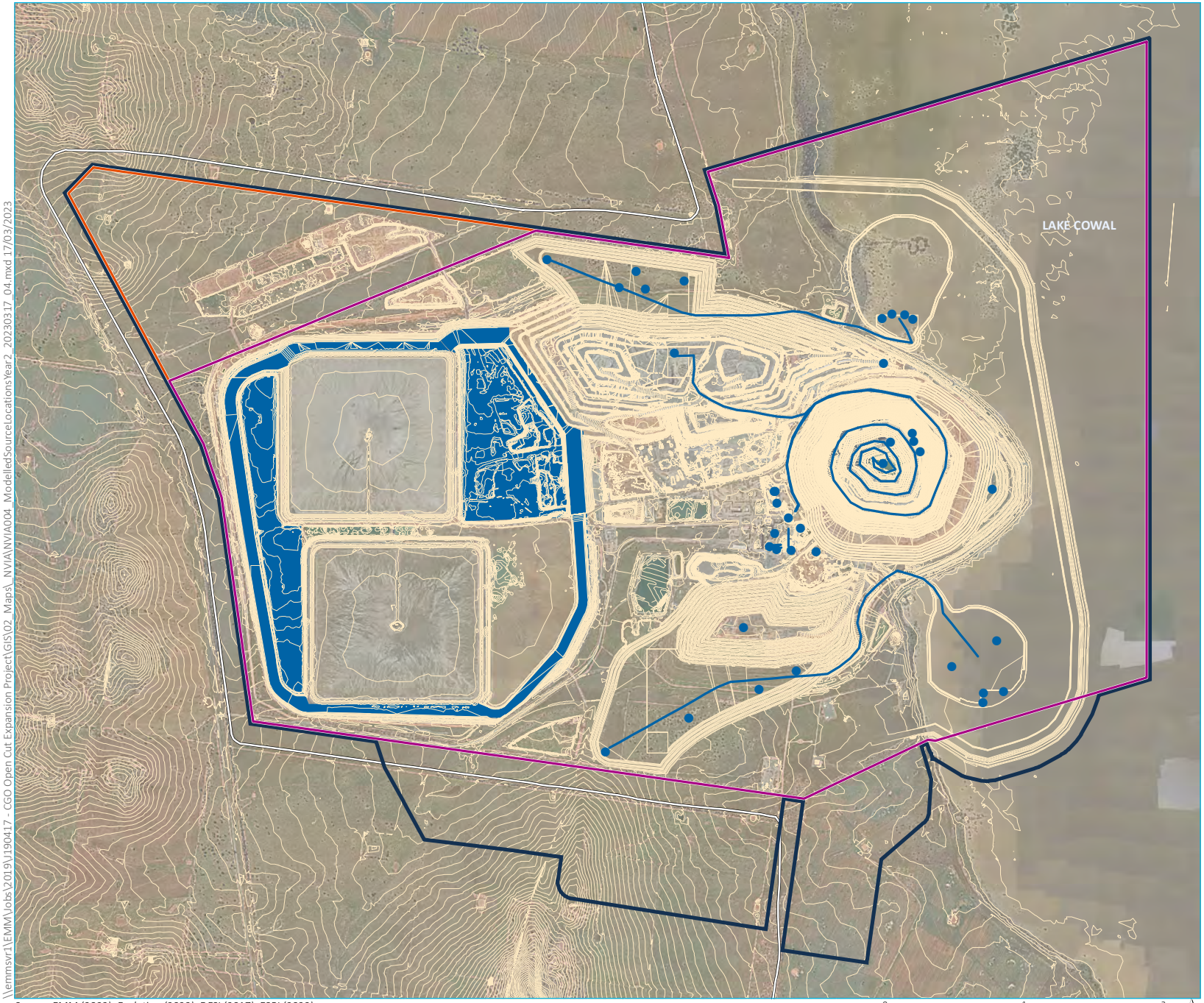
Modelled source locations - existing operations

Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Noise and Vibration Impact Assessment
Figure C.1

EMM
creating opportunities



KEY

- Project area
- Mining lease (ML1535)
- Mining lease (ML1791)
- Major road
- Topographic contour (1 m interval)
- Modelled source location

\\emmsvr1\EMM\Jobs\2019\I190417 - CGO Open Cut Expansion Project\GIS\02_Maps_NVIA\NVIA004_ModelledSourceLocationsYear2_20230317_04.mxd 17/03/2023

Source: EMM (2023); Evolution (2023); DFSI (2017); ESRI (2023)

0 1 2 km

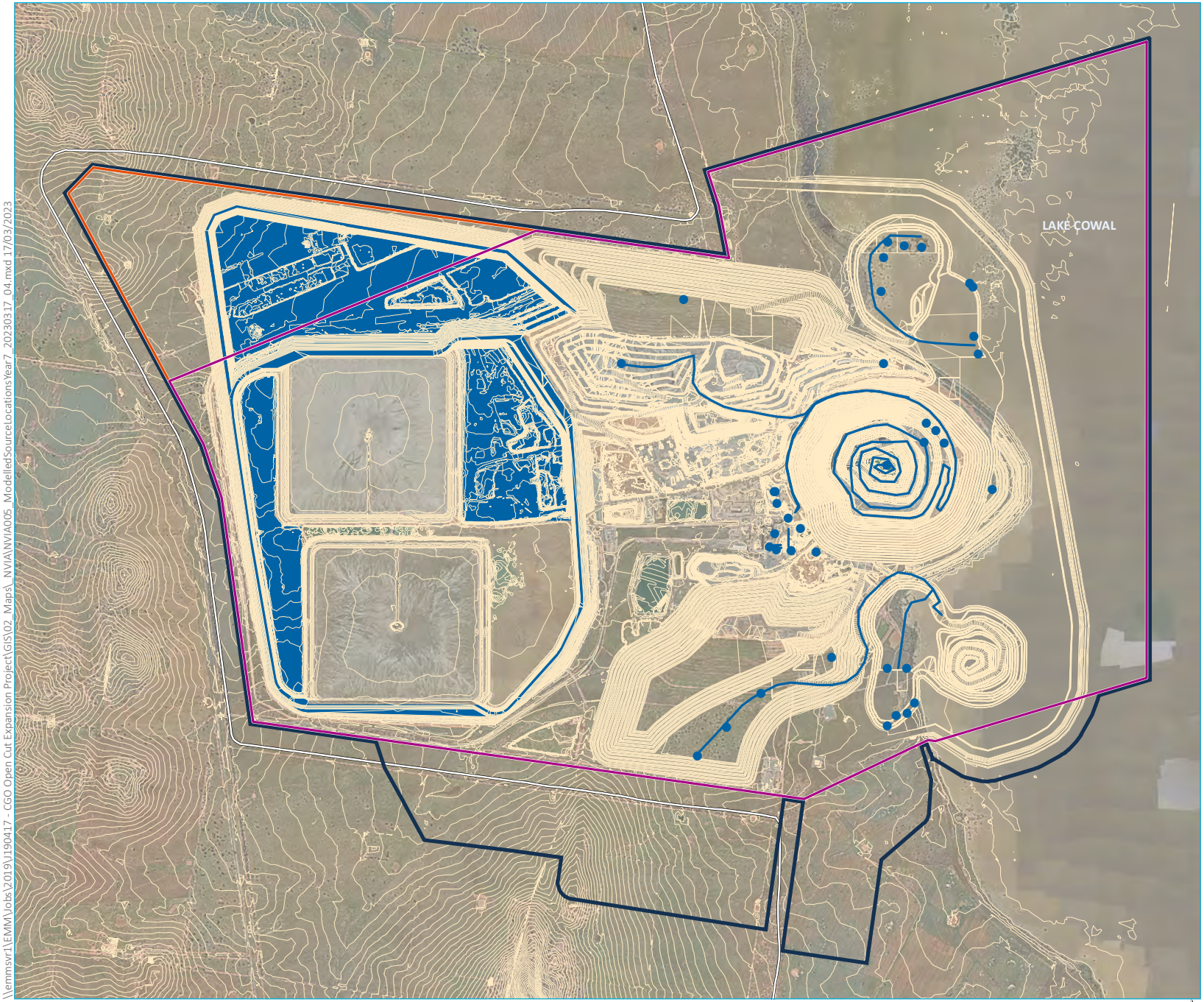
GDA 1994 MGA Zone 55

N

Modelled source locations
- future year 2

Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Noise and Vibration Impact Assessment
Figure C.2

EMM
creating opportunities



KEY

- Project area
- Mining lease (ML1535)
- Mining lease (ML1791)
- Major road
- Topographic contour (1 m interval)
- Modelled source location

Source: EMM (2023); Evolution (2023); DFSI (2017); ESRI (2023)

0 1 2 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM\Jobs\2019\J190417 - CGO Open Cut Expansion Project\GIS\02_Maps_NVIA\NVIA005_ModelledSourceLocationsYear7_20230317_04.mxd 17/03/2023

Modelled source locations
- future year 7

Evolution Mining
Cowal Gold Operations
Open Pit Continuation Project
Noise and Vibration Impact Assessment
Figure C.3

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Attachment D

Modelled sound power levels

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Table D.1 Modelled sound power levels (single octave or one-third octave), dB(A)

Plant/equipment	Sound power level spectrum – one-third octave centre frequencies (Hz)																											Total
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	
Process plant	70	79	82	88	97	99	103	105	106	111	112	114	113	116	116	114	114	112	111	109	107	104	100	95	89	82	75	124
Primary crusher	-	78	-	-	96	-	-	95	-	-	96	-	-	108	-	-	105	-	-	103	-	-	97	-	-	89	-	111
Secondary crusher (Sag and Ball mill)	68	75	77	91	96	91	94	99	99	102	103	106	107	108	108	105	105	105	102	100	98	96	97	96	89	87	83	116
Mobile crusher	-	81	-	-	99	-	-	98	-	-	99	-	-	111	-	-	108	-	-	16	-	-	100	-	-	92	-	113
Stockpile conveyors	-	77	-	-	88	-	-	93	-	-	94	-	-	102	-	-	98	-	-	95	-	-	90	-	-	79	-	105
Excavator – EX9400	-	76	-	-	100	-	-	105	-	-	105	-	-	115	-	-	115	-	-	111	-	-	101	-	-	89	-	119
Haul truck – CAT 789C	56	70	69	76	82	87	93	103	100	102	103	109	109	111	109	108	108	108	107	107	105	102	100	98	95	91	85	119
Loader TCR652 – 926G	-	68	-	-	81	-	-	100	-	-	100	-	-	104	-	-	105	-	-	104	-	-	95	-	-	85	-	110
Loader TCR653 – IT62G	-	68	-	-	81	-	-	100	-	-	100	-	-	104	-	-	105	-	-	104	-	-	95	-	-	85	-	110
Loader TCR654 – 980G	-	76	-	-	87	-	-	103	-	-	108	-	-	107	-	-	103	-	-	108	-	-	102	-	-	96	-	114
Wheel loader – 992G	-	78	-	-	94	-	-	91	-	-	96	-	-	101	-	-	104	-	-	102	-	-	97	-	-	87	-	108
Track dozer – CAT D10T	-	84	-	-	99	-	-	100	-	-	111	-	-	115	-	-	113	-	-	112	-	-	110	-	-	104	-	120
Wheel dozer – 834H	-	79	-	-	94	-	-	95	-	-	106	-	-	110	-	-	108	-	-	107	-	-	105	-	-	99	-	115
Water truck – CAT 777D	-	65	-	-	83	-	-	98	-	-	104	-	-	109	-	-	110	-	-	106	-	-	100	-	-	94	-	114
Grader – CAT 16H	-	70	-	-	86	-	-	97	-	-	99	-	-	101	-	-	103	-	-	102	-	-	94	-	-	85	-	108

Table D.1 Modelled sound power levels (single octave or one-third octave), dB(A)

Plant/equipment	Sound power level spectrum – one-third octave centre frequencies (Hz)																											Total
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	
Drill	-	71	-	-	93	-	-	105	-	-	108	-	-	113	-	-	111	-	-	109	-	-	105	-	-	106	-	118
Ancillary excavator	-	75	-	-	99	-	-	104	-	-	104	-	-	114	-	-	114	-	-	110	-	-	100	-	-	88	-	118
Roller	-	89	-	-	94	-	-	99	-	-	102	-	-	97	-	-	95	-	-	92	-	-	86	-	-	80	-	106
Dump truck – CAT 45t Articulated	-	73	-	-	94	-	-	99	-	-	97	-	-	101	-	-	103	-	-	102	-	-	95	-	-	87	-	109
Grader – CAT 14M	68	67	66	70	73	77	89	86	89	99	95	94	95	96	98	99	99	98	97	96	95	92	89	86	82	79	76	108
Water truck – Volvo A40D	57	65	68	76	78	85	91	88	89	92	92	96	97	97	100	100	99	99	96	94	91	88	85	82	79	73	68	108
Excavator – 390FL (90t)	-	86	-	-	95	-	-	101	-	-	102	-	-	107	-	-	110	-	-	107	-	-	101	-	-	92	-	114
Excavator (30t)	-	74	-	-	95	-	-	99	-	-	105	-	-	105	-	-	96	-	-	103	-	-	96	-	-	87	-	110
Track dozer – CAT D8	-	74	-	-	88	-	-	97	-	-	102	-	-	107	-	-	113	-	-	114	-	-	110	-	-	103	-	118
Track dozer – CAT D9	-	83	-	-	90	-	-	110	-	-	104	-	-	108	-	-	110	-	-	112	-	-	108	-	-	97	-	117
Underground mine trucks – Sandvik TH663	-	72	-	-	87	-	-	104	-	-	110	-	-	114	-	-	112	-	-	110	-	-	104	-	-	96	-	118
Pastefill plant	-	97	-	-	105	-	-	103	-	-	105	-	-	107	-	-	105	-	-	104	-	-	101	-	-	96	-	113
Ventilation fan	-	95	-	-	104	-	-	118	-	-	118	-	-	114	-	-	108	-	-	106	-	-	101	-	-	90	-	122

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