



Appendix F

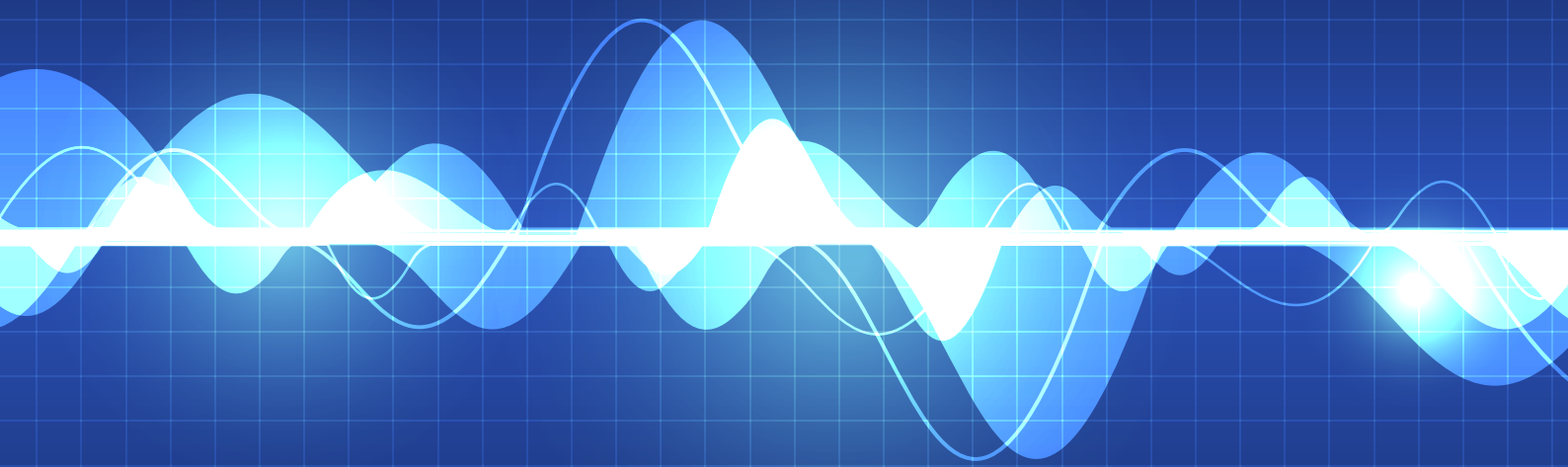
Noise and vibration impact assessment



Noise and vibration impact assessment

Cowal Gold Operations Underground Development & Modification 16

Prepared for Evolution Mining (Cowal) Pty Limited
August 2020





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Noise and vibration impact assessment

Cowal Gold Operations Underground Development & Modification 16

Report Number

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Client

Evolution Mining (Cowal) Pty Limited

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1 Introduction

1.1 Overview

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the Cowal Gold Operations (CGO) located approximately 38 kilometres (km) north-east of West Wyalong, New South Wales (NSW). The location of CGO in a regional context is shown in Figure 1.1.

CGO is an existing open cut mine which has been in operation since 2005 and has approvals in place to continue processing at a rate of 9.8 million tonnes of ore per annum (Mtpa) until 2032. The existing mine site is located immediately adjacent to the ephemeral Lake Cowal.

The area of land to which the CGO Development Consent (DA 14/98) is relevant includes Mining Lease (ML) 1535, ML 1791 and the CGO water supply pipeline and Bland Creek Palaeochannel Borefield. Open cut mining operations are currently undertaken within ML 1535, which encompasses approximately 2,636 hectares (ha).

Evolution is seeking State Significant Development (SSD) consent under Division 4.1 of Part 4 of the EP&A Act to extend mining operations at CGO by way of an underground development, which would be wholly contained within ML 1535. The Underground Development proposal (the project) seeks to introduce an underground mine using stope mining practices, in addition to the existing open cut mine, to exploit an identified ore deposit in proximity to the current E42 pit. Furthermore, as part of the project, Evolution is seeking a modification of the Development Consent DA 14/98 (Modification 16) to upgrade approved existing surface infrastructure to support operations associated with the proposed underground mine. This would extend the life of the operations at CGO from 31 December 2032, as approved under DA 14/98, to 31 December 2039.

This report presents an assessment of potential noise and vibration impacts from the project. Potential noise impacts from the proposed construction works and future mining operations (existing open cut mine and proposed underground mine combined) on the surrounding community have been assessed, as well as the potential vibration impacts from the proposed underground mine operations.

This assessment references the development consent, noise policies and blasting assessment guidelines as follows:

- NSW Department of Planning, Industry and Environment (DPIE), Development Consent (DA 14/98), modified in August 2019 (Mod 15);
- NSW Environment Protection Authority (EPA), Environment Protection licence (EPL 11912), issued on 26 June 2019.
- NSW EPA, Industrial Noise Policy, 2000;
- NSW EPA, Noise Policy for Industry, 2017;
- NSW Department of Environment and Climate Change (DECC), Interim Construction Noise Guideline, 2009;
- NSW Department of Environment, Climate Change and Water (DECCW), Road Noise Policy, 2011;
- Australian and New Zealand Environment and Conservation Council (ANZECC), Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration, 1990;
- Standards Australia, Australian Standard AS 2187.2-2006 'Explosives – Storage and use – Part 2: Use of explosives';

- ICI Technical Services, Imperial Chemical Industries (ICI) Explosives Blasting Guide, 1995;
- Secretary Environmental Assessment Requirements issued on 27 September 2019;
- Evolution, approved Blast Management Plan (BMP), 2015; and
- Evolution, approved Noise Management Plan (NMP), 2018.

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

1.2 Noise and vibration assessment requirements

This noise and vibration impact assessment (NVIA) has been prepared in accordance with the Planning Secretary’s Environmental Assessment Requirements (SEARs) relevant to the project, issued 27 September 2019. The NSW Environment Protection Authority (EPA) has also provided details of key issues requiring assessment for the project.

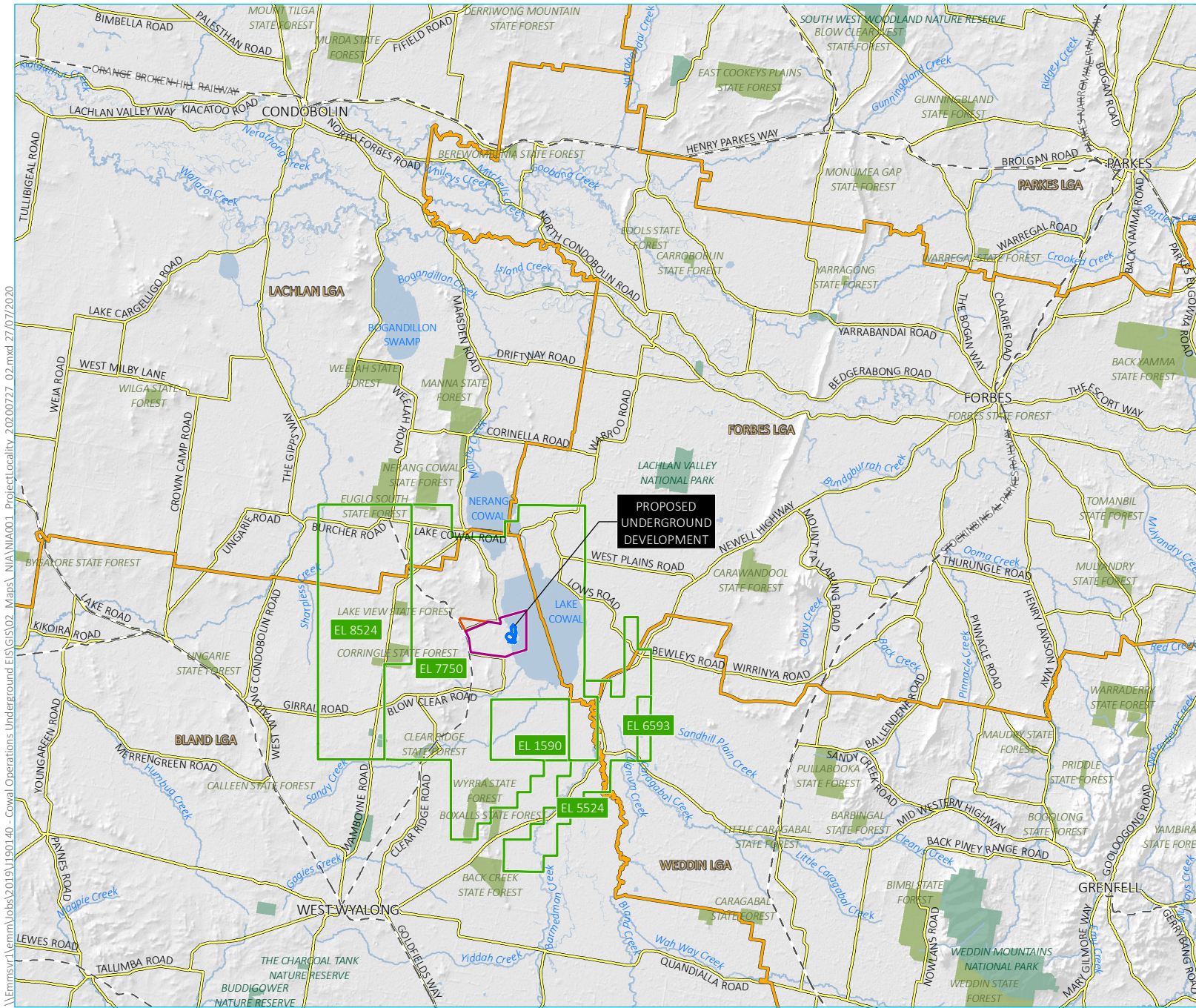
The SEARs relevant to this assessment and where they are addressed in this report are shown in Table 1.1.

Table 1.1 Noise and vibration assessment requirements

Relevant authority and assessment requirement	Relevant section of this report
Underground Development and Modification 16 of DA 14/98	
DPIE	
Noise and Blasting / Vibration – including:	
- an assessment of the likely operational noise impacts of the development (including construction noise) under the Noise Policy for Industry (EPA), and the Voluntary Land Acquisition and Mitigation Policy;	5.1
- 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 under the Interim Construction Noise Guideline;	N/A
- an assessment of the likely road traffic noise impacts of the development under the NSW Road Noise Policy; and	5.2
- 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.	5.3
EPA	
Potential impacts of noise	
The goals of the project should include design, construction, operation and maintenance of the facility in accordance with relevant EPA policy, guidelines and criteria, and in order to minimise potential impacts from noise.	3.1, 3.2
The EPA expects that potential noise sources are assessed in accordance with the <i>Noise Policy for Industry</i> (EPA 2017), and where required mitigation measures are proposed (eg appropriate equipment chosen to minimise noise levels). All residential or noise sensitive premises likely to be impacted by the development must be identified and included in the assessment.	2.5, 3.1, 4.1
The proposed development may result in an increase in traffic movements associated with the receipt of materials. The number of traffic movements associated with the proposal should be quantified and the potential noise impacts associated with these traffic movements need to be assessed in accordance with the <i>NSW Road Noise Policy</i> (DECCW 2011).	4.2, 5.2

Table 1.1 **Noise and vibration assessment requirements**

Relevant authority and assessment requirement	Relevant section of this report
Monitoring	
The EIS must outline the proposed monitoring regime to be implemented in relation to the following potential impacts, where relevant.	
• Construction and operational noise	2.5.4, 5.1, 6



- KEY**
- ▭ Proposed underground development
 - ▭ Mining lease (ML1535)
 - ▭ Mining lease (ML1791)
 - ▭ Exploration licence (EL)
 - - - Rail line
 - ▭ Main road
 - ▭ Named watercourse
 - ▭ Waterbody
 - ▭ Local government area
 - ▭ NPWS reserve
 - ▭ State forest

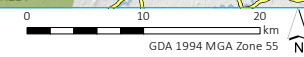
Project location in a regional context

Evolution Mining
 Cowl Gold Operations
 Noise and vibration impact assessment
 Figure 1.1



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Source: EMM (2020); Evolution (2020); DFSI (2017); GA (2011); ASGC (2006)



2 Project overview and existing environment

2.1 Project location

The CGO site (the site) is located approximately 38 km north-east of West Wyalong, 60 km south-west of Forbes, and approximately 350 km west of Sydney (refer to Figure 1.1).

The site is located adjacent to Lake Cowal in the Lachlan Catchment, an ephemeral inland wetland system. Lake Cowal is the largest natural inland lake in NSW, and when full is approximately 21 km long (north to south) and 9.5 km wide (east to west) covering an area of over 13,000 ha. The area of land to which the CGO current development consent (DA 14/98) is relevant includes the underlying ML 1535, ML 1791 and the CGO water supply pipeline to the Bland Creek Palaeochannel Borefield and associated infrastructure.

The project works are located within and adjacent to the existing operational open cut mine and are wholly contained within ML 1535.

2.2 Existing CGO

CGO is an existing open cut mine which operates within ML 1535 (due to expire 31 December 2032) and ML 1791 (due to expire 20 June 2040). The current open cut pit is located within ML 1535 and has an approved disturbance area which allows for the progressive expansion of the pit. When complete the total pit area will be approximately 131 ha and will have a final depth of -331 meters (m) Australian Height Datum (AHD).

As per current approvals, approximately 167 million tonnes (Mt) of ore will be extracted over the 28-year life span of the mine, processing at a rate of up to 9.8 Mtpa. Gold extraction is undertaken using a conventional carbon-in-leach cyanide leaching circuit.

Waste rock is presently managed at three emplacement areas within the site; the northern, southern and perimeter. The northern waste rock emplacement is licenced to be constructed to a maximum height of 308 m AHD, the southern to a maximum height of 283 m AHD and the perimeter to a maximum height of 223 m AHD.

Approved heavy vehicle access to the site is via the designated route between the site and West Wyalong with light vehicle access also available via Condobolin and Forbes. Hazardous goods are transported to site by truck either from Port Botany or their point of production (eg Yarwan, Queensland or Melbourne, Victoria etc.) via the approved local road network.

Open cut mining operations at CGO are currently supported by the following on-site facilities:

- processing plant, including:
 - primary crusher;
 - float tails leach circuit; and
 - carbon in-leach cyanide leaching circuit.
- stockpiles including:
 - run-of-mine (RoM) pads;

- low-grade and high-grade ore stockpiles;
- mineralised material stockpiles; and
- soil and clay stockpiles.
- Tailings storage facility (TSF) including:
 - northern TSF; and
 - southern TSF.
- waste rock emplacements (WRE) surrounding the open cut pit including:
 - northern WRE;
 - southern WRE; and
 - perimeter WRE.
- water management structures including:
 - lake protection bund;
 - temporary isolation bund;
 - water supply pipeline;
 - saline groundwater supply bores within ML 1535; and
 - water diversion systems (including Up-Catchment Diversion System and Internal Catchment Drainage System) and drainage.
- ancillary facilities including access roads, internal roads and haul roads, electricity transmission lines, waste storage and transfer facility, workshop facilities and administration buildings.

2.3 Proposed underground mine

Evolution is seeking to develop and operate an underground gold ore mining domain at CGO using stope mining methods, to extract ore from the GRE46 Mineralisation and deliver the ore to the surface.

Evolution is also seeking as part of the SSD application to develop supporting underground mine infrastructure, including a pastefill plant, box-cut and underground access decline, access tunnels, mine ventilation system and dewatering infrastructure. The SSD application also seeks to backfill the extracted stopes using a paste made from tailings and waste rock.

Changes to existing surface infrastructure to support the underground mine are not part of the SSD application. These will be considered under Modification 16 (Mod 16) of the current CGO development consent (DA 14/98).

The project area for the proposed underground mine extends northwards under Lake Cowal from a decline entrance in the eastern part of the existing open cut pit. The underground mine will require a 24-hour-a-day, seven-days-a-week operation consistent with the existing open cut operations. The underground mine would produce approximately 1.8 Mtpa of ore over a life of 20 years.

The SDD CGO underground mine components are summarised in Table 2.1.

Table 2.1 **SSD CGO underground development project overview**

Aspect	Description
General description	<p>Construction and operation of an underground mine at the Cowal Gold Mine to extract the GRE46 mineralisation, which includes:</p> <ul style="list-style-type: none"> • a box-cut entry to the underground workings; • a decline from the box-cut to provide access for personnel and maintenance; • six access points to the decline for access, ore haulage, ventilation circuit, underground services and emergency egress; • a network of underground tunnels to provide access to the ore, transportation to the surface and ventilation; • use of sub-level open stoping (SLOS) to extract the ore; • production of up to 27 Mt of ore at a rate of 1.8 Mtpa; • production of approximately 5.74 Mt of waste rock; • delivery of extracted ore and waste rock to the surface by truck; • development of a paste fill plant, and the delivery of paste via a borehole and the backfilling underground stopes with the paste; and • development of ancillary underground infrastructure to support the underground operation, including dewatering infrastructure, ventilation system, electrical reticulation.
Project duration	<p>A project life of 20 years comprising:</p> <ul style="list-style-type: none"> • construction of the decline and development drives over a period of up to two years; and • ore production of the currently known economic resource over 18 years.
Mining method	Top down SLOS to a depth of -850 m AHD with approximately 1,106 stopes developed over the life of the mine.
Stope backfill	<ul style="list-style-type: none"> • Stopes to be fully backfilled with paste material made from dewatered tailings and cement. • Paste material to be produced in a purpose-built paste plant on the surface. • Paste material will be delivered to the underground workings via a borehole near the paste fill plant.
Ore transport	Ore will be transported to the surface by truck.

2.4 Proposed Modification 16 to development consent DA 14/98

The proposed underground mine at CGO would require a range of supporting surface infrastructure. Most of this infrastructure is already in place at CGO, in terms of ore stockpiling and processing, internal transportation systems, water management and the emplacement of tailings and waste rock.

Some of the existing surface infrastructure (eg processing plant) would however require to be augmented, in order to handle and process the higher-grade ore from the underground mine, and to emplace additional tailings and waste rock.

To make these necessary changes, Evolution is seeking to modify its existing development consent DA 14/98 (known as Modification 16).

The proposed modification components are summarised and compared to the approved CGO components in Table 2.2.

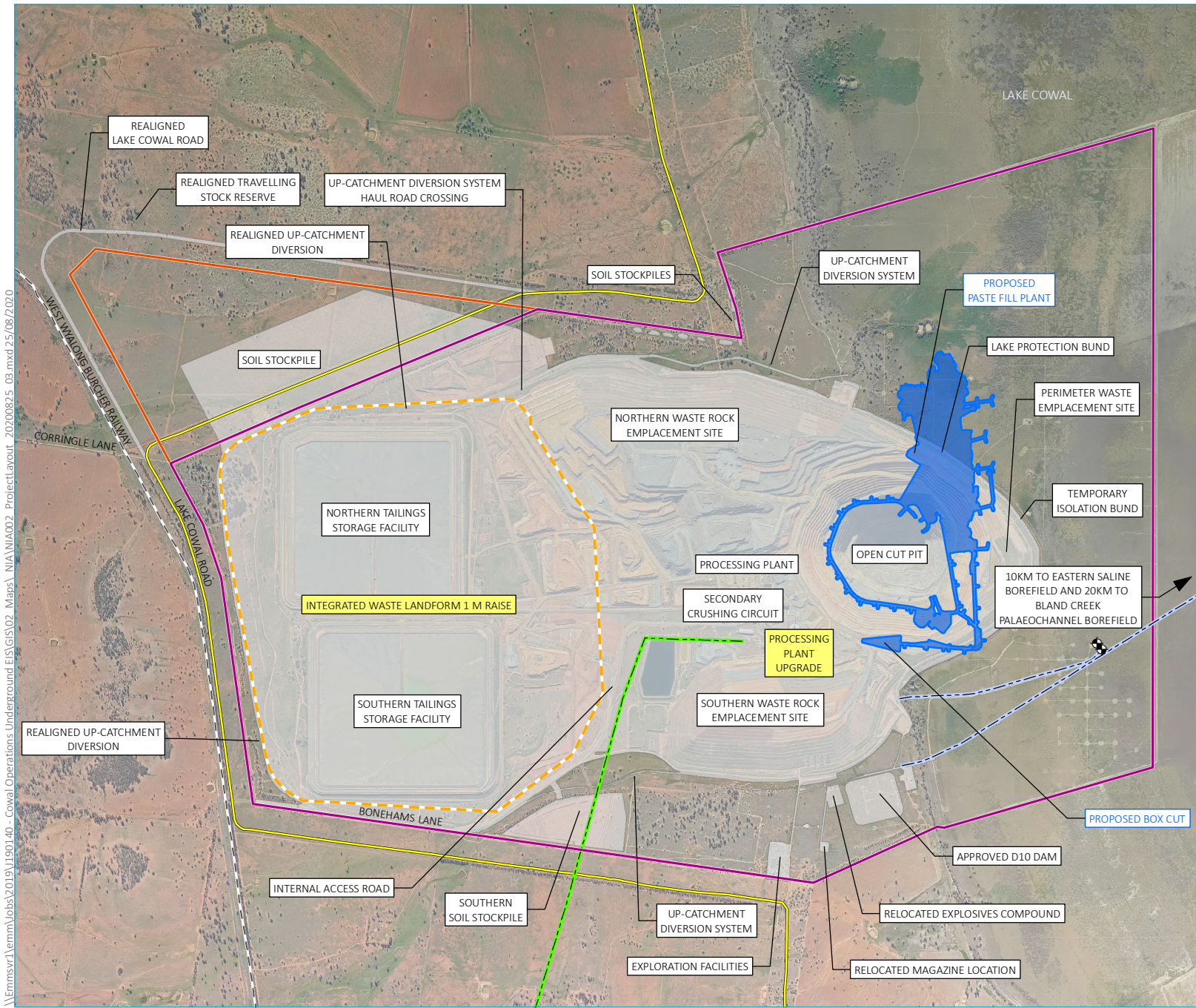
Table 2.2 Proposed modification components

Development component	Approved CGO	Proposed modification
Life of Mine	CGO is approved to operate to the end of 2032.	Extension to the end of 2040.
Gold Production	Production of approximately 6.1 million ounces (Moz) of gold over the life of the CGO.	Production of a further 1.8 Moz of gold (approximate).
On-site ore Transportation	Ore is transported from the open-cut by truck to a temporary stockpile prior to rehandling to the primary crusher.	No change. Underground ore trucked from the underground run-of-mine stockpile to the temporary ore stockpile.
Ore processing Facility	Ore processing is undertaken at the ore processing facility at a rate up to 9.8 Mtpa. A secondary ore crushing circuit within existing process plant is approved to be constructed.	No change to processing rate. The existing processing facility would be modified to include: <ul style="list-style-type: none"> • a tailings desliming and tailings thickener circuit; • an ore receival bin and mill feed conveyor; and • an upgraded elution circuit.
Cyanide Consumption	Use of a primary ore conventional carbon-in-leach circuit, which includes recovery of gold from flotation tailings.	No change. Increase in annual cyanide consumption associated with the higher grade ore.
Site Water Management Infrastructure	The existing CGO water management infrastructure is comprised of the following key components: <ul style="list-style-type: none"> • Up-catchment Diversion System (UCDS) and • the ICDS (including the contained water storages); • lake isolation system (comprising the temporary isolation bund, lake protection bund and perimeter waste rock emplacement); • integrated erosion, sediment and salinity control system; and open pit sump and dewatering borefield.	No change to UCDS and ICDS. Pipeline from the tailings deslimer to the paste fill plant and a return water pipeline from the paste fill plant to the processing facility. Augmentation of dam D5A. This augmentation would not change the overall catchment area of the dam. Augmentation of other on-site water storages from time to time depending on water supply and on-site requirements.
Tailings storage	Tailings are deposited in two (Northern and Southern) tailings storage facilities (TSFs). NTSF and STSF are allowed to be constructed to approximately 240 mAHD and 248 mAHD, respectively. These TSFs are also approved to be combined with the northern waste rock emplacement to form the integrated waste landform (IWL), which would provide a life of mine tailings strategy. The IWL is approved to be developed to a final rehabilitated height of 245 mAHD.	A height increase from 245 mAHD to 246 mAHD to the final rehabilitated height of the IWL.
Waste rock	Approximately 299 Mt of waste rock would be produced over the life of the approved CGO and emplaced in the Northern, Southern and Perimeter waste rock emplacements.	Approximately 5.74 Mt of additional underground mine waste rock would be emplaced.

Table 2.2 Proposed modification components

Development component	Approved CGO	Proposed modification
Ancillary surface infrastructure	A range of ancillary surface infrastructure is operated to support open-cut mining operations, including that related to administration, water management, maintenance, pipelines, magazines and other functions.	Development of additional surface infrastructure and augmentation of existing infrastructure, all within the existing approved disturbance areas, including (but not limited to): administration facilities, offices and car parking, warehouses and stores, vehicle washdown facilities, heavy vehicle and light vehicle maintenance workshop and maintenance bays, control room, fuel farm, core yards and drill sheds, hard stands and go lines, ablutions, bathhouse and changerooms, communications infrastructure, access tracks, water storages and other minor ancillary infrastructure.

The project area and indicative site layout; including the underground mine extent and the additional Modification 16 surface infrastructure are shown in Figure 2.1.



- KEY**
- Proposed underground development
 - Mining lease (ML1535)
 - Mining lease (ML1791)
 - DA14/98 approved surface disturbance
 - Indicative integrated waste landform perimeter
 - Electricity transmission line
 - Water supply pipeline
 - Saline groundwater supply bore
 - Rail line
 - Main road
 - xxx Underground development elements
 - xxx Mod 16 surface elements
 - xxx Approved surface elements

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Source: EMM (2020); Evolution (2020); DFSI (2017)



Project layout

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Figure 2.1



2.5 Existing environment

2.5.1 Assessment locations

The area surrounding the project includes a number of privately-owned properties with the closest residence located approximately 2.3 km south-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 2.3 and their locations are shown in Figure 2.2.

Table 2.3 Noise and vibration assessment locations

Assessment location ID	Receiver type	Property name	Easting	Northing
1a	Residential	Coniston (Evolution-owned dwelling)	535153	6282548
1b	Residential	Lakeside (Evolution-owned dwelling)	536424	6283400
1c	Residential	Hillgrove (Evolution-owned dwelling)	534407	6272697
1d	Residential	Lake Cowal (Evolution-owned dwelling)	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
31a	Residential	Koobah	549554	6273711
36a	Residential	The Glen	535625	6284898
36b	Residential	Wamboyne II	530297	6286030
38	Residential	Gumbelah	545613	6276295
42 ²	Residential	Westlea	532383	6274566
43a	Residential	Lake Cowal II	545105	6271379
43b	Residential	Billabong	547179	6268189
49a	Residential	Foxman Downs	531145	6271554

Table 2.3 Noise and vibration assessment locations

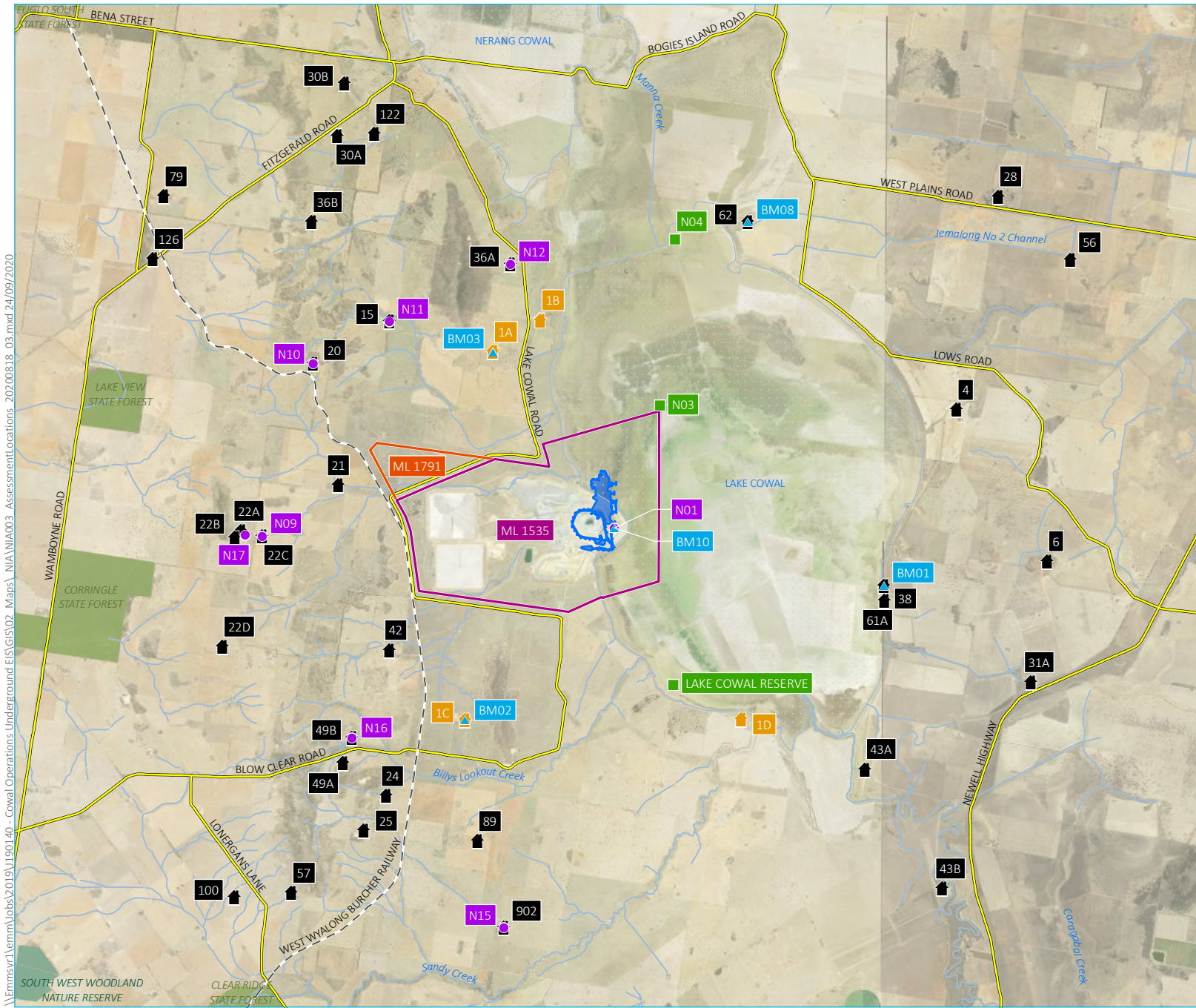
Assessment location ID	Receiver type	Property name	Easting	Northing
49b	Residential	Foxman Downs II	531386	6272221
56	Residential	Mattiske II	550605	6285032
57	Residential	Harmer	529760	6268071
61a	Residential	Bungabulla	545627	6275893
62	Residential	Cowal North	541979	6286026
79	Residential	Ridley	526342	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 land owner of this privately-owned property (ID 15).
2. Subject to acquisition upon request in accordance with the development consent.
3. Subject to mitigation upon request in accordance with the development consent.

Other assessment locations (non-residential) also included in this assessment are provided in Table 2.4. The locations of these non-residential assessment locations are also shown on Figure 2.2.

Table 2.4 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



- KEY**
- Proposed underground development
 - Mining lease (ML1535)
 - Mining lease (ML1791)
 - Rail line
 - Main road
 - Watercourse/drainage line
 - Waterbody
 - NPWS reserve
 - State forest
- Monitoring locations**
- Noise monitoring
 - Blast monitoring
- Assessment locations**
- Residential (Evolution-owned)
 - Residential (privately-owned)
 - Non-residential

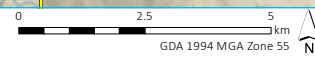
Monitoring and assessment locations

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Noise and vibration impact assessment
Figure 2.2



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Source: EMM (2020); Evolution (2020); DFSI (2017)



2.5.2 Existing operational noise limits

Condition 6.4 of Schedule 2 of the development consent DA 14/98 and Condition L4 of the EPL (11912) provides noise limits the site must meet during its operational phase. These noise limits were derived in accordance with the INP (EPA 2000) in previous noise assessments. Extracts of the development consent and EPL are provided in Appendix B and Appendix C, respectively.

Operational noise limits provided in the development consent are summarised in Table 2.5. The aim of this assessment is to demonstrate that site can achieve contemporary target noise levels in accordance with the NPfl (EPA 2017) as required in the SEARs (refer to Table 1.1). It will also be shown that noise from the project will largely meet the current development consent noise limits, including noise emissions associated with the proposed upgraded processing plant, pastefill plant, box-cut and underground mining fleet.

Table 2.5 Development consent (DA 14/98) noise limits

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

Notes: 1. Day period: Monday to Saturday: 7 am to 6 pm, on Sundays and public holidays: 8 am to 6 pm.
 2. Evening period: Monday to Saturday: 6 pm to 10 pm, on Sundays and public holidays: 6 pm to 10 pm.
 3. Night period: Monday to Saturday: 10 pm to 7 am, on Sundays and public holidays: 10 pm to 8 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).

Assessment locations 21 (Westella) and 42 (Westlea) qualify for acquisition upon request in accordance with the development consent and therefore noise limits do not apply at these privately-owned residential properties. Nonetheless, this assessment has modelled the noise emissions for the Project at these locations.

It is noted that the noise limits presented in Table 2.5 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 DPIE has been notified in writing of this agreement. This is the case for assessment location 15 where Evolution has a noise agreement in place with the land owner of this privately-owned property. Nonetheless, this assessment has modelled the noise emissions for the Project at location 15.

2.5.3 Ambient noise environment

A key element in assessing environmental noise impacts from industrial sources is to quantify the existing ambient acoustic environment. It was identified during the ambient noise monitoring completed by Renzo Tonin & Associates (Renzo Tonin) for the Modification 13 noise and blasting assessment that background noise levels in the surrounding community are at or below the NPfl minimum RBL of 35 dB for the day period, and 30 dB for the evening and night periods. These minimum RBLs have been adopted for all assessment locations in this assessment.

2.5.4 Existing CGO noise emissions

CGO has been operating since 2005 and has been through several operational modifications. Throughout the life of the 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 2.2). A review of the attended noise monitoring data recorded between quarter 1 of 2017 and quarter 2 of 2020 identified that site noise contributions during the monitoring have in all cases satisfied the relevant noise limits.

A review of CGO's quarterly noise monitoring data over the last five years shows that the mine has complied with the noise limits prescribed in the development consent. A review of the complaints history shows that there have been two noise complaints in the last five years. Records show that these complaints were handled swiftly, and resolved under the mine's established complaints management process.

2.5.5 Existing blasting limits

Condition 6.3 of Schedule 2 of the development consent provides blasting limits the site must meet in relation to airblast overpressure and ground vibration. Airblast overpressure and ground vibration limits in the development consent are summarised in Table 2.6. Blast is managed in accordance with the CGO Blast Management Plan (BMP) (Evolution 2015), which includes blast monitoring at five monitoring locations consisting of one near-field on-site location and four off-site locations.

Table 2.6 Development consent blasting limits

Location and time	Airblast overpressure (dB(LinPeak))	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.

2.6 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 (katabatic winds), as these conditions can enhance received noise levels. To account for the influence of weather conditions in the 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 NPfl specifies two options in regard to 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 NPfl provisions. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.

This assessment has adopted the NPfl option 1 to account for the influence of weather conditions in the noise impact assessment. Meteorological conditions adopted for noise impact assessment purposes, in accordance with the NPfl (option 1 approach), are provided in Section 4.1.5.

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 DPIE (whichever is the relevant consent authority) in accordance with development consent conditions. These instruments stipulate the noise limits that are required to be complied with in the day, evening and night periods.

Noise limits are generally derived by either applying the project specific noise trigger levels allowable under government policy or from applying the highest predicted operational noise levels which are below the trigger levels at various assessment locations near the industrial site. The limits are based on EPA guidelines (ie NPfl or previous INP) or on noise levels that can be achieved by a specific site following the application of all reasonable and feasible noise mitigation.

It is noted that since the Modification 14 (Mod 14) noise and blasting assessment, the INP (EPA 2000) has been superseded by the NPfl (EPA 2017). In accordance with the SEARs for the underground mine and Mod 16 (refer to Table 1.1), and the EPA's *Implementation and transitional arrangements for the Noise Policy for Industry (2017)*, this assessment has adopted the NPfl approach and hence assessment requirements for operational noise (eg criteria) and modelling methodologies (eg modelled meteorological conditions) have been updated where applicable.

3.1.1 Applying the NPfl to existing sites

The NPfl provides a method for assessing noise from existing industrial sites. The NPfl acknowledges that some industrial sites have been designed to emit noise emissions greater than those allowed under the NPfl 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 NPfl levels can be limited and/or costly to implement.

The NPfl recognises this, and at Section 6.1 states that:

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 the existing site exceed the project noise trigger levels (PNTLs) as defined in the NPfl, the relevant regulatory authorities and proponent will determine achievable noise limits for the site through negotiation and discussion with relevant stakeholders as required.

The process for applying the NPfl to existing sites is outlined in Section 6.1.1 of the NPfl and is summarised as follows as applicable to the amended project:

1. Undertake an initial evaluation, including whether approvals/licences include noise limits and whether they are being met.
2. Establish relevant PNTLs, in accordance with the NPfl, to establish a benchmark level to assess the need to consider noise mitigation.
3. Measure/predict the noise levels produced by the source in question, having regard to meteorological effects such as wind and temperature inversions.

4. Compare the measured/predicted noise level with the PNTLs.
5. Where the PNTLs are exceeded, assess feasible and reasonable noise mitigation strategies.
6. Develop and refine achievable noise limits 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 the PNTLs.
7. Monitor compliance with the agreed noise limits, and review and amend the noise performance of the site as required.

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

To ensure these objectives are met, the EPA provides PNTLs based on the intrusiveness and amenity noise levels as described in the NPfl.

3.1.2 Intrusiveness noise levels

The intrusiveness noise levels require that $L_{Aeq,15min}$ noise levels from the site during the relevant operational periods do not exceed the RBL by more than 5 dB.

Table 3.1 presents the intrusiveness noise levels determined for the site based on the adopted RBLs for the day, evening and night periods. 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)			Project intrusiveness noise level (RBL + 5 dB), $L_{Aeq,15min}$, dB		
	Day	Evening	Night	Day ²	Evening ³	Night ⁴
All residential locations ⁵	35	30	30	40	35	35

- Notes:
1. Based on the NPfl minimum RBLs for the day, evening and night periods. Evening and night RBLs are consistent with the those adopted in the Mod 14 noise and blasting assessment (Renzo Tonin 2018).
 2. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays.
 3. Evening: 6 pm to 10 pm.
 4. Night: remaining periods.
 5. Excludes mine-owned properties and privately-owned properties where Evolution has a noise agreement in place with the land owner.

3.1.3 Amenity noise levels

The assessment of amenity is based on noise levels specific to the land use. The noise levels assessed relate only to industrial noise and exclude road noise. Where the measured existing industrial noise approaches recommended amenity noise levels, it needs to be demonstrated that noise levels from new industry will not contribute to existing industrial noise such that amenity noise levels are exceeded.

To ensure that total industrial noise levels (ie existing levels plus new levels) remain within the recommended amenity noise levels for an area, the project amenity noise levels for an industrial development are the recommended amenity noise levels (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 amenity noise levels 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 amenity noise levels for rural residential receivers and passive recreation areas (outlined in Table 2.2 of the NPfI) were adopted for this assessment. The corresponding amenity noise levels for the project are given in Table 3.2.

Table 3.2 Project amenity noise levels

Assessment location	Amenity area	Time period ¹	Project amenity noise level, $L_{Aeq,period}$, dB (Recommended amenity noise level)
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 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am Monday to Saturday; 10 pm to 8 am Sundays and public holidays.
2. Excludes mine-owned properties and privately-owned properties where Evolution has a noise agreement in place with the land owner.

3.1.4 Project noise trigger levels

The PNTLs 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 the time periods for the intrusiveness and amenity noise levels, the NPfI states that the $L_{Aeq,15min}$ is equivalent to the $L_{Aeq,period} + 3$ dB.

Table 3.3 Project noise trigger levels

Assessment location	Intrusiveness noise level $L_{Aeq,15min}$, dB			Amenity noise level ¹ $L_{Aeq,15min}$, dB			PNTL ² $L_{Aeq,15min}$, dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
	All residential locations ³	40	35	35	53	48	43	40	35
Lake Cowal Reserve (LCR)	N/A	N/A	N/A	53	53	53	53	53	53

Notes: 1. Project amenity $L_{Aeq,15min}$ noise level is the project amenity noise level $L_{Aeq,period} + 3$ dB as per the NPfl.
 2. PNTLs are the lower of the calculated intrusiveness or amenity noise levels.
 3. Excludes mine-owned properties and privately-owned properties where Evolution has a noise agreement in place with the land owner.
 4. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: remaining periods.

The PNTLs shown in Table 3.3 are largely unchanged from the existing DA 14/98 development consent limits. The only changes are a consequence of the NSW EPA policy changes (ie INP to NPfl) for the less sensitive daytime period, where the intrusiveness level is 40 dB.

There are six assessment locations which are referenced in the development consent (refer to Table 2.5) where existing noise limits are already higher than the PNTLs shown in Table 3.3 for the evening and night periods. As these existing limits at these assessment locations were based on operational noise levels predicted in the Mod 14 noise and blasting assessment (Renzo Tonin 2018) and inclusive of feasible and reasonable noise mitigation measures, they were also adopted for this assessment.

3.1.5 Sleep disturbance

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

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

- $L_{Aeq,15min}$ 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

Assessment location	Adopted (night) RBL, dB(A)	Maximum noise level event screening criteria, dB	
		RBL +5 dB or standard ¹	RBL +15 dB or standard ¹
		$L_{Aeq,15min}$	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 land owner.

3.1.6 Voluntary land acquisition and mitigation policy

In September 2018, the NSW Government released the revised Voluntary Land Acquisition and Mitigation Policy (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 the relevant impact assessment criteria, or if the 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 the impact assessment, mitigation or acquisition criteria, with the exception of the 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 with regard to the application of 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 impacts¹³.

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

Of most interest is the last point above relating to the relative noise impact of the proposed operation compared to the existing development. This assessment demonstrates that the noise emissions from the project are predicted to be relatively the same as existing CGO operational noise emissions at all assessment locations.

The characterisation of the noise impacts (as outlined in the VLAMP) are 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 0-2 dB above the PNTL is therefore considered negligible.

Voluntary mitigation or voluntary acquisition rights apply when a development contributes to exceedances of the 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 amenity noise levels 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.
All time periods 3-5 dB	< recommended amenity noise level > recommended amenity noise level 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.

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 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	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	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 by the consent authority (ie DPIE) in the development consent for three existing residential properties following the Mod 14 noise and blasting assessment (Renzo Tonin 2018).

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(s).

Voluntary acquisition rights have been included in the development consent for two privately-owned residences, (locations 21 - Westella and 42 - Westlea). The development consent states that CGO shall acquire the land(s) upon receiving a written request from the relevant landowner(s).

3.2 Construction noise

The SEARs reference the DECC’s Interim Construction Noise Guideline (ICNG) (2009) for the assessment of noise from proposed construction activities where it is demonstrated to be relevant.

However noise associated with construction activities for mining operations are generally assessed as operational noise, as noise emissions from plant and equipment items associated with construction are similar to those used for operations. Furthermore, operational noise trigger levels are generally more stringent for the day period than those provided in the ICNG.

Therefore, the operational PNTLs presented in Table 3.3 have been conservatively adopted as the construction noise criteria for the project.

3.3 Road traffic noise

Construction and operational related traffic require assessment for potential noise impact. The principle guidance to assess the impact of road traffic noise at assessment locations is in the Road Noise Policy (RNP).

The majority of workforce (approximately 80%) travel to West Wyalong with the remaining workforce commuting to either Condobolin (approximately 10%) or Forbes (approximately 10%). During severe wet weather conditions, unsealed roads in the region are closed, and hence transport routes to Condobolin and Forbes are unavailable for access and alternate transport routes to Condobolin and Forbes are used (refer to section 4.2).

Table 3.6 presents the road traffic noise assessment criteria for residential land uses (ie assessment locations), reproduced from Table 3 of the RNP for road categories relevant to the project.

Table 3.6 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria – dB	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 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 3.6), 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 3.7 should be considered for mitigation. It is noted that the relative increase criteria do not apply to local roads.

Table 3.7 Road traffic relative increase criteria for residential land uses

Road Category	Type of project/development	Total traffic noise level increase - dB	
		Day (7 am to 10 pm)	Night (10 pm to 7 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 $L_{Aeq(15hr)}+12$ dB (external)	Existing traffic $L_{Aeq(9hr)}+ 12$ dB (external)

Source: RNP (DECCW 2011).

3.4 Blasting

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

The blasting criteria address two main effects of blasting:

- airblast noise overpressure; and
- ground vibration.

Airblast overpressure and ground vibration limits exist for the project (refer to Table 2.5) as specified in the development consent. Blasting at CGO is approved to occur 24 hours a day and seven days a week. The CGO airblast overpressure and ground vibration limits provided in the development consent are relatively consistent with the ANZECC criteria. However, the development consent includes airblast overpressure and ground vibration limits for the day, evening and night periods. The limits for the evening and night periods, as well as for Sundays and public holidays are more stringent (refer to Table 2.6) than the ANZECC criteria, as the ANZECC guideline recommends that blasting be limited between 9 am and 5 pm Monday to Saturday.

4 Assessment method

4.1 Noise modelling

4.1.1 Software

Quantitative modelling of construction and operational noise was completed using DGMR iNoise noise prediction software (from the developers of the long standing Predictor product). This software calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources. The model incorporated factors such as:

- the lateral and vertical location of plant and equipment;
- source-to-receiver distances;
- ground effects;
- atmospheric absorption;
- topography; and
- meteorological conditions.

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 calibration

To establish the noise model for this assessment, noise from approved existing CGO operations was modelled, based on the Mod 14 2020 operational scenario (Renzo Tonin 2018). The Mod 14 2020 operational scenario was considered as the year with the highest combined materials movement with maximum fleet in operation and is representative of existing CGO operations.

It is noted that the Mod 14 noise modelling assessment assumed worst-case scenario with all plant and equipment operating simultaneously. Furthermore, the Mod 14 noise modelling assessment adopted a calibration reduction of 3 dB to be consistent with field measurements and modelled results as per previous CGO assessments.

Noise levels from existing CGO operations were modelled based on noise-enhancing meteorological conditions in accordance with the NPfI and then compared to the Mod 14 2020 noise predictions for the day, evening and night periods. Where modelled existing noise levels were found to be lower than the Mod 14 2020 noise predictions, positive adjustments were made to modelled existing noise levels to adjust the noise model accordingly. The adjusted noise model considers the differences from the effect of meteorological conditions on site noise propagation to assessment locations, including the influence of strong temperature inversion conditions during the evening and night periods.

Where modelled existing noise levels were found to be at or higher than the Mod 14 2020 noise predictions, no adjustments were made to the modelled existing noise levels. This was the case for the day period where only calm meteorological conditions were used in the Mod 14 noise modelling assessment, which likely contributed to the lower Mod 14 2020 noise predictions for the day period. Modelled existing noise levels were also found to be at or higher than the Mod 14 2020 noise predictions at assessment locations further from site during the evening and night periods. Such differences in the noise modelling results were likely due to the different algorithms used and the calibration reduction adopted in the Mod 14 noise modelling assessment.

4.1.3 Project noise modelling

To assess noise from the Project (ie proposed underground mine and Mod 16 operations), the noise model (consistent with the Mod 14 noise model) was used to predict noise from plant and equipment related to the proposed underground mine and additional Mod 16 surface operations for year 2031 at CGO. This is the year when the proposed underground mine will be at maximum production and hence is considered the worst-case scenario for operational noise emissions.

Modelled operational noise sources for the proposed underground mine, including underground mine trucks and the paste fill plant and for the additional Mod 16 surface operations for 2031 and associated sound power levels are summarised in Table 4.1.

The sound power levels are based on on-site measurements (referenced from previous noise assessments completed for CGO) or otherwise have been supplemented using EMM’s database of equipment used for similar projects. Single octave sound power levels are provided in Appendix D. It is noted that other plant and equipment items associated with the operation of the proposed underground mine would be operating underground and hence were not included in the project noise model.

Table 4.1 Modelled worst-case acoustically significant noise sources for the proposed underground mine and additional Mod 16 surface operations for 2031

Plant or equipment item – model	Quantity (2031)	Sound power level ¹ , dB(A)
Underground mine trucks – Sandvik TH663	6	118 ²
Pastefill plant	1	113 ³

Notes: 1. Per unit of plant or equipment.
 2. Referenced from the manufacturer’s technical specification. It is noted that sound power level measurement undertaken by EMM for another project has identified a much lower level for this equipment model.
 3. Referenced from a noise assessment prepared for a similar project.

To establish a future site-wide operational noise modelling scenario, predicted 2031 noise levels from plant and equipment related to the proposed underground mine and additional Mod 16 surface operations were combined with the Mod 14 2024 noise predictions. The Mod 14 2024 operational scenario is considered relevant to the timeframe of the project and represents the following approved CGO open cut mining operations:

- TSF lift works and supplementary IWL development activities during the day period;
- IWL construction 24 hours a day and seven days a week with the IWL at its approved maximum height (ie 245 m AHD); and
- all other CGO open cut mining operations.

This future site-wide operational noise modelling scenario for the project is therefore considered worst-case.

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 type of additional noise sources proposed for the underground mine and Mod 16 surface operations as well as the large distance between CGO and nearest residential receivers, it is unlikely that operational noise sources (existing and proposed) would contain annoying characteristics such as tonality, intermittency, irregularity or generate dominant low frequency noise. Therefore, no modifying factor corrections were applied to predicted noise levels. This is consistent with the findings in previous noise assessments completed for CGO in relation to modifying factors.

4.1.4 Construction noise modelling

The construction noise modelling was based on information received from Evolution, including the locations of the proposed works, the list of plant and equipment items and construction hours.

The construction activities associated with development of the IWL have commenced and are expected to be completed in 2024. The maximum final rehabilitated IWL height is proposed to be increased by one metre (ie from 245 m AHD to 246 m AHD), however the overall lateral footprint of the IWL would remain as approved. Therefore, noise emissions generated by construction activities associated with development of the IWL are not anticipated to change as a result of the proposed underground mine and additional Mod 16 surface operations.

Activities associated with the construction of the pastefill plant and upgrade to the processing plant are unlikely to result in significant noise levels at all assessment locations and therefore have not been assessed further. This in part was due to the relatively lower noise emission levels of likely plant and equipment to be used.

The construction of the box-cut however is likely to generate relatively higher noise emissions and hence have been modelled as a worst-case construction scenario for the project. The box-cut construction has been assumed to occur during approved existing CGO mining operational hours, 24 hours and seven days per week.

Further, proposed construction works will occur concurrently with mining operations at CGO and hence predicted noise levels for the box-cut construction have been combined with the Mod 14 2024 noise predictions before comparison to the operational PNTLs.

Modelled noise sources and sound power levels for the box-cut construction are summarised in Table 4.2. The sound power levels are based on data referenced from the Mod 14 noise and blasting assessment.

Table 4.2 Modelled acoustically significant noise sources for the box-cut construction

Plant or equipment item – model	Quantity	Sound power level ^{1,2} , dB(A)
Excavator – Liebherr 9400	1	121
Excavator – Hitachi EX-1900	1	115 ³
Excavator – Hitachi EX-1200	1	115 ³
Truck – CAT 789	3	124
Truck – CAT 777	3	116

- Notes:
1. Sound power levels were referenced from the Mod 14 noise and blasting assessment (Renzo Tonin 2018), unless stated otherwise.
 2. Per unit of quantity.
 3. Sound power level for this smaller excavator model was not available and hence a conservative sound power level for a larger excavator model (ie Hitachi EX-3600) was referenced from the Mod 14 noise and blasting assessment (Renzo Tonin 2018).

4.1.5 Modelled meteorological conditions

Winds and temperature inversions were not identified applicable to the project area in accordance with the NPfI (refer to Section 2.6).

As a conservative approach however, the noise model established for the project considers noise-enhancing meteorological conditions for the day, evening and night periods in accordance with the NPfI. Additionally, where the noise model was under predicting for the evening and night periods in comparison to the Mod 14 noise predictions, the noise model was adjusted to the Mod 14 noise predictions which account for the influence of strong temperature inversion conditions (8°C/100 m).

A summary of modelling 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	Noise enhancing
Evening	Noise enhancing or strong temperature inversion conditions (8°C/100 m) ²
Night	Noise enhancing or strong temperature inversion conditions (8°C/100 m) ²

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: remaining periods.
2. Whichever provides the higher noise prediction for the relevant assessment location.

4.2 Road traffic noise

The potential noise impacts resulting from existing and future operational related traffic on public roads are assessed against criteria defined in the RNP. The application of appropriate road traffic noise criteria for the site has followed the two-step process identifying the assessment and the relative increase criteria for both the construction stages and future operational stage as outlined in Section 3.4.1 of the RNP.

Existing site related traffic utilise one of three routes to site. The majority of workforce (approximately 80%) travel via light vehicles, busses and coaches to West Wyalong with the remaining workforce commuting to either Condobolin (approximately 10%) or Forbes (approximately 10%).

Occasionally, due to severe wet weather conditions, unsealed roads in the region are closed, which makes part of the preferred transport routes to Condobolin and Forbes unavailable for access. Under these circumstances, the alternate transport route from Condobolin is used.

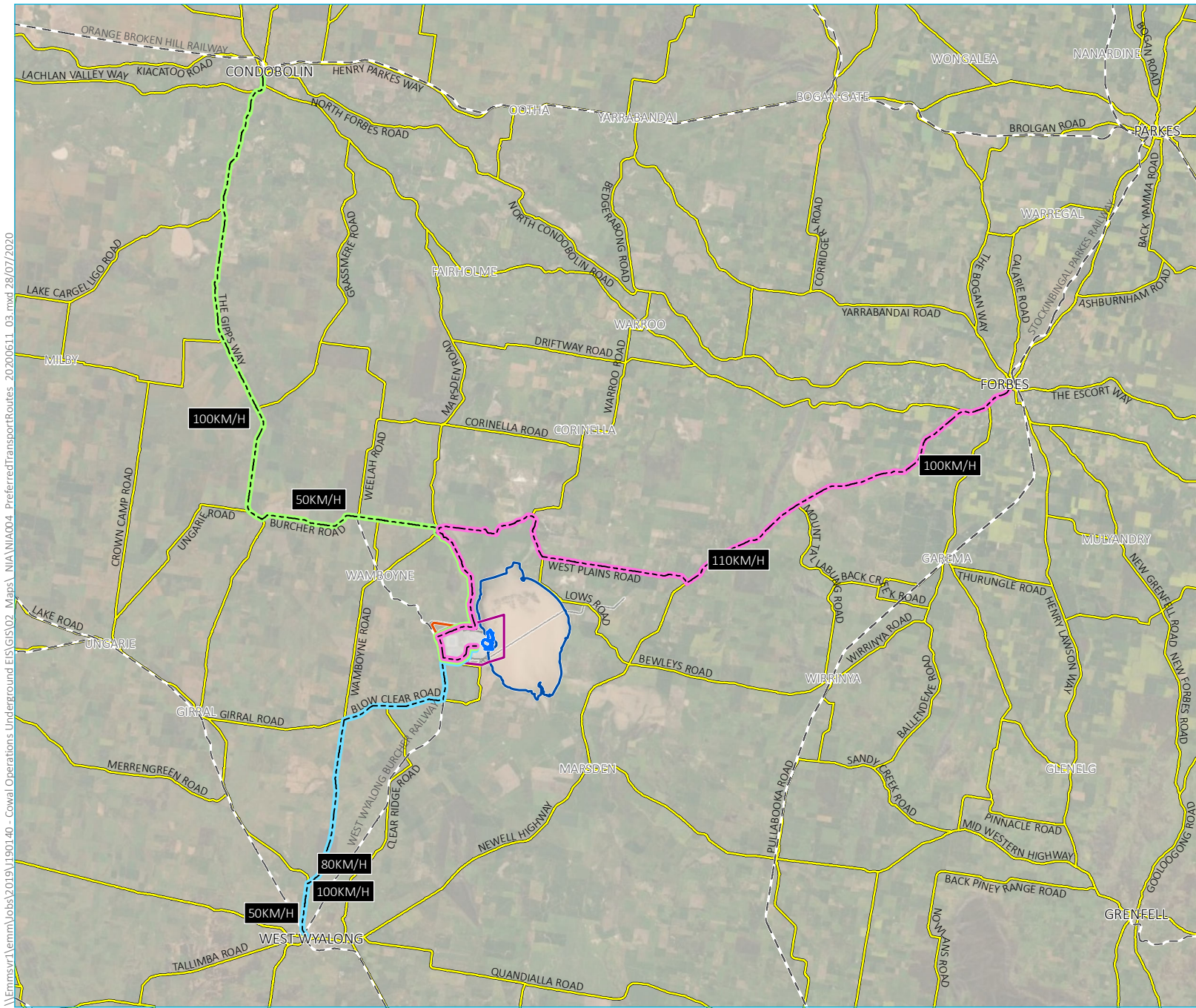
Likewise, under severe weather conditions, the alternate transport route from Forbes is via the Newell Highway to West Wyalong, then following the preferred transport route from West Wyalong to the site.

Also, when the water level is high at Lake Cowal/Nerang Cowal, the preferred transport route via Lake Cowal Road and Bogies Island Road become inaccessible for cars and trucks. Under these circumstances, the alternate transport route from Forbes is used.

The preferred and alternate transport routes are summarised in Table 4.4 and shown in Figure 4.1 and Figure 4.2.

Table 4.4 **Transportation routes**

Origin or destination	Preferred transport route
West Wyalong	Newell Highway <-> Ungarie Road <-> Wamboyne Road <-> Blow Clear Road <-> Bonehams Lane <-> Mine access road
Condobolin	The Gipps Way <-> Burcher Road <-> Bena Street <-> Lake Cowal Road (east-west) <-> Fitzgerald Road <-> Lake Cowal Road (north-south) <-> Mine access road
Forbes	Newell Highway <-> West Plains Road <-> Bogies Island Road <-> Lake Cowal Road (east-west) <-> Fitzgerald Road <-> Lake Cowal Road (north-south) <-> Mine access road
Origin location	Alternative transport route
Condobolin	The Gipps Way <-> Burcher Road <-> Bena Street <-> Wamboyne Road <-> Blow Clear Road <-> Bonehams Lane <-> Mine access road
Forbes	Newell Highway <-> Lachlan Valley Way <-> Driftway Road <-> Warroo Road <-> Corinella Road <-> Marsden Road <-> Lake Cowal Road (east-west) <-> Fitzgerald Road <-> Lake Cowal Road (north-south) <-> Mine access road



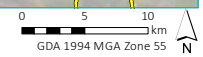
- KEY**
- Proposed underground development
 - Mining lease (ML1535)
 - Mining lease (ML1791)
 - Approved surface disturbance
 - Rail line
 - Main road
 - Extent of Lake Cowal
 - Preferred transport routes
 - Condoblin route
 - Forbes route
 - West Wyalong route

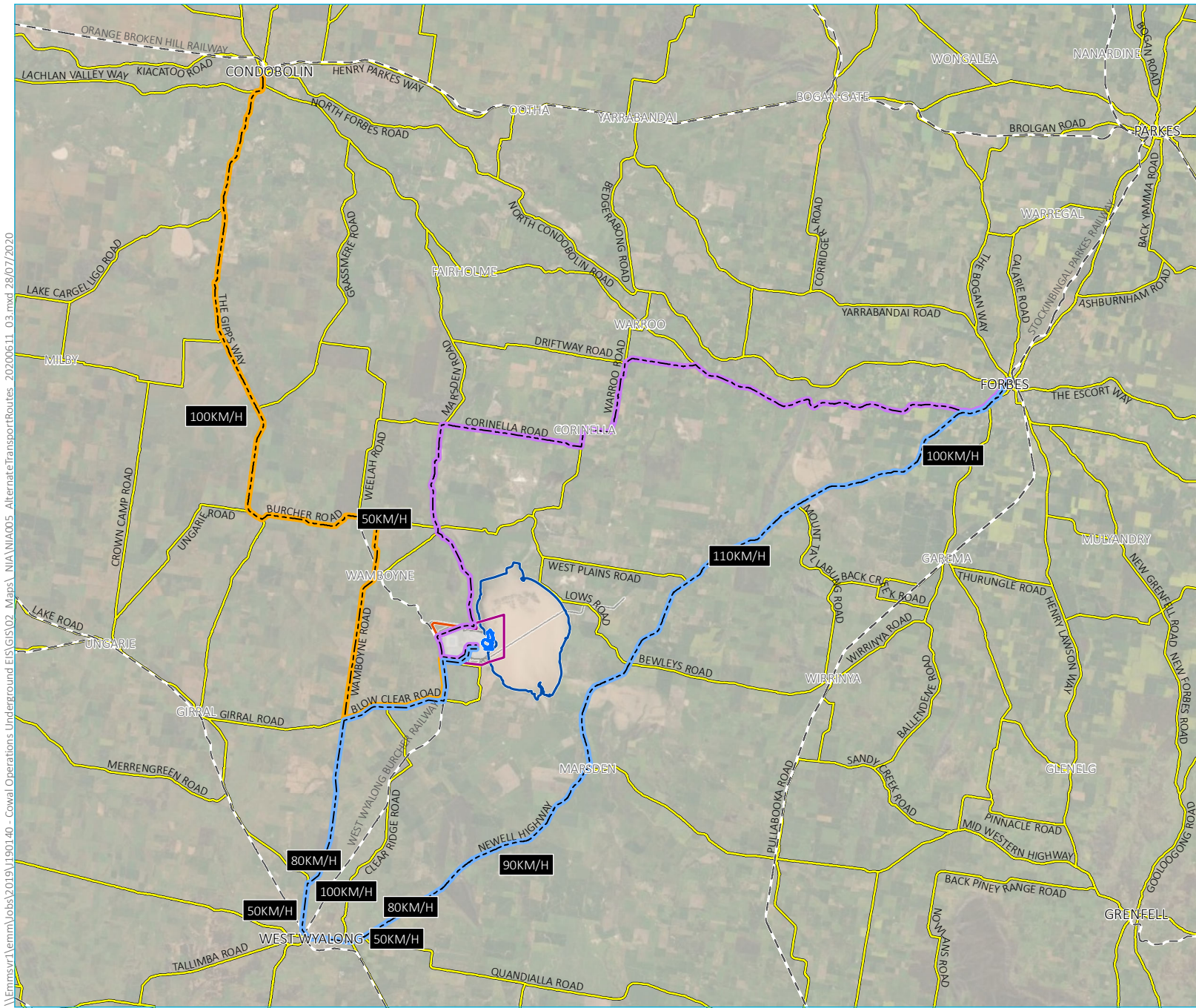
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Preferred transport routes

Evolution Mining
Cowl Gold Operations
Noise and vibration impact assessment
Figure 4.1

Source: EMM (2020); Evolution (2020); DFSI (2017)





- KEY**
- Proposed underground development
 - Mining lease (ML1535)
 - Mining lease (ML1791)
 - Approved surface disturbance
 - Rail line
 - Main road
 - Extent of Lake Cowal
 - Alternate transport routes
 - Condoblin alternate route due to weather condition
 - Forbes alternate route due to weather condition
 - Forbes alternate route due to high water level

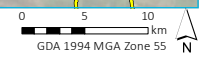
Preferred transport routes

Evolution Mining
Cowl Gold Operations
Noise and vibration impact assessment
Figure 4.2



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Source: EMM (2020); Evolution (2020); DFSI (2017)



4.2.1 Workforce movements

Additional daily mine traffic movements will primarily be related to the additional workforce travel. The project will generate light vehicle movements from individual employee cars and utes, as well as heavy vehicle movements from buses and coaches which will be transporting the major proportion of the additional project workforce (75%) to and from the site each day.

The peak construction workforce for the project will occur during month 9 of construction, with a total of 335 persons at this time. The proposed construction hours for the project will generally be from 6 am to 6 pm seven days per week, resulting in two hourly peak periods of construction related traffic movements, travelling to site between 5 am and 6 am and travelling from site between 6 pm and 7 pm.

The future workforce for the project will comprise a total of 83 persons for each 12-hour shift. The shift work hours for the project will be from 6 am to 6 pm and from 6 pm to 6 am, seven days per week, resulting in peak periods of project workforce traffic movements between 5 am to 7 am and 5 pm to 7 pm.

The RNP sets a noise level increase threshold of 2 dB. That is, if project related road traffic movements increase total road traffic noise levels by more than 2 dB, then mitigation for affected residential properties should be considered. A detailed calculation of total road traffic noise levels has been completed where a potential increase of greater than 2 dB has been identified.

4.2.2 Existing traffic volumes

Existing average daily traffic volumes were counted during 2018 to 2020 in RMS surveys across roadways throughout the Bland Shire. The traffic volumes for relevant surrounding roadways and their corresponding classification for the purposes of this road traffic noise assessment are summarised in Table 4.5. No detailed traffic survey data was available for West Plains Road, Burcher Road or The Gipps Way, however, existing day and night traffic volumes along these roads were estimated based on existing adjoining road traffic volumes:

- Ungarie Road for The Gipps Way; and
- Lake Cowal Road for West Plains Road and Burcher Road.

Table 4.5 Existing traffic movements on surrounding roads

Road name	Road classification	Vehicle description	Traffic movements		
			Day	Night	Total
Ungarie Road	Sub-arterial	Light vehicle	894	144	1038
		Heavy vehicle	274	37	311
Wamboyne Road	Sub-arterial	Light vehicle	189	111	300
		Heavy vehicle	75	37	112
Blow Clear Road	Sub-arterial	Light vehicle	169	111	280
		Heavy vehicle	86	41	127
Bonehams Lane	Sub-arterial	Light vehicle	197	128	325
		Heavy vehicle	60	30	90
Mine Access Road	Sub-arterial	Light vehicle	154	142	296
		Heavy vehicle	38	31	69

Table 4.5 Existing traffic movements on surrounding roads

Road name	Road classification	Vehicle description	Traffic movements		
			Day	Night	Total
Lake Cowal Road	Sub-arterial	Light vehicle	36	24	60
		Heavy vehicle	12	11	23
West Plains Road	Sub-arterial	Light vehicle	24	18	42
		Heavy vehicle	6	4	10
Burcher Road	Sub-arterial	Light vehicle	25	18	43
		Heavy vehicle	6	4	10
The Gipps Way	Sub-arterial	Light vehicle	159	25	184
		Heavy vehicle	84	13	97
Newell Highway	Freeway	Light vehicle	1044	79	1123
		Heavy vehicle	897	195	1092

Notes: 1. The RNP day period is between 7 am and 10 pm.
2. The RNP night period is between 10 pm and 7 am.

4.2.3 Future operations

Traffic generation predictions for the project are provided in the Traffic Impact Assessment (TIA) completed for the project (EMM 2020). It was estimated in the TIA that approximately 80% of future project related traffic would travel south-west to West Wyalong, with the remaining 20% evenly split between travelling to Condobolin and Forbes.

During future underground mining operations, the total number of additional vehicles generated for 83 persons per shift will be 25 vehicles (4 buses and 21 light vehicles) travelling both to and from the site. This represents a total of 100 additional daily vehicle movements for the two 12-hour shifts. There will also be approximately five additional daily truck deliveries (or 10 additional truck movements). These additional daily vehicle movements will be distributed approximately as follows:

- 76 daily vehicle movements (30 light vehicles, 4 buses and 4 trucks) travelling to and from the Wyalong/West Wyalong area;
- 17 daily vehicle movements (6 light vehicles, 2 buses and up to 1 truck) travelling to and from the Forbes Shire urban or rural areas; and
- 17 daily vehicle movements (6 daily light vehicles, 2 daily buses and up to 1 truck) travelling to and from the Lachlan Shire urban or rural areas.

Future road traffic movements adopted for the operational road traffic assessment are presented in Table 4.6.

Table 4.6 Future traffic generation on public roads during operations

Road name	Vehicle description	Future additional vehicle movements (project related) during operations		Total vehicle movements (including existing)	
		Day	Night	Day	Night
Ungarie Road	Light vehicle	66	10	960	154
	Heavy vehicle	14	2	288	39
Wamboyne Road	Light vehicle	49	27	238	138
	Heavy vehicle	10	6	85	43
Blow Clear Road	Light vehicle	47	29	216	140
	Heavy vehicle	10	6	96	47
Bonehams Lane	Light vehicle	47	29	244	157
	Heavy vehicle	10	6	70	36
Mine Access Road	Light vehicle	58	52	212	194
	Heavy vehicle	14	12	52	43
Lake Cowal Road	Light vehicle	20	14	56	38
	Heavy vehicle	6	4	18	15
West Plains Road	Light vehicle	10	7	34	25
	Heavy vehicle	3	2	9	6
Burcher Road	Light vehicle	10	7	35	25
	Heavy vehicle	3	2	9	6
The Gipps Way	Light vehicle	8	1	167	26
	Heavy vehicle	3	0	87	13
Newell Highway	Light vehicle	18	3	1062	82
	Heavy vehicle	4	1	901	196

Notes: 1. The RNP day period is between 7 am and 10 pm.
 2. The RNP night period is between 10 pm and 7 am.
 3. Traffic volumes were referenced from the TIA (EMM 2020).

4.2.4 Construction

During the construction phase, it was estimated in the TIA that approximately 80% of project related traffic would travel south-west to West Wyalong, with the remaining 20% evenly split between travelling to Condobolin and Forbes.

This represents a total of 105 vehicles (5 trucks, 16 buses and 84 light vehicles) travelling both to and from the site (total 210 daily vehicle movements). These additional daily vehicle movements will be distributed approximately as follows:

- 168 daily vehicle movements (68 daily light vehicles, 12 daily buses and 4 daily trucks) travelling to and from the Wyalong/West Wyalong area;
- 21 daily vehicle movements (8 light vehicles, 2 buses and up to 1 truck) travelling to and from the Forbes Shire urban or rural areas; and
- 21 daily vehicle movements (8 light vehicles, 2 buses and up to 1 truck) travelling to and from the Lachlan Shire urban or rural areas.

Furthermore, the peak construction period has also been assessed, as the greatest increase in road traffic volumes throughout the construction phase is anticipated during this period.

Project related road traffic movements adopted for the construction road traffic assessment are presented in Table 4.7.

Table 4.7 Traffic generation on public roads during construction

Road name	Vehicle description	Future additional vehicle movements (project related) during construction		Total vehicle movements (including existing)	
		Day	Night	Day	Night
Ungarie Road	Light vehicle	145	23	1039	167
	Heavy vehicle	28	4	302	41
Wamboyne Road	Light vehicle	108	60	297	171
	Heavy vehicle	21	11	96	48
Blow Clear Road	Light vehicle	105	63	274	174
	Heavy vehicle	20	12	106	53
Bonehams Lane	Light vehicle	104	64	301	192
	Heavy vehicle	20	12	80	42
Mine Access Road	Light vehicle	110	100	264	242
	Heavy vehicle	22	20	60	51
Lake Cowal Road	Light vehicle	24	18	60	42
	Heavy vehicle	6	4	18	15
West Plains Road	Light vehicle	12	9	36	27
	Heavy vehicle	3	2	9	6
Burcher Road	Light vehicle	12	9	37	27
	Heavy vehicle	3	2	9	6
The Gipps Way	Light vehicle	10	1	169	26
	Heavy vehicle	3	0	87	13
Newell Highway	Light vehicle	18	3	1062	82
	Heavy vehicle	4	1	901	196

Notes: 1. The RNP day period is between 7 am and 10 pm.
 2. The RNP night period is between 10 pm and 7 am.
 3. Traffic volumes were referenced from the TIA (EMM 2020).

4.3 Blasting

Proposed blast activities during the proposed underground mine operation will be conducted underground. Following the construction of the box-cut, blasting will be required during the development of the underground access decline development. Potential impacts associated with airblast overpressure and ground vibration in the early stages of the underground access decline development (ie when close to the surface) have been assessed.

Following the completion of the underground access decline, blast activities for the proposed underground mine will be conducted underground. Potential impacts associated with airblast overpressure will be negligible and the only potential impact from underground blasting will be related to ground vibration.

The following sections provide the methods for calculating airblast overpressure and ground vibration levels from the project.

4.3.1 Airblast overpressure

Airblast overpressure monitoring data relevant to CGO was provided to EMM by Evolution. This data included blast ID information, maximum instantaneous charge (MIC) and measured airblast overpressure levels at surrounding monitoring locations. The development of prediction site laws for airblast overpressure was not possible due to a low degree of correlation between the airblast overpressure monitoring results. Hence, airblast overpressure levels have been calculated using the method provided in the AS 2187-2:2006 and the ICI Explosives Blasting Guide (1995). This formula has been shown to be conservative in calculating airblast overpressure levels.

The formula adopted to calculate the airblast overpressure is as follows:

$$\text{Airblast overpressure} = 164.2 - 24(\log_{10} R - 0.33 \log_{10} Q).$$

Where airblast overpressure is the peak blast overpressure (dB Linear), R is the distance between charge and receiver (m) and Q is the MIC (kg).

Airblast overpressure levels from blasting during the early stages of the underground access decline development were calculated using the above formula to determine the allowable MICs to achieve the existing airblast overpressure limits at surrounding sensitive receivers.

4.3.2 Ground vibration

Blast ground vibration monitoring data relevant to CGO was provided to EMM by Evolution. This data included blast ID information, maximum instantaneous charge (MIC) and measured ground vibration levels at surrounding monitoring locations. Blast monitoring results between January 2019 and June 2020 were used to develop prediction site laws for ground vibration for this assessment. Site specific relationships between the level of blast emissions and scaled distances have been developed based on the measured data as shown graphically in Figure 4.3.

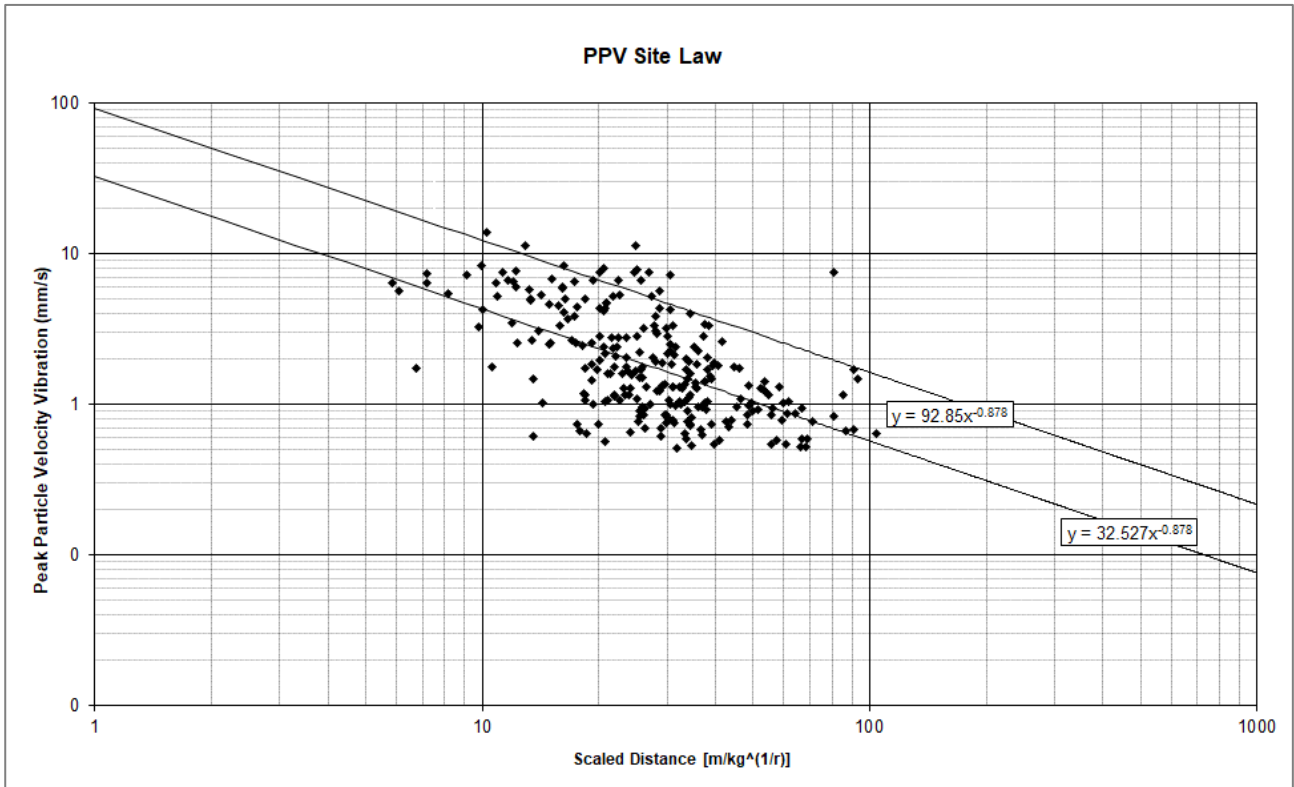


Figure 4.3 Ground vibration monitoring data and site law

Two scaled distance methods were initially used to develop prediction site laws, namely the square-root scaled distance or the cube-root scaled distance. Analysis of the blast ground vibration monitoring data showed that both methods had a similar degree of correlation (59%). A square-root scaled distance is commonly used for the purpose of open cut mining blast vibration predictions to account for the cylindrical dispersion of energy from a blast. As a result, the cube-root scaled distance has been adopted for the purpose of assessing the potential blast vibration impacts from the proposed underground mine.

The scaled distance is determined from the following equation:

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

Where D is the distance between the monitoring location and the blast site and MIC is the maximum instantaneous charge (kg) detonated in an eight-millisecond interval.

The site law equation for ground vibration emissions has been calculated to be:

$$PPV(95\%) = 92.85SD^{-0.878}$$

Where peak particle velocity (PPV) (95%) is the level of ground vibration (peak particle velocity in 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 underlying measured sample.

Calculations of ground vibration levels from blasting were conducted using the site law equation developed based on measured data, in order to determine the allowable MICs to achieve the existing ground vibration limits at surrounding sensitive receivers.

5 Assessment results

5.1 Mine noise

5.1.1 Construction noise

Acoustically significant plant and equipment items to be used for the box-cut construction were modelled at worst-case locations (ie at the highest and most exposed topographical points).

Predicted noise levels for the box-cut construction during noise-enhancing meteorological conditions (refer to Table 4.3) have been combined with the Mod 14 2024 noise predictions for the day, evening and night periods before comparison to the existing development consent (DA 94/18) limits as shown in Table 5.1.

Table 5.1 Predicted noise levels during the box-cut construction

Assessment location	Mod 14 2024 L _{Aeq,15min} noise predictions ¹ , dB			Predicted L _{Aeq,15min} noise levels during the box-cut construction ² , dB			Existing limits (DA 14/98), L _{Aeq,15min} , dB			Exceedance of the existing limits (DA 14/98), dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
4	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
6	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
15 ³	<35	<35	<35	<35	<35	35	N/A	N/A	N/A	N/A	N/A	N/A
20	<35	<35	35	<35	35	35	35	35	35	Nil	Nil	Nil
21 ⁴	<35	44	44	<35	44	44	N/A	N/A	N/A	N/A	N/A	N/A
22a	<36	<36	36	<36	<36	36	36	36	36	Nil	Nil	Nil
22b	<35	35	35	<35	35	35	35	35	35	Nil	Nil	Nil
22c ⁵	<38	38	38	<38	38	38	38	38	38	Nil	Nil	Nil
22d	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
24	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
25	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
28	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
30a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
30b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
31a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
36a	<37	<37	<37	<37	<37	<37	37	37	37	Nil	Nil	Nil
36b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
38	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil

Table 5.1 Predicted noise levels during the box-cut construction

Assessment location	Mod 14 2024 L _{Aeq,15min} noise predictions ¹ , dB			Predicted L _{Aeq,15min} noise levels during the box-cut construction ² , dB			Existing limits (DA 14/98), L _{Aeq,15min} , dB			Exceedance of the existing limits (DA 14/98), dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
42 ⁴	<35	46	46	<35	46	46	N/A	N/A	N/A	N/A	N/A	N/A
43a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
43b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
49a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
49b	<36	<36	36	<36	<36	36	36	36	36	Nil	Nil	Nil
56	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
57	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
61a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
62	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
79	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
89	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
90	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
100	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
122	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
126	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
LCR	<35	<53	<53	<53	<53	<53	N/A	N/A	N/A	N/A	N/A	N/A
NO3	<35	42	42	<40	44	44	N/A	N/A	N/A	N/A	N/A	N/A
N04	<35	<35	<35	<40	<35	<35	N/A	N/A	N/A	N/A	N/A	N/A

- Notes:
1. Referenced from the Mod 14 noise and blasting assessment prepared by Renzo Tonin (2018).
 2. Combined Mod 14 2024 noise predictions and predicted box-cut construction noise levels.
 3. Evolution has a noise agreement in place with the land owner of this privately-owned property.
 4. Subject to acquisition upon request in accordance with the development consent.
 5. Subject to mitigation upon request in accordance with the development consent.
 6. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: remaining periods.
 7. N/A = not applicable.

The modelling results show that CGO noise levels during the box-cut construction (predicted box-cut construction noise levels combined with the Mod 14 2024 noise predictions) during noise-enhancing meteorological conditions are predicted to satisfy the existing operational noise limits in development consent DA 14/98 at all assessment locations.

For the waterbird breeding areas (assessment locations N03 and N04), the modelling results show that CGO noise levels during the box-cut construction are predicted to be up to 44 dB $L_{Aeq,15min}$ during evening and night periods. 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. No significant noise impact is anticipated during the box-cut entry construction.

5.1.2 Operational noise

To assess potential noise impacts from the Project, noise levels from the proposed underground mining operations (ie underground mine trucks and pastefill plant) were predicted for 2031 during noise-enhancing meteorological conditions (refer to Table 4.3). The predicted 2031 noise levels were then combined with the Mod 14 2024 noise predictions for the day, evening and night periods and represent future operational noise levels.

Future operational noise levels are shown in Table 5.2.

Table 5.2 Predicted future operational noise levels

Assessment location	Mod 14 2024 L _{Aeq,15min} noise predictions ¹ , dB			Predicted future L _{Aeq,15min} noise levels ² , dB			Existing limits (DA 14/98), L _{Aeq,15min} , dB			Exceedance of the existing limits (DA 14/98), dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
4	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
6	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
15 ³	<35	<35	<35	<35	<35	35	N/A	N/A	N/A	N/A	N/A	N/A
20	<35	<35	35	<35	35	35	35	35	35	Nil	Nil	Nil
21 ⁴	<35	44	44	<35	44	44	N/A	N/A	N/A	N/A	N/A	N/A
22a	<36	<36	36	<36	<36	36	36	36	36	Nil	Nil	Nil
22b	<35	35	35	<35	35	35	35	35	35	Nil	Nil	Nil
22c ⁵	<38	38	38	<38	38	38	38	38	38	Nil	Nil	Nil
22d	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
24	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
25	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
28	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
30a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
30b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
31a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
36a	<37	<37	<37	<37	<37	<37	37	37	37	Nil	Nil	Nil
36b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
38	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil

Table 5.2 Predicted future operational noise levels

Assessment location	Mod 14 2024 L _{Aeq,15min} noise predictions ¹ , dB			Predicted future L _{Aeq,15min} noise levels ² , dB			Existing limits (DA 14/98), L _{Aeq,15min} , dB			Exceedance of the existing limits (DA 14/98), dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
42 ⁴	<35	46	46	<35	46	46	N/A	N/A	N/A	N/A	N/A	N/A
43a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
43b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
49a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
49b	<36	<36	36	<36	<36	36	36	36	36	Nil	Nil	Nil
56	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
57	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
61a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
62	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
79	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
89	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
90	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
100	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
122	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
126	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
LCR	<35	<53	<53	<53	<53	<53	N/A	N/A	N/A	N/A	N/A	N/A
NO3	<35	42	42	<40	45	45	N/A	N/A	N/A	N/A	N/A	N/A
N04	<35	<35	<35	<40	<35	<35	N/A	N/A	N/A	N/A	N/A	N/A

- Notes:
1. Referenced from the Mod 14 noise and blasting assessment prepared by Renzo Tonin (2018).
 2. Combined Mod 14 2024 noise predictions and predicted 2031 noise levels.
 3. Evolution has a noise agreement in place with the land owner of this privately-owned property.
 4. Subject to acquisition upon request in accordance with the development consent.
 5. Subject to mitigation upon request in accordance with the development consent.
 6. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: remaining periods.
 7. N/A = not applicable.

The modelling results show that future operational noise levels (predicted 2031 noise levels combined with the Mod 14 2024 noise predictions) for the day, evening and night periods during noise-enhancing meteorological conditions are relatively unchanged from existing approved operations and are predicted to satisfy the existing noise limits in development consent DA 14/98 at all assessment locations.

The VLAMP states that voluntary mitigation and voluntary land acquisition rights should not be applied where a modification to an existing development with legacy noise issues would have beneficial or negligible noise impacts. This noise assessment has demonstrated that noise emissions from the project (approved and proposed) are predicted to be relatively the same as existing CGO noise emissions at all assessment locations and generate no additional noise impacts. Feasible and reasonable mitigation measures have previously been considered as part of the Mod 14 noise assessment (Renzo Tonin 2018) and therefore have not been considered further as part of this assessment.

For the waterbird breeding areas (assessment locations N03 and N04), the modelling results show that CGO noise levels during the project are predicted to be up to 45 dB $L_{Aeq,15min}$ during evening and night periods. Noise and 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 noise emissions. The bird behaviour monitoring is expected to continue during the project in accordance with the CGO Flora and Fauna Management Plan. No significant noise impact is anticipated as a result of the Project.

It is important to note that predicted future operational noise levels represent worst-case scenarios for each assessment period and operations. Notwithstanding, noise management measures currently in place at CGO such as quarterly attended noise monitoring will continue to be implemented.

5.1.3 Sleep disturbance

Maximum noise levels from future night-time mining operations (proposed underground mine and Mod 16 operations) with the potential to cause sleep disturbance at nearby residences have been assessed in accordance with the NPfI.

Predicted future operational $L_{Aeq,15min}$ noise levels for the night period were taken from Table 5.2 and assessed against the relevant sleep disturbance screening criteria.

Further, maximum L_{Amax} noise events from future night-time operations considered for this assessment included an excavator bucket hitting the ground or a truck loading ore into the primary crusher at the processing area. A sound power level of 125 dB L_{Amax} was adopted to cover any of these possible events in the prediction of sleep disturbance impacts at residential assessment locations during night-time noise-enhancing meteorological conditions.

Maximum noise levels from future (approved and proposed) night-time mining operations are provided in Table 5.3.

Table 5.3 Predicted night-time maximum noise levels at residential assessment locations

Residential assessment location	Predicted night-time maximum noise levels, dB		Screening criteria, dB		Exceedance of the screening criteria, dB	
	L _{Aeq,15min} ¹	L _{Amax}	L _{Aeq,15min}	L _{Amax}	L _{Aeq,15min}	L _{Amax}
4	<35	<52	40	52	Nil	Nil
6	<35	<52	40	52	Nil	Nil
15 ²	35	<52	N/A	N/A	N/A	N/A
20	35	<52	40	52	Nil	Nil
21 ³	44	<52	N/A	N/A	N/A	N/A
22a	36	<52	40	52	Nil	Nil
22b	35	<52	40	52	Nil	Nil
22c ⁴	38	<52	40	52	Nil	Nil
22d	<35	<52	40	52	Nil	Nil
24	<35	<52	40	52	Nil	Nil
25	<35	<52	40	52	Nil	Nil
28	<35	<52	40	52	Nil	Nil
30a	<35	<52	40	52	Nil	Nil
30b	<35	<52	40	52	Nil	Nil
31a	<35	<52	40	52	Nil	Nil
36a	<37	<52	40	52	Nil	Nil
36b	<35	<52	40	52	Nil	Nil
38	<35	<52	40	52	Nil	Nil
42 ³	46	<52	N/A	N/A	N/A	N/A
43a	<35	<52	40	52	Nil	Nil
43b	<35	<52	40	52	Nil	Nil
49a	<35	<52	40	52	Nil	Nil
49b	36	<52	40	52	Nil	Nil
56	<35	<52	40	52	Nil	Nil
57	<35	<52	40	52	Nil	Nil
61a	<35	<52	40	52	Nil	Nil
62	<35	<52	40	52	Nil	Nil
79	<35	<52	40	52	Nil	Nil
89	<35	<52	40	52	Nil	Nil
90	<35	<52	40	52	Nil	Nil
100	<35	<52	40	52	Nil	Nil
122	<35	<52	40	52	Nil	Nil
126	<35	<52	40	52	Nil	Nil

- Notes:
1. Taken from Table 5.2.
 2. Evolution has a noise agreement in place with the land owner 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 pm to 7 am Monday to Saturday, 10 pm to 8 am Sundays and public holidays.

Maximum L_{Aeq} noise levels are predicted to satisfy the screening criteria for sleep disturbance at all residential assessment locations during night-time noise-enhancing meteorological conditions. Therefore, the project is unlikely to cause CGO maximum L_{Aeq} noise levels to increase above the L_{Aeq} screening criterion at any of the assessment locations where Mod 14 2024 noise predictions previously satisfied the L_{Aeq} screening criterion for sleep disturbance.

Noise modelling results show that maximum L_{Amax} noise levels are predicted to satisfy the screening criteria for sleep disturbance at all residential assessment locations during night-time noise-enhancing meteorological conditions.

5.2 Road traffic noise

Based on the projected daily traffic volume increases for the peak mine operational periods, it is anticipated that the effect of these additional traffic movements and the corresponding noise impact generated will be negligible. The noise level increase due to the additional project related road traffic movements has been provided and compared to the RNP 2 dB increase threshold to determine if further detailed assessment is required.

5.2.1 Operational traffic

Road traffic noise levels predicted at the nearest residential facades for the RNP day and night periods are shown in Table 5.4.

The results show that the existing (2019) road traffic noise levels calculated for the day and night periods at the nearest residential facade along the Newell Highway currently exceed the relevant criteria. Existing (2019) road traffic noise level calculated for the day period at the nearest residential facade along Ungarie Road currently exceeds the relevant criterion. Future (with project related operation traffic) road traffic noise levels at the nearest residential facade along these roads are predicted to negligibly increase (by up to 0.2 dB) from existing noise levels. Hence, road traffic noise levels are predicted to satisfy the RNP 2 dB allowance increase criterion and unlikely to cause an impact during operation.

Road traffic noise levels on all other roads are predicted to satisfy the day and night criteria and therefore unlikely to cause an impact during operation.

Table 5.4 Operational road traffic noise results

Road name	Distance to nearest receiver (m)	Existing (2019) noise levels, dB		Future noise levels, dB		Criteria, dB		Increase between existing and future, dB	
		Day	Night	Day	Night	Day	Night	Day	Night
		L _{Aeq,15hr}	L _{Aeq,9hr}	L _{Aeq,15hr}	L _{Aeq,9hr}	L _{Aeq,15hr}	L _{Aeq,9hr}		
Ungarie Road	30	61	54	61	55	60	55	0.2	0.2
Wamboyne Road	40	57	54	58	55	60	55	0.6	0.7
Blow Clear Road	240	49	48	50	49	60	55	0.6	0.6
Bonehams Lane	800	41	40	42	41	60	55	0.6	0.8
Mine Access Road	800	39	41	41	42	60	55	1.3	1.4
Lake Cowal Road	230	39	41	41	43	60	55	1.7	1.4
West Plains Road	220	37	37	39	39	60	55	1.7	1.8
Burcher Road	95	41	42	43	44	60	55	1.6	1.7
The Gipps Way	300	48	42	48	42	60	55	0.1	0.1
Newell Highway	20	72	68	72	68	60	55	Nil	Nil

Notes: 1. The RNP day period is between 7 am and 10 pm.
 2. The RNP night period is between 10 pm and 7 am.
 3. Traffic volumes were referenced from the TIA (EMM 2020).

5.2.2 Construction traffic

Road traffic noise levels predicted at the nearest residential facades for the RNP day and night periods are shown in Table 5.5. The noise level increase due to the additional project related road traffic movements has been provided and compared to relevant criteria and (where necessary) to the RNP 2 dB increase threshold to determine if further detailed assessment is required.

The results show that the existing (2019) road traffic noise levels calculated for the day and night periods at the nearest residential facade along the Newell Highway currently exceed the relevant criteria. Existing (2019) road traffic noise level calculated for the day period at the nearest residential facade along Ungarie Road currently exceeds the relevant criterion. Future (with project related construction traffic) road traffic noise levels at the nearest residential facade along these roads are predicted to negligibly increase (by up to 0.4 dB) from existing noise levels. Hence, road traffic noise levels are predicted to satisfy the RNP 2 dB allowance increase criterion and unlikely to cause an impact during construction.

Road traffic noise levels at all other locations are predicted to satisfy both the day and night absolute criteria and therefore unlikely to cause an impact during construction.

Table 5.5 Construction traffic noise results

Road name	Distance to nearest receiver (m)	Existing (2019) noise levels, dB		Future noise levels, dB		Criteria, dB		Increase between existing and future, dB	
		Day	Night	Day	Night	Day	Night	Day	Night
		L _{Aeq,15hr}	L _{Aeq,9hr}	L _{Aeq,15hr}	L _{Aeq,9hr}	L _{Aeq,15hr}	L _{Aeq,9hr}		
Ungarie Road	30	61	54	61	55	60	55	0.4	0.4
Wamboyne Road	40	57	54	58	55	60	55	1.1	1.3
Blow Clear Road	240	49	48	50	50	60	55	1.1	1.2
Bonehams Lane	800	41	40	42	42	60	55	1.3	1.5
Mine Access Road	800	39	41	41	43	60	55	2.0	2.2
Lake Cowal Road	230	39	41	41	43	60	55	1.7	1.5
West Plains Road	220	37	37	39	39	60	55	1.7	1.8
Burcher Road	95	41	42	43	44	60	55	1.7	1.8
The Gipps Way	300	48	42	48	42	60	55	0.1	0.1
Newell Highway	20	72	68	72	68	60	55	Nil	Nil

Notes: 1. The RNP day period is between 7 am and 10 pm.
 2. The RNP night period is between 10 pm and 7 am.
 3. Traffic volumes were referenced from the TIA (EMM 2020).

5.3 Blasting results

The results of the allowable MIC calculations based on the relevant airblast overpressure and ground vibration equations (Section 4.3) for the early stages of the underground access decline development and underground mine operation are provided in Table 5.6 and Table 5.7 for the nearest privately-owned residences.

The allowable MIC calculations show that there are no significant restrictions to the MIC for blasts proposed to occur during the early stages of the underground access decline development during the day and evening periods Monday to Saturday. For Sundays and public holidays and the night period Monday to Saturday, the MIC should be limited to 520 kg to achieve the relevant airblast overpressure limits at the nearest assessment location (ie assessment location 42) during the early stages of the underground access decline development. The allowable MIC calculations for the early stages of the underground access decline development indicate that the MIC will be limited by airblast overpressure levels.

Table 5.6 Blasting results for the underground access decline development (early stages)

Assessment location	Approx. distance to potential underground access decline blasts ¹	Airblast overpressure criteria (dB Linear)	Ground vibration criteria PPV (mm/s)	Limiting MIC (kg) based on airblast overpressure predictions
42	6,050 m	115	5	<176,900
		105	2	<9,600
		95	1	<520
21	6,820 m	115	5	<254,300
		105	2	<13,800
		95	1	<750
38	7,950 m	115	5	<404,700
		105	2	<22,100
		95	1	<1,200
61a	8,030 m	115	5	<417,200
		105	2	<22,700
		95	1	<1,200

Notes: 1. During the early stages of the underground access decline development when blasting will occur close to the surface.

The allowable MIC calculations indicate that there are no significant restrictions to the MIC of blasts to achieve the existing ground vibration limits for the proposed underground mine operation.

Table 5.7 Blasting ground vibration results for the underground mine operation

Assessment location	Approx. distance to potential underground blast ¹	Ground vibration criteria PPV (mm/s)	Limiting MIC (kg) based on ground vibration predictions
21, 42	6,950 m	≤5	<766,000
		≤2	<45,000
		≤1	<5,400
38, 61a	7,900 m	≤5	<1,100,000
		≤2	<67,000
		≤1	<8,000

Notes: 1. Based on the approximate geographical distance and depth to the nearest proposed blast location.

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.

Potential impacts from blasting at the waterbird bird breeding areas (assessment locations N03 and N04) has been considered. 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. The bird behaviour monitoring is expected to continue during the project in accordance with the CGO Flora and Fauna Management Plan and hence no significant noise impact is anticipated as a result of blasting for the project.

6 Management measures

Noise and vibration emissions will continue to be managed in accordance with the NMP (Evolution Mining 2018) and BMP (Evolution Mining 2015). Evolution will continue to implement the management measures outlined below.

- Quarterly attended noise monitoring will continue to be conducted at the following monitoring locations:
 - N01 – New Lake Foreshore (reference site);
 - N09 – “Lakeview III” residence;
 - N10 – “Bramboyne” residence;
 - N11 – “Laurel Park” residence;
 - N12 – “The Glen” residence;
 - N15 – “Caloola II” residence;
 - N16 – “Foxham Downs II” residence; and
 - 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 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 night-time movement of material to areas shielded by barriers or mounds and reserving large-scale material movement for daytime. The lake protection bund and perimeter waste rock emplacement provides some noise shielding, thereby reducing the potential for noise levels to propagate from the open-cut pit across Lake Cowal;
 - scheduling the use of any noisy equipment during daytime;
 - 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 noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise;
 - 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 (eg positioning idling trucks in appropriate areas);

- reducing the speed limit on the portions of the mine access road where residents may be affected by mine generated traffic in consultation with relevant authorities;
 - educating staff on the effects of noise and the use of quiet work practices;
 - specify maximum noise/sound levels when purchasing equipment; and
 - include maximum noise/sound levels in tender documents and contracts.
- Independent Environmental Audits and Annual Reviews will continue to be conducted in accordance with development consent (14/98).
 - A complaints register will continue to be maintained in accordance with EPL Condition M5.1, with a dedicated Community Complaints Line (via 02 6975 3454 or via community.cowal@evolutionmining.com.au) that is available 24 hours, seven days a week for community members who have enquiries or wish to lodge complaints.

Where required, the NMP and the BMP will be updated following determination of the Project and Modification 16.

7 Conclusion

EMM completed a noise and vibration impact assessment for the proposed Cowal Gold Underground Project. The assessment considered the potential impacts from noise and vibration for the project and has been prepared in accordance with the methodologies outlined in the NPfl, VLAMP, RNP, as well as other relevant guidelines and standards.

Noise trigger levels for the construction and operation of the project have been established based on ambient noise levels and method provided in the NPfl.

Construction and operational activities were modelled at all assessment locations for noise-enhancing meteorological conditions. Modelled CGO operational activities included approved existing operations and the proposed underground mine and additional Mod 16 surface operations. Modelled construction activities represent the box-cut construction.

Findings of the assessment are summarised as follows:

- Noise levels during the box-cut construction were assessed against the existing limits (DA 14/98) for the day, evening and night periods for noise-enhancing meteorological conditions. The modelling results showed that CGO noise levels during the box-cut construction are predicted to satisfy the existing development consent limits at all locations.
- Future operational noise levels were assessed against the existing limits (DA 14/98) for the day, evening and night periods for noise-enhancing meteorological conditions. The modelling results showed that future operational noise levels (predicted 2031 noise levels combined with the Mod 14 2024 noise predictions) are predicted to satisfy the existing development consent limits at all locations.
- The sleep disturbance assessment demonstrated that night-time maximum $L_{Aeq,15min}$ and L_{Amax} noise levels are predicted to satisfy the relevant screening criteria at all residential assessment locations.
- The project will result in additional road traffic movements during future operations, however, the overall increase in average road traffic noise at nearest residential facades is predicted to satisfy relevant RNP criteria during both the day and night periods. Therefore, noise impacts from road traffic noise associated with the project is shown to be unlikely.
- A blasting assessment was completed for the proposed underground mine. There are no significant restrictions to the MIC for blasts proposed to occur during the early stages of the underground access decline development during the day and evening periods Monday to Saturday. For Sundays and public holidays and the night period Monday to Saturday, the MIC should be limited to 520 kg to achieve the relevant 95% airblast overpressure and ground vibration limits at the nearest residential receiver during the early stages of the underground access decline development. During the underground mine operation, no strict control of MIC values is required to achieve the relevant 95% PPV ground vibration limits at the nearest residential receivers.

References

ANZECC 1990, *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*, Australian and New Zealand Environment and Conservation Council (ANZECC).

Australian Standard AS 2187.2 - 2006 “*Explosives - Storage and Use - Use of Explosives: Part 2: Use of explosives*”.

EMM 2020, *Cowal Gold Operations Underground Development Project: Traffic Impact Assessment*, prepared by EMM Consulting Pty Ltd for Evolution Mining Pty Ltd.

Evolution 2015, *Blast Management Plan*, Evolution Mining Pty Ltd.

Evolution 2018, *Noise Management Plan*, Evolution Mining Pty Ltd.

Renzo Tonin 2016, *Appendix D: Noise and Blasting Assessment*, prepared for Evolution Mining Pty Ltd as part of Cowal Gold Operations Mine Life Modification environmental assessment (Modification 13).

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ICI Technical Services 2995, *Imperial Chemical Industries (ICI) Explosives Blasting Guide*.

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

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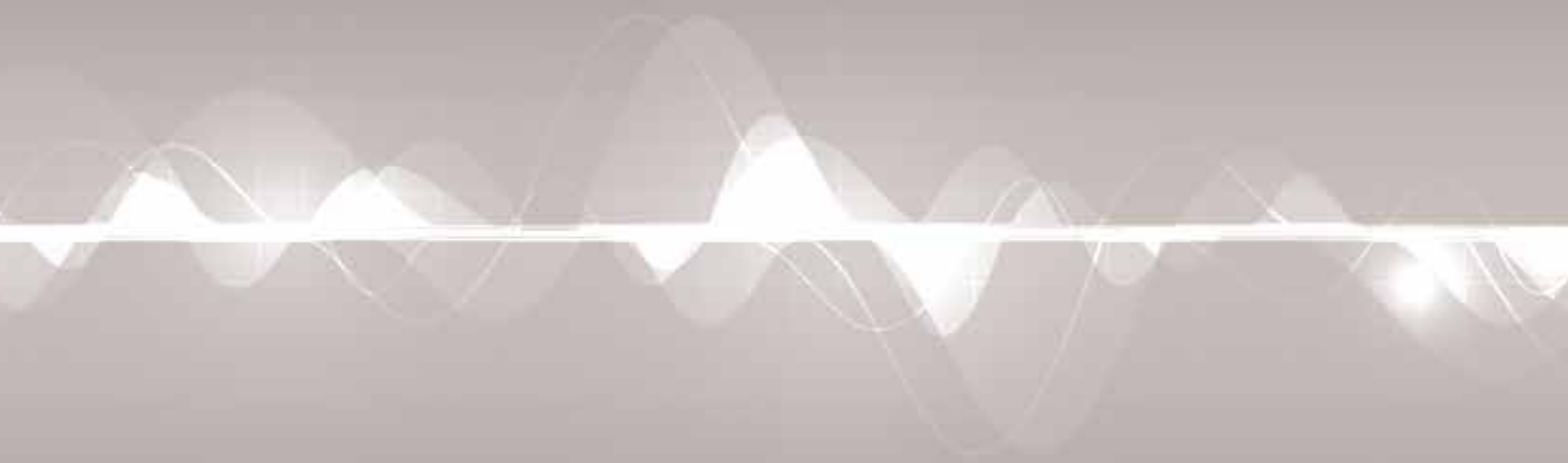
NSW Environment Protection Authority (EPA) 2000, *NSW Industrial Noise Policy (INP)*.

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

NSW Government 2018, *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments*.

Appendix A

Glossary of acoustic terms



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 NPfl 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.
Amenity noise level	The amenity noise levels relate to the overall level of industrial noise subject to land zoning or use.
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.
BoM	Bureau of Meteorology
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
dB	Noise is measured in the unit called the decibel (dB).
DPIE	NSW Department of Planning, Industry and Environment
DECCW	NSW Department of Environment, Climate Change and Water
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 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
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.
ISO	International organisation for standardisation
ISO 9613-2:1996	Standard that describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions.
IWL	Integrated waste landform
$L_{A1,1min}$	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. It is approximately equivalent to the average of maximum noise levels.
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.
$L_{Aeq,period}$	The $L_{Aeq,period}$ 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 $L_{Aeq,15min}$ minus 3 dB.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.

Table A.1 Glossary of acoustic terms and abbreviations

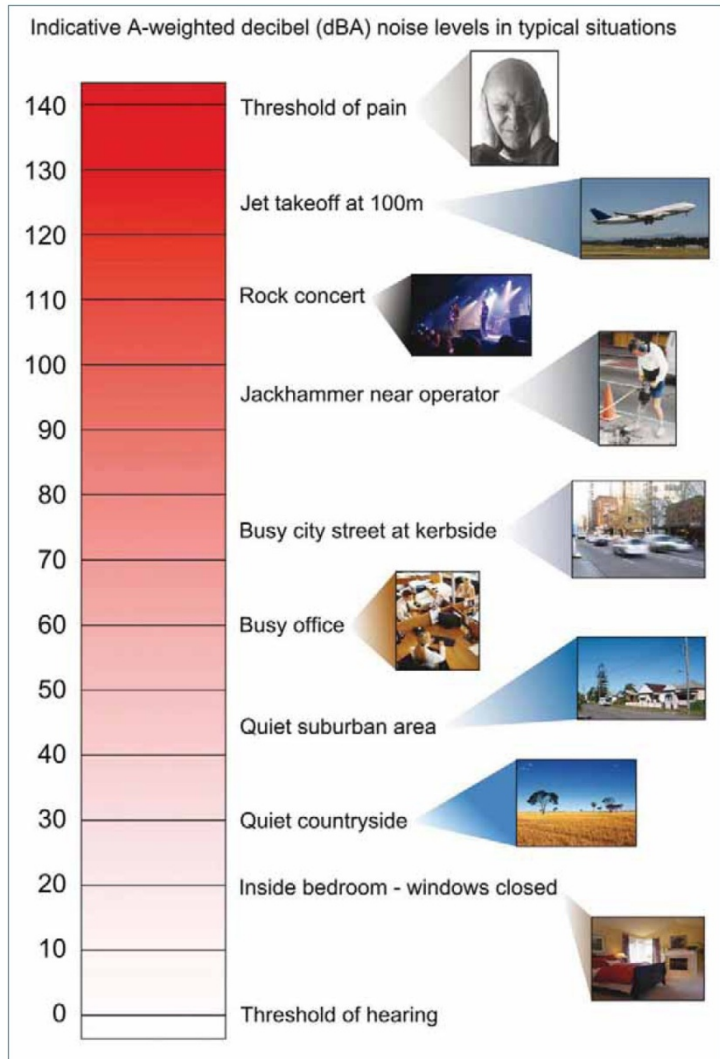
Term	Description
L _{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
MIC	Maximum instantaneous charge
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
NPfi	NSW Noise Policy for Industry (EPA 2017)
Evolution Mining	Evolution Mining (Cowel) Pty Limited
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.
RoM	Run-of-Mine
RNP	NSW Road Noise Policy (DECCW 2011)
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.
Temperature inversion	A positive atmospheric temperature gradient where atmospheric temperature increases with altitude.
TSF	Tailings storage facility
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 what an average person perceives about changes in noise levels.

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.

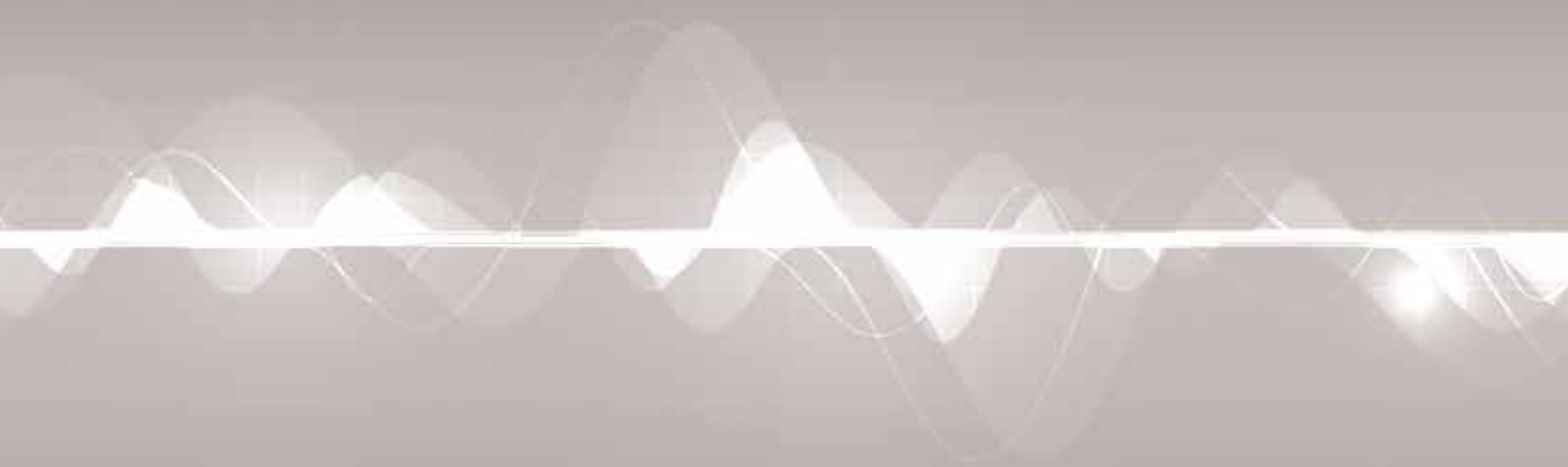


Source: RNP (DECCW 2011).

Figure A.1 Common noise levels

Appendix B

Development consent (DA 14/98) - Noise and blasting



6.3 Blast Management

(a) Impact Assessment Criteria

The Applicant shall ensure that blasting on site does not cause any exceedence of the criteria in Table 6.

Table 6: *Blasting impact assessment criteria*

Location & Time	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedence
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

However, these criteria do not apply if the Applicant has a written agreement with the relevant owner to exceed the limits in Table 6, and the Applicant has advised the Department in writing of the terms of this agreement.

(b) Blasting Frequency

The Applicant may carry out a maximum of 1 blast a day on site. This condition does not apply to blasts required to ensure the safety of the mine or its workers.

Note: For the purposes of this condition a blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a discrete area of the mine.

(c) Property Investigations

If the owner of any privately-owned land claims that buildings and/or structures on his/her land have been damaged as a result of blasting on the site, and the Planning Secretary agrees an independent investigation of the claim is warranted, then within 2 months of receiving this claim the Applicant shall:

- (i) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties to investigate the claim; and
- (ii) give the landowner a copy of the property investigation report.

If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Applicant shall repair the damage to the satisfaction of the Planning Secretary.

If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Applicant or the landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Planning Secretary for resolution.

(d) Operating Conditions

The Applicant shall:

- (i) implement best management practice to:
 - protect the safety of people and livestock in the areas surrounding blasting operations;
 - protect public or private infrastructure/property in the surrounding area from damage from blasting operations; and

- minimise the dust and fume emissions of any blasting;
- (ii) operate a suitable system to enable the public to get up-to-date information on the proposed blasting schedule on site; and
- (iii) carry out regular monitoring to determine whether the development is complying with the relevant conditions of **this consent**,

to the satisfaction of the **Planning Secretary**.

(e) **Blast Management Plan**

The Applicant shall prepare and implement a Blast Management Plan for the development to the satisfaction of the **Planning Secretary**. This plan must:

- (i) be prepared in consultation with the EPA;
- (ii) describe the measures that would be implemented to ensure compliance with the blast criteria and operating conditions of **this consent**; and
- (iii) include a monitoring program for evaluating and reporting on compliance with the blasting criteria and operating conditions of **this consent**.

6.4 Noise Management

(a) **Acquisition Upon Request**

Upon receiving a written request for acquisition from the owner of any land listed in Table 7, the Applicant shall acquire the land in accordance with the procedures in condition 8.3.

Table 7: Land subject to acquisition upon request

Westella
Westlea

Note: To interpret the location referred to Table 7, see the map in Appendix 6.

(b) **Additional Noise Mitigation**

Upon receiving a written request from the owner of the residences listed in **Tables 7 and 7A**, the Applicant shall implement additional noise mitigation measures (such as double-glazing, insulation, and/or air conditioning) at the residence in consultation with the landowner. These measures must be reasonable and feasible, and directed towards reducing the noise impacts of the development on the residence.

If within 3 months of receiving this request from the owner, the Applicant and the owner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the **Planning Secretary** for resolution.

Table 7A: Land subject to mitigation upon request

Lakeview III

Note: To interpret the location referred to Table 7A, see the map in Appendix 6.

(c) **Impact Assessment Criteria**

The Applicant shall ensure that the noise generated by the development does not exceed the noise impact assessment criteria in Table 8 at any residence on privately-owned land.

Table 8: Noise Impact Assessment Criteria dB(A) $L_{Aeq}(15min)$

Land	Day/Evening/Night
------	-------------------

Lakeview III	38
The Glen	37
Lakeview, Foxman Downs II	36
All other privately-owned land	35

Note: To identify the land referred to in Table 8, see the map in Appendix 6.

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy* (as may be updated from time-to-time). Appendix 5 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

(d) Operating Conditions

The Applicant shall:

- (i) implement best management practice, including all reasonable and feasible mitigation measures, to minimise the operational, low frequency, and road noise of the development, including mitigation measures to:
- (ii) minimise the noise impacts of the development during meteorological conditions when the noise limits in [this consent](#) do not apply (see Appendix 5); and
- (iii) carry out regular attended monitoring to determine whether the development is complying with the relevant conditions of [this consent](#),

to the satisfaction of the [Planning Secretary](#).

(e) Noise Management Plan

The Applicant shall prepare and implement a Noise Management Plan for the development to the satisfaction of the [Planning Secretary](#). This plan must:

- (i) be prepared in consultation with the EPA, and submitted to the [Planning Secretary](#) for approval prior to carrying out any development under [this consent](#), unless the [Planning Secretary](#) agrees otherwise;
- (ii) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in [this consent](#); and
- (iii) include a monitoring program that:
 - evaluates and reports on:
 - compliance with the noise criteria in [this consent](#); and
 - compliance with the noise operating conditions;
 - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

6.5 Visual Management

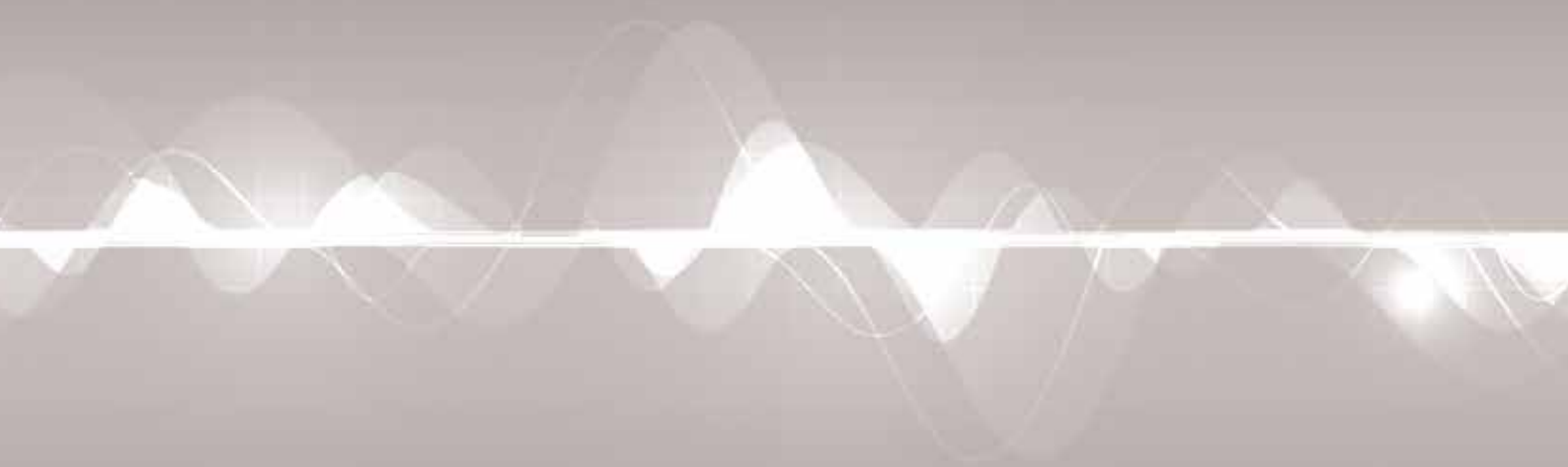
(a) Additional Visual Impact Mitigation

Upon receiving a written request from the owner of any residence on privately-owned land which has, or would have, significant direct views of the mining operations and infrastructure on-site during the development, the Applicant shall implement additional visual impact mitigation measures (such as landscaping treatments or vegetation screens) to reduce the visibility of the mining operations and infrastructure from the residences on the privately-owned land.

These mitigation measures must be reasonable and feasible, and must be implemented within a reasonable timeframe.

Appendix C

EPL (11912) - Noise and blasting



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e) Waste generated at the premises as described in Attachment A 'Cowel Gold Mine Proposed On-Site Waste Tyre Management' of the licence variation application supporting documentation received by the DECC on the 4 February 2009 and classified as special waste in accordance with the Waste Classification Guidelines (DECC 2008) is permitted by this licence to be disposed at the premises.

Disposal of this waste must be undertaken in accordance with the conditions of this licence and within the waste rock emplacements only.

L4 Noise limits

L4.1 Noise generated from the premises must not exceed criteria outlined in Table 1 at any residence on privately owned land, as shown on the plan Appendix 6 of the Cowal Gold Mine development consent DA 14/98, as modified on 4 October 2018.

Table 1

Location	Day/Evening/Night dB(A) LAeq(15 minutes)
Lakeview III	38
The Glen	37
Lakeview, Foxham Downs II	36
Any other privately owned residence	35

Note:

- The noise impact assessment criteria do not apply if the Licensee has an agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Licensee has advised the NSW Department of Planning and Environment in writing of the terms of the agreement.
- The noise impact assessment criteria do not apply to property and land subject to acquisition upon request as identified in Table 7 of Development Consent DA 14/98.

Note: LAeq means the equivalent continuous noise level – the level of noise equivalent to the energy-average of noise levels occurring over a measurement period.

L4.2 Noise generated from the premises is to be monitored and measured in accordance with the relevant requirements and exemptions of the "NSW Industrial Noise Policy".

L4.3 The noise criteria identified in condition L4.1 apply under meteorological conditions of temperature inversion conditions of up to 8.0°C/100 metres and wind speed up to 1 metre per second measured at 10 metres above ground level.

The 1 metre per second drainage-flow wind applies where the development is at higher altitude than the residential receiver, with no intervening higher ground.

The noise criteria identified in condition L4.1 do not apply during:

a) periods of rain or hail;

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- b) average wind speeds at microphone height that exceed 5 metres per second; or
- c) average wind speeds that exceed 3 metres per second measured at 10 metres above ground level.

L4.4 Attended monitoring is to be used to evaluate compliance with conditions L4.1 to L4.3.

L4.5 Monitoring is to be carried out quarterly unless otherwise directed by the Secretary of NSW Department of Planning and Environment.

L5 Blasting

L5.1 The overpressure level from blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 120 dB (Lin Peak) at any time at any noise sensitive locations. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L5.2 The overpressure level from blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 115dB (Lin Peak) Monday to Saturday during the day for more than five per cent of the total number of blasts over a period of 12 months.

The overpressure level from blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 105dB (Lin Peak) Monday to Saturday during the evening for more than five per cent of the total number of blasts over a period of 12 months.

The overpressure level from blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 95dB (Lin Peak) Monday to Saturday at night or on Sundays and public holidays (24 hours) for more than five per cent of the total number of blasts over a period of 12 months.

Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L5.3 Ground vibration peak particle velocity from the blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 10 mm/sec at any time. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L5.4 Ground vibration peak particle velocity from the blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 5 mm/sec Monday to Saturday during the day for more than five per cent of the total number of blasts over a period of 12 months.

Ground vibration peak particle velocity from the blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 2 mm/sec Monday to Saturday during the evening for more than five per cent of the total number of blasts over a period of 12 months.

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Ground vibration peak particle velocity from the blasting operations at the premises at residences on privately owned land, when measured at the locations defined in condition M7.1 must not exceed 1 mm/sec Monday to Saturday at night and on Sundays and public holidays (24 hours) for more than five per cent of the total number of blasts over a period of 12 months.

Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L6 Potentially offensive odour

L6.1 No condition of this licence identifies a potentially offensive odour for the purposes of section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

- a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
- b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:

- a) must be maintained in a proper and efficient condition; and
- b) must be operated in a proper and efficient manner.

O2.2 All persons associated with the licensee including employee's, agents' licensee, contractors and subcontractors must be advised of their responsibilities and liabilities under the Protection of the Environment Operations Act 1997.

O3 Dust

O3.1 Activities occurring in or on the premises must be carried out in a manner that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.

Appendix D

Sound power levels for acoustically significant plant and equipment

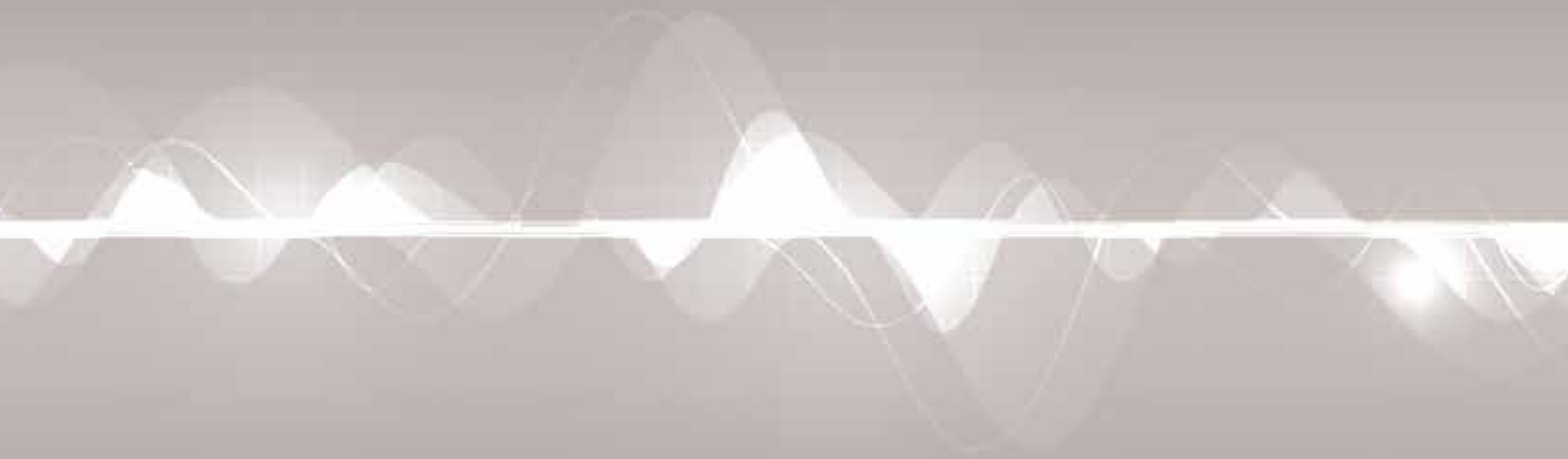


Table D.1 **Single octave sound power levels for acoustically significant sources**

Source	Single octave sound power level spectrum, dB(A)									Total, dB(A)
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Underground 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



