



**APPENDIX D**  
Noise and Blasting Assessment

**COWAL GOLD OPERATIONS**  
**MINE LIFE MODIFICATION**  
Environmental Assessment  
2016



# COWAL GOLD OPERATIONS - MINE LIFE MODIFICATION

## Noise and Blasting Assessment

10 November 2016

Evolution Mining (Cowal) Pty Limited

TJ215-01D01 Report (r5)

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Address:	PO Box 210 West Wyalong NSW 2671
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Supplementary professional advice should be sought in respect of these issues.

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# 1 Introduction

Renzo Tonin & Associates was engaged by Evolution Mining (Cowal) Pty Limited (Evolution), the owner and operator of the existing Cowal Gold Operations (CGO), located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure 1), to conduct an assessment examining the potential noise and blasting impacts of a proposed modification to the CGO.

The issues addressed in this study include noise emissions from:

- operational activities;
- blasting activities; and
- road traffic associated with the CGO.

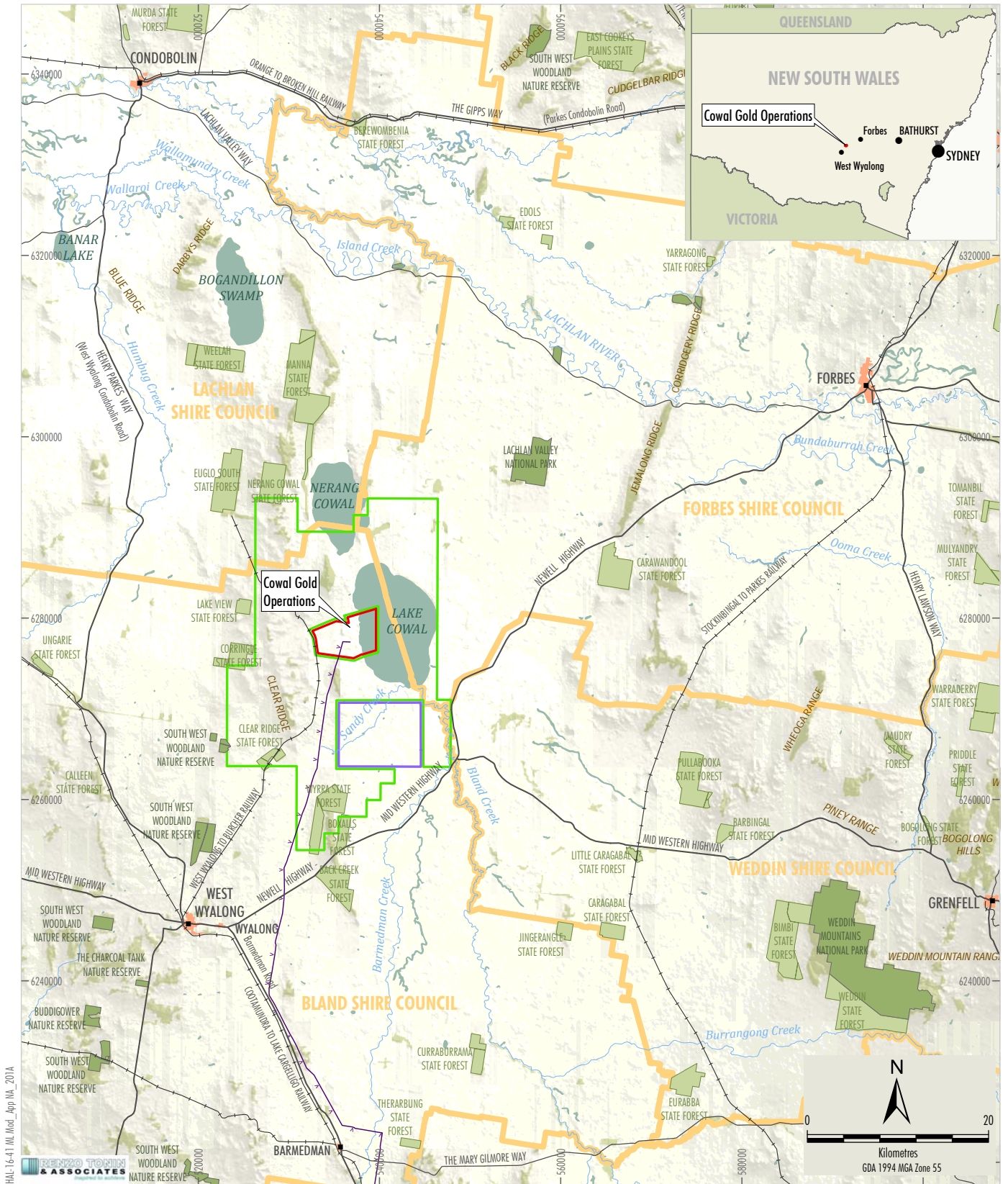
Noise impacts are assessed following a number of policies, guidelines and standards, including:

- NSW Industrial Noise Policy (INP) (Environment Protection Authority [EPA], 2000);
- Voluntary Land Acquisition and Mitigation Policy – State Significant Development (SSD) Mining (NSW Government, 2014);
- Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration (Australian and New Zealand Environment Conservation Council, 1990);
- NSW Environmental Noise Control Manual (EPA, 1994); and
- NSW Road Noise Policy (RNP) (Department of Environment, Climate Change and Water, 2011)<sup>1</sup>.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

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<sup>1</sup> This Policy has replaced the NSW *Environmental Criteria for Road Traffic Noise* (EPA, 1999).



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RENZIO TONIN & ASSOCIATES

**LEGEND**

- Mining Lease Boundary (ML 1535)
- Exploration Licence (EL 1590)
- Exploration Licence (EL 7750)
- National Park & Nature Reserve
- State Forest
- Local Government Area Boundary
- Electricity Transmission Line
- Railway

Source: Geoscience Australia (2006); NSW Department of Industry (2016)



**CGO MINE LIFE MODIFICATION**  
Regional Location

**Figure 1**

## 2 Modification Overview

Mining at the CGO commenced in 2005, while gold production commenced in 2006. Open pit mining operations at the CGO are approved to 31 December 2024 and are carried out in accordance with Development Consent DA 14/98 (as modified).

Mining operations at the CGO are supported by on-site facilities including water management infrastructure/storages, a process plant and tailings storage facilities (TSFs). Mined waste rock from the open pit is hauled to waste rock emplacements. Ore mined from the open pit is hauled directly to the primary crusher (adjacent to the process plant), run-of-mine pads or low grade ore stockpiles prior to processing. Mineralised material is also separately stockpiled for potential future processing.

Gold is extracted from the ore using a conventional carbon-in-leach cyanide leaching circuit in the process plant. Tailings are pumped from the process plant via a pipeline to the TSFs. The gold product is recovered and poured as gold bars or doré.

Evolution proposes to modify Development Consent DA 14/98 under Section 75W of the NSW Environmental Planning and Assessment Act, 1979 to facilitate the continuation of open pit mining and processing operations at the CGO for an additional 8 years (i.e. to end 2032) (herein referred to as the Modification).

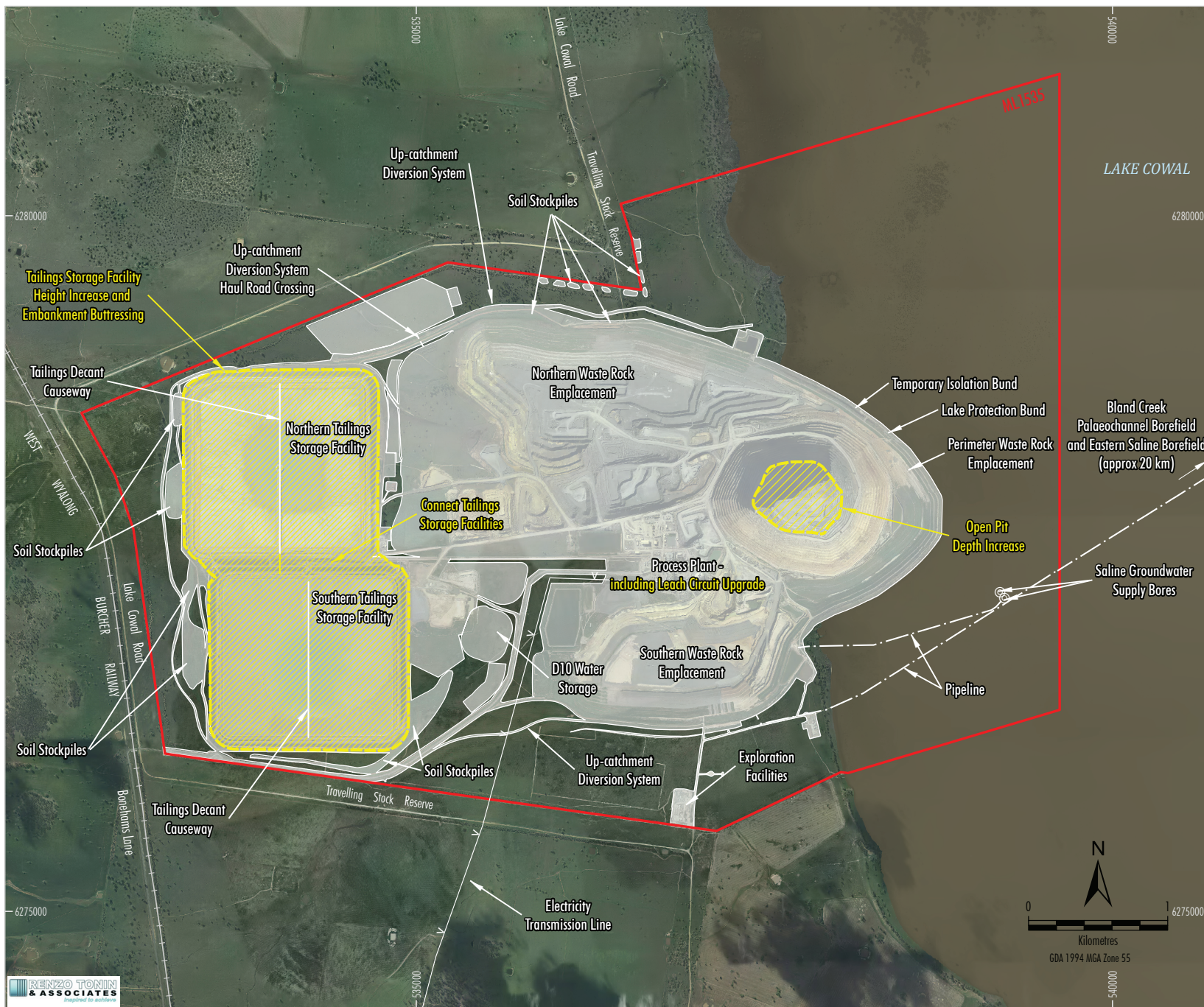
The main activities associated with development of the Modification would include:

- increasing the final depth of the open pit by 70 metres (m) to enable mining of additional ore and an increase in total gold production (Figure 2);
- extending the life of the approved CGO by up to 8 years, to 31 December 2032;
- upgrades to the existing leach circuit within the processing plant to improve gold recovery;
- increasing the total life of mine ore production/volume of tailings and mined waste rock;
- maximising tailings storage capacity of the existing TSFs via additional lifts and converting the area between the existing TSFs into a new storage area (Figure 2);
- incorporation of a rock fill buttress cover on the outer slopes of the TSF embankments to provide long-term stability (Figure 2); and
- the existing mobile mine equipment fleet used at the CGO would be increased to reflect the deeper open pit, and the TSF embankment lift fleet would also be increased.

The Modification would involve no change to the following key components of the existing CGO:

- mining tenement;
- lake isolation system;
- existing/approved surface development extent of the CGO;





- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Approximate Extent of Approved Surface Development
  - Modification Components

Source: Evolution - Orthophoto (August 2016)



**CGO MINE LIFE MODIFICATION  
Modification General Arrangement**

**Figure 2**

- water management system and design objectives;
- mining methods;
- ore processing rate;
- waste rock emplacement disturbance areas;
- cyanide destruction method;
- approved cyanide concentration limits in the aqueous component of the tailings slurry;
- water supply sources;
- approved daily or annual extraction limits of the Bland Creek Palaeochannel Borefield;
- site access road;
- power supply;
- exploration activities;
- average or peak annual employment;
- hours of operation; or
- TSF embankment construction hours of 7:00 am to 6:00 pm.

## 3 Noise Receivers and Surrounding Land Uses

### 3.1 Land Use and Receiver Locations

Land use in the local area is predominantly agricultural operations. Properties surrounding the CGO are generally privately-owned or Evolution-owned, with some Crown Land.

The receiver locations considered in this assessment are listed in Table 3.1 and shown in Figure 3a. Landholders for the dwellings shown on Figure 3a are listed on Figure 3b.

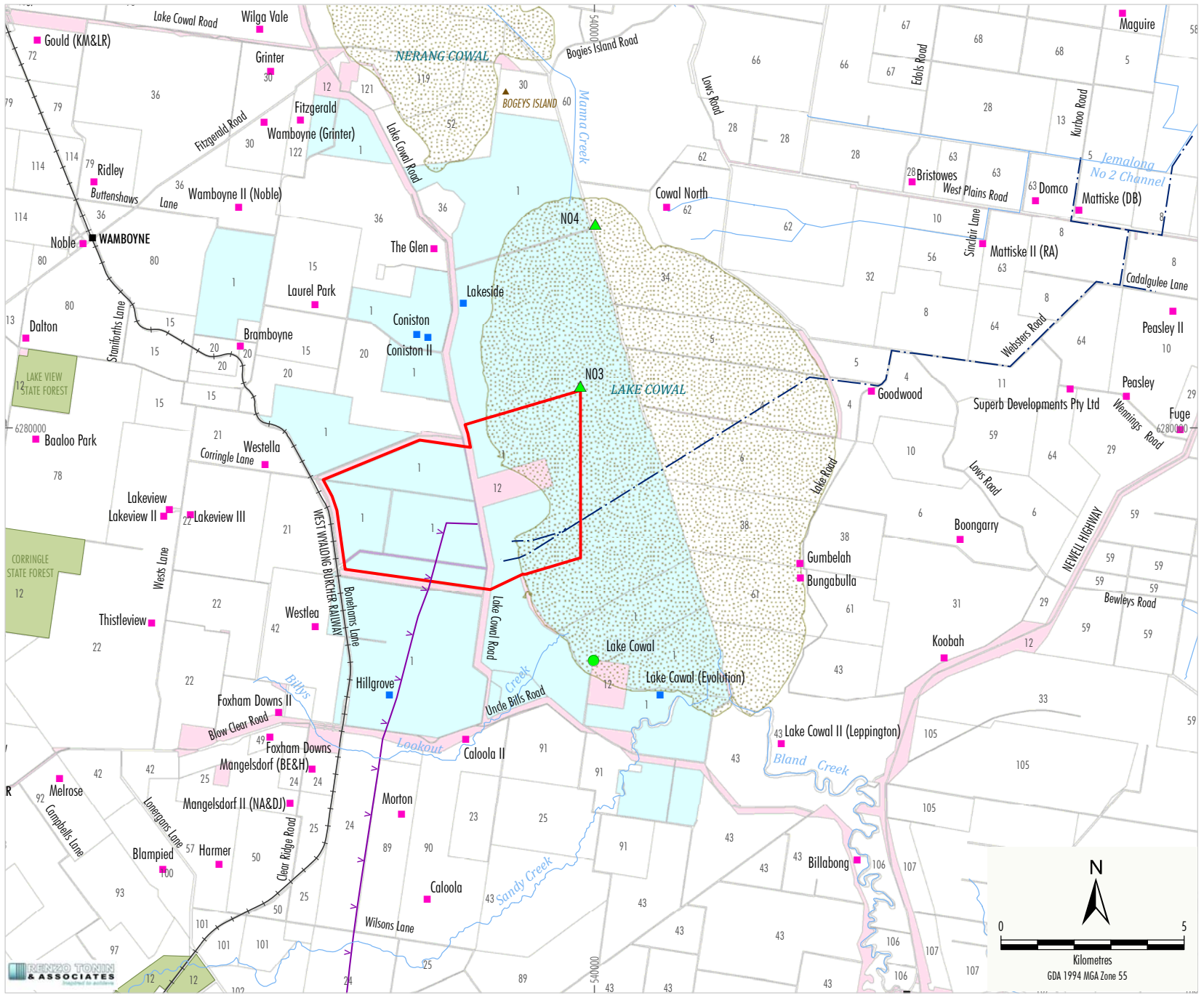
Two bird breeding areas and a reserve have also been modelled for assessment purposes (Table 3.1).

**Table 3.1 – Receiver Locations and Ownership Details**

Reference ID	Name	Type	Easting	Northing
<b>Evolution-owned Dwellings</b>				
1a	Coniston	Evolution-owned	535152.6	6282548.2
1b	Coniston II	Evolution-owned	535456.0	6282474.0
1c	Lakeside	Evolution-owned	536423.7	6283399.9
1d	Hillgrove	Evolution-owned	534406.7	6272697.3
1e	Lake Cowal	Evolution-owned	541793.9	6272704.4
<b>Privately-owned Dwellings</b>				
4	Goodwood	Privately-owned	547567.0	6281001.0
6	Boongarry	Privately-owned	549988.9	6276946.2
15	Laurel Park	Privately-owned	532377.6	6283364.0
20	Bramboyne	Privately-owned	530336.9	6282231.2
21	Westella	Privately-owned	531013.3	6278985.4
22a	Lakeview	Privately-owned	528401.6	6277761.4
22b	Lakeview II	Privately-owned	528248.6	6277583.4
22c	Lakeview III	Privately-owned	528976.2	6277625.7
22d	Thistleview	Privately-owned	527917.6	6274661.8
24	Mangelsdorf	Privately-owned	532297.9	6270665.3
25	Mangelsdorf II	Privately-owned	531695.0	6269734.0
28	Bristowes	Privately-owned	548681.0	6286710.0
30a	Wamboyne	Privately-owned	530988.5	6288345.0
30b	Grinter	Privately-owned	531171.0	6289740.0
31a	Koobah	Privately-owned	549553.6	6273711.2
36a	The Glen	Privately-owned	535625.2	6284898.3
36b	Wamboyne II	Privately-owned	530297.0	6286030.1
38	Gumbelah	Privately-owned	545612.6	6276295.3
42	Westlea	Privately-owned	532383.1	6274565.5
43a	Lake Cowal II	Privately-owned	545105.2	6271379.0



Reference ID	Name	Type	Easting	Northing
43b	Billabong	Privately-owned	547179.0	6268189.4
49a	Foxham Downs	Privately-owned	531145.0	6271554.0
49b	Foxham Downs II	Privately-owned	531386.0	6272221.0
56	Mattiske II	Privately-owned	550605.0	6285032.0
57	Harmer	Privately-owned	529760.0	6268071.0
61a	Bungabulla	Privately-owned	545626.8	6275892.6
62	Cowal North	Privately-owned	541978.6	6286026.4
79	Ridley	Privately-owned	526342.0	6286717.0
89	Morton	Privately-owned	534740.0	6269452.0
90a	Caloola	Privately-owned	535441.0	6267130.6
90b	Caloola II	Privately-owned	536489.0	6271490.0
100	Blampied	Privately-owned	528226.0	6267940.0
122	Fitzgerald	Privately-owned	531978.0	6288396.0
126	Noble	Privately-owned	526050.0	6285038.0
<b>Other Modelled Receivers</b>				
Bird Breeding Area North (NO4)	Bird Breeding Area North (NO4)	Bird Breeding Area	540025.0	6285561.0
Bird Breeding Area South (NO3)	Bird Breeding Area South (NO3)	Bird Breeding Area	539620.0	6281131.0
Relocated Crown Reserve	Relocated Crown Reserve	Lake Cowal	539977.5	6273640.0



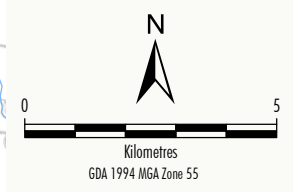
**LEGEND**

- Mining Lease Boundary (ML 1535)
- Railway
- Pipeline
- Electricity Transmission Line
- State Forest
- Company-owned
- Crown Land
- Local Government
- Privately Owned
- Company-owned Dwelling
- Privately-owned Dwelling
- ▲ Bird Breeding Area
- Relocated Crown Reserve

Refer to Figure 3b for Landholder Key  
 Source: Evolution (2016); Land and Property Information (2016)



**CGO MINE LIFE MODIFICATION  
 Land Tenure**



**Figure 3a**

Reference No	Landholder	Reference No	Landholder
1	Evolution Mining (Cowl) Pty Limited	71	LM & TJ Mackay and LJ & RP Grayson
2	Bland Shire Council	72	KM & LR Gould
3	Graincorp Operations Limited	73	CI Ridley
4	BE Mattiske	74	HM Corliss and JA & FG Ridley
5	DB Mattiske	75	The Grain Handling Authority Of New South Wales
6	IW Low	77	Country Rail Infrastructure Authority
8	PG Hammond	78	CF Fuller
10	SL Peasley	79	IO Ridley
11	RG Hammond	80	TG & JM Dalton
12	The State of New South Wales	81	West Wyalong Local Aboriginal Land Council
13	West Plains (Forbes) Pty Limited	82	LJ Doecke
15	HJ & WJ Buttenshaw	83	RJ Moore
20	WJ Buttenshaw	85	JM Ridley
21	AJ McClintock	89	GM & BM Morton
22	The West Pastoral Company Pty Limited	90	RJ Granleese and PJ & DK Donohue
23	EA & M Mangelsdorf	91	GR Spackman
24	BE & H Mangelsdorf	92	KA Lindner & GP Lindner
25	NA & DJ Mangelsdorf	93	EJ McCarthy
27	State Rail Authority of New South Wales	95	JD & VH Boneham
28	Bristowes Pastoral Pty Ltd	96	BY & IG Boyd
29	NJ Fuge	97	Clevedon Properties Pty Ltd
30	SK & RC Grinter	98	MM Rees
31	JA Duff	100	AJ & LF Blampied
32	HE & AJ Duff	101	MM & MD Carnegie
33	AJ Duff	102	W Goodwin
34	HE Duff	103	LR Martin
36	MM & G Noble	104	MM & MD Carnegie
38	BR Dent	105	MK & RT Coles
42	GJ Davies	106	FR Maslin
43	Leppington Pastoral Co Pty Limited	107	Marsden Minoru Pty Limited
44	MH Duff	109	EH & JW Maslin
49	CL Lee	113	BC & DW Rogers
50	GF Carnegie	114	WJ Worner
51	HC & GK West	116	IJ Ridley
52	HJ Buttenshaw	118	AB & KM Maslin
56	RA Mattiske	119	ML & CI Ridley
57	RF Harmer	120	Forbes Shire Council
58	Twynam Pastoral Co Pty Limited	121	BJ & RK Gould
59	Wyalong Rural Investments Pty Limited	122	DG Fitzgerald
60	SJ & EP Mickan	123	Telstra Corporation Limited
61	ML Dent	124	AGL Pipelines (NSW) Pty Limited
62	WR Low	126	D Williams
63	Domco Trading Pty Limited	130	N.S.W. Grain Corporation Limited
64	Superb Developments Pty Ltd	131	IH Shephard
66	BV Tooth	132	CR & RD McManus
67	HWR McDonald	133	MA Squier
68	AJR McDonald	134	JT Gray
69	GLR McDonald	135	NA Wilson
70	KA Maguire		



Source: Evolution (2016) and Land and Property Information (2016)



CGO MINE LIFE MODIFICATION  
Landholder Key

Figure 3b

## 4 Existing Acoustic Environment

Appendix B of the NSW EPA's INP outlines two methods for determining the background noise level of an area, being 'B1 – Long-term background noise method' and 'B2 – Short-term background noise method'. This assessment has used long-term noise monitoring.

As the noise environment of an area almost always varies over time, background and ambient noise levels need to be determined for the operational times of the proposed development. For example, in a suburban or urban area the noise environment is typically at its minimum at 3:00 am in the morning and at its maximum during the morning and afternoon traffic peak hours. The INP outlines the following standard time periods over which the background and ambient noise levels are to be determined:

- Day: 7:00 am - 6:00 pm Monday to Saturday and 8:00 am - 6:00 pm Sundays & Public Holidays.
- Evening: 6:00 pm - 10:00 pm Monday to Sunday & Public Holidays.
- Night: 10:00 pm - 7:00 am Monday to Saturday and 10:00 pm - 8:00 am Sundays & Public Holidays.

Criteria for the assessment of operational noise are usually derived from the existing noise environment of an area, excluding noise from the subject development. Long-term background noise surveys to characterise the existing acoustic environment in the area surrounding Mining Lease 1535 were undertaken in July and December 1994 prior to the operation of the CGO. Additional background noise monitoring was not considered appropriate for the Modification given the existing operation of the approved CGO. The Rating Background Levels (RBL) and representative ambient  $L_{eq}$  noise levels for each assessment period were previously presented in the Modification 11 Noise and Blasting Impact Assessment (SLR Consulting, 2013) and have been utilised in the assessment.

### 4.1 Background Noise Measurement Results

Table 4.1 presents the overall single RBL and representative ambient  $L_{eq}$  noise levels for each assessment period, determined in accordance with the INP, as presented in the Modification 11 Noise and Blasting Impact Assessment. It is noted that the RBLs determined are the minimum that can be obtained in accordance with the INP, and will therefore provide a conservative assessment.

**Table 4.1 – Noise Monitoring Results, A-weighted decibels (dB[A])**

Receiver Location	$L_{A90}$ RBL			$L_{Aeq}$ Ambient noise levels <sup>4</sup>		
	Day <sup>1</sup>	Evening <sup>2</sup>	Night <sup>3</sup>	Day <sup>1</sup>	Evening <sup>2</sup>	Night <sup>3</sup>
Privately-owned	30	30	30	<44	<39	<34

- Notes:
1. Day: 7:00 am - 6:00 pm Monday to Saturday and 8:00 am - 6:00 pm Sundays & Public Holidays.
  2. Evening: 6:00 pm - 10:00 pm Monday to Sunday & Public Holidays.
  3. Night: 10:00 pm - 7:00 am Monday to Saturday and 10:00 pm - 8:00 am Sundays & Public Holidays.
  4. As required by the INP, the external ambient noise levels presented are free-field noise levels (ie. no façade reflection is incorporated).

## 4.2 Ongoing Noise Monitoring

The Noise Management Plan (Barrick, 2010) prepared to satisfy the requirements of Development Consent (DA 14/98) following approval of Modification 10 included noise monitoring on a half-yearly basis, and was implemented until March 2015. The revised Noise Management Plan (Evolution, 2014) prepared to satisfy Development Consent DA 14/98 following approval of Modification 11, and approved by the DP&E on 5 March 2015, was then implemented for the CGO. The revised Noise Management Plan includes quarterly noise monitoring.

For the period January 2013 to July 2016, operational noise surveys demonstrated that the CGO is operating in compliance with the noise assessment criteria imposed in Development Consent DA 14/98 and Environment Protection Licence 11912 conditions. During the period, operator attended noise monitoring results showed no exceedance of the noise impact assessment criteria.

## 4.3 Noise Complaints Record

Three noise-related complaints were received by the CGO from the date of submission of Modification 11 in September 2013 to September 2016. Investigations undertaken in response to noise-related complaints indicated that the CGO was operating in accordance with the relevant Development Consent DA 14/98 noise limits.

## 5 Meteorology

Certain meteorological conditions may increase noise levels by focusing sound-wave propagation paths at a single point. Such refraction of sound waves occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level) and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receiver.

Temperature inversions occurring within the lowest 50 m to 100 m of atmosphere can affect noise levels measured on the ground. Temperature inversions are most commonly caused by radiative cooling of the ground at night leading to the cooling of the air in contact with the ground. This is especially prevalent on cloudless nights with little wind. Air that is somewhat removed from contact with the ground will not cool as much, resulting in warmer air aloft than nearer the ground.

Similarly, when significant wind exists, the conditions can materially affect noise levels at receptor points downwind of a noise source. This would depend, however, on the particular direction and the velocity of the wind at that time. It should also be noted that although wind can raise noise emission levels as perceived from a downstream assessment point, background noise also tends to increase as a result of increased wind activity. This often causes masking of potential increases in intrusive noise.

The NSW EPA's INP recommends that project noise criteria are to apply under weather conditions characteristic of an area. These conditions may include calm, wind and temperature inversions. In this regard, the increase in noise that results from atmospheric temperature inversions and wind effects may need to be assessed. The noise levels predicted under characteristic meteorological conditions for each receiver are then compared with the criteria, to establish whether the meteorological effect will cause a significant impact.

The NSW EPA's INP permits two approaches for assessing these effects: use of default parameters and use of site-specific parameters:

- With using default parameters, general meteorological values are used to predict noise levels, foregoing detailed analyses of site-specific meteorological data. This approach assumes that meteorological effects are conservative, in that it is likely to predict the upper range of increases in noise levels. Actual noise levels may be less than predicted.
- The use of site-specific parameters is a more detailed approach, which involves analysing site meteorological data to determine whether inversion and/or wind effects are significant features warranting assessment. Where assessment is warranted, default parameters are available for use in predicting noise or, where preferred, measured values may be used instead. The use of site-specific parameters provides a more accurate prediction of noise increases due to meteorological factors, however, is more costly especially if suitable site data is unavailable and long-term meteorological monitoring is required. Existing weather data may be used, provided the site is within a radius of 30 km of the collection point and in the same topographical basin.

The more detailed approach using site-specific meteorological parameters was conducted previously in the Modification 11 Noise and Blasting Impact Assessment. Wind enhancement was not found to be a feature of the area but temperature inversions were found to be a feature. To provide a comparative assessment to the modelling conducted for Modification 11, the meteorological analysis from that study has been adopted for the Modification. As such, temperature inversions are included in the operational noise computer modelling.

## 5.1 Summary of Meteorological Assessment Conditions

Based on the findings of the Modification 11 Noise and Blasting Impact Assessment, Table 5.1 presents a summary of the meteorological conditions considered for the operational noise computer modelling.

**Table 5.1 – Summary of Meteorological Assessment Conditions**

Period	Meteorological Assessment Condition	Air Temperature	Relative Humidity	Wind Velocity <sup>1</sup>	Temperature Gradient
Day (8:30 am to 5:00 pm)	Calm	12°C	64%	0 m/s	0°C/100 m
Late Afternoon (5:00 pm to 6:00 pm) and Early Morning (7:00 am to 8:30 am)	Moderate Inversion	12°C	64%	0 m/s	3°C/100 m
Evening (6:00 pm to 10:00 pm)	Strong Inversion	10°C	70%	0 m/s	8°C/100 m
Night (10:00 pm to 7:00 am)	Strong Inversion	8°C	80%	0 m/s	8°C/100 m

Notes: 1. Local topography is generally flat and drainage flows are not considered a feature of the area.  
°C = degrees Celsius; m/s = metres per second; °C/100 m = degrees Celsius per 100 metres.



## 6 Applicable Noise Criteria

### 6.1 Operational Noise

Operational noise from the Modification is assessed in accordance with the INP. The INP is used as a guide by the EPA for setting statutory limits in licences for scheduled noise sources.

The INP has two components:

- Controlling intrusive noise impacts in the short term for residences.
- Maintaining noise level amenity for particular land uses for residences and other land uses.

#### 6.1.1 Intrusive Noise Impacts

According to the INP, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the  $L_{Aeq}$  descriptor) does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). The intrusiveness criterion is only applicable to residential type receivers and is summarised as follows:

- $L_{Aeq,15minute} \leq \text{RBL plus 5 dB(A)}$ .

Table 6.1 presents the intrusiveness criteria established for the nearest noise sensitive residential receivers based upon the noise monitoring outlined in Section 4.1.

**Table 6.1 – Intrusiveness Criteria**

Receiver Location	RBL			Intrusiveness Criteria $L_{Aeq,15minute}$		
	Day	Evening	Night	Day	Evening	Night
All Residential Receivers	30	30	30	35	35	35

Notes: RBL levels have adopted the minimum background noise levels nominated in the INP as long term background noise levels were recorded at approximately 30 dB(A) and below (refer to Section 4.1).

#### 6.1.2 Protecting Noise Amenity

The amenity criteria are determined in accordance with Chapter 2 of the INP. The INP recommends base acceptable noise levels for various receivers, including residential, commercial, industrial and sensitive receivers such as schools, hospitals, churches and parks. These base noise criteria are then lowered by up to 10 dB depending on the extent of existing industrial noise impact upon the receiver (if applicable). Higher levels of existing industrial noise therefore result in stricter amenity criteria applied to any new industrial development. In this way the cumulative impacts of existing and known future industrial noise sources are minimised.

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the policy, the applicable parts of which are reproduced in Table 6.2 below.

It is noted that as a general rule, building structures would typically provide a minimum of 10 dB(A) reduction from external noise levels to internal noise levels, with windows opened sufficiently for fresh air ventilation.

**Table 6.2 – Amenity Criteria – Recommended  $L_{Aeq}$  Noise Levels from Industrial Sources**

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq,Period}$ Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
School classrooms – internal	All	Noisiest 1 hour period when in use	35	40
Hospital ward - internal - external	All	Noisiest 1 hour period	35	40
			50	55
Place of worship – internal	All	When in use	40	45
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55
Active recreation area (e.g. school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

- Notes:
1. Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am.
  2. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
  3. The  $L_{Aeq}$  index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

### 6.1.3 Noise Impact Assessment Criteria

The existing CGO Development Consent (DA 14/98) (as modified, dated 22 July 2014) contains noise impact assessment criteria. The extract presented below from Condition 6.4, Schedule 2 of DA 14/98, includes the relevant conditions regarding Acquisition Upon Request and Noise Impact Assessment Criteria:

(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 the procedures in condition 8.3.*

Table 7: Land subject to acquisition upon request

Coniston
McLintock
Westlea

(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
Laurel Park	37
Bramboyne, Bungabulla, The Glen and Gumbelah	36
All other privately-owned land	35

It is noted that the 'Coniston' property has since been acquired by Evolution and 'McLintock' is now known as 'Westella'.

#### 6.1.4 Project Specific Noise Levels

In accordance with the INP, noise impacts should be assessed in terms of both intrusiveness and amenity. Based on the background and ambient noise monitoring carried out at the nearest affected receiver locations, the Project Specific Noise Levels (PSNLs) are outlined in Table 6.3 below.

Table 6.3 – Project Specific Noise Levels

Locality	Land Use	Intrusiveness, $L_{Aeq,15min}$ dB(A)			Amenity, $L_{Aeq,Period}$ dB(A)		
		Day	Evening	Night	Day	Evening	Night
Privately-owned Land	Rural Residential	35	35	35	50	45	40
Relocated Crown Reserve	Passive Recreation	-	-	-	50 (when in use)		

Notes: 1. RBL levels have adopted the minimum background noise levels nominated in the INP as long term background noise levels were recorded at approximately 30 dB(A) and below.  
2. Residential locations have been categorised as 'Rural'.

#### 6.1.5 Voluntary Land Acquisition and Mitigation Policy

The INP states that the intrusiveness and amenity criteria have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, then it is unlikely that most people would consider the resultant noise levels excessive.

In those cases when the PSNLs are not, or cannot be, achieved, then it does not automatically follow that those people affected by the noise would find the noise unacceptable. In subjective terms, exceedances of the PSNLs are described in the NSW Government's *Voluntary Land Acquisition and Mitigation Policy – SSD Mining* and reproduced in Table 6.4 below.

**Table 6.4 – Characterisation of Noise Impacts & Potential Treatments**

Residual Noise Exceeds INP Criteria By	Characterisation of Impacts	Potential Treatment
0-2 dB(A) above the PSNL	Impacts are considered to be <b>negligible</b>	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls.
3-5 dB(A) above the PSNL in the INP <u>but</u> the development would contribute less than 1 dB to the total industrial noise level	Impacts are considered to be <b>marginal</b>	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
3-5 dB(A) above the PSNL in the INP <u>and</u> the development would contribute more than 1 dB to the total industrial noise level	Impacts are considered to be <b>moderate</b>	As for marginal impacts but also upgraded façade elements like windows, doors, roof insulation etc. to further increase the ability of the building façade to reduce noise levels.
>5 dB(A) above the PSNL in the INP	Impacts are considered to be <b>significant</b>	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions below.

Furthermore, the policy also presents information regarding the requirements for voluntary mitigation and voluntary 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 non-network rail lines (private rail lines), on or exclusively servicing industrial sites (see Appendix 3 of the RING);*

*But not:*

- *Construction noise impacts, as these impacts are shorter term and can be controlled;*
- *Noise impacts on the public road or rail network; or*
- *Modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts. In such cases, these legacy noise issues should be addressed through site-specific pollution reduction programs under the Protection of the Environment Operations Act 1997.*

### Voluntary Mitigation Rights

A consent authority should only grant voluntary mitigation rights where, even with the implementation of best practice management:

- *The noise generated by the development would be equal to or greater than 3 dB(A) above the INP project-specific noise level 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(A), and noise levels at the residence are already above the recommended amenity criteria in Table 2.1 of the INP; 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 (see Appendix B) by greater than or equal to 3 dB(A) at any residence on privately-owned land.*

All noise levels must be calculated in accordance with the INP or Rail Infrastructure Noise Guideline (RING) (as applicable).

The selection of mitigation measures should be guided by the potential treatments identified in those cases when the PSNLs are not, or cannot be, achieved as per Table 6.4 above.

#### Voluntary Land Acquisition Rights

A consent authority should only grant voluntary land acquisition rights where, even with the implementation of best practice management:

- *The noise generated by the development would be more than 5 dB(A) above the Project specific noise level at any residence on privately-owned land; or*
- *The noise generated by the development would contribute to exceedances of the recommended maximum noise levels in Table 2.1 of the INP 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 at any residence on privately-owned land.*

All noise levels must be calculated in accordance with the INP or RING (as applicable).

#### **6.1.6 Cumulative Noise Levels**

For cumulative noise levels, the INP amenity criteria is applicable as it is intended to control the total noise level at a receiver location from all industrial or mining developments. The cumulative noise levels are therefore assessed against the amenity criteria nominated in Table 6.2. However, there are currently no industrial or mining developments in the vicinity of the Modification which would impact the identified receiver locations. Accordingly, potential cumulative noise impacts are not considered further.

### 6.1.7 Sleep Disturbance

Noise emanating from the Modification has been assessed for its potential to disturb sleep. The NSW EPA (2013) has made the following policy statement with respect to sleep disturbance:

*Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.*

*Research on sleep disturbance is reviewed in the NSW Road Noise Policy. This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*

*From the research, the EPA recognised that current sleep disturbance criterion of an  $L_{A1, (1 \text{ minute})}$  not exceeding the  $L_{A90, (15 \text{ minute})}$  by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, the EPA will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.*

*The detailed analysis should cover the maximum noise level or  $L_{A1, (1 \text{ minute})}$  that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the NSW Road Noise Policy. Other factors that may be important in assessing the extent of impacts on sleep include:*

- *how often high noise events will occur.*
- *time of day (normally between 10 pm and 7 am).*
- *whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).*

*The  $L_{A1, (1 \text{ minute})}$  descriptor is meant to represent a maximum noise level measured under 'fast' time response. EPA will accept analysis based on either  $L_{A1, (1 \text{ minute})}$  or  $L_{A, (Max)}$ .*

The policy states that a sleep disturbance criterion of  $L_{A1,1\text{minute}} \leq L_{A90,15\text{minute}} + 15 \text{ dB(A)}$ , should be used as a first step 'guide' as it is 'not ideal' and 'where it is not met, a more detailed analysis is required'.

That detailed analysis includes a reference to the research material contained in the RNP in the assessment of the subject proposal.

The RNP contains a summary of the findings of world-wide research undertaken on sleep disturbance from noise up until the time when this publication was produced. It summarises all of the research with the following statement:

*From the research on sleep disturbance to date it can be concluded that:*

- *maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep*
- *one or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly.*

Therefore, from the above research a 50-55 dB(A) maximum internal noise level would be equivalent to approximately 65-70 dB(A) maximum noise level outside a bedroom window. These external noise limits are in line with the noise limits described by Griefahn [Acoustics Australia vol 20 No 2 August 1992 pp 43-47] and the RNP which address sleep disturbance.

In summary, the sleep disturbance criteria described in policies above are used for the purpose of noise impact assessment for this study, however due consideration is also given to the RNP research findings in setting an appropriate 'upper' limit.

The sleep disturbance criteria are summarised in Table 6.5 below.

**Table 6.5 – Sleep Disturbance Criteria**

Receiver	Sleep disturbance criteria, 10:00 pm - 7:00 am, $L_{A1,1\text{minute}}$	
	$L_{A90,15\text{minute}} + 15$	Upper limit
All residential	$30 + 15 = 45 \text{ dB(A)}$	65 dB(A)



## 7 Operational Noise Assessment

### 7.1 Operational Noise Modelling Scenario

The Modification would consist of two distinct production phases and the scenarios selected for operational noise modelling were:

- 2018 – the year of highest combined materials movement (i.e. ore and waste rock) with maximum fleet in operation.
- 2022 – the final year before the mobile fleet significantly reduces and the northern waste emplacement near to the maximum height of 308 metres Relative Level (mRL).

### 7.2 Operational Noise Sources

The sound power levels (SWLs) of plant likely to be used during the operation of the Modification have been determined based on manufacturer's specifications, or other available information including Renzo Tonin & Associates database of noise levels and previous studies.

Modifying factor adjustments, as per Section 4 of the INP, have been considered for all proposed plant and equipment. Based on Renzo Tonin & Associates' experience, noise from all sources, individually and in combination were determined not likely to exhibit tonal, low-frequency, impulsive, and/or intermittent characteristics. Therefore, no modifying factors corrections are required.

A summary of plant and equipment included in the noise modelling for the Modification and relevant SWLs, are provided in Table 7.1.

**Table 7.1 – Sound Power Levels**

Plant Item	SWL, dB(A)	Quantity		
		Modification 11	2018	2022
<b>Fixed Plant</b>				
Process Plant	124	1	1	1
<b>Mining Fleet</b>				
Hydraulic Excavator 994B (310t)	118	3	1	-
Hydraulic Excavator 9400	121	-	1	1
Hydraulic Excavator EX3600	115	-	1	1
Haul Truck 789B / 789C (317t GVM, 184t payload capacity)	124	12	17	17
Haul Truck 785C (249t GVM, 136t payload capacity)	123	3	3	3
TCR652 – 962G	112	-	1	1
TCR653 – IT62G	113	-	1	1
TCR654 – 980G	112	-	1	1
Wheel Loader 992G	117	2	2	2

Plant Item	SWL, dB(A)	Quantity		
		Modification 11	2018	2022
Track Dozer D10T	121	4	4	3
Wheel Dozer 834H	115	1	1	1
Water Truck 777D	116	2	2	2
Grader 16H	115	2	2	2
Drills 165-200 mm	118	7	6	6
Excavator ancillary	118	2	2	2
Roller	109	1	1	1
<b>Tailings Storage Facility Embankment Lift Fleet</b>				
Dump Truck CAT 45t Articulated (74.4t GVM, 45t payload)	110	6	14	14
Grader 14M	114	1	1	1
Water Truck Volvo A40D	110	2	1	1
Compactor CAT 825	113	1	1	1
Excavator 390FL (90t)	114	-	2	2
Excavator 349FL (50t)	112	-	1	1
Excavator (24t)	108	-	1	1
Track Dozer D6	117	1	1	1
Track Dozer D8	118	1	2	2
Roller	109	-	1	1
Scraper 627F	116	2	-	-
Excavator ZX850	113	1	-	-
<b>Total Site SWL, dB(A)</b>		<b>137.6</b>	<b>138.5</b>	<b>138.4</b>
<b>Evening/Night SWL, dB(A)</b>		<b>137.3</b>	<b>138.2</b>	<b>138.1</b>

Notes: t = tonnes; mm = millimetres.

### 7.3 Noise Modelling Methodology

Noise emissions from the various plant and processes listed in Table 7.1 were calculated to the nearest and potentially most affected residential receiver locations. Noise emissions were determined by modelling the noise sources, receiver locations, topographical features of the intervening area and recommended noise control treatments, using the Environmental Noise Model (ENM)

Noise levels were calculated at the nearest affected residential locations to each site considering the worst case scenario of all plant operating simultaneously. As a further exercise, the noise levels resulting from adverse meteorological conditions, potentially increasing noise emissions at the nearest residences, were computed using the ENM. These occurrences are expected to be infrequent based on typical weather patterns for the study area.

The Modification 11 Noise and Blasting Impact Assessment considered Lake Cowal to be full for a conservative assessment of noise impacts, simulating less noise attenuation from the lake surface when full of water by comparison with the empty lake bed. A similar approach applies for this assessment as the latest topographical data used in the ENM for Lake Cowal was at near full condition.

Where feasible and reasonable, mitigation measures have been introduced to reduce potential noise emissions from the Modification. The iterative steps undertaken are described below:

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Modification to identify the potential for noise exceedances.
2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.
3. Review of the effectiveness of these measures and assessment of their feasibility by Evolution.

Steps 1 and 2 above determined that the mobile equipment, in particular the haul truck fleet, are prominent contributors to predicted operational noise levels. Accordingly, the review of the effectiveness of mitigation measures (Step 3) focussed on the SWLs of mobile equipment.

Noise modelling conducted by SLR Consulting (2013) for Modification 11 assessed the effectiveness of:

- noise bunds to shield mobile equipment operating on the waste rock emplacements during adverse weather; and
- locating mobile equipment on the eastern side of the waste rock emplacements (i.e. away from the closest receivers to the west of the CGO) during adverse weather conditions.

The noise modelling indicated that while these measures would reduce noise levels, the predicted reductions during adverse weather conditions were very limited (SLR Consulting, 2013).

SLR Consulting (2013) also assessed the effectiveness of scheduling the TSF lift works during the daytime only. As this was shown to appreciably reduce predicted evening and night-time noise levels at privately-owned receivers, undertaking TSF lift works during the daytime only was incorporated into the predictive modelling for Modification 11. This measure has also been incorporated into the predictive modelling for the Modification.

The existing CGO mobile equipment fleet would continue to be operated for the Modification, with some additional equipment required to reflect the deeper open pit for the Modification. With the implementation of this additional fleet, total site night-time sound power levels would increase by less than 1 dB, as shown in Table 7.1.

Evolution has investigated retrofitting the existing haul truck fleet with noise attenuation kits, however the expected capital cost for this is not considered to be reasonable by Evolution. Ongoing operational costs associated with maintaining the effectiveness of the noise attenuation would be additional to this capital cost.

Given the additional haul trucks required for the Modification would use the same haul routes as the existing haul truck fleet (and the existing fleet would outnumber the new haul trucks), the noise experienced by privately-owned receivers would be dominated by the existing fleet. Therefore it is not considered by Evolution to be reasonable to purchase extra quiet haul trucks for the Modification, as the additional cost would not result in materially lower predicted noise levels at the nearest privately-owned receivers.

Noise management consisting of treatment measures at privately-owned receivers is proposed, consistent with the *Voluntary Land Acquisition and Mitigation Policy* (NSW Government, 2014) (Section 7.5).

## 7.4 Predicted Operational Noise Levels

Table 7.2 and Table 7.3 below present predicted operational noise levels for 2018 and 2022, respectively, at the nearest potentially affected receivers. Consistent with previous assessments a moderate calibration reduction of 3 dB(A) has been incorporated into the noise model and is generally consistent with field measurements and modelling results from similar large scale resource developments. Previous field noise monitoring results conducted by SLR Consulting for the CGO have confirmed the accuracy of the calibration reduction.

Detailed operational noise contours are presented in Appendix B. With regards to noise contours, the calculation involves numerical interpolation from a series of calculations to specific points within a regular spaced grid, 1.5 m above ground level. It is noted that the noise contours are estimates of the predicted noise levels, and the contour values may differ slightly from equivalent calculations at individual residences.

**Table 7.2 – Predicted Operational Noise Levels for 2018 at Nearest Affected Receivers (L<sub>Aeq,15minute</sub>)**

Receiver ID	PSNL			Predicted Operational Noise Levels, dB(A)			
	Day	Evening	Night	Day (8:30 am to 5:00 pm)	Late Afternoon (5:00 pm to 6:00 pm) and Early Morning (7:00 am to 8:30 am)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
<b>Evolution-owned Dwellings</b>							
1a	35	35	35	34	39	45	45
1b	35	35	35	34	39	45	46
1c	35	35	35	29	37	42	43
1d	35	35	35	26	34	39	39
1e	35	35	35	22	32	38	38
<b>Privately-owned Dwellings</b>							
4	35	35	35	<20	25	29	30
6	35	35	35	<20	21	24	25
15 <sup>1</sup>	35	35	35	28	34	38	39

Receiver ID	PSNL			Predicted Operational Noise Levels, dB(A)			
	Day	Evening	Night	Day (8:30 am to 5:00 pm)	Late Afternoon (5:00 pm to 6:00 pm) and Early Morning (7:00 am to 8:30 am)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
20	35	35	35	25	34	37	38
21 <sup>2</sup>	35	35	35	34	41	43	44
22a	35	35	35	26	33	37	37
22b	35	35	35	25	33	36	37
22c	35	35	35	27	35	38	39
22d	35	35	35	<20	28	32	33
24	35	35	35	20	30	33	34
25	35	35	35	<20	27	31	32
28	35	35	35	<20	20	22	23
30a	35	35	35	<20	21	25	26
30b	35	35	35	<20	<20	24	24
31a	35	35	35	<20	21	24	25
36a	35	35	35	23	33	38	38
36b	35	35	35	<20	27	30	31
38	35	35	35	<20	29	34	35
42 <sup>2</sup>	35	35	35	32	39	42	43
43a	35	35	35	<20	26	30	31
43b	35	35	35	<20	20	23	24
49a	35	35	35	21	30	34	35
49b	35	35	35	21	30	36	37
56	35	35	35	<20	<20	21	21
57	35	35	35	<20	<20	21	22
61a	35	35	35	<20	29	33	34
62	35	35	35	<20	28	31	32
79	35	35	35	<20	<20	23	24
89	35	35	35	<20	27	31	32
90a	35	35	35	<20	23	27	28
90b	35	35	35	22	33	38	38
100	35	35	35	<20	<20	23	23
122	35	35	35	<20	21	26	26
126	35	35	35	<20	<20	22	23
<b>Other Modelled Receivers</b>							
Bird Breeding Area North (NO4)	N/A	N/A	N/A	21	30	35	35

Receiver ID	PSNL			Predicted Operational Noise Levels, dB(A)			
	Day	Evening	Night	Day (8:30 am to 5:00 pm)	Late Afternoon (5:00 pm to 6:00 pm) and Early Morning (7:00 am to 8:30 am)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
Bird Breeding Area South (NO3)	N/A	N/A	N/A	31	41	47	48
Relocated Crown Reserve	N/A	N/A	N/A	25	37	43	44

Notes Predicted noise levels at privately-owned dwellings highlighted in **bold** exceed the PSNLs, while receiver IDs for privately-owned dwellings that previously exceeded the PSNLs are highlighted in *italics*.

1. Evolution has a noise agreement in place with the owner of this property.
2. The owners of these receivers currently have the right to acquisition upon request in Development Consent DA 14/98.

**Table 7.3 – Predicted Operational Noise Levels for 2022 at Nearest Affected Receivers ( $L_{Aeq,15minute}$ )**

Receiver ID	PSNL			Predicted Operational Noise Levels, dB(A)			
	Day	Evening	Night	Day (8:30 am to 5:00 pm)	Late Afternoon (5:00 pm to 6:00 pm) and Early Morning (7:00 am to 8:30 am)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
<b>Evolution-owned Dwellings</b>							
1a	35	35	35	32	38	45	45
1b	35	35	35	32	38	45	46
1c	35	35	35	29	36	42	43
1d	35	35	35	30	37	39	40
1e	35	35	35	22	31	36	37
<b>Privately-owned Dwellings</b>							
4	35	35	35	<20	24	27	28
6	35	35	35	<20	20	23	24
15 <sup>1</sup>	35	35	35	28	34	<b>38</b>	<b>39</b>
20	35	35	35	25	32	<b>36</b>	<b>37</b>
21 <sup>2</sup>	35	35	35	34	<b>39</b>	<b>42</b>	<b>43</b>
22a	35	35	35	28	32	35	35
22b	35	35	35	27	31	34	35
22c	35	35	35	30	33	<b>36</b>	<b>37</b>
22d	35	35	35	21	29	31	32
24	35	35	35	23	30	33	33
25	35	35	35	22	28	30	31
28	35	35	35	<20	<20	21	22
30a	35	35	35	<20	22	25	26

Receiver ID	PSNL			Predicted Operational Noise Levels, dB(A)			
	Day	Evening	Night	Day (8:30 am to 5:00 pm)	Late Afternoon (5:00 pm to 6:00 pm) and Early Morning (7:00 am to 8:30 am)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
30b	35	35	35	<20	<20	23	24
31a	35	35	35	<20	20	23	24
36a	35	35	35	23	32	38	39
36b	35	35	35	<20	26	29	29
38	35	35	35	20	28	33	34
42 <sup>2</sup>	35	35	35	34	<b>40</b>	<b>42</b>	<b>42</b>
43a	35	35	35	<20	25	28	29
43b	35	35	35	<20	<20	22	23
49a	35	35	35	24	31	33	34
49b	35	35	35	24	32	34	35
56	35	35	35	<20	<20	20	20
57	35	35	35	<20	21	23	24
61a	35	35	35	20	27	32	33
62	35	35	35	<20	27	31	32
79	35	35	35	<20	<20	20	21
89	35	35	35	<20	28	31	32
90a	35	35	35	<20	23	27	28
90b	35	35	35	25	34	<b>38</b>	<b>38</b>
100	35	35	35	<20	20	22	23
122	35	35	35	<20	20	24	25
126	35	35	35	<20	<20	21	22
<b>Other Modelled Receivers</b>							
Bird Breeding Area North (NO4)	N/A	N/A	N/A	21	30	34	35
Bird Breeding Area South (NO3)	N/A	N/A	N/A	31	39	46	47
Relocated Crown Reserve	N/A	N/A	N/A	25	37	42	43

Notes Predicted noise levels at privately-owned dwellings highlighted in **bold** exceed the PSNLs, while receiver IDs for privately-owned dwellings that previously exceeded the PSNLs are highlighted in *italics*.

1. Evolution has a noise agreement in place with the owner of this property.
2. The owners of these receivers currently have the right to acquisition upon request in Development Consent DA 14/98.

A number of residential receivers were predicted to exceed the PSNL in Table 7.2 and Table 7.3. A summary of the privately-owned receivers with PSNL exceedances during the operational phase are presented in Table 7.4.

**Table 7.4 – Summary of Properties with PSNL Exceedances**

Property Ownership	2018			2022		
	Negligible 0-2 dB(A) above PSNL	Marginal to Moderate 3-5 dB(A) above PSNL	Significant >5 dB(A) above PSNL	Negligible 0-2 dB(A) above PSNL	Marginal to Moderate 3-5 dB(A) above PSNL	Significant >5 dB(A) above PSNL
Privately-owned	22a, 22b, 49b	<i>15<sup>1</sup></i> , 20, 22c, 36a, 90b	<i>21<sup>2</sup></i> , 42 <sup>2</sup>	20, 22c	<i>15<sup>1</sup></i> , 36a, 90b	<i>21<sup>2</sup></i> , 42 <sup>2</sup>

Notes: Receiver IDs for privately-owned dwellings that previously exceeded the PSNLs are highlighted in *italics*.

1. Evolution has a noise agreement in place with the owner of this property.
2. The owners of these receivers currently have the right to acquisition upon request in Development Consent DA 14/98.

Receivers 22a, 22b, and 49b experience negligible exceedances above the PSNL and are not considered further as per NSW Government (2014) policy. Noise management measures should be considered for properties that are privately-owned with marginal, moderate and significant exceedances above the PSNL. Section 7.5 provides recommended noise management measures for these properties.

It is noted that when the existing operational noise criteria (Section 6.1.3) are considered:

- Receiver 15 is predicted to experience a 2 dB(A) increase on its current operational noise limit (Evolution has a noise agreement in place with the owner of this property);
- Receiver 20 is predicted to experience up to a 2 dB(A) increase on its current operational noise limit; and
- Receiver 36a is predicted to experience up to a 3 dB(A) increase on its current operational noise limit.

## 7.5 Noise Management Measures

### 7.5.1 Noise Management Zone

The noise management zone is defined as where properties experience marginal exceedances of 1-5 dB(A) above the PSNL. The following management measures are recommended for properties in this zone:

- Noise monitoring on-site and within the community;
- Prompt response to any community issues of concern;
- Refinement of on-site noise mitigation measures and operating procedures, where practicable; and



- Implementation of reasonable and feasible acoustical mitigation at receivers. Consistent with NSW Government (2014), potential treatment measures would be considered at privately owned receivers 15, 20, 22c, 36a and 90b including provision of mechanical ventilation/comfort systems (e.g. air conditioning) to enable windows to be closed without compromising internal air quality/amenity (refer to Table 6.4). It is noted that Evolution has a noise agreement in place with the owner of property 15.

### 7.5.2 Noise Affection Zone

The noise affection zone is defined as where properties experience significant exceedances >5 dB(A) above the PSNL. Consistent with NSW Government (2014), these receivers are afforded acquisition upon request rights. As shown in Table 7.4, only receivers 21 and 42 are predicted to be in the noise affection zone and as discussed in Section 6.1.3, receivers 21 and 42 already have these rights in accordance with the existing Development Consent (DA 14/98).

## 7.6 Amenity Noise Levels

For privately-owned receivers, the intrusive criteria are more stringent than the amenity criteria during all time periods. Furthermore cumulative noise assessment is not required due to the absence of any industrial or mining developments in the vicinity of the Modification (Section 6.1.6), so analysis of amenity noise levels is not required. Therefore the intrusiveness criteria are the controlling criteria for privately-owned receivers and the amenity criteria are not considered further for privately-owned receivers.

The amenity criteria are applicable for the Relocated Crown Reserve, a non-residential receiver. Table 7.5 and Table 7.6 present the predicted noise levels for the Relocated Crown Reserve for the Modification compared to the amenity noise criteria.

**Table 7.5 – Predicted Operational Noise Levels for 2018 at Relocated Crown Reserve ( $L_{Aeq,Period}$ )**

Receiver ID	Amenity Criteria			Predicted Operational Noise Levels, dB(A)		
	Day	Evening	Night	Day (7:00 am to 6:00 pm)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
Relocated Crown Reserve	50 (when in use)			31	43	44

**Table 7.6 – Predicted Operational Noise Levels for 2022 at Relocated Crown Reserve ( $L_{Aeq,Period}$ )**

Receiver ID	Amenity Criteria			Predicted Operational Noise Levels, dB(A)		
	Day	Evening	Night	Day (7:00 am to 6:00 pm)	Evening (6:00 pm to 10:00 pm)	Night (10:00 pm to 7:00 am)
Relocated Crown Reserve	50 (when in use)			39	42	43

The Relocated Crown Reserve is predicted to comply with the amenity criteria for both operational years.

## 7.7 Sleep Disturbance

Consistent with the methodology used in the Modification 11 Noise and Blasting Impact Assessment, the mean difference between the intrusive  $L_{Aeq,15\text{minute}}$  and the corresponding  $L_{A1,1\text{minute}}$  noise levels from 6-monthly operator-attended night time noise monitoring results was found to be 7dB(A).

Based on the mean difference, Table 7.7 presents the predicted night time  $L_{A1,1\text{minute}}$  noise levels at the nearest affected receivers. The maximum noise level predictions take into account the meteorological assessment conditions nominated in Section 5.1 for night-time and presented values are the maximum over all modelled conditions.

**Table 7.7 – Predicted Sleep Disturbance Noise Levels at Nearest Affected Receivers ( $L_{A1,1\text{minute}}$ )**

Receiver	Sleep disturbance criteria (10:00 pm - 7:00 am)		Predicted Sleep Disturbance Level $L_{A1,1\text{minute}}$	
	$L_{A90, 15\text{ minute}} + 15$	Upper limit	Year 2018	Year 2022
<b>Evolution-owned Dwellings</b>				
1a	45	65	52	52
1b	45	65	53	53
1c	45	65	50	50
1d	45	65	46	47
1e	45	65	45	44
<b>Privately-owned Dwellings</b>				
4	45	65	37	35
6	45	65	32	31
15 <sup>1</sup>	45	65	46	46
20	45	65	45	44
21 <sup>2</sup>	45	65	51	50
22a	45	65	44	42
22b	45	65	44	42
22c	45	65	46	44
22d	45	65	40	39
24	45	65	41	40
25	45	65	39	38
28	45	65	30	29
30a	45	65	33	33
30b	45	65	31	31
31a	45	65	32	31
36a	45	65	45	46
36b	45	65	38	36
38	45	65	42	41
42 <sup>2</sup>	45	65	50	49
43a	45	65	38	36

Receiver	Sleep disturbance criteria (10:00 pm - 7:00 am)		Predicted Sleep Disturbance Level $L_{A1,1\text{minute}}$	
	$L_{A90, 15 \text{ minute}} + 15$	Upper limit	Year 2018	Year 2022
43b	45	65	31	30
49a	45	65	42	41
49b	45	65	44	42
56	45	65	28	27
57	45	65	29	31
61a	45	65	41	40
62	45	65	39	39
79	45	65	31	28
89	45	65	39	39
90a	45	65	35	35
90b	45	65	45	45
100	45	65	30	30
122	45	65	33	32
126	45	65	30	29

Notes **Green** denotes exceedance of  $L_{A90(15\text{min})} + 15$  screening criterion but within upper limit of 65 dB(A).

1. Evolution has a noise agreement in place with the owner of this property.
2. The owners of these receivers currently have the right to acquisition upon request in Development Consent DA 14/98.

From Table 7.7, privately-owned receivers 15, 22c and 36a were predicted to exceed the sleep disturbance screening criterion by 1 dB(A). These receivers were predicted to be within the sleep disturbance upper limit criterion of 65 dB(A).

Receivers 21 and 42 were predicted to exceed the sleep disturbance screening criterion by up to 6 dB(A), but not the sleep disturbance upper limit criterion of 65 dB(A). The owners of these receivers currently have the right to acquisition upon request in Development Consent DA 14/98.

Predicted noise levels at all other privately-owned receivers were found to be within both nominated criteria.

It is considered that the mitigation/management measures discussed in Section 7.5 would adequately mitigate the potential sleep disturbance exceedances:

- Receivers 21 and 42 are subject to existing acquisition upon request conditions in the existing Development Consent (DA 14/98).
- Implementation of feasible and reasonable mitigation measures at receivers 15, 22c and 36a is proposed including provision of mechanical ventilation/comfort systems (e.g. air conditioning) to enable windows to be closed without compromising internal air quality/amenity.

## 7.8 Twenty-five Percent Land Assessment

As discussed in Section 6.1.5, in NSW Government (2014), voluntary land acquisition rights are conferred on privately property owners where there are predicted exceedances of the maximum noise levels of the INP amenity criteria on more than 25% of any privately-owned land. From review of the operational noise contours in Appendix B (incorporating a -3 dBA allowance to convert the  $L_{Aeq,15minute}$  contours shown to  $L_{Aeq,Period}$ ), it is noted that the following privately-owned property would exceed the INP rural night-time amenity recommended maximum noise levels by greater than 25%:

- Receiver 21 (Westella [formerly McLintock]).

It is noted that receiver 21 is already subject to existing acquisition upon request conditions in the existing Development Consent (DA 14/98).

As part of this review, it was also noted that receiver 20 (Bramboyne) would also exceed INP rural night-time amenity recommended maximum noise levels by greater than 25% of its property area. However, the owner of Bramboyne (WJ Buttenshaw) also owns the contiguous property 15 (Laurel Park) with HJ Buttenshaw. Therefore, when considering the contiguous lots owned by WJ Buttenshaw, less than 25% of the total contiguous property area (i.e. properties 20 and 15) would exceed the INP rural night-time amenity recommended maximum noise levels.

## 7.9 Bird Breeding Areas

The predicted results indicate that the maximum intrusive noise level at the closest bird breeding area (Bird Breeding Area South [NO3]) would be 48 dBA  $L_{Aeq,15minute}$  (Tables 7.2 and 7.3). Noise and bird behaviour monitoring is conducted at the CGO, with a focus on abrupt events more likely to affect waterbird behaviour. Results of waterbird behaviour monitoring conducted at the CGO found that there was no abrupt change in the behaviour of any bird species to noise (or other effects) from blasts conducted at the CGO (Trevor Brown and Associates, 2016). Given the proposed continuation of noise and bird behaviour monitoring in accordance with the Flora and Fauna Management Plan (Evolution, 2015), noise emissions from the Modification would be unlikely to significantly impact any fauna species.

## 8 Other Issues

### 8.1 Blasting

Blasting produces ground-borne vibration and air blast overpressure, both of which can cause discomfort, and at higher levels, damage to property. The existing CGO Development Consent (DA 14/98) contains blasting impact assessment criteria, as shown in the following extract from Condition 6.3, Schedule 2 of Development Consent DA 14/98.

(a) Impact Assessment Criteria

*The Applicant shall ensure that blasting at the project does not exceed the criteria in Table 6.*

**Table 6: Blasting impact assessment criteria**

<b>Location &amp; Time</b>	<b>Airblast overpressure (dB(Lin Peak))</b>	<b>Ground vibration (mm/s)</b>	<b>Allowable exceedance</b>
<i>Residence on privately-owned land - Anytime</i>	120	10	0%
<i>Residence on privately-owned land – Monday to Saturday during day</i>	115	5	5% of the total number of blasts over a period of 12 months
<i>Residence on privately-owned land – Monday to Saturday during evening</i>	105	2	5% of the total number of blasts over a period of 12 months
<i>Residence on privately-owned land - Monday to Saturday at Night, Sundays and public holidays</i>	95	1	5% of the total number of blasts over a period of 12 months

This Modification involves a deepening of the existing CGO open pit. Accordingly, blast extents and design parameters remain similar to what was presented in the Modification 11 Noise and Blasting Impact Assessment. Notwithstanding, the Modification would result in a continuation of blasting effects for a further five (5) years, corresponding with the proposed extension of mining activities.

In Modification 11, all receiver locations were predicted to comply with vibration and blast overpressure criteria except at Coniston (1a and 1b) which has a moderate exceedance of 3 dB above the daytime Sunday/Public Holidays airblast overpressure criteria. However the continued blast monitoring results show that measured airblast levels are below human comfort criterion of 95dB;pk at Coniston. Blast monitoring should continue at Coniston to confirm that compliance with the airblast overpressure criteria is maintained. Blast size may be modified (i.e. Maximum Instantaneous Charge may be reduced) should blast monitoring indicate that blast overpressure is approaching the criteria of 95 dB(Lin) peak. Blasting is not considered further in this report.

## 8.2 Road Traffic Noise

Additional heavy vehicle deliveries associated with the Modification would be due to the increased use of some consumables. However the additional deliveries required (approximately 1 to 2 trucks per day) would only involve a small increase to the current total daily truck deliveries at the CGO. There will be no additional light vehicle traffic generation on the surrounding road network due to the operational activities of the Modification. An increase of 1-2 trucks per day would not be material to road noise levels along the Mine Access Road (i.e. Ungarie, Wamboyne and Blow Clear Roads). In addition, the Modification would result in a continuation of road noise impacts for a further eight (8) years, corresponding with the proposed extension of the approved mine life.

As road traffic noise was previously determined in Modification 11 to be within the relevant noise criteria (SLR Consulting, 2013), traffic noise is not considered further.

## 9 Conclusion

### 9.1 General

- Gold production commenced at the CGO in 2006, which involves open pit mining operations occurring 24 hours a day, 7 days a week. The Modification would extend the life of the approved CGO by up to 8 years. The main activities include increasing the final depth of the open pit by 70 m, upgrades to the existing leach circuit and increasing the total life of mine ore production/volume of tailings and mined waste rock.
- A background noise survey was conducted prior to the operation of the CGO and the RBLs, determined in accordance INP methodology, were found to be consistent with what is expected of a rural region. Additional background noise monitoring was not considered appropriate for the Modification given the existing operation of the approved CGO. The RBL for day, evening and night periods used in this assessment have adopted the minimum RBL nominated in the INP of 30 dB(A) to allow for a conservative assessment.
- An analysis of noise enhancement from adverse meteorological conditions has previously been conducted in accordance with the INP based upon meteorological data collected at the CGO meteorological station. Wind enhancement was not found to be a feature of the area but temperature inversions were included in the operational noise modelling. Noise modelling for the operational phase was undertaken under a varied set of adverse meteorological conditions.

### 9.2 Operational Noise

- Operational scenarios were considered for 2018 and 2022, coinciding with the year of highest combined materials movement with maximum fleet in operation and the final year before the mobile fleet significantly decreases and the northern waste emplacement nearing the maximum height of 308 mRL, respectively.
- Three (3) privately-owned receivers are predicted to experience negligible exceedances of the PSNL. Five (5) privately-owned receivers are predicted to experience moderate exceedances of the PSNL and when existing operational noise criteria are considered, three (3) of these receivers are predicted to experience up to a 3 dB(A) increase on their operational noise limit. It is noted, however, that Evolution has a noise agreement in place with the owner of one of the properties (15 – Laurel Park). Two (2) privately-owned receivers are predicted to experience significant exceedances of the PSNL (the owners of both receivers currently have the right to acquisition upon request in Development Consent DA 14/98).
- Recommendations for noise management measures for operational noise at the receiver locations exceeding the PSNLs have been provided, including provision of mechanical ventilation/comfort systems (e.g. air conditioning) to enable windows to be closed without compromising internal air quality/amenity.

- All privately-owned receivers are predicted to experience night-time  $L_{A1,1\text{minute}}$  noise within the upper limit of the sleep disturbance criteria. Some exceedances of the EPA's sleep disturbance screening criteria are predicted, however these receivers are either currently afforded acquisition rights or are predicted for negligible exceedances of 1 dB(A) and are recommended for management measures of operational noise at the receiver in this assessment.
- Review of the predicted noise contours over privately-owned land (25% of land assessment) as required by the NSW Government's (2014) *Voluntary Land Acquisition and Management Policy* indicates that one (1) privately-owned property would exceed the INP amenity maximum noise level criteria for greater than 25% of the property's total area, however the relevant property (21 - Westella) already has acquisition rights in Development Consent DA 14/98.



## 10 References

1. Australian and New Zealand Environment Conservation Council (1990) *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration*.
2. Australian Standard 2187.2-1993 (1993) *Explosives – Storage, Transport and Use – Part 2 Use of Explosives*.
3. Australian Standard 2187.2-2006 (2006) *Explosives – Storage, Transport and Use – Part 2 Use of Explosives*.
4. Barrick (2010) *Noise Management Plan*.
5. Brown, T (2016) *Independent Environmental Audit Cowal Gold Operations*.
6. Department of Environment, Climate Change and Water (2011) *NSW Road Noise Policy*.
7. Environment Protection Authority (1994) *NSW Environmental Noise Control Manual*.
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9. Environment Protection Authority (2000) *NSW Industrial Noise Policy*.
10. Environment Protection Authority (2013) *Application Notes – NSW Industrial Noise Policy*. Available at <http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm>
11. Evolution Mining (Cowal) Pty Ltd (2014) *Noise Management Plan*.
12. Evolution Mining (Cowal) Pty Ltd (2015) *Flora and Fauna Management Plan*.
13. Griefahn (1992) *Noise control during the night*, Acoustics Australia, vol 20(2), pp43-47.
14. NSW Government (2014) *Voluntary Land Acquisition and Mitigation Policy – SSD Mining*.
15. SLR Consulting (2013) *Cowal Gold Mine Extension Modification Noise and Blasting Impact Assessment*.

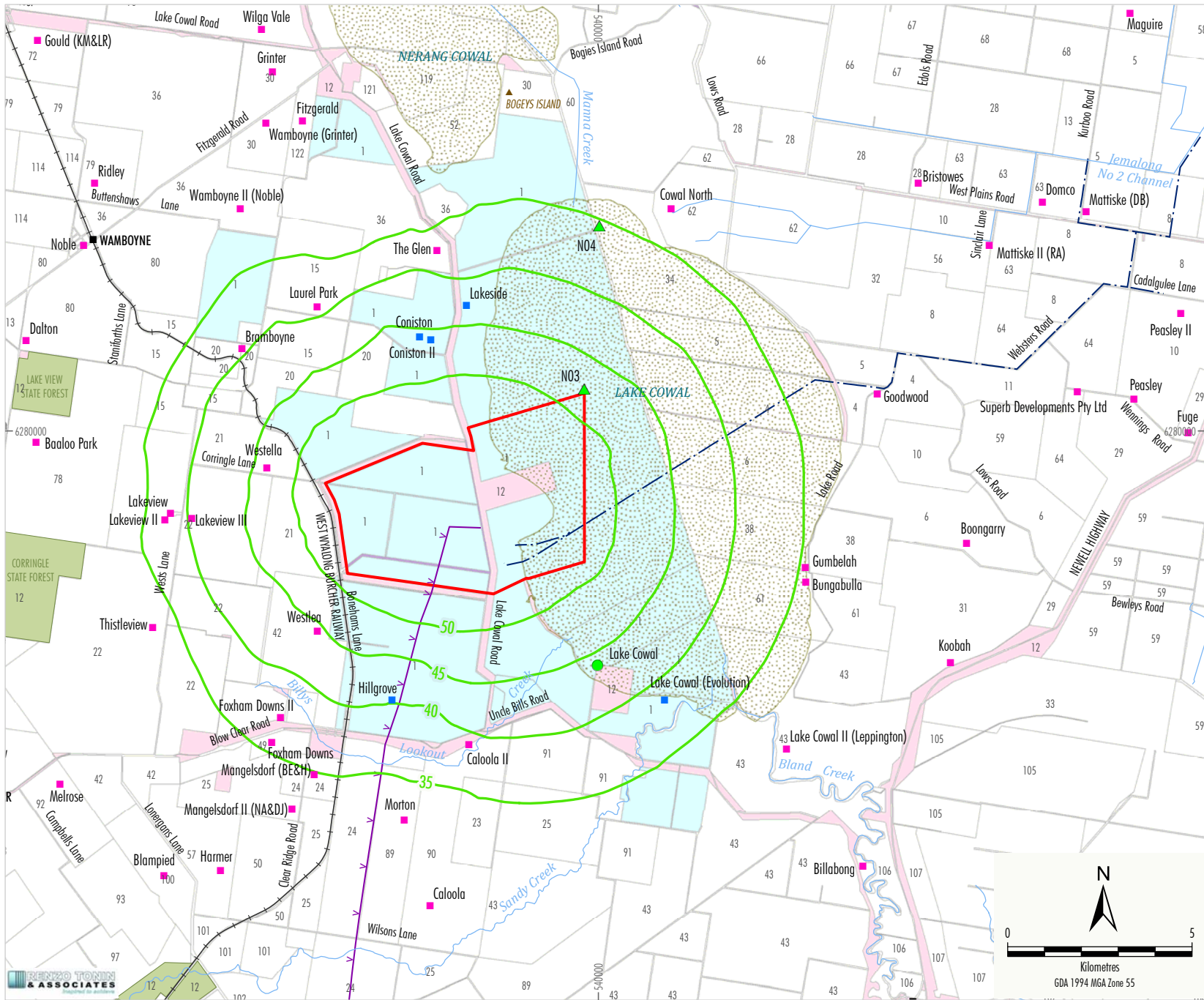
## APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the $L_{90}$ noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0 dB     The faintest sound we can hear 30 dB     A quiet library or in a quiet location in the country 45 dB     Typical office space. Ambience in the city at night 60 dB     CBD mall at lunch time 70 dB     The sound of a car passing on the street 80 dB     Loud music played at home 90 dB     The sound of a truck passing on the street 100 dB    The sound of a rock band 115 dB    Limit of sound permitted in industry 120 dB    Deafening
dB(A)	A-weighted decibels. The A-weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
$L_{Max}$	The maximum sound pressure level measured over a given period.
$L_{Min}$	The minimum sound pressure level measured over a given period.
$L_1$	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
$L_{10}$	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

L <sub>90</sub>	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L <sub>eq</sub>	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

## APPENDIX B **Operational Noise Contours**

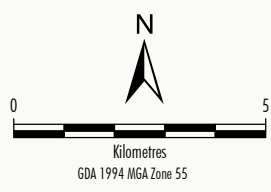


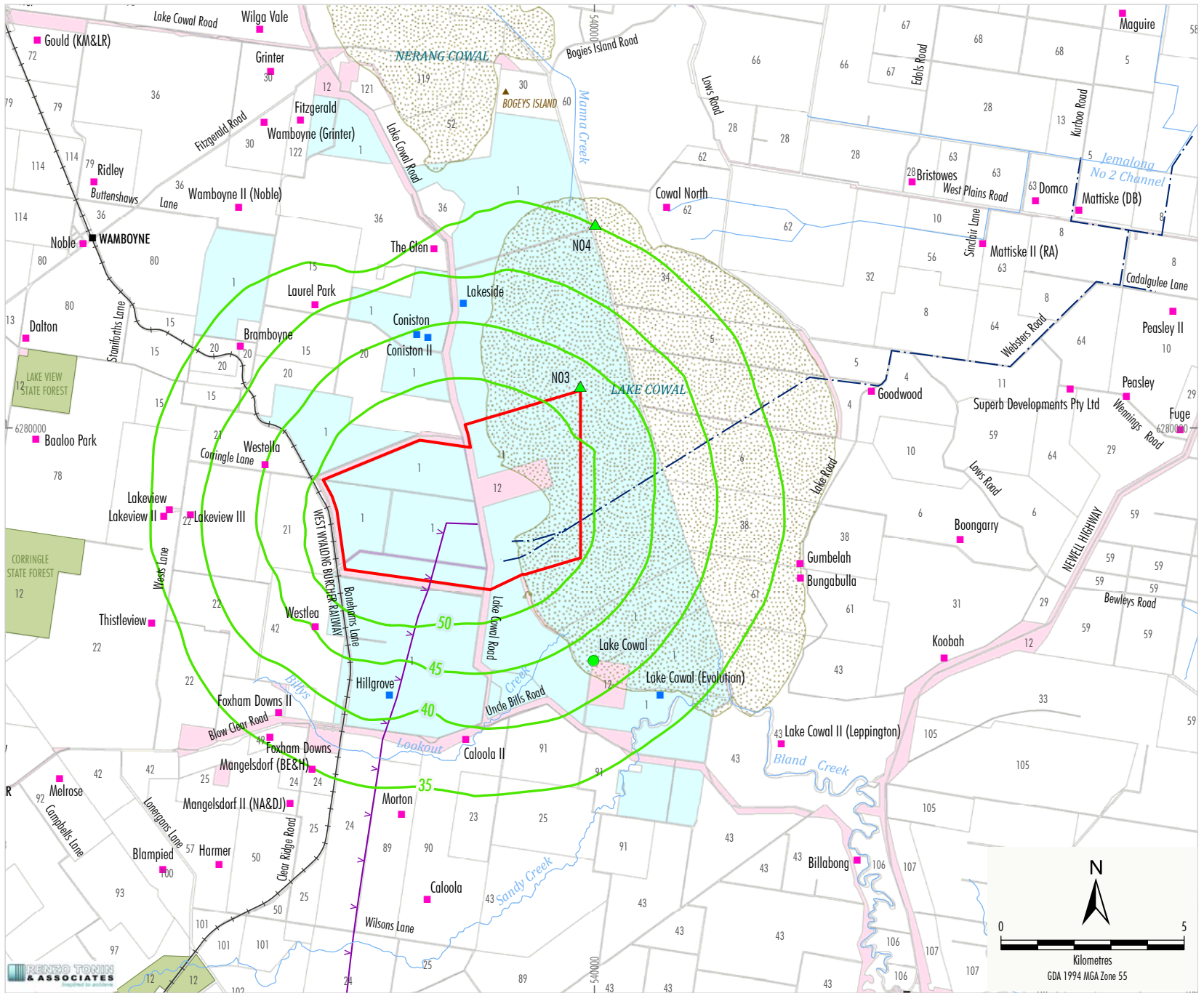
- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Railway
  - Pipeline
  - Electricity Transmission Line
  - State Forest
  - Company-owned
  - Crown Land
  - Local Government
  - Privately Owned
  - Company-owned Dwelling
  - Privately-owned Dwelling
  - ▲ Bird Breeding Area
  - Relocated Crown Reserve
  - Predicted ( $L_{Aeq}(15min)$ ) Noise Contours Night-time Inversion (dBA)

Refer to Figure 3b for Landholder Key  
 Source: Evolution (2016); Land and Property Information (2016)



**CGO MINE LIFE MODIFICATION**  
**Predicted Noise Contours**  
**Night-time Inversion (2018)**





- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Railway
  - Pipeline
  - Electricity Transmission Line
  - State Forest
  - Company-owned
  - Crown Land
  - Local Government
  - Privately Owned
  - Company-owned Dwelling
  - Privately-owned Dwelling
  - ▲ Bird Breeding Area
  - Relocated Crown Reserve
  - Predicted ( $L_{Aeq}(15\text{minute})$ ) Noise Contours
  - Night-time Inversion (dBA)

Refer to Figure 3b for Landholder Key  
 Source: Evolution (2016); Land and Property Information (2016)



**CGO MINE LIFE MODIFICATION**  
**Predicted Noise Contours**  
**Night-time Inversion (2022)**

