Evolution MINING

APPENDIX E

Noise and Blasting Assessment

COWAL GOLD OPERATIONS
PROCESSING RATE MODIFICATION

Environmental Assessment
2018

Resource Strategies

RENZO TONIN & ASSOCIATES
Inspired to achieve

Acoustics
Vibration
Structural Dynamics

COWAL GOLD OPERATIONS PROCESSING RATE MODIFICATION

Noise and Blasting Assessment

28 March 2018

Evolution Mining (Cowal) Pty Limited

00904358-007

Sydney Melbourne Brisbane Gold Coast Kuwait
Renzo Tonin & Associates (NSW) Pty Ltd ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

Document details

Detail	Reference
Doc reference:	00904358-007
Prepared for:	Evolution Mining (Cowal) Pty Limited
Address:	PO Box 210 West Wyalong NSW 2671
Attention:	Ms Bronwyn Flynn

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
06.03.2017	Draft	-	0-5	WC		
21.03.2017	Final		6	WC		WC

Contents

List of tables

List of figures

1 Introduction

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 in New South Wales (NSW) (Figure 1). Renzo Tonin & Associates was engaged by Evolution to conduct an assessment examining the potential noise and blasting impacts of a proposed modification to the CGO (herein referred to as the Modification).

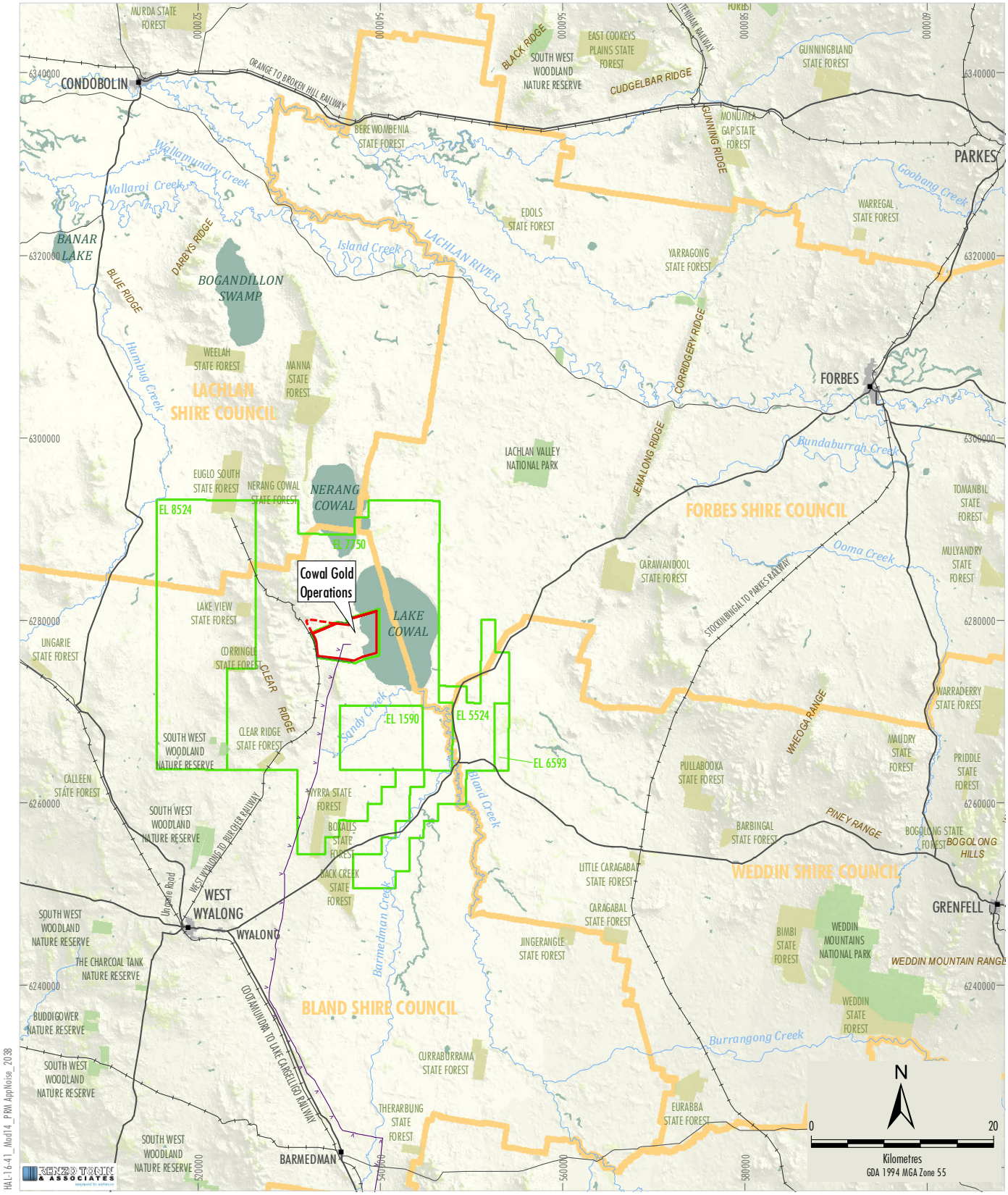
The issues addressed in this study include noise emissions from:

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

The Secretary's Environmental Assessment Requirements (SEARs) for the Modification nominate the following specific noise issues to be addressed in this assessment (Table 1.1).

Table 1.1 – Location of the Addressed SEARs in this Document

Secretary's Environmental Assessment Requirements	Section of Report Addressing SEAR Content
• an assessment of the likely operational noise impacts (including construction noise) of the proposed modification under the NSW Industrial Noise Policy; and	Section 7
• 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 Australian and New Zealand Environment Conservation Council (ANZECC) guidelines.	Section 8



LEGEND

- Mining Lease Boundary (ML 1535)
- Mining Lease Application (MLA 1)
- Exploration Licence (EL)
- National Park & Nature Reserve
- State Forest
- Local Government Area Boundary
- Electricity Transmission Line
- Railway

Source: © NSW Department of Finance, Services & Innovation (2017); Office of Environment & Heritage NSW (2017)

Evolution MINING
Cowal

CGO PROCESSING RATE MODIFICATION

Regional Location

Figure 1

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

- NSW *Industrial Noise Policy* (INP) (Environment Protection Authority [EPA], 2000)[1];
- *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* (ANZECC, 1990);
- *Interim Construction Noise Guideline* (ICNG) (Department of the Environment and Climate Change, 2009);
- NSW *Environmental Noise Control Manual* (EPA, 1994); and
- NSW *Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water, 2011).

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.

It is noted that the Noise Policy for Industry (EPA, 2017) was released in October 2017. However, since the SEARs refer to the INP, this assessment has been conducted in accordance with the INP.

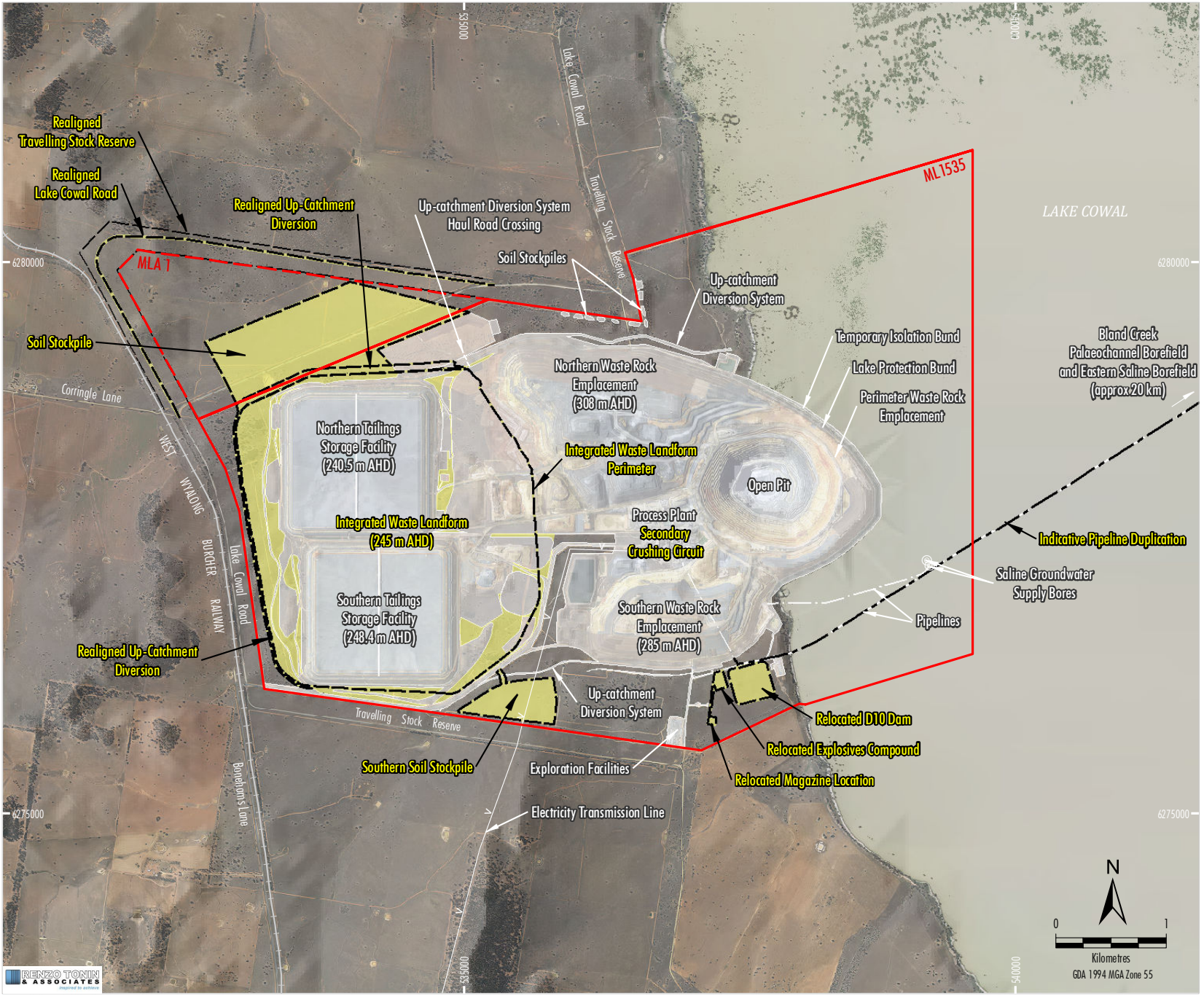
[1] It is noted that the NSW Noise Policy for Industry (EPA, 2017) was recently introduced to replace the INP. However for this assessment, noise impacts have been assessed in accordance to the INP as the SEARs refer to the use of the INP.

2 Modification Overview

Recent feasibility studies have identified potential opportunities to maximise the ore processing capacity of the CGO's existing process plant. On this basis, Evolution proposes to modify Development Consent DA 14/98 under section 75W of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) to increase the CGO's approved ore processing rate of 7.5 million tonnes per annum (Mtpa) to 9.8 Mtpa.

The main activities associated with development of the Modification would include (Figure 2):

- increasing the ore processing rate from 7.5 Mtpa to 9.8 Mtpa;
- modification of the existing Tailings Storage Facilities (TSFs) to form one larger TSF, which would also accommodate mine waste rock (herein referred to as the Integrated Waste Landform [IWL]);
- relocation of water management infrastructure (i.e. the Up-Catchment Diversion System and approved location for contained water storage D10) and other ancillary infrastructure (e.g. internal roads and soil and ore stockpiles) elsewhere within Mining Lease (ML) 1535 and Mining Lease Application (MLA) 1;
- installation of a secondary crushing circuit within the existing process plant area;
- duplication of the existing water supply pipeline across Lake Cowal;
- increased annual extraction of water from the CGO's external water supply sources;
- increased consumption of cyanide and other process consumables;
- an increase in the average and peak workforce employed at the CGO;
- relocation of a travelling stock reserve (TSR) and Lake Cowal Road; and
- provision of crushed rock material to local councils to assist with road base supplies.



LEGEND

- Mining Lease Boundary (ML 1535)
- Mining Lease Application Boundary (MLA 1)
- Approximate Extent of Approved Surface Development
- Approximate Extent of Additional Modification Surface Disturbance
- Modification Component

Source: Evolution (2018); © NSW Department of Finance, Services & Innovation (2017)
Orthophoto: Evolution (Oct 2017)

Evolution MINING Cowal

CGO PROCESSING RATE MODIFICATION

Modification General Arrangement

Figure 2

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 Crown reserve have also been modelled for assessment purposes (Table 3.1).

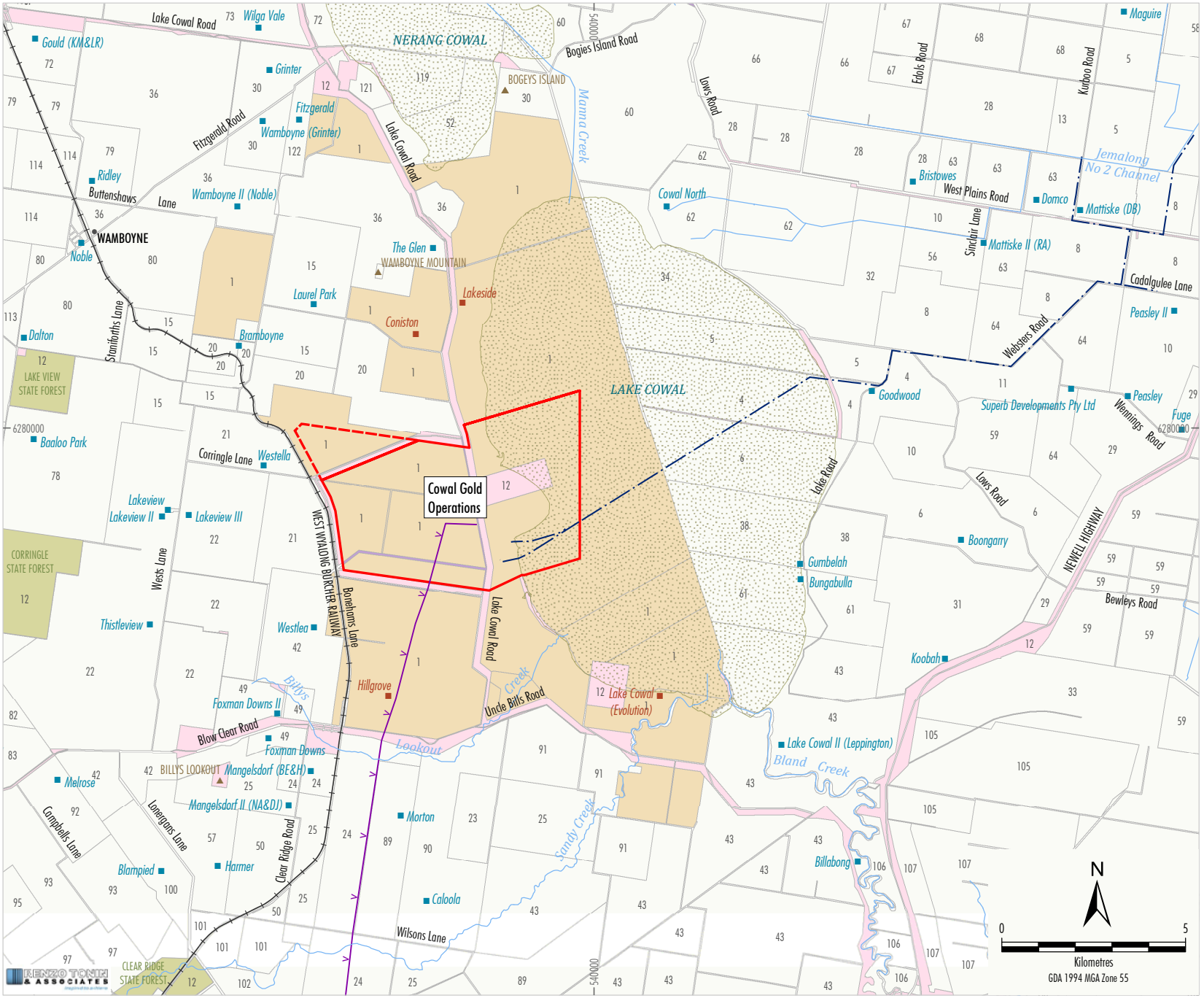
Table 3.1 – Receiver Locations and Ownership Details

Reference ID	Name	Type	Easting	Northing
Evolution-owned Dwellings				
1a	Coniston	Evolution-owned	535153	6282548
1b	Lakeside	Evolution-owned	536424	6283400
1c	Hillgrove	Evolution-owned	534407	6272697
1d	Lake Cowal	Evolution-owned	541794	6272704
Privately-owned Dwellings				
4	Goodwood	Privately-owned	547567	6281001
6	Boongarry	Privately-owned	549989	6276946
15	Laurel Park	Privately-owned	532378	6283364
20	Bramboyne	Privately-owned	530337	6282231
21	Westella	Privately-owned	531013	6278985
22a	Lakeview	Privately-owned	528402	6277761
22b	Lakeview II	Privately-owned	528249	6277583
22c	Lakeview III	Privately-owned	528976	6277626
22d	Thistleview	Privately-owned	527918	6274662
24	Mangelsdorf	Privately-owned	532297	6270665
25	Mangelsdorf II	Privately-owned	531695	6269734
28	Bristowes	Privately-owned	548681	6286710
30a	Wamboyne	Privately-owned	530989	6288345
30b	Grinter	Privately-owned	531171	6289740
31a	Koobah	Privately-owned	549554	6273711
36a	The Glen	Privately-owned	535625	6284898
36b	Wamboyne II	Privately-owned	530297	6286030
38	Gumbelah	Privately-owned	545613	6276295
42	Westlea	Privately-owned	532383	6274566
43a	Lake Cowal II	Privately-owned	545105	6271379

Reference ID	Name	Type	Easting	Northing
43b	Billabong	Privately-owned	547179	6268189
49a	Foxman Downs[1]	Privately-owned	531145	6271554
49b	Foxman Downs II[1]	Privately-owned	531386	6272221
56	Mattiske II	Privately-owned	550605	6285032
57	Harmer	Privately-owned	529760	6268071
61a	Bungabulla	Privately-owned	545627	6275893
62	Cowal North	Privately-owned	541979	6286026
79	Ridley	Privately-owned	526342	6286717
89	Morton	Privately-owned	534740	6269452
90[2]	Caloola[2]	Privately-owned	535441	6267131
100	Blampied	Privately-owned	528226	6267940
122	Fitzgerald	Privately-owned	531978	6288396
126	Noble	Privately-owned	526050	6285038
Other Modelled Receivers				
Bird Breeding Area North (NO4)	Bird Breeding Area North (NO4)	Bird Breeding Area	540025	6285561
Bird Breeding Area South (NO3)	Bird Breeding Area South (NO3)	Bird Breeding Area	539620	6281131
Relocated Crown Reserve	Relocated Crown Reserve	Lake Cowal	539978	6273640

Notes: 1. These dwellings were previously known as 'Foxham Downs' and Foxham Downs II'.

2. It is noted that following investigation, no dwelling appears to be present at the location of the previously identified receiver known as 'Caloola II' or dwelling ID 90b. The owner of the property has confirmed that no habitable building is present. The dwelling ID for the receiver known as 'Caloola' has therefore changed from 90a to 90.



LEGEND

- Mining Lease Boundary (ML 1535)
- Mining Lease Application (MLA 1)
- Evolution Mining (Cowal) Pty Limited
- Crown Land
- Local Government
- Private Landholder
- State Forest
- Company-owned Dwelling
- Privately-owned Dwelling
- Railway
- Electricity Transmission Line
- Pipeline

Refer to Figure 3b for Landholder Key

Source: Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)

Evolution Mining Cowal

CGO PROCESSING RATE MODIFICATION

Land Tenure

Figure 3a

HAL-16-41_Mod14_PRM AppNoise_205B

Reference No	Landholder
1	Evolution Mining (Cowal) Pty Limited
2	Bland Shire Council
3	Graincorp Operations Limited
4	BE Mattiske
5	DB Mattiske
6	IW Low
8	PG Hammond
10	SL Peasley
11	RG Hammond
12	The State of New South Wales
13	West Plains (Forbes) Pty Limited
15	HJ & WJ Buttenshaw
20	WJ Buttenshaw
21	AJ McClintock
22	The West Pastoral Company Pty Limited
23	EA & M Mangelsdorf
24	BE & H Mangelsdorf
25	NA & DJ Mangelsdorf
27	State Rail Authority of New South Wales
28	Bristowes Pastoral Pty Ltd
29	NJ Fuge
30	SK & RC Grinter
31	JA Duff
32	HE & AJ Duff
33	AJ Duff
34	HE Duff
36	Corrie Vale Pastoral Company Pty Limited
38	BR Dent
42	GJ Davies
43	Leppington Pastoral Co Pty Limited
44	MH Duff
49	CL Lee
50	GF Carnegie
51	HC & GK West
52	HJ Buttenshaw
56	RA Mattiske
57	RF Harmer
58	Twynam Pastoral Co Pty Limited
59	Wyalong Rural Investments Pty Limited
60	SJ & EP Mickan
61	ML Dent
62	WR Low
63	Domco Trading Pty Limited
64	Superb Developments Pty Ltd
66	BV Tooth
67	HWR McDonald
68	AJR McDonald
69	GLR McDonald
70	KA Maguire

Reference No	Landholder
71	LM & TJ Mackay and LJ & RP Grayson
72	KM & LR Gould
73	CI Ridley
74	HM Corliss and JA & FG Ridley
75	The Grain Handling Authority Of New South Wales
77	Country Rail Infrastructure Authority
78	CF Fuller
79	IO Ridley
80	TG & JM Dalton
81	West Wyalong Local Aboriginal Land Council
82	LJ Doecke
83	RJ Moore
85	JM Ridley
89	GM & BM Morton
90	Boltefam Pty Ltd
91	Zillo Investments Pty Ltd
92	KA Lindner & GP Lindner
93	EJ McCarthy
95	JD & VH Boneham
96	BY & IG Boyd
97	Clevedon Properties Pty Ltd
98	MM Rees
100	AJ & LF Blampied
101	MM & MD Carnegie
102	W Goodwin
103	LR Martin
104	MM & MD Carnegie
105	MK & RT Coles
106	FR Maslin
107	Marsden Minoru Pty Limited
109	EH & JW Maslin
113	BC & DW Rogers
114	WJ Worner
116	IJ Ridley
118	AB & KM Maslin
119	ML & CI Ridley
120	Forbes Shire Council
121	BJ & RK Gould
122	DG Fitzgerald
123	Telstra Corporation Limited
124	AGL Pipelines (NSW) Pty Limited
126	D Williams
130	N.S.W. Grain Corporation Limited
131	IH Shephard
132	CR & RD McManus
133	MA Squier
134	JT Gray
135	NA Wilson

HAL-16-41_Mod14_PRM Applause_001B

RIENZO TONIN & ASSOCIATES

Source: Evolution (2018) and Land and Property Information (2017)

Evolution Mining Cowal

CGO PROCESSING RATE 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'.

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 ML 1535 (Figure 1) 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 13 Noise and Blasting Impact Assessment (Renzo Tonin & Associates, 2016) and have been utilised in this 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 13 Noise and Blasting Impact Assessment (Renzo Tonin & Associates, 2016). 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[4]		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
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 NSW Department of Planning and Environment (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 September 2017, 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

One noise-related complaint was received by the CGO from January 2015 to January 2018, in November 2015. An investigation undertaken in response to the noise-related complaint indicated that the CGO was operating in accordance with the relevant Development Consent DA 14/98 noise limits. Further information regarding complaints received in each year and their resolution are described in the Annual Review.

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 metres (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 analysis 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 (SLR Consulting, 2013) and subsequently in the Modification 13 Noise and Blasting Impact Assessment (Renzo Tonin & Associates, 2016). Wind enhancement was not found to be a feature of the area but temperature inversions are a feature. To provide a comparative assessment to the modelling conducted for Modifications 11 and 13, the meteorological analysis from those studies have been adopted for the Modification. As such, temperature inversions are included in the operational noise computer modelling.

5.1 Summary of Meteorological Assessment Conditions

Table 5.1 presents a summary of the meteorological conditions considered for the operational noise computer modelling in Modifications 11 and 13, as well as for this assessment.

Table 5.1 – Summary of Meteorological Assessment Conditions

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

The ICNG provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.
- Application of reasonable and feasible noise mitigation measures.
- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.
- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Given the scale and duration of the construction works proposed for the Modification, a quantitative assessment is carried out herein, consistent with the ICNG.

Table 6.1, reproduced from the ICNG, sets out the Noise Management Levels (NMLs) and how they are to be applied for residential receivers.

Table 6.1 – Noise Management Levels at Residential Receivers

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

After: ICNG (Department of the Environment and Climate Change, 2009).

The construction activities relevant to the Modification and their proposed construction hours are below:

- Lake Cowal Road relocation – recommended standard construction hours only.
- Pipeline duplication – recommended standard construction hours except where construction is undertaken on the western side of Lake Cowal (adjacent to CGO operations which are conducted 24 hours per day).

Based on the above ICNG requirements and applicable construction hours, Table 6.2 presents the construction NMLs established for the nearest noise sensitive residential receivers based upon the noise monitoring outlined in Section 4.1.

Table 6.2 – Construction Noise Management Levels at Residential Receivers

Receiver Location	L_{A90} RBL[1], dB(A)			NML $L_{Aeq(15min)}$, dB(A)		
	Day	Evening	Night	Day	Evening	Night
All Residential Receivers	30	30	30	40	35	35

Notes: 1. RBLs have adopted the minimum background noise levels nominated in the INP as long-term background noise levels. The noise levels were recorded at approximately 30 dB(A) and below (refer to Section 4.1).

6.2 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.

6.2.1 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:

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

Table 6.3 presents the intrusiveness criteria established for the nearest noise sensitive residential receivers based upon the noise monitoring outlined in Section 4.1.

Table 6.3 – Intrusiveness Criteria

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

Notes: RBLs have adopted the minimum background noise levels nominated in the INP as long term background noise levels. The noise levels were recorded at approximately 30 dB(A) and below (refer to Section 4.2 of the INP).

6.2.2 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 6.4 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 6.4 – Amenity Criteria – Recommended L_{Aeq} Noise Levels from Industrial Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1, 2]	Recommended $L_{Aeq,Period}$[3] Noise Level, dB(A)	
			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	All	Noisiest 1 hour period		
- internal			35	40
- external			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.

6.2.3 Noise Impact Assessment Criteria

The existing CGO Development Consent (DA 14/98) (as modified) 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 with the procedures in condition 8.3.

Table 7: Land subject to acquisition upon request

Westella
Westlea

b) Additional Noise Mitigation

Upon receiving a written request from the owner of the residents 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 Secretary for resolution.

Table 7A: Land subject to mitigation upon request

Laurel Park
Lakeview III
Bramboyne
The Glen
Caloola II

c) Noise 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, Lakeview III	*39*
Bramboyne, The Glen, Caloola II	*38*
Lakeview, Lakeview II, Foxham Downs II	*37*
All other privately-owned land	*35*

It is noted that the 'Foxham Downs II' receiver is now known as 'Foxman Downs II'.

6.2.4 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 6.5 below.

Table 6.5 – Project Specific Noise Levels

Locality	Land Use	Intrusiveness, $L_{Aeq,15min}$, dB(A)[1]			Amenity, $L_{Aeq,Period}$, dB(A)[1]		
		Day	Evening	Night	Day	Evening	Night
Privately-owned Land	Rural Residential[2]	35	35	35	50	45	40
Relocated Crown Reserve	Passive Recreation	-	-	-	50 (when in use)		

Notes: 1. RBLs have adopted the minimum background noise levels nominated in the INP as long term background noise levels were recorded at approximately 30dB(A) and below.

2. Residential locations have been categorised as 'Rural'.

6.2.5 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 6.6 below.

Table 6.6 – 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 **negligible**	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 but the development would contribute less than 1 dB to the total industrial noise level	Impacts are considered to be **marginal**	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 and the development would contribute more than 1 dB to the total industrial noise level	Impacts are considered to be **moderate**	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 **significant**	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 6.6 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).

An amended draft Voluntary Land Acquisition and Mitigation Policy was released in December 2017. As the amendments are in draft at the time of writing, they are not considered further in this assessment.

6.2.6 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 6.4. However, there are currently no industrial or other mining developments in the vicinity of the Modification which would impact the identified receiver locations. Accordingly, potential cumulative noise impacts are not considered further.

6.2.7 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 $L_{A1, (1\ minute)}$ not exceeding the $L_{A90, (15\ minute)}$ 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 $L_{A1, (1\ minute)}$, 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 $L_{A1, (1\ minute)}$ descriptor is meant to represent a maximum noise level measured under 'fast' time response. EPA will accept analysis based on either $L_{A1, (1\ minute)}$ or $L_{A, (Max)}$.

The policy states that a sleep disturbance criterion of $L_{A1,1minute} \leq L_{A90,15minute}$ + 15 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 research material contained in the RNP.

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; and*
- *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 6.7 below.

Table 6.7 – Sleep Disturbance Criteria

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

7 Construction Noise Assessment

7.1 Construction Noise Modelling Scenario

The Modification would include two distinct construction activities:

- duplication of a water pipeline to the eastern side of Lake Cowal; and
- realignment of Lake Cowal Road.

Construction of the IWL would occur in conjunction with mining operations, therefore is assessed as operational noise in Section 8.

7.2 Construction Noise Sources

The Sound Power Levels (SWLs) of plant likely to be used during the construction activities 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, has been considered for all proposed plant and equipment. Based on Renzo Tonin & Associates' experience, noise from all proposed plant and equipment, individually and in combination were determined not 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 construction scenarios, and relevant SWLs, is provided in Table 7.1.

Table 7.1 – Indicative Construction Plant and Equipment Fleet List and SWLs

Plant Item	Specification	SWLs, dB(A) re. 1pW (per Item)	Number of Items
Pipeline Duplication			
Compactor	-	110	2
Excavator	30 t	110	4
Manitou / Telehandler	-	110	2
Water Cart	-	110	1
Dozer	D6	109	1
Fuel / Service Truck	-	108	1
Generator	-	100	3
Lighting Plant	-	100	2
Light Vehicle	-	100	4
Franna Crane	-	99	1
Road Relocation			
Scraper	-	110	1

Plant Item	Specification	SWLs, dB(A) re. 1pW (per Item)	Number of Items
Dozer	D8 or D9	109	1
Padfoot Roller	-	109	2
Smooth Drum Roller	-	109	1
Excavator	30 t	110	1
Grader	-	107	1
Semi Water Cart	-	104	2
Tipper	-	101	3

Note: t = tonnes; 1pW = one picoWatt.

7.3 Construction Hours

The proposed construction works will be undertaken during standard construction hours, except for construction of the pipeline duplication on the western side of Lake Cowal, adjacent to the CGO. Given the proximity to the CGO and significant distance to sensitive receivers, construction of this portion of the pipeline would be 24 hours, 7 days per week. The recommended standard construction hours are as follows:

- Mondays to Fridays 7:00 am to 6:00 pm
- Saturdays 8:00 am to 1:00 pm
- Sundays & Public Holidays No work performed

7.4 Construction Minimum Distance Limits

Table 7.2 presents the minimum distances from each construction activity to the nearest receivers that would result in compliance with the 'Noise affected' NMLs. In other words, any receiver that is further from the construction activity than the minimum distance limit specified in Table 7.2 would comply with the relevant 'Noise affected' NML. No receivers are predicted to exceed the 'Highly noise affected' NML.

Note to determine the minimum distance limits a time correction value of -5 dB(A) was applied to the total SWL for each construction activity, as the entire construction fleet would not always operate concurrently.

Table 7.2 – Minimum Distance Limits to Comply with Day NML

Construction Activity	Day NML, dB(A)	Minimum Distance Limits, m
Pipeline Duplication	40	2,391
Road Relocation	40	1,743

Review of the extents of construction works in relation to the nearest receivers show that the following receivers are located within the minimum distance limits and may potentially be impacted by construction activities (Table 7.3).

Table 7.3 – Receivers Located Within Minimum Distance Limits

Construction Activity	Receiver Located Within Minimum Distance Limits		
	ID	Name	Distance to Construction Activity, m
Pipeline Duplication	4	Goodwood	1,190
Road Relocation	21	Westella	1,260

In light of the potential of noise impacts from construction activities at two privately owned properties, it is recommended that a feasible and reasonable approach towards noise management measures be applied to reduce noise levels as much as possible to manage the impact from construction noise.

Further details on recommended construction noise mitigation and management measures are provided in Section 7.5 below. Construction activities outside of standard hours would only occur on the western side of Lake Cowal and adjacent to the CGO. These areas are sufficiently distant from privately owned receivers to not warrant further assessment.

7.5 Construction Noise Mitigation and Management Measures

The following recommendations provide in-principle feasible and reasonable noise control solutions to reduce noise impacts to sensitive receivers.

The following general noise management measures should be followed:

- Use less noisy plant and equipment, where feasible and reasonable.
- Plant and equipment should be properly maintained.
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended.
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Any equipment not in use for extended periods should be switched off.
- In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
- Good relations with people living and working in the vicinity of a construction site should be maintained throughout the Modification. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Where noise level exceedances cannot be avoided, then consideration may be given to implementing time restrictions and/or providing periods of repose for residents, where feasible and reasonable. That is, daily periods of respite from noisy activities may also be scheduled for building occupants during business hours.

8 Operational Noise Assessment

8.1 Operational Noise Modelling Scenario

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

- 2020 – the year of highest combined materials movement (i.e. ore and waste rock) with maximum fleet in operation.
- 2024 – development of the IWL to its maximum height.

8.2 Operational Noise Sources

The 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 8.1.

Table 8.1 – Sound Power Levels

Plant Item	SWL, dB(A)	Quantity		
		Modification 13	2020	2024
Fixed Plant				
Process Plant	124	1	1	1
Secondary Crushing Circuit	119	-	1	1
Mobile Crusher	113	-	1	1
Mining Fleet (Including IWL Development)				
Hydraulic Excavator 994B (310 t)	118	1	-	-
Hydraulic Excavator 9400	121	1	1	1
Hydraulic Excavator EX3600	115	1	1	-
Haul Truck 789B / 789C (317 t GVM, 184 t payload capacity)	124	17	15	7
Haul Truck 785C (249t GVM, 136 t payload capacity)	123	3	3	3
Wheel Loader TCR652 – 962G	112	1	1	1
Wheel Loader TCR653 – IT62G	113	1	1	1
Wheel Loader TCR654 – 980G	112	1	1	1

Plant Item	SWL, dB(A)	Quantity		
		Modification 13	2020	2024
Wheel Loader 992G	117	2	2	2
Track Dozer D10T	121	4	3	2
Wheel Dozer 834H	115	1	1	1
Water Truck 777D	116	2	2	1
Grader 16H	115	2	2	1
Drills 165-200 mm	118	6	8	5
Excavator ancillary	118	2	2	2
Roller	109	1	1	1
Tailings Storage Facility Embankment Lift Fleet / IWL Development Support Fleet				
Dump Truck CAT 45 t Articulated	110	14	18	7
Grader 14M	114	1	1	1
Water Truck Volvo A40D	110	1	1	1
Compactor CAT 825	113	1	1	-
Excavator 390FL (90 t)	114	2	1	1
Excavator 349FL (50 t)	112	1	1	-
Excavator (30 t)	110	-	1	1
Excavator (24 t)	108	1	-	-
Track Dozer D6	117	1	-	-
Track Dozer D8	118	2	2	1
Track Dozer D9	119	-	1	1
Roller	109	1	1	1
Topsoil Stripping Fleet				
Loader 992G	117	-	1	-
777 Haul Truck	116	-	4	-
Dozer D10T	121	-	1	-
Other Fleet				
Contractor Road Truck (gravel)	113	-	1	1
Total Site SWL, dB(A)		**138.5**	**138.5**	**136.1**
Evening/Night SWL, dB(A)		**138.2**	**138.2**	**135.8**

Notes: mm = millimetres.

8.3 Noise Modelling Methodology

Noise emissions from the various plant and processes listed in Table 8.1 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 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.

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 Modifications 11 and 13. This measure has also been incorporated into the predictive modelling for the Modification (for TSF lifts and some aspects of IWL development).

The IWL includes haulage of waste rock to the IWL embankments as a run-of-mine activity during operation of the open pit. Accordingly, haulage of waste rock to the IWL and operation of support fleet at the IWL embankment (e.g. dozer) would be undertaken 24 hours per day (i.e. consistent with open pit operational hours).

The existing CGO mobile equipment fleet would continue to be operated for the Modification.

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, given that the haulage fleet would be progressively decommissioned up until the cessation of open pit mining in approximately 2024, and the limited number of privately-owned receivers predicted to experience exceedances of the relevant criteria. Ongoing operational costs associated with maintaining the effectiveness of the noise attenuation would be additional to this capital cost.

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

8.4 Predicted Operational Noise Levels

Table 8.2 and Table 8.3 below present predicted operational noise levels for 2020 and 2024, respectively, at the nearest potentially affected receivers. Consistent with the previous Modification 13 Noise and Blasting Impact Assessment, 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 8.2 – Predicted Operational Noise Levels for 2020 at Nearest Affected Receivers ($L_{Aeq,15minute}$)

Receiver ID	PSNL, dB(A)			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)
Evolution-owned Dwellings							
1a	35	35	35	23	35	42	42
1b	35	35	35	<20	34	40	41
1c	35	35	35	22	33	36	36
1d	35	35	35	<20	30	35	36
Privately-owned Dwellings							
4	35	35	35	<20	25	27	28
6	35	35	35	<20	21	24	24
15[1]	35	35	35	20	31	35	35
20	35	35	35	<20	31	34	34

Receiver ID	PSNL, dB(A)			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)
21[2]	35	35	35	24	**36**	**39**	**39**
22a	35	35	35	<20	31	33	33
22b	35	35	35	<20	30	32	33
22c	35	35	35	20	32	34	35
22d	35	35	35	<20	25	29	30
24	35	35	35	<20	28	30	31
25	35	35	35	<20	26	28	29
28	35	35	35	<20	20	21	22
30a	35	35	35	<20	<20	23	23
30b	35	35	35	<20	<20	21	22
31a	35	35	35	<20	20	22	23
36a	35	35	35	<20	32	**36**	**37**
36b	35	35	35	<20	24	27	28
38	35	35	35	<20	27	33	34
42[2]	35	35	35	28	**37**	**40**	**40**
43a	35	35	35	<20	24	27	28
43b	35	35	35	<20	<20	21	21
49a	35	35	35	<20	29	31	32
49b	35	35	35	<20	28	32	33
56	35	35	35	<20	<20	20	21
57	35	35	35	<20	<20	20	21
61a	35	35	35	<20	27	32	33
62	35	35	35	<20	28	31	31
79	35	35	35	<20	<20	<20	<20
89	35	35	35	<20	27	30	31
90	35	35	35	<20	23	25	25
100	35	35	35	<20	<20	20	21
122	35	35	35	<20	<20	23	24
126	35	35	35	<20	<20	<20	<20
Other Modelled Receivers							
Bird Breeding Area North (NO4)	N/A	N/A	N/A	<20	30	34	34
Bird Breeding Area South (NO3)	N/A	N/A	N/A	27	37	47	47

Receiver ID	PSNL, dB(A)			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)
Relocated Crown Reserve	50 (when in use)			22	35	41	42

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 8.3 – Predicted Operational Noise Levels for 2024 at Nearest Affected Receivers ($L_{Aeq,15minute}$)

Receiver ID	PSNL, dB(A)			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)
Evolution-owned Dwellings							
1a	35	35	35	26	34	39	39
1b	35	35	35	22	32	37	38
1c	35	35	35	30	36	40	40
1d	35	35	35	<20	29	33	34
Privately-owned Dwellings							
4	35	35	35	<20	20	23	24
6	35	35	35	<20	<20	<20	20
15[1]	35	35	35	22	30	33	34
20	35	35	35	23	31	34	35
21[2]	35	35	35	36	**40**	**44**	**44**
22a	35	35	35	27	32	35	**36**
22b	35	35	35	27	31	35	35
22c	35	35	35	30	34	**38**	**38**
22d	35	35	35	<20	27	31	32
24	35	35	35	20	29	33	33
25	35	35	35	<20	26	29	30
28	35	35	35	<20	<20	<20	<20
30a	35	35	35	<20	<20	21	22
30b	35	35	35	<20	<20	<20	<20
31a	35	35	35	<20	<20	<20	20
36a	35	35	35	<20	28	32	33
36b	35	35	35	<20	22	25	26
38	35	35	35	<20	24	29	30

Receiver ID	PSNL, dB(A)			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)
42[2]	35	35	35	**39**	**42**	**46**	**46**
43a	35	35	35	<20	22	25	26
43b	35	35	35	<20	<20	<20	<20
49a	35	35	35	22	30	33	34
49b	35	35	35	23	32	35	**36**
56	35	35	35	<20	<20	<20	<20
57	35	35	35	<20	20	22	23
61a	35	35	35	<20	24	29	30
62	35	35	35	<20	23	26	27
79	35	35	35	<20	<20	<20	<20
89	35	35	35	<20	24	29	30
90	35	35	35	<20	<20	23	24
100	35	35	35	<20	<20	22	22
122	35	35	35	<20	<20	<20	20
126	35	35	35	<20	<20	<20	20
Other Modelled Receivers							
Bird Breeding Area North (NO4)	N/A	N/A	N/A	<20	25	29	30
Bird Breeding Area South (NO3)	N/A	N/A	N/A	26	35	42	42
Relocated Crown Reserve	50 (when in use)			23	34	39	40

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 8.2 and Table 8.3. A summary of the privately-owned receivers with PSNL exceedances during the operational phase are presented in Table 8.4 below.

Table 8.4 – Summary of Properties with PSNL Exceedances

Property Ownership	2020			2024		
	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	*36a*[2]	*21*[1], *42*[1]	-	*22a, 49b*	*22c*[2]	*21*[1], *42*[1]

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

1. The owners of these receivers currently have the right to acquisition upon request in Development Consent DA 14/98.
2. The owners of these receivers currently have the right to additional noise mitigation in Development Consent DA 14/98.

Receivers 22a, 36a and 49b are predicted to 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 8.5 provides recommended noise management measures for these properties.

8.5 Noise Management Measures

8.5.1 Noise Management Zone

The noise management zone is defined as where properties experience marginal or moderate exceedances of 3-5 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 receiver 22c 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 6.6).

8.5.2 Noise Affectation Zone

The noise affectation 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 8.2, only receivers 21 and 42 are predicted to be in the noise affectation zone and as discussed in Section 6.2.3, these receivers already have these rights in accordance with the existing Development Consent (DA 14/98).

8.6 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 other mining developments in the vicinity of the Modification (Section 6.2.6) 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 8.5 and Table 8.6 present the predicted noise levels for the Relocated Crown Reserve from the Modification compared to the amenity noise criteria.

Table 8.5 – Predicted Operational Noise Levels for 2020 at Relocated Crown Reserve ($L_{Aeq,Period}$)

Receiver ID	Amenity Criteria, dB(A)			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)			28	41	42

Table 8.6 – Predicted Operational Noise Levels for 2024 at Relocated Crown Reserve ($L_{Aeq,Period}$)

Receiver ID	Amenity Criteria, dB(A)			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)			27	39	40

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

8.7 Sleep Disturbance

Consistent with the methodology used in the Modification 11 Noise and Blasting Impact Assessment (SLR Consulting, 2013), the mean difference between the intrusive $L_{Aeq,15minute}$ and the corresponding $L_{A1,1minute}$ noise levels from 6-monthly operator-attended night time noise monitoring results was found to be 7 dB(A).

Based on the mean difference, Table 8.7 presents the predicted night time $L_{A1,1minute}$ 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 8.7 – Predicted Sleep Disturbance Noise Levels at Nearest Affected Receivers ($L_{A1, 1\ minute}$)

Receiver	Sleep disturbance criteria (10:00 pm - 7:00 am), dB(A)		Predicted Sleep Disturbance Level $L_{A1, 1\ minute}$, dB(A)	
	$L_{A90, 15\ minute}$ + 15	Upper limit	Year 2020	Year 2024
Evolution-owned Dwellings				
1a	45	65	49	46
1b	45	65	48	44
1c	45	65	43	47
1d	45	65	42	40
Privately-owned Dwellings				
4	45	65	33	31
6	45	65	29	27
15[1]	45	65	40	41
20	45	65	39	41
21[2]	45	65	44	51
22a	45	65	38	42
22b	45	65	37	42
22c	45	65	39	45
22d	45	65	34	38
24	45	65	36	40
25	45	65	33	37
28	45	65	27	25
30a	45	65	28	29
30b	45	65	26	25
31a	45	65	28	27
36a	45	65	41	40
36b	45	65	32	32
38	45	65	38	36
42[2]	45	65	45	53
43a	45	65	33	32
43b	45	65	26	26
49a	45	65	36	41
49b	45	65	37	42
56	45	65	25	23
57	45	65	25	30
61a	45	65	38	36
62	45	65	36	33
79	45	65	22	25
89	45	65	35	37
90	45	65	30	31
100	45	65	26	29

Receiver	Sleep disturbance criteria (10:00 pm - 7:00 am), dB(A)		Predicted Sleep Disturbance Level $L_{A1,\ 1\ minute}$, dB(A)	
	$L_{A90,\ 15\ minute}$ + 15	Upper limit	Year 2020	Year 2024
122	45	65	29	27
126	45	65	22	27

Notes **Green** denotes exceedance of $L_{A90(15min)}$ + 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 8.7, receivers 21 and 42 were predicted to exceed the sleep disturbance screening criterion by up to 11 dB(A), but not the sleep disturbance upper limit criterion of 65 dB(A).

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 8.5 would adequately mitigate the potential sleep disturbance exceedances.

8.8 Twenty-five Percent Land Assessment

As discussed in Section 6.2.5, in NSW Government (2014), voluntary land acquisition rights are conferred on private 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 dB[A] allowance to convert the $L_{Aeq,15minute}$ contours shown to $L_{Aeq,Period}$), no privately-owned property was found to exceed the INP rural night-time amenity recommended maximum noise levels for greater than 25% of the property's total area.

8.9 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 47 dB(A) $L_{Aeq,15minute}$ (Table 8.2 and Table 8.3). 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.

9 Other Issues

9.1 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 on site does not cause any exceedance of the criteria in Table 6.

Table 6: Blasting impact assessment criteria

Location & Time	***Airblast overpressure (dB[Lin Peak])***	***Ground vibration (mm/s)***	***Allowable exceedance***
Residence on privately-owned land - Any time	*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*

Note: mm/s = millimetres per second

Blast parameters and the pit remain the same as what was presented in the Modification 13 Noise and Blasting Impact Assessment (Renzo Tonin & Associates, 2016). Therefore the previous Modification 13 blasting assessment still applies.

For Modification 13, all privately-owned receiver locations were predicted to comply with vibration and blast overpressure criteria. It is noted blast size may be modified (i.e. Maximum Instantaneous Charge may be reduced) should blast monitoring indicate that blast overpressure is approaching the relevant blasting criteria. Blasting is therefore not considered further in this report.

9.2 Road Traffic Noise

9.2.1 Criteria

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the RNP. The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the subject site, with the aim of preserving the amenity appropriate to the land use.

Table 9.1 sets out the assessment criteria for residences, to be applied to particular types of projects, road category and land use. These criteria are for assessment against façade corrected noise levels when measured in front of a building façade. The surrounding road network potentially impacted by the Modification traffic consists of roads classified as sub-arterial roads.

In Table 9.1 below and in accordance with the RNP, freeways, arterial roads and sub-arterial roads are grouped together and attract the same criteria.

Table 9.1 – Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7:00 am – 10:00 pm	Night 10:00 pm – 7:00 am
Freeway / arterial / sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(9\ hour)}$ 55 (external)

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria.

As described in the RNP, in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

The RNP also states:

> *For existing residences and other sensitive land uses affected by* **additional traffic on existing roads generated by land use developments***, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.*

This means that any increase in total traffic noise due to a new project, or modification to an existing project, should be limited to 2 dB above the existing total traffic noise levels.

9.2.2 Road Traffic Noise Assessment

A Road Transport Assessment (Appendix H) for the Modification was prepared by GTA Consultants (2018). The Road Transport Assessment identified five road locations for forecasting traffic volumes to determine the impact on the surrounding road network for the years 2020 and 2024. Table 9.2 presents the future day (7:00 am to 10:00 pm) and night (10:00 pm to 7:00 am) total traffic for years 2020 and 2024 without the Modification and years 2020 and 2024 with the Modification. The forecast traffic volumes at the five surrounding road locations include a breakdown of light and heavy vehicles.

Table 9.2 – Traffic Volumes

Road	Total Traffic (vehicles per day)					
	Day (7:00 am – 10:00 pm)			Night (10:00 pm - 7:00 am)		
	Light	Heavy	Total	Light	Heavy	Total
Year 2020 No Modification						
1. CGO Access Road	156	84	240	87	21	108
2. Blow Clear Road	161	78	239	77	24	101
3. Wamboyne Road	78	15	93	4	0	4
4. Ungarie Road	901	264	1,165	123	38	161
5. Newell Highway	1,200	698	1,898	76	157	233
Year 2024 No Modification						
1. CGO Access Road	156	84	240	87	21	108
2. Blow Clear Road	163	79	242	77	24	101
3. Wamboyne Road	82	16	98	4	0	4
4. Ungarie Road	932	270	1,202	125	40	165
5. Newell Highway	1,245	724	1,969	79	164	243
Year 2020 With Modification						
1. CGO Access Road	162	108	270	93	29	122
2. Blow Clear Road	165	96	261	81	30	111
3. Wamboyne Road	78	15	93	4	0	4
4. Ungarie Road	905	286	1,191	127	44	171
5. Newell Highway	1,200	707	1,907	76	160	236
Year 2024 With Modification						
1. CGO Access Road	159	175	334	90	24	114
2. Blow Clear Road	164	90	254	78	27	105
3. Wamboyne Road	82	16	98	4	0	4
4. Ungarie Road	933	361	1,294	126	43	169
5. Newell Highway	1,245	729	1,974	79	165	244

Based on the traffic volumes in Table 9.2, and the nearest distance from each of the five road locations to residential receivers, the predicted traffic noise levels at the worst affected receiver locations are predicted for the years 2020 and 2024 and compared against the no Modification situation in Table 9.3.

If the predicted traffic noise levels at the closest residential receiver meets the proposed criteria then the criteria would be met at all other residential receivers along the same road.

Table 9.3 – Predicted Day $L_{Aeq, 15hour}$ and Night $L_{Aeq, 9hour}$ Traffic Noise Levels

Road	Distance to Nearest Receiver, m	Day $L_{Aeq, 15hour}$ (dB[A]) (7:00 am – 10:00 pm)			Night $L_{Aeq, 9hour}$ (dB[A]) (10:00 pm - 7:00 am)		
		With Modification	No Modification	Difference	With Modification	No Modification	Difference
Year 2020							
1. CGO Access Road	800	33	32	1.0	30	29	1.1
2. Blow Clear Road	240	41	40	0.7	38	37	0.8
3. Wamboyne Road	69	41	41	0.0	26	26	0.0
4. Ungarie Road	36	56	56	0.2	50	49	0.5
5. Newell Highway	17	61	61	0.0	56	56	0.1
Year 2024							
1. CGO Access Road	800	35	32	2.9	29	29	0.5
2. Blow Clear Road	240	40	40	0.5	38	37	0.4
3. Wamboyne Road	69	41	41	0.0	26	26	0.0
4. Ungarie Road	36	57	56	0.9	50	50	0.2
5. Newell Highway	17	61	61	0.0	56	56	0.0

From Table 9.3, the daytime $L_{Aeq\ 15hour}$ traffic noise levels predicted for receivers along the Newell Highway marginally exceed the RNP $L_{Aeq\ 15hour}$ noise criterion of 60 dB(A) for both years 2020 and 2024, however predicted $L_{Aeq\ 15hour}$ traffic noise levels with and without the Modification are the same. All other receivers along the other four road locations are within the RNP $L_{Aeq\ 15hour}$ noise criterion of 60 dB(A) for both years 2020 and 2024. The 2 dB(A) relative increase criteria is exceeded for receivers near the CGO Access Road in 2024, however predicted $L_{Aeq\ 15hour}$ traffic noise levels with the Modification are at least 25 dB(A) below the RNP noise criterion of 60 dB(A).

From Table 9.3, the night-time $L_{Aeq\ 9hour}$ traffic noise levels predicted for receivers along the Newell Highway marginally exceed the RNP $L_{Aeq\ 9hour}$ noise criterion of 55 dB(A) for both years 2020 and 2024, however predicted $L_{Aeq\ 9hour}$ traffic noise levels with and without the Modification are the same. All other receivers along the other four road locations are within the RNP $L_{Aeq\ 9hour}$ noise criterion of 55 dB(A) for both years 2020 and 2024. The 2 dB(A) relative increase criteria is not predicted to be exceeded for any receivers.

10 Conclusion

10.1 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 increase the ore processing capacity of the CGO's existing process plant from 7.5 Mtpa to 9.8 Mtpa. The main activities include modifying the existing TSF into an IWL and installation of secondary crushing circuit.
- 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 however 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.

10.2 Construction Noise

- Construction activities include duplication of a water pipeline and realignment of Lake Cowal Road. These activities would occur during standard hours of construction, with the exception of construction of the water pipeline on the western side of Lake Cowal, which would be undertaken 24 hours per day, 7 days per week.
- Two (2) privately-owned receivers were found to lie within the minimum distance limits to comply with the day time NML.
- In-principle recommendations have been provided to limit the potential impact of noise and vibration generated by construction activities to acceptable levels.

10.3 Operational Noise

- Operational scenarios were considered for 2020 and 2024, coinciding with the year of highest combined materials movement with maximum fleet in operation and development of the IWL to its maximum height, respectively.
- Four (4) privately-owned receivers are predicted to experience negligible exceedances of the PSNL. One (1) privately-owned receiver is predicted to experience moderate exceedances of the PSNL. 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 $L_{A1,1minute}$ noise within the sleep disturbance screening criterion and the upper limit of the sleep disturbance criterion. Exceedances of the EPA's sleep disturbance screening criteria are predicted at two properties, however these receivers are currently afforded acquisition upon request rights.
- 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 no privately-owned property would exceed the INP amenity maximum noise level criteria for greater than 25% of the property's total area.

10.4 Road Traffic Noise

- Road traffic noise was assessed for the years 2020 and 2024, and five road locations representative of the surrounding road network, as determined by the Road Transport Assessment for the Modification (GTA Consultants, 2018).
- Predicted road traffic noise at all locations for all periods were found to comply with the RNP criteria.

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. Barrick (2010) *Noise Management Plan*.
3. Brown, T (2016) *Independent Environmental Audit Cowal Gold Operations*.
4. Department of the Environment and Climate Change (2009) *Interim Construction Noise Guideline*.
5. Department of Environment, Climate Change and Water (2011) *NSW Road Noise Policy*.
6. Environment Protection Authority (1994) *NSW Environmental Noise Control Manual*.
7. Environment Protection Authority (2000) *NSW Industrial Noise Policy*.
8. Environment Protection Authority (2013) *Application Notes – NSW Industrial Noise Policy*. Available at http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm
9. Environment Protection Authority (2017) *Noise Policy for Industry*.
10. Evolution Mining (Cowal) Pty Ltd (2014) *Noise Management Plan*.
11. Evolution Mining (Cowal) Pty Ltd (2015) *Flora and Fauna Management Plan*.
12. Griefahn (1992) *Noise control during the night*, Acoustics Australia, vol 20(2), pp43-47.
13. GTA Consultants (2018) *Cowal Gold Operations Modification 14 Road Transport Assessment*.
14. NSW Government (2014) *Voluntary Land Acquisition and Mitigation Policy – SSD Mining*.
15. Renzo Tonin & Associates (2016) *Cowal Gold Operations – Mine Life Modification Noise and Blasting Assessment*.
16. SLR Consulting (2013) *Cowal Gold Mine Extension Modification Noise and Blasting Impact Assessment*.

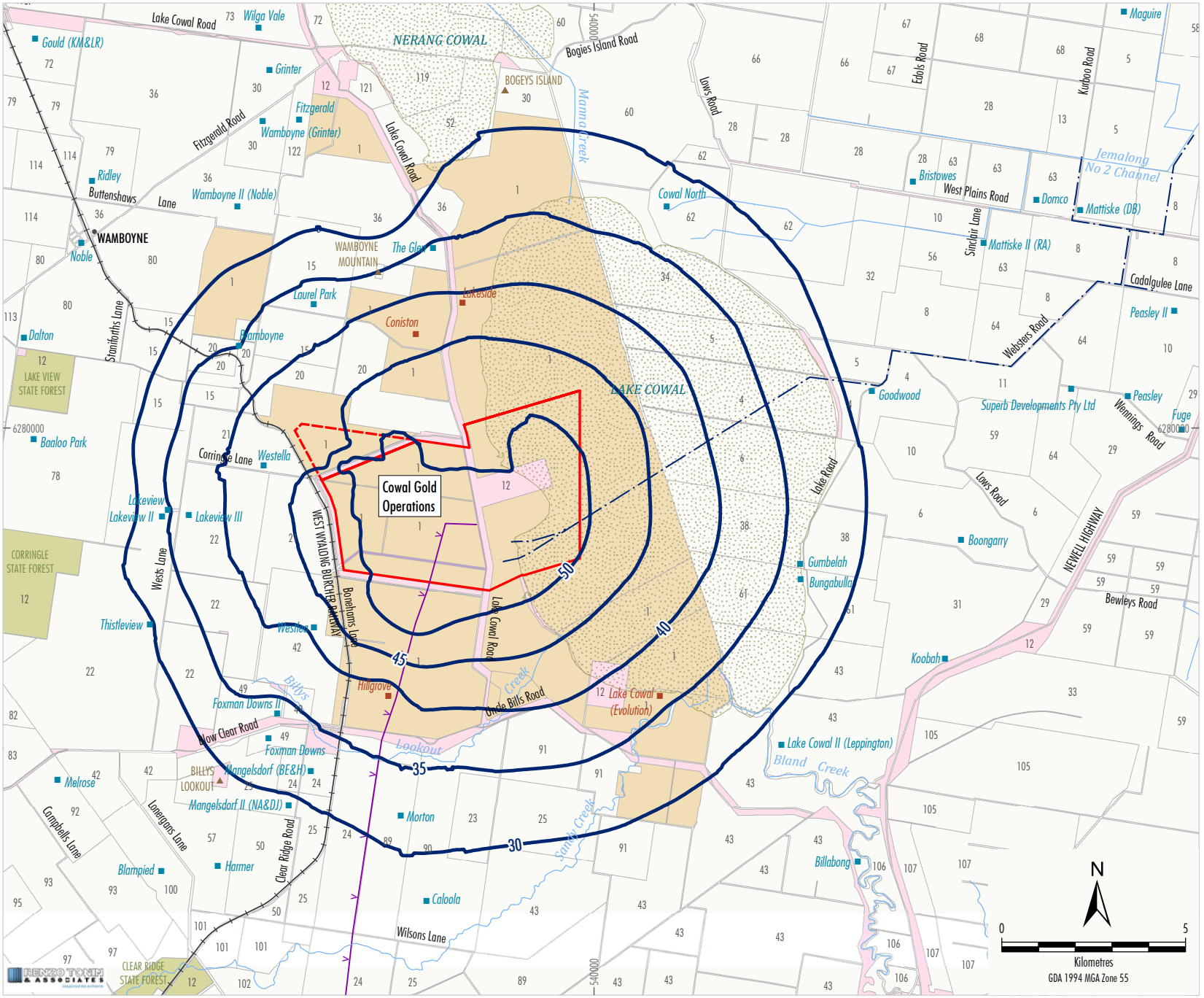
APPENDIX A Glossary of Terminology

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 110 dB Operating a chainsaw or jackhammer 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_{90}	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_{eq}	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)
- Mining Lease Application (MLA 1)
- Evolution Mining (Cowal) Pty Limited
- Crown Land
- Local Government
- Private Landholder
- State Forest
- Company-owned Dwelling
- Privately-owned Dwelling
- Railway
- Electricity Transmission Line
- Pipeline
- Noise Contour (dBA)

Refer to Figure 3b for Landholder Key

Source: Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)

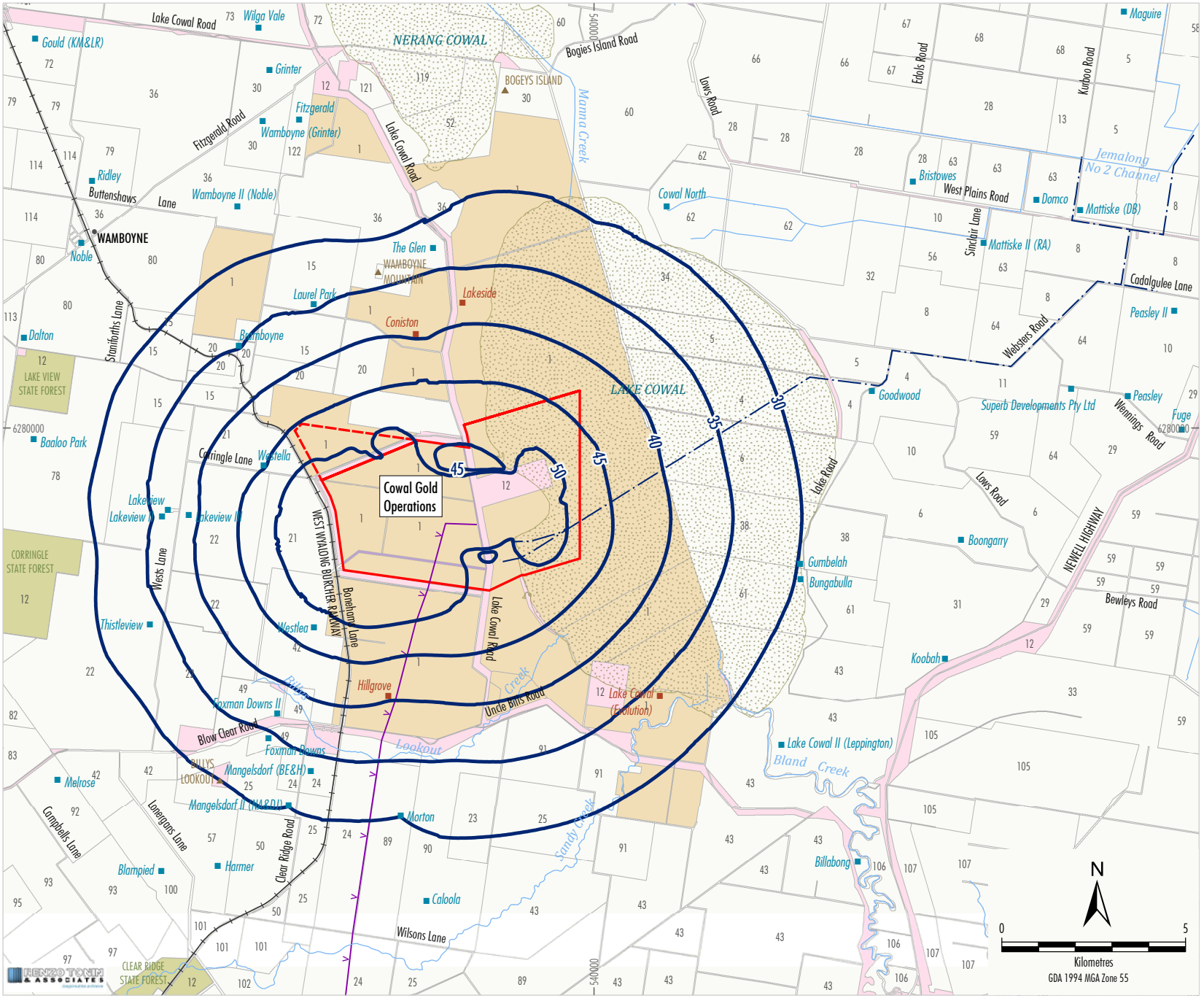
Evolution Mining Cowal

CGO PROCESSING RATE MODIFICATION

Noise Contours - 2020

Figure B-1

HAL-16-41_Mod14_PRM AppNoise_201B



LEGEND

- Mining Lease Boundary (ML 1535)
- Mining Lease Application (MLA 1)
- Evolution Mining (Cowal) Pty Limited
- Crown Land
- Local Government
- Private Landholder
- State Forest
- Company-owned Dwelling
- Privately-owned Dwelling
- Railway
- Electricity Transmission Line
- Pipeline
- Noise Contour (dBA)

Refer to Figure 3b for Landholder Key

Source: Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)

Evolution Mining Cowal

CGO PROCESSING RATE MODIFICATION

Noise Contours - 2024

Figure B-2

HAL-16-41_Mod14_PRM AppNoise_202B