REPORT 10-6547-R1

Revision 0

Cowal Gold Mine E42 Modification

Noise and Blasting Impact Assessment

PREPARED FOR

Barrick Australia Limited
Cowal Gold Mine
PO Box 210
WEST WYALONG NSW 2671

13 JULY 2008

HEGGIES PTY LTD
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Cowal Gold Mine E42 Modification

Noise and Blasting Impact Assessment

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F1 INTRODUCTION

F1.1 Assessment Requirements

Barrick Australia Limited (Barrick) is proposing to modify a number of components of the approved Cowal Gold Mine (CGM), located on Mining Lease (ML) 1535 approximately 38 kilometres (km) north-east of West Wyalong in central New South Wales (NSW) (**Figure F-1**). Changes implemented to the approved CGM by the E42 Modification would result in the modified CGM. A summary of the approved CGM approvals history is provided in the main text of the Environmental Assessment.

The assessment of potential noise and blasting impacts arising from the approved CGM are presented in Appendix H of the "*Cowal Gold Project Environmental Impact Statement*" (the EIS) (North Limited, 1998).

Heggies Pty Ltd (Heggies) has been engaged by Barrick to evaluate and assess the potential noise and blasting impacts associated with the modified CGM. This assessment has been guided by the NSW Department of Planning's (DoP) Director-Generals Requirements (DGRs) dated 14 April 2008 in relation to noise and blasting impacts.

In accordance with the DoPs DGRs, the major sources of noise emissions may be grouped as follows:

On-site Operational Noise

Year 7 Operations: Representative of the maximum noise emissions from the modified CGM for the nearest receptors to the south of the modified CGM (ie with embankment lift works occurring at the southern tailings storage facility).

Year 9 Operations: Representative of the maximum noise emissions from the modified CGM for the nearest receptors to the north of the modified CGM (ie with embankment lift works occurring at the northern tailings storage facility).

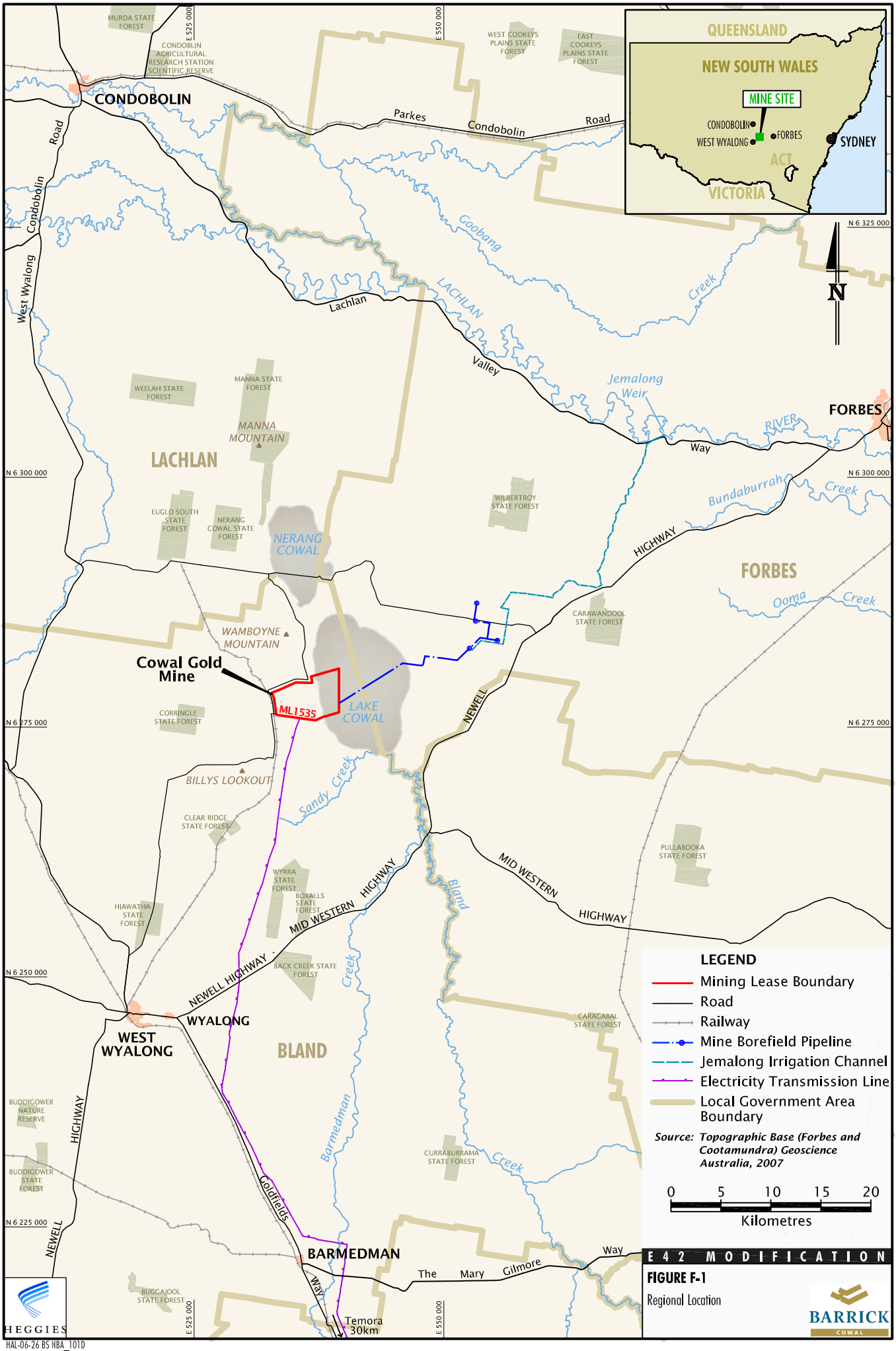
The assessment of potential on-site operational noise impacts has been undertaken in accordance with the "*NSW Industrial Noise Policy*" (INP) (Environment Protection Authority [EPA], 2000), which provides non-mandatory procedures for setting acceptable equivalent continuous noise levels $L_{Aeq(15minute)}$ intrusive (and $L_{Aeq(period)}$) amenity noise levels for various receiver areas and guidelines for assessing noise impacts from on-site stationary noise sources.

On-site Open Pit Blasting

The average blasting frequency employed at the approved CGM (ie generally limited to one blast per day) would not change as a result of the E42 Modification, although there would be some changes to the blast design parameters. A review of the modified blast design parameters has been carried out in this assessment.

The assessment of potential blasting impacts has been undertaken in accordance with the Australia and New Zealand Environment Council Committee (ANZECC) "*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*" (ANZECC, 1990) for assessing potential annoyance from blast emissions during daytime hours, which is adopted by NSW Department of Environment and Climate Change (DECC).

The assessment has also been guided by Australian Standard (AS) 2187.2-2006 *"Explosive - Storage and use Part 2: Use of Explosives - Appendix J"*, which provides guidance on relevant procedures for assessing the blast-induced noise and vibration effects on buildings and their occupants. The DECC's *"Assessing Vibration: A Technical Guideline"* (DEC, 2006) does not address blast-induced effects.


QUEENSLAND
NEW SOUTH WALES
MINE SITE
CONDOBOLIN
WEST WYALONG
FORBES
SYDNEY
ACT
VICTORIA
CONDOBOLIN
Parkes Road
Condobolin Road
West Wyalong Road
Lachlan Valley Way
Goobang Creek
LACHLAN
Jemalong Weir
FORBES
RIVER
Way
Bundaburrah Creek
HIGHWAY
FORBES
Ooma Creek
LACHLAN
MANNA MOUNTAIN
WAMBOYNE MOUNTAIN
BILLYS LOOKOUT
NERANG COWAL
LAKE COWAL
Cowal Gold Mine
ML1535
NEWELL HIGHWAY
MID WESTERN HIGHWAY
Sandy Creek
Bland Creek
WYALONG
WEST WYALONG
BLAND
BARMEDMAN
Barmedman Creek
Goldfields Way
The Mary Gilmore Way
Temora 30km
MURDA STATE FOREST
CONDOBLIN AGRICULTURAL RESEARCH STATION SCIENTIFIC RESERVE
WEST COOKEYS PLAINS STATE FOREST
EAST COOKEYS PLAINS STATE FOREST
WEELAH STATE FOREST
MANNA STATE FOREST
EUGLO SOUTH STATE FOREST
NERANG COWAL STATE FOREST
WILBERTROY STATE FOREST
CARAWANDOOL STATE FOREST
CORRINGLE STATE FOREST
CLEAR RIDGE STATE FOREST
WYRRA STATE FOREST
BOXALLS STATE FOREST
HIAWATHA STATE FOREST
BACK CREEK STATE FOREST
PULLABOOKA STATE FOREST
CARACABAL STATE FOREST
CURRABURRAMA STATE FOREST
BUDDIGOWER NATURE RESERVE
BUDDIGOWER STATE FOREST
BUGGAJOOL STATE FOREST
E 525 000
E 550 000
N 6 325 000
N 6 300 000
N 6 275 000
N 6 250 000
N 6 225 000
N
LEGEND
Mining Lease Boundary
Road
Railway
Mine Borefield Pipeline
Jemalong Irrigation Channel
Electricity Transmission Line
Local Government Area Boundary
Source: Topographic Base (Forbes and Cootamundra) Geoscience Australia, 2007
0 5 10 15 20
Kilometres
E42 MODIFICATION
FIGURE F-1
Regional Location
HEGGIES
BARRICK
COWAL
HAL-06-26 BS NBA_101D

Off-site Road Traffic Noise

The modified CGM would include an increase in road traffic along the existing mine access road from West Wyalong, as well as road traffic along mine access roads from Forbes and Condobolin. These changes have therefore been assessed in accordance with the DoP's DGRs.

The assessment of potential off-site road traffic noise impacts has been undertaken in accordance with the "*NSW Environmental Criteria for Road Traffic Noise*" (ECRTN) (EPA, 1999), which provides non-mandatory procedures for setting acceptable L_{Aeq} noise levels on arterial, collector and local roads and guidelines for assessing noise impacts from off-site road traffic.

F2 MODIFICATION OVERVIEW

F2.1 Modification Summary

Barrick proposes to modify a number of components of the approved CGM. The modified CGM is scheduled to commence in approximately Year 5 of CGM operations. The main changes to the approved CGM as a result of the E42 Modification would include those presented below:

- An increase to the operational mine life from 13 years to approximately 24 years.
- An increase in total production from approximately 76 million tonnes (Mt) of ore, to approximately 129 Mt of ore.
- An increase in the maximum ore processing rate from approximately 6.9 Mtpa to approximately 7.5 Mtpa.
- An increase in gold production from approximately 2.7 million ounces (Moz) of gold to approximately 3.5 Moz of gold
- An increase in the total surface area of the open pit from approximately 70 ha to approximately 130 ha, with final pit dimensions increased from approximately 1,000 m long, 850 m wide and 325 m deep to approximately 1,250 m long, 1,350 m wide and 440 m deep.
- An increase in the total volume of waste rock to be removed from the open pit from approximately 128 Mt to approximately 184 Mt.
- An increase in the height and area of the northern waste emplacement to an approximate final height of RL 275 m Australian Height Datum (AHD) (increased from RL 243 m AHD) and area of approximately 320 ha (increased from approximately 160 ha).
- An increase in the height and area of the southern waste emplacement to an approximate final height of RL 255 m AHD (increased from RL 223 m AHD) and area of approximately 140 ha (increased from approximately 120 ha).
- A reduction in the height of the perimeter waste emplacement in places.
- An increase in the total surface area of low grade ore stockpiles from approximately 35 ha to approximately 60 ha.
- An increase in the total volume of tailings produced from approximately 76 Mt to approximately 129 Mt.
- An increase in the heights of the northern and southern tailings storages to a final RL of 252 m (from approximately RL 233.5 m AHD) and 256 m (from approximately RL 241.5 m AHD), respectively.
- Extraction of saline water from a saline groundwater supply borefield located within ML 1535.
- Other associated minor changes to infrastructure, plant, equipment and activities.

The approved and modified CGM hours of operation are presented in Table F-1.

Table F-1 Approved and Modified CGM Hours of Operation

Activity	Approved CGM	Modified CGM
On-site open pit and waste emplacement operations	24 Hours per day 7 Days per week	Unchanged
On-site ore handling, processing and stockpiling	24 Hours per day 7 Days per week	Unchanged
On-site Blasting	0900 hrs to 1700 hrs Monday to Saturday (where practicable)	Unchanged
Off-site road transport (medium and light vehicles)	24 Hours per day 7 Days per week	Unchanged
Off-site road transport (heavy vehicles)	0700 hrs to 2200 hrs 7 Days per week (as far as practicable)	Unchanged

Source: Barrick pers. comm. 2008

F2.2 Modified CGM Operating Configurations and Fleet

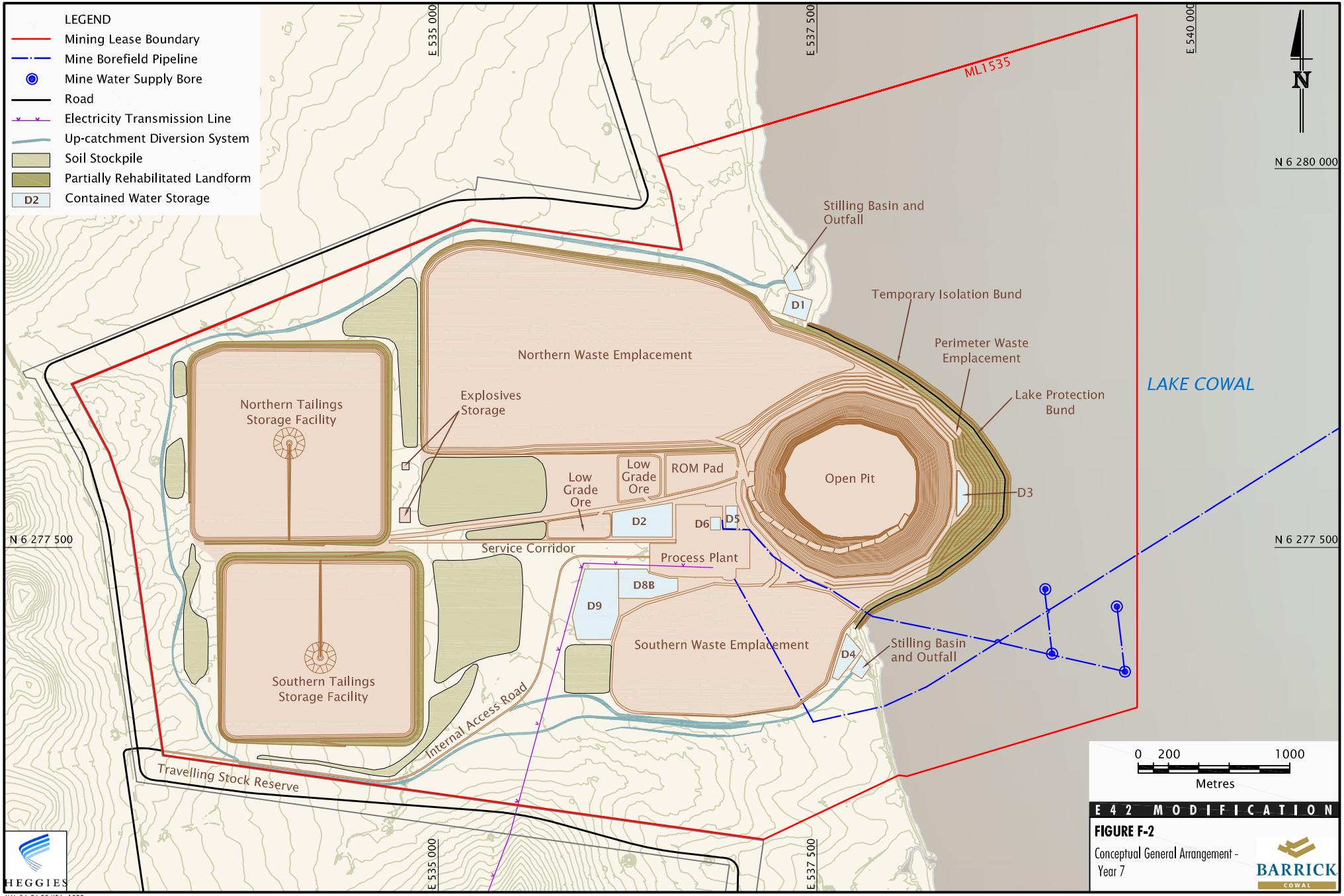
Conceptual general arrangements for Years 7 and 9 are shown on **Figures F-2** and **F-3**, respectively. The typical number of each equipment type required during each year of operations for the modified CGM is presented in **Table F-2**. The modified CGM is anticipated to commence in approximately Year 5 of CGM operations. An assessment of noise impact is presented in **Section F6**.

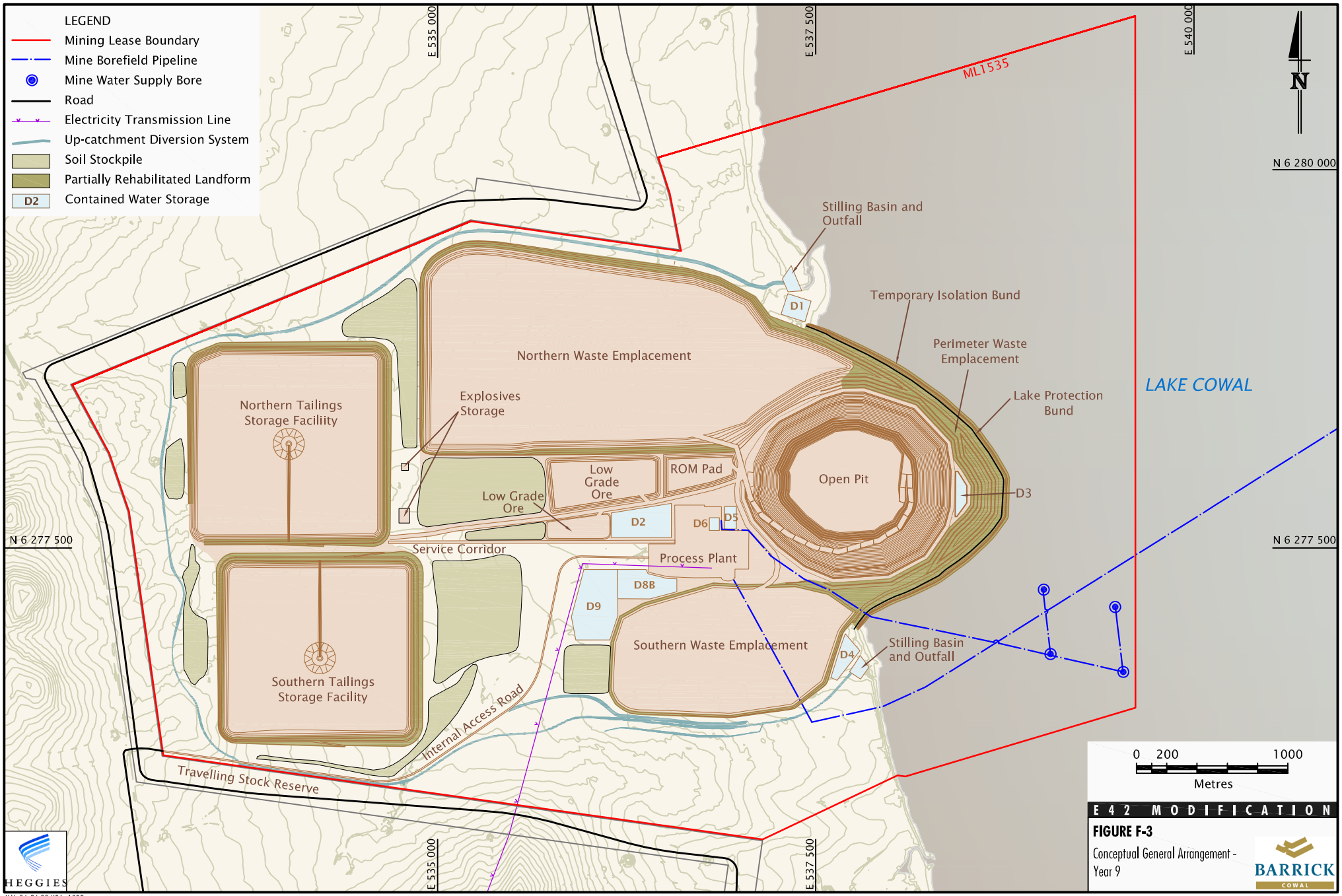
Table F-2 Typical Mobile Equipment Fleet

Fleet Item	Approximate Capacity	Typical Number of Items Required in each Year of Operation*										
		5 - 11	12 - 13	14 - 15	16	17	18	19 - 20	21	22	23	24
Hydraulic Excavator	994B (310 tonnes [t])	3	3	3	2	2	2	1	1	1	1	1
Haul Truck	789C (184 t)	13	12	12	12	12	10	3	0	0	0	0
Haul Truck	785B (140 t)	3	3	3	3	3	3	3	3	3	3	3
Wheel Loader	992D	2	2	2	2	2	2	1	1	1	1	1
Track Dozer	D10N	2	2	2	2	2	2	1	1	1	1	1
Wheel Dozer	834H	2	1	1	1	1	1	1	0	0	0	0
Water Truck	777D	2	2	2	2	2	2	1	1	1	1	1
Grader	16H	2	2	2	2	2	2	1	1	1	1	1
Drills	165-200 millimetres (mm)	4	4	4	4	3	3	1	1	0	0	0
Tailings Lift Fleet												
Dump Truck	A40E Volvo (40t)	4	4	4	4	4	4	4	4	4	4	4
Scraper	627F (40t)	2	2	2	2	2	2	2	2	2	2	2
Grader	14G	1	1	1	1	1	1	1	1	1	1	1
Water Truck	Volvo A40D	2	2	2	2	2	2	2	2	2	2	2
Compactor	CAT 825	1	1	1	1	1	1	1	1	1	1	1
Track Dozer	D8	1	1	1	1	1	1	1	1	1	1	1
Track Dozer	D7	1	1	1	1	1	1	1	1	1	1	1
Excavator	ZX850 (85t)	1	1	1	1	1	1	1	1	1	1	1

Source: Barrick pers. comm. 2008

* The modified CGM is scheduled to commence in approximately Year 5 of CGM operations.


LEGEND
Mining Lease Boundary
Mine Borefield Pipeline
Mine Water Supply Bore
Road
Electricity Transmission Line
Up-catchment Diversion System
Soil Stockpile
Partially Rehabilitated Landform
D2 Contained Water Storage
E 535 000
E 537 500
E 540 000
N
N 6 280 000
N 6 277 500
ML1535
LAKE COWAL
Stilling Basin and Outfall
D1
Temporary Isolation Bund
Perimeter Waste Emplacement
Lake Protection Bund
Northern Waste Emplacement
Northern Tailings Storage Facility
Explosives Storage
Low Grade Ore
Low Grade Ore
ROM Pad
Open Pit
D3
D2
D6
D5
Service Corridor
Process Plant
D8B
D9
Southern Waste Emplacement
D4
Stilling Basin and Outfall
Southern Tailings Storage Facility
Internal Access Road
Travelling Stock Reserve
0 200 1000
Metres
E42 MODIFICATION
FIGURE F-2
Conceptual General Arrangement - Year 7
HEGGIES
BARRICK
COWAL
HAL-06-26 BS NBA_102G


LEGEND
Mining Lease Boundary
Mine Borefield Pipeline
Mine Water Supply Bore
Road
Electricity Transmission Line
Up-catchment Diversion System
Soil Stockpile
Partially Rehabilitated Landform
D2
Contained Water Storage
E 535 000
E 537 500
E 540 000
N
N 6 280 000
N 6 277 500
ML1535
LAKE COWAL
Stilling Basin and Outfall
D1
Temporary Isolation Bund
Perimeter Waste Emplacement
Lake Protection Bund
Northern Waste Emplacement
Northern Tailings Storage Facility
Explosives Storage
Low Grade Ore
ROM Pad
Low Grade Ore
Open Pit
D3
D2
D6
D5
Service Corridor
Process Plant
D8B
D9
Southern Waste Emplacement
D4
Stilling Basin and Outfall
Southern Tailings Storage Facility
Internal Access Road
Travelling Stock Reserve
0 200 1000
Metres
E42 MODIFICATION
FIGURE F-3
Conceptual General Arrangement - Year 9
BARRICK
COWAL
HEGGIES
HAL-06-26 BS NBA_103G

F2.3 Modified CGM Open Pit Blasting

The average blasting frequency employed at the approved CGM (ie generally limited to one blast per day) would not change as a result of the E42 Modification, although there would be some changes to the blast design parameters. A review of the modified blast design parameters is presented in **Section F7.3**.

F2.4 Modified CGM Road Transport

The E42 Modification would include an increase in road traffic along the existing mine access road from West Wyalong, as well as road traffic along existing roads from Forbes and Condobolin to the approved CGM. An assessment of potential traffic noise impacts is presented in **Section F8**.

The primary access to the site (for employees, major deliveries and heavy vehicles) would be from West Wyalong via the existing mine access road shown on **Figure F-1**. Two additional mine access routes would be used (mainly for employees) to access the modified CGM from Forbes and Condobolin. These routes are also shown on **Figure F-1**. Light vehicles and Barrick operated shuttle buses for use by employees would use all three routes.

Table F-3 outlines the type and typical number of traffic movements along each of the mine access routes for the modified CGM. The distribution of arrivals/departures of heavy vehicles would generally be evenly spread between the hours of 0700 hours and 2200 hours. An assessment of potential traffic noise impacts associated with the modified CGM is presented in **Section F8**.

Table F-3 Mine Access Routes Estimated Modified CGM Vehicle Movements

Type of Vehicle	**Estimated Number of Modified CGM Vehicle Movements[1]**					
	West Wyalong via Existing Access Road		**Forbes via Carrawandool-Warroo Road[2]**		**Condobolin via Burcher Road[2]**	
	Average	**Peak**	**Average**	**Peak**	**Average**	**Peak**
Car (ie employees) movements per day[1]	217	310	16	42	0	0
Buses (ie employee shuttle buses) movements per day[1]	6	6	4	4	4	4
Heavy vehicles (ie deliveries) movements per day[1]	20	30	0	0	0	0
Oversize vehicles movements per month[1]	2	4	0	0	0	0

Source: Barrick pers. comm. 2008

Note [1]: Vehicle movements presented here includes vehicle movements associated with the modified CGM.

Note [2]: Employee movements per day would alternate between the access routes from Forbes and Condobolin.

F2.5 Receiver Areas

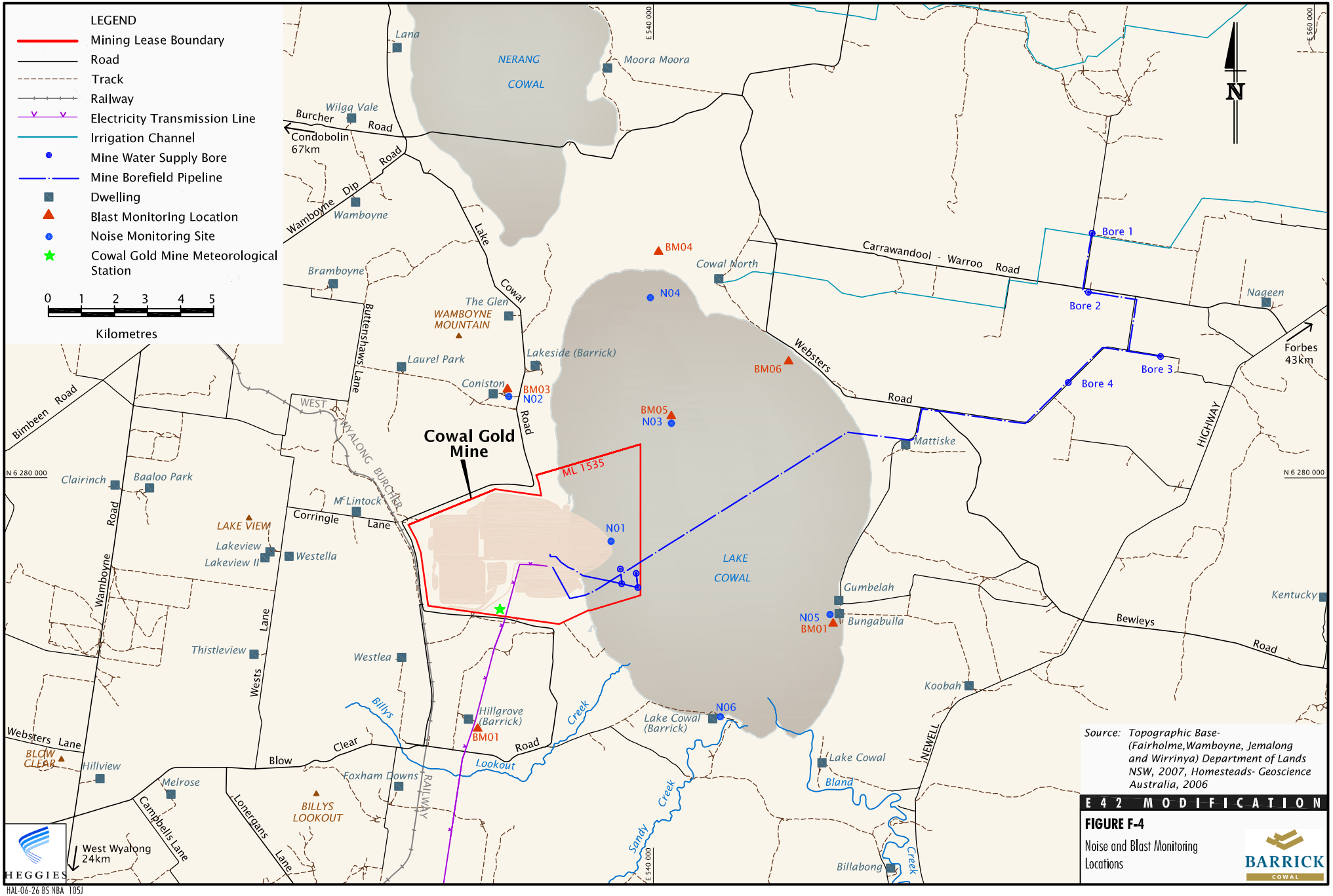
The nearest potentially affected sensitive receivers to ML 1535 are shown on **Figure F-4** and are summarised in **Table F-4**.

Table F-4 Potentially Affected Receiver Areas and Assessment Locations

Receiver Area	LEP Zone	INP Noise Amenity Zone[1]	Property Reference	Ground Elevation (RL m AHD)
Privately Owned	1(a) General Use Zone	Rural	Billabong	206
			Bramboyne	240
			Bungabulla	206
			Coniston (N02)	221
			Cowal North	206
			Foxham Downs	240
			Gumbelah (N05)	206
			Hillview	256
			Koobah	206
			Lake Cowal	206
			Lakeview	256
			Lakeview II	256
			Laurel Park	239
			Mattiske	206
			McLintock	227
			Melrose	256
			Moora Moora	206
			The Glen	226
			Thistlleview	256
			Wamboyne	240
			Westella	256
			Westlea	236
			Wilga Vale	256
Barrick Owned[2]	1(a) General Use Zone	n/a	Lake Cowal (N06) (Barrick)	219
			Lakeside (Barrick)	220
			Hillgrove (Barrick)	240
Bird Breeding Area	1(a) General Use Zone	Passive Recreation	Bird Breeding Area South (N03)	204
			Bird Breeding Area North (N04)	206

Note [1]: See **Attachment FA** for discussion on the use of Rural, Suburban, Urban and Urban/Industrial Noise Amenity Zones.

Note [2]: Barrick owned properties are listed for information purposes and not further considered in this assessment.


LEGEND
Mining Lease Boundary
Road
Track
Railway
Electricity Transmission Line
Irrigation Channel
Mine Water Supply Bore
Mine Borefield Pipeline
Dwelling
Blast Monitoring Location
Noise Monitoring Site
Cowal Gold Mine Meteorological Station
0 1 2 3 4 5
Kilometres
N
Cowal Gold Mine
ML 1535
LAKE COWAL
NERANG COWAL
WAMBOYNE MOUNTAIN
WEST WYALONG
BILLYS LOOKOUT
Lana
Moora Moora
Wilga Vale
Burcher Road
Condobolin 67km
Wamboyne Dip Road
Wamboyne
Bramboyne
Lake Cowal Road
The Glen
Laurel Park
Coniston
Lakeside (Barrick)
Buttenshaws Lane
Bimbeen Road
Clairinch
Baaloo Park
Wamboyne Road
LAKE VIEW
Lakeview
Lakeview II
Westella
Mc Lintock
Corringle Lane
Thistleview
Wests Lane
Westlea
Billys Lookout Creek
Hillgrove (Barrick)
Foxham Downs
RAILWAY
Websters Lane
BLOW CLEAR
Hillview
Blow Clear Road
Melrose
Campbells Lane
Lonergans Lane
West Wyalong 24km
Cowal North
Carrawandool - Warroo Road
Bore 1
Bore 2
Bore 3
Bore 4
Nageen
Forbes 43km
Websters Road
Mattiske
HIGHWAY
Gumbelah
Bungabulla
Kentucky
Bewleys Road
Koobah
Lake Cowal (Barrick)
Lake Cowal
Bland
NEWELL
Billabong Creek
Sandy Creek
BM01
BM03
BM04
BM05
BM06
N01
N02
N03
N04
N05
N06
E 540 000
E 560 000
N 6 280 000
Source: Topographic Base- (Fairholme,Wamboyne, Jemalong and Wirrinya) Department of Lands NSW, 2007, Homesteads- Geoscience Australia, 2006
E42 MODIFICATION
FIGURE F-4
Noise and Blast Monitoring Locations
BARRICK COWAL
HEGGIES
HAL-06-26 BS NBA_105J

F3 EXISTING METEOROLOGICAL AND NOISE ENVIRONMENT

F3.1 Meteorological Environment

Prevailing Winds

Section 5.3 of the INP (EPA, 2000), Wind Effects, states:

> *"Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season."*

An assessment of prevailing wind conditions was derived from the on-site automatic weather station located within ML 1535 (**Figure F-4**). The dominant seasonal wind speeds and directions for a one year period commencing September 2006 are presented in **Attachment FB** for daytime (0700 hours to 1800 hours), evening (1800 hours to 2200 hours) and night-time (2200 hours to 0700 hours).

In accordance with the INP definition, prevailing winds are not considered a feature of any season during the daytime, evening and night-time periods and therefore wind effects are not relevant to the site.

Temperature Inversions

Section 5.2 of the INP (EPA, 2000), Temperature Inversions, states:

> *"Assessment of impacts is confined to the night noise assessment period (10.00 pm to 7.00 am), as this is the time likely to have the greatest impact - that is, when temperature inversions usually occur and disturbance to sleep is possible."*
>
> *"Where inversion conditions are predicted for at least 30% (or approximately two nights per week) of total night-time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment".*

An assessment of atmospheric stability conditions has also been prepared from the meteorological data set described above. The winter evening and night-time frequency of occurrence of atmospheric stability classes are presented in **Table F-5**, together with estimated Environmental Lapse Rates (ELR).

Table F-5 Atmospheric Stability Frequency of Occurrence - Winter Evening and Night

Stability Class	**Occurrence Percentage**	**Estimated ELR[1] °C/100 m**	**Qualitative Description**
A	0%	<-1.9	Lapse
B	0%	-1.9 to-1.7	Lapse
C	0%	-1.7 to-1.5	Lapse
D	32%	-1.5 to-0.5	Neutral
E	32%	-0.5 to 1.5	Weak Inversion
F	23%	1.5 to 4.0	Moderate Inversion
G	13%	>4.0	Strong Inversion

Note [1]: ELR (Environmental Lapse Rate).
°C degrees Celsius

In accordance with Table E2 of the INP, the combined frequency of occurrence of moderate to strong (ie 1.5 to >4.0 degrees Celsius per hundred metres [^{o}C/100 m]) winter temperature inversions is greater than 30% during the combined evening and night-time period and therefore requires assessment (EPA, 2000).

Direct measurement samples of the prevailing temperature gradient were carried out during winter noise monitoring surveys in August 2005, July 2006 and July 2007. The temperature gradient measurement methodology and results are presented in Heggies Report 10-4111-R5 "*Cowal Gold Project Mine Operation Noise Monitoring July 2007"* (Heggies, 2008) and summarised in **Table** F-6.

Table F-6 Environmental Lapse Rate Sample Measurement Results Summary

0830 to 1730 hours	1730 to 1800 hours	1800 to 0700 hours	0700 to 0830 hours
Typically ELR ≤ 0^{0}C/100 m	Typically ELR ≤ 8^{0}C/100 m	Typically ELR ≥ 8^{0}C/100 m	Typically ELR ≤ 8^{0}C/100 m

The Environmental Noise Model (ENM) noise modelling meteorological parameters presented in **Table F-7** are based on analysis of the approved CGM meteorological data set and field measurements. The observed meteorological conditions at the approved CGM can be summarised as follows:

- Daytime: Generally unstable atmospheric conditions coinciding with temperature lapses and an absence of prevailing winds. However, overnight moderate to strong temperature inversions may not dissipate for several hours in the morning, particularly during winter.
- Evening: Generally stable atmospheric conditions coinciding with moderate to strong temperature inversions in the absence of prevailing winds with minimal topographic characteristics to enhance drainage flows.
- Night-time: Generally stable atmospheric conditions coinciding with moderate to strong temperature inversions in the absence of prevailing winds with minimal topographic characteristics to enhance drainage flows.

Table F-7 Calm (Neutral) and Noise Enhancing Meteorological Modelling Parameters

Period	Meteorological Parameter	Air Temp	Relative Humidity	Wind Velocity[1]	Temperature Gradient
Daytime	Calm	20^{o}C	70%	0 m/s	0^{o}C/100 m
Early Morning (particularly Winter)	Moderate to Strong Inversion only	10^{o}C	90%	0 m/s	3-8^{o}C/100 m
Evening (particularly Winter)	Moderate to Strong Inversion only	10^{o}C	90%	0 m/s	3-8^{o}C/100 m
Night-time (particularly Winter)	Moderate to Strong Inversion only	10^{o}C	90%	0 m/s	3-8^{o}C/100 m

Note [1]: Local topography is generally flat to undulating and drainage flows are not considered a feature of the area.
m/s: metres per second.

F3.2 Noise Environment

Additional background noise monitoring to determine the Assessment Background Level (from which the Rating Background Level [RBL] is derived for assessment purposes) was not considered appropriate for the modified CGM given the on-going operation of the approved CGM.

However, it is appropriate to review the existing pre-mine background noise data (in this case data from 1994 was used) to determine the relevant RBLs and noise amenity levels ($L_{Aeq(period)}$) in accordance with the INP procedures. For INP assessment purposes, a 24-hour day is divided into three periods: day (0700 hours to 1800 hours pm); evening (1800 hours to 2200 hours); and night (2200 hours to 0700 hours).

Background Noise Monitoring 1994

Background noise surveys to characterise and quantify the background (ie prior to the development of the approved CGM) acoustical environment in the area surrounding ML 1535 were conducted in July and December 1994. Unattended noise loggers were positioned at "Coniston", "Lakeside", "Lake Cowal (Barrick)" and "Gumbelah".

The unattended ambient noise logger data from each monitoring location together with the on-site weather conditions are presented in the EIS (North Limited, 1998). The background noise data was previously processed in accordance with the requirements of the "*Environmental Noise Control Manual*" (ENCM) (EPA, 1994) to determine the minimum repeated background noise levels as shown in **Table F-8**.

Table F-8 Background Noise Environment in 1994 (dBA re 20 µPa)

Property Reference	**Winter[2] - Minimum Repeated $L_{A90(15minute)}$ Background Level**		**Summer[2] - Minimum Repeated $L_{A90(15minute)}$ Background Level**	
	Daytime[1]	**Night-time[1]**	**Daytime[1]**	**Night-time[1]**
Coniston (N02)	30	25	27	26
Lakeside (Barrick)	30	25	31	34
Lake Cowal (N06) (Barrick)	30	25	30	25
Gumbelah (N05)	29	27	31	32

Note [1]: Measured noise levels less than 31 dBA may have a signal to noise ratio less than 5 dBA.
Note [2]: Daytime/evening 0700 hours to 2200 hours and Night-time 2200 hours to 0700 hours (EPA, 1994).
dBA: A-weighted decibel.
µPa: Micropascal.

The data shows that the background noise levels in the vicinity of the CGM were typically around 30 dBA (or less), consistent with a relatively remote rural environment comprising of agricultural and domestic activity together with seasonal fauna noise sources and with an absence of major industrial development and continuous transportation systems.

As was the case with the ENCM (and remains the case with the INP) where the background level is found to be less than 30 dBA, the background level is set to 30 dBA.

Noise Monitoring 2005 to 2008

In accordance with the "*Cowal Gold Project Noise Management Plan*" (Barrick 2004) unattended noise logging has been carried out at nearby residential monitoring locations on a regular basis since the commencement of construction and mining operations.

The resulting noise data and on-site weather conditions have been processed in accordance with the requirements of the INP to derive the $L_{A90(15minute)}$ ambient (operating) noise levels (ie all noise sources inclusive of any mine noise) as represented in **Table F-9**.

Table F-9 Ambient (Operating) Noise Environment 2005 to 2008 (dBA re 20 µPa)

Receiver Area	Measured $L_{A90(15minute)}$ ambient noise levels (inclusive of any mine operating noise)																	
	2005			2006						2007						2008		
	August			February			July			January			July			January		
	D	E	N	D	E	N	D	E	N	D	E	N	D	E	N	D	E	N
Coniston (N02)	29	28	27	26	27	27	31	29	30	31	33	30	-	-	-	29	31	32
Gumbelah (N05)	31	30	30	31	33	29	29	27	27	24	26	23	25	24	23	28	29	28
Lake Cowal (Barrick) (N06)	27	25	25	25	26	25	30	28	28	27	26	26	29	29	31	-	-	-
Westlea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	33	33

Note: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

The monitoring of ambient (operating) noise levels indicates that current noise levels are sometimes above the background noise levels measured in 1994. Notwithstanding, the ambient background noise level for the modified CGM has been assumed to be 30 dBA (in accordance with the INP, where the ambient level is found to be less than 30 dBA, the ambient level is set to 30 dBA) in order to provide for a conservative assessment.

Background Noise and Amenity Levels for INP Assessment Purposes

In view of the foregoing, the RBLs and noise amenity levels ($L_{Aeq(period)}$) in the absence of the existing approved CGM are presented in **Table F-10**, which form the basis of establishing the Project-specific noise levels.

Table F-10 Background Noise and Amenity Levels for Assessment (dBA re 20 µPa)

Receiver Area	Property Name	Estimated RBL[1] - All Noise Sources			Estimated $L_{Aeq(Period)}$[1, 2] Industrial Noise Only		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Privately Owned	All residential dwellings	30	30	30	<44	<39	<34

Note [1]: Estimated RBLs and noise amenity levels in the absence of the approved CGM's operation.

Note [2]: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

F4 OPERATIONAL NOISE IMPACT ASSESSMENT PROCEDURE

F4.1 Sleep Disturbance Assessment Criteria

The INP does not specifically address sleep disturbance from high noise level events.

The DECC use the ECRTN (EPA, 1999) sleep disturbance criterion of the $L_{A1(1minute)}$ not exceeding the $L_{A90(15minute)}$ by more than 15 dBA 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 DECC's interim "*Sleep Disturbance Noise Criteria Guideline*" (DEC 2004) indicates that the $L_{A1(60second)}$ level 15 dBA above the RBL is a suitable screening criteria for sleep disturbance for the night-time period. In practice, sleep disturbance is assessed as the emergence of the $L_{A1(60second)}$ level above the $L_{A90(15minute)}$ prevailing at the time as described in the guideline and consistent with the DECC's ECRTN (EPA, 1999) Appendix B Section B5.

The INP's more recent "*Application Notes - NSW Industrial Noise Policy*" (Application Notes) (EPA, 2006) indicates that a more detailed analysis should cover the maximum noise level or $L_{A1(1minute)}$, 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 ECRTN (EPA, 1999). 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 2200 hours and 0700 hours).
- Whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).

The $L_{A1(1minute)}$ descriptor is meant to represent a maximum noise level measured under "fast" time response. The DECC will accept analysis based on either $L_{A1(1minute)}$ or L_{Amax}. A review of noise events from the approved CGM night-time operations indicates that the maximum (L_{Amax}) levels are typically less than 10 dBA above the $L_{Aeq(15minute)}$ intrusive level when measured at a distant receiver.

Hence, if the $L_{Aeq(15minute)}$ criteria (ie background plus 5 dBA) are achieved then the DECC's sleep disturbance criteria would also be met. This relationship enables the noise assessment process to focus on the setting and impact assessment of INP-based intrusive noise and amenity levels which aim to minimise annoyance at noise sensitive receiver locations.

F4.2 Intrusive Noise and Amenity Levels Assessment Criteria

The DECC has regulatory responsibility for the control of noise from "scheduled premises" (CGM is a scheduled premises) under the *Protection of the Environment Operations Act, 1997*. The procedure for assessing the potential impacts of the industrial noise sources is set out in the INP. The INP assessment procedure for industrial noise sources has two components (EPA 2000):

- controlling intrusive noise impacts in the short-term; and
- maintaining noise level amenity for particular landuses over the medium to long-term.

The INP prescribes detailed calculation routines for establishing "Project-specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity (ie non-transport related) criteria for a development at potentially affected receivers (EPA, 2000).

In accordance with the INP's Chapter 2 Industrial Noise Criteria in conjunction with the INP's Application Notes, the Project-specific intrusive and amenity assessment criteria for the rural residential and passive recreational receiver areas are presented in **Table F-11**. These criteria are nominated for the purposes of assessing potential noise impacts from a project.

The intrusiveness criterion is met if the $L_{Aeq(15minute)}$ is less than or equal to the RBL plus 5 dBA, where the RBL is determined from monitoring data following the INP procedures discussed in **Section F3.2**. Thus, the most stringent Project-specific criterion for the modified CGM would be the intrusiveness criterion (ie 35 dBA $L_{Aeq[15minute]}$).

Table F-11 Project-specific Noise Assessment Criteria (dBA re 20 µPa)

Receiver Area	Land Use	Intrusive $L_{Aeq(15minute)}$			Amenity $L_{Aeq(period)}$[1]		
		Day	Evening	Night	Day	Evening	Night
Private Dwellings	Rural Residential	35	35	35	50	45	40
Lake Cowal	Passive Recreation	Intrusive noise not applicable			50 when in use[2]		

Note [1]: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note [2]: At the most-affected point within 50 m of the area boundary.

The INP states that these criteria have been selected to preserve the amenity of 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 most people would consider the resultant noise levels acceptable.

In those cases where the INP Project-specific assessment criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. In subjective terms, exceedances of the INP Project-specific assessment criteria can be generally described as follows:

- Negligible noise level increase <1 dBA (Not noticeable by all people).
- Marginal noise level increase 1 dBA to 2 dBA (Not noticeable by most people).
- Moderate noise level increase 3 dBA to 5 dBA (Not noticeable by some people but may be noticeable by others).
- Appreciable noise level increase >5 dBA (Noticeable by most people).

F4.3 Operational Noise Impact Assessment Methodology

In view of the foregoing, **Table F-12** presents the methodology for assessing operational noise against the INP Project-specific noise assessment criteria.

Table F-12 Project-specific Noise Assessment Methodology (dBA re 20 µPa)

Assessment Criteria	Project-specific Criteria	Noise Management Zone		Noise Affectation Zone
		Marginal	Moderate	
Intrusive $L_{Aeq(15minute)}$	RBL plus 5 dBA	1 to 2 dBA above Project-specific criteria	3 to 5 dBA above Project-specific criteria	> 5 dBA above Project-specific criteria
Amenity[1] $L_{Aeq(period)}$	INP based on existing industrial level			

Note [1]: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

For the purposes of assessing the potential noise impacts, the management and affectation criteria are further defined as follows:

Noise Management Zone

Depending on the degree of predicted exceedance of the Project-specific criteria (1 dBA to 5 dBA) potential noise impacts in the noise management zone could range from negligible to moderate (in terms of the perceived noise level increase). In addition to the noise mitigation measures included in the predictive modelling, noise management procedures would include:

- 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.

- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine which are 3 to 5 dBA above Project-specific noise criteria.

Noise Affectation Zone

Exposure to noise levels greater than 5 dBA above Project-specific criteria may be considered unacceptable by some landowners. Management procedures for the noise affectation zone would include:

- Discussions with relevant land owners to assess concerns and define responses.
- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine which are >5 dBA above Project-specific noise criteria.
- Negotiated agreements with land owners where required.

F4.4 Potential Effects of Noise on Birds

A number of recent literature reviews have been conducted on the effects of noise on wildlife (Radle, 2007; Kaseloo, 2005; Institute for Environmental Monitoring and Research, 2001).

Noise can potentially impact certain fauna species, although studies on the effect of noise on wildlife have shown potential impacts are varied. Many studies have shown that fauna are well adapted to human activities and noise, while other studies have shown that noise can cause masking of vocalisation, physiological stress and changes in movement/patterns of behaviour (Radle, 2007; Kaseloo, 2005; Institute for Environmental Monitoring and Research, 2001).

The E42 Modification would involve an increase to the existing levels of noise from the mine, which may have the potential to disrupt the routine activities of vertebrate fauna.

F5 OPERATIONAL NOISE MODELLING

F5.1 Noise Model Establishment and Calibration Procedure

The CGM computer model was prepared using the NSW Road and Transport Authority's (RTA) Software's ENM (ENM for Windows, Version 3.06), a commercial software system developed in conjunction with the DECC. The acoustical algorithms utilised by this software have been endorsed by the ANZECC and all State Environmental Authorities throughout Australia as representing one of the most appropriate predictive methodologies currently available.

The modified CGM computer model was developed to incorporate the significant noise sources associated with the proposed development, surrounding terrain and nearby receivers. On-site noise measurements to determine fixed plant sound power levels (SWLs) were conducted on 30 January 2008. Noise measurement procedures were guided by the requirements of AS 1217.7-1985 "*Acoustics - Determination of Sound Power Levels Part 7 Survey Method*".

Preliminary predictive noise modelling was conducted for comparison with recent field noise monitoring results, in particular, the measured mine noise levels from July and September 2007 were considered most useful for the purposes of noise model calibration. A moderate calibration reduction of 3 dBA has been incorporated into the noise model and is generally consistent with field measurement and modelling results from similar large scale resource developments.

The following scenarios were assessed, namely:

- **Year 7 Operations**: Representative of the maximum noise emissions from the modified CGM for the nearest receptors to the south of the modified CGM (ie with embankment lift works occurring at the southern tailings storage facility).
- **Year 9 Operations**: Representative of the maximum noise emissions from the modified CGM for the nearest receptors to the north of the modified CGM (ie with embankment lift works occurring at the northern tailings storage facility).

The two operational noise modelling scenarios include all significant fixed plant and mobile equipment operating concurrently to simulate the likely intrusive $L_{Aeq(15minute)}$ emission levels.

F5.2 Noise Management and Mitigation Included in the Assessment

The predictive modelling involved the investigation of feasible and reasonable noise mitigation measures, particularly in relation to night-time operations. These mitigation measures were assumed to be implemented for the purposes of the predictive modelling.

A number of iterative steps were taken to develop noise mitigation measures for the modified CGM, including:

- Preliminary noise modelling of scenarios representative of the maximum noise emissions from the mine to identify areas of noise management and noise affectation.
- Consideration of various combinations of noise management and mitigation measures to assess their relative effectiveness.
- Adoption by Barrick of a range of noise management and mitigation measures to appreciably reduce noise emissions associated with the modified CGM, including:
  - scheduling the use of any noisy equipment during daytime, where practicable (eg tailings embankment lift works scheduled to occur between 0800 and 1800 hours); and
  - optimising the mine equipment fleet and keeping equipment well maintained.

The typical plant and equipment fleet for the modified CGM is presented in **Table F-13** together with the SWLs from each item based on the current fleet and its achievable noise emission when maintained and operated in good order.

Table F-13 Typical Plant and Equipment Fleet for the Modified CGM

Fleet Item	Typical number of Items[1] during Years 7 and 9	SWL per item (dBA re 10 pW)
Fixed Plant		
Process Plant	1	124
Mining Fleet		
Hydraulic Excavator 994B (310t)	3	118
Haul Truck 789C (184t)	13	124
Haul Truck 785B (140t)	3	123
Wheel Loader 992D	2	117
Track Dozer D10N	2	121
Wheel Dozer 834H	2	115
Water Truck 777D	2	116
Grader 16H	2	115
Drills 165-200 mm	4	118
Tailings Lift Fleet		
Dump Truck A40E Volvo (40t)	4	110
Scraper 627F (40t)	2	116
Grader 14G	1	114
Water Truck Volvo A40D	2	110
Compactor CAT 825	1	113
Track Dozer D8	1	118
Track Dozer D7	1	117
Excavator ZX850 (85t)	1	113
Total Site	**47**	**137 dBA**

Note [1]: Refer to **Table F-2**

The L_{Aeq} SWLs presented in **Table F-13** do not include noise emissions which emanate from alarms. Alarms would be subject to procurement specifications detailing the tone frequency, noise emission levels, directionality and coverage. Alarms would be installed to optimise safety and to minimise off-site noise leakage.

In the unlikely event that alarm noise remains a source of disturbance, further on-site optimisation would be examined to achieve further noise reductions without compromising safety standards. This optimisation could include retrofitting of broad-band alarms to existing mobile equipment where required.

F6 POTENTIAL OPERATIONAL NOISE IMPACT ASSESSMENT

F6.1 Year 7 Modification Operation

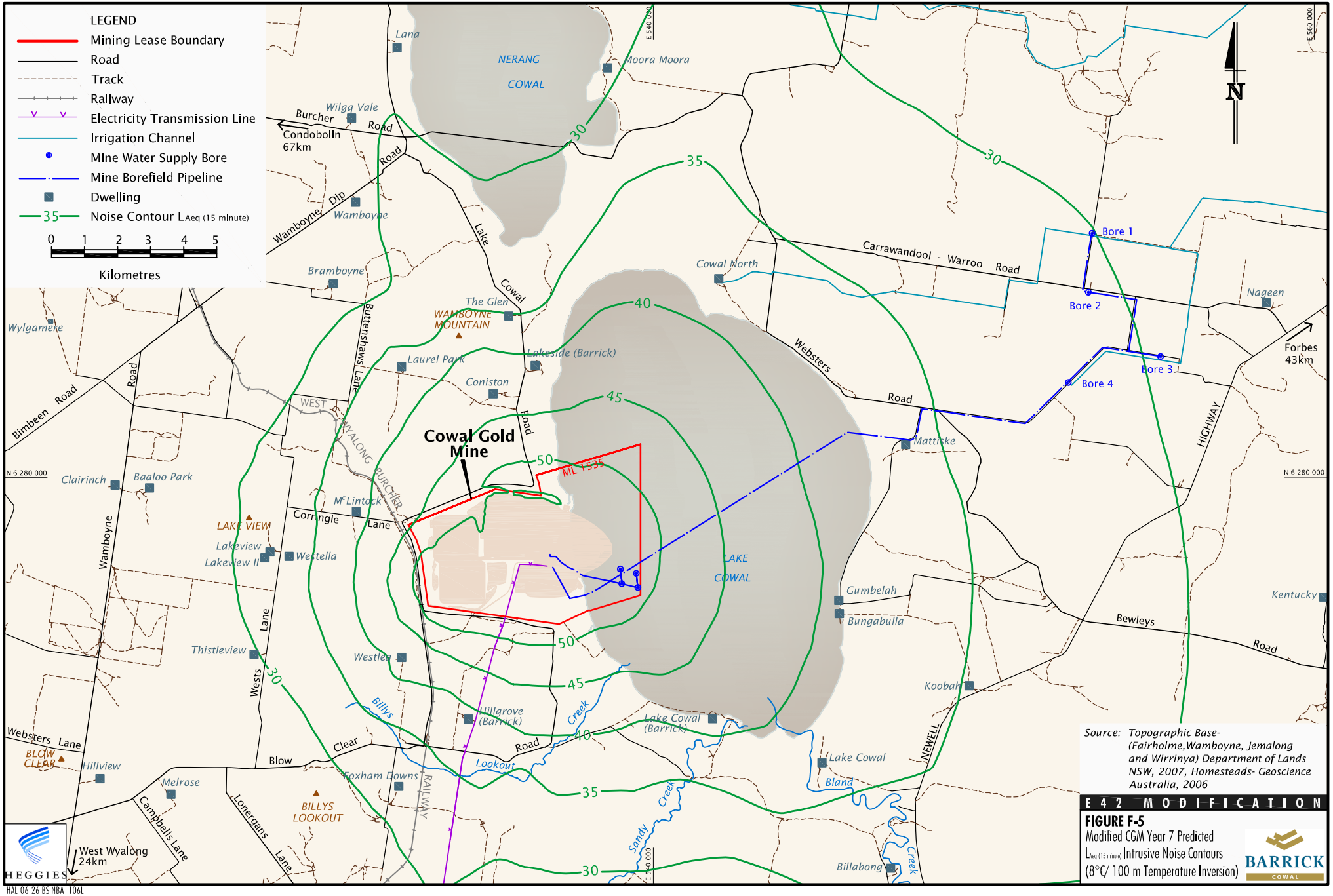
The predicted $L_{Aeq(15minute)}$ intrusive noise levels for Year 7 during daytime, evening and night-time operation whilst Lake Cowal is full at the nearest residential receiver areas are presented in **Table F-14** and shown on **Figure F-5**. The lake full scenario has been assessed in order to provide for a conservative assessment of noise impacts, simulating less noise attenuation with lake surface water by comparison with the empty lake bed.

Table F-14 Year 7 Operational Intrusive Noise (dBA re 20 µPa)

Receiver Area	Property Reference	Daytime	Evening/Night-time and early morning up to 08:30 hours		Project-specific Criteria
		Calm[1]	Moderate Inversion[1]	Strong Inversion[1]	
Privately Owned	Billabong	23 (16)[2]	31(24)[2]	32 (26)[2]	35
	Bramboyne	18	25	28	
	Bungabulla	31 (25)[2]	**37**[3] (34)[2]	**39**[4] (35)[2]	
	Coniston (N02)	31	**39**[4]	**43**[5]	
	Cowal North	29 (24)[2]	**36**[3] (33)[2]	**38**[4] (35)[2]	
	Foxham Downs	22	30	33	
	Gumbelah (N05)	32 (26)[2]	**37**[3] (34)[2]	**39**[4] **(36)**[2]	
	Hillview	12	19	22	
	Koobah	27 (21)[2]	33 (28)[2]	35 (30)[2]	
	Lake Cowal	29 (22)[2]	**36**[3] (30)[2]	**38**[4] (32)[2]	
	Lakeview	24	30	33	
	Lakeview II	23	30	33	
	Laurel Park	26	34	**37**[3]	
	Mattiske	29 (24)[2]	35 (32)[2]	**36**[3] (34)[2]	
	McLintock	27	35	**39**[4]	
	Melrose	9	16	20	
	Moora Moora	21	29	31	
	The Glen	25	35	**37**[3]	
	Thistleview	20	27	30	
	Wamboyne	16	24	29	
	Westella	26	32	35	
	Westlea	32	**38**[4]	**41**[5]	
	Wilga Vale	15	28	30	
Bird Breeding Area	Bird Breeding Area South (N03)	32 (31)[2]	40 (39)[2]	43 (42)[2]	N/A
	Bird Breeding Area North (N04)	29 (25)[2]	36 (33)[2]	38 (34)[2]	

Note [1]: Daytime, evening and night-time meteorological parameters as described in **Table F-7**.
Note [2]: Predicted intrusive noise emission with lake empty.
Note [3]: Marginal Noise Management Zone 1 to 2 dBA above Project-specific Criteria (bold).
Note [4]: Moderate Noise Management Zone 3 to 5 dBA above Project-specific Criteria (bold).
Note [5]: Noise Affectation Zone > 5 dBA above Project-specific Criteria (Shaded).

A summary of the privately owned dwellings with predicted exceedances of the Project-specific criteria is given in **Section F6.3** for Year 7 with Lake Cowal full or empty.


LEGEND
Mining Lease Boundary
Road
Track
Railway
Electricity Transmission Line
Irrigation Channel
Mine Water Supply Bore
Mine Borefield Pipeline
Dwelling
35 Noise Contour LAeq (15 minute)
0 1 2 3 4 5
Kilometres
N
Cowal Gold Mine
ML 1535
Bore 1
Bore 2
Bore 3
Bore 4
30
35
40
45
50
Lana
NERANG
COWAL
Moora Moora
Wilga Vale
Burcher Road
Condobolin 67km
Wamboyne Dip
Wamboyne
Lake Cowal
Bramboyne
The Glen
WAMBOYNE MOUNTAIN
Laurel Park
Coniston
Lakeside (Barrick)
Cowal North
Carrawandool - Warroo Road
Nageen
Forbes 43km
Websters Road
Mattiske
HIGHWAY
Wylgamere
Buttenshaws Lane
WEST WYALONG
BURCHER
Bimbeen Road
Clairinch
Baaloo Park
Mc Lintock
Corringle Lane
LAKE VIEW
Lakeview
Lakeview II
Westella
Wamboyne
Thistleview
Wests Lane
Westlea
Billys Creek
Hillgrove (Barrick)
Lake Cowal (Barrick)
Lookout
Foxham Downs
RAILWAY
Gumbelah
Bungabulla
Bewleys Road
Kentucky
Koobah
NEWELL
Lake Cowal
Bland
Billabong Creek
Sandy Creek
Websters Lane
BLOW CLEAR
Hillview
Blow Clear Road
Melrose
Campbells Lane
Lonergans Lane
BILLYS LOOKOUT
West Wyalong 24km
N 6 280 000
E 540 000
E 560 000
E 580 000
HEGGIES
HAL-06-26 BS NBA_106L
Source: Topographic Base- (Fairholme,Wamboyne, Jemalong and Wirrinya) Department of Lands NSW, 2007, Homesteads- Geoscience Australia, 2006
E42 MODIFICATION
FIGURE F-5
Modified CGM Year 7 Predicted LAeq (15 minute) Intrusive Noise Contours (8°C/ 100 m Temperature Inversion)
BARRICK
COWAL

The predicted results indicate that the maximum intrusive noise level at the closest monitored bird breeding area (Bird Breeding Area South [N03]) would be 43 dBA during Year 7 (with the lake full) and ranging to approximately 38 dBA in northern areas of Lake Cowal. Given the proposed continuation of noise and bird behaviour monitoring in accordance with the "*Cowal Gold Project Flora and Fauna Management Plan*" (FFMP) (Barrick, 2003), as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna in accordance with the FFMP, noise emissions from the modified CGM would be unlikely to significantly impact any fauna species.

F6.2 Year 9 Modification Operation

The predicted $L_{Aeq(15minute)}$ intrusive noise levels for Year 9 during daytime, evening and night-time operation whilst Lake Cowal is full at the nearest residential receiver areas are presented in **Table F-15** and shown on **Figure F-6**. As for the Year 7 modelling scenario, the lake full scenario has been assessed in order to provide for a conservative assessment of noise impacts, simulating less noise attenuation with lake surface water by comparison with the empty lake bed.

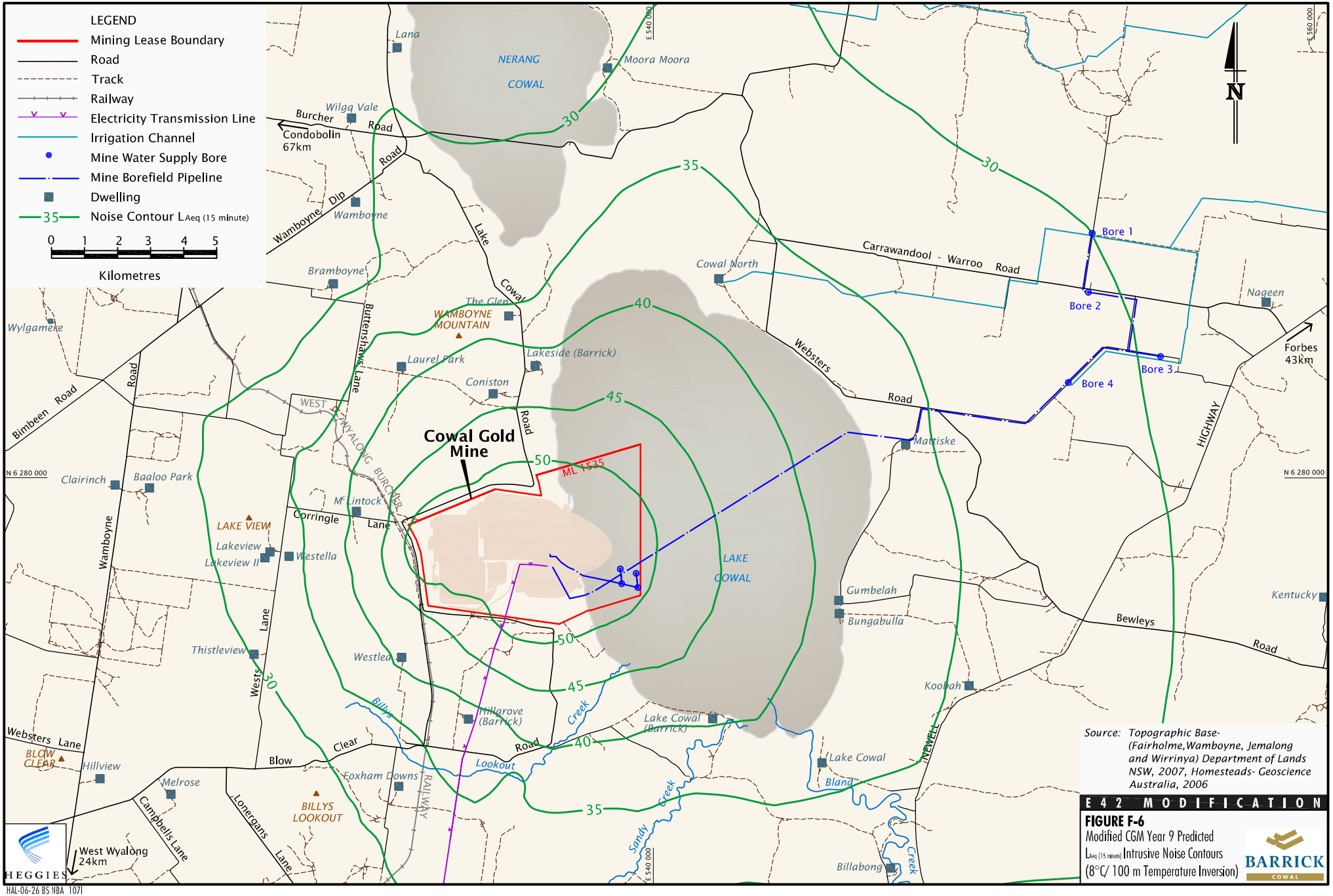
Table F-15 Year 9 Operation Intrusive Noise (dBA re 20 µPa)

Receiver Area	**Property Reference**	**Daytime**	**Evening/Night-time and Daytime up to 08:30 hours**		**Project-specific Criteria**
		Calm[1]	**Moderate Inversion[1]**	**Strong Inversion[1]**	
Privately Owned	Billabong	23 (18)[2]	30 (26)[2]	32 (27)[2]	35
	Bramboyne	19	27	29	
	Bungabulla	31(27)[2]	**37**[3] (34)[2]	**39**[4] **(36)**[2]	
	Coniston (N02)	33	**40**[4]	**44**[5]	
	Cowal North	29 (25)[2]	**36**[3] (33)[2]	**38**[4] (35)[2]	
	Foxham Downs	23	31	34	
	Gumbelah (N05)	32 (27)[2]	**37**[3] (34)[2]	**39**[4] **(36)**[2]	
	Hillview	11	21	24	
	Koobah	27 (23)[2]	33 (29)[2]	34 (30)[2]	
	Lake Cowal	29 (24)[2]	35 (31)[2]	**37**[3] (33)[2]	
	Lakeview	24	30	34	
	Lakeview II	22	30	33	
	Laurel Park	28	**36**[3]	**39**[4]	
	Mattiske	29 (25)[2]	34 (32)[2]	**36**[3] (34)[2]	
	McLintock	29	**37**[3]	**41**[5]	
	Melrose	14	20	24	
	Moora Moora	21	29	31	
	The Glen	26	**36**[3]	**38**[4]	
	Thistleview	20	27	31	
	Wamboyne	18	25	29	
	Westella	25	32	35	
	Westlea	31	**38**[4]	**41**[5]	
	Wilga Vale	16	28	30	

Table F-15 (Continued) Year 9 Operation Intrusive Noise (dBA re 20 µPa)

Receiver Area	Property Reference	Daytime	Evening/Night-time and Daytime up to 08:30 hours		Project-specific Criteria
		Calm[1]	Moderate Inversion[1]	Strong Inversion[1]	
Bird Breeding Area	Bird Breeding Area South (N03)	33 (32)[2]	40 (39)[2]	43 (42)[2]	N/A
	Bird Breeding Area North (N04)	30 (25)[2]	36 (32)[2]	38 (34)[2]	

Note [1]: Daytime, evening and night-time meteorological parameters as described in **Table F-7**.
Note [2]: Predicted intrusive noise emission with lake empty
Note [3]: Marginal Noise Management Zone 1 to 2 dBA above Project-specific Criteria (bold).
Note [4]: Moderate Noise Management Zone 3 to 5 dBA above Project-specific Criteria (bold).
Note [5]: Noise Affectation Zone > 5 dBA above Project-specific Criteria (Shaded).


LEGEND
Mining Lease Boundary
Road
Track
Railway
Electricity Transmission Line
Irrigation Channel
Mine Water Supply Bore
Mine Borefield Pipeline
Dwelling
35 Noise Contour LAeq (15 minute)
0 1 2 3 4 5
Kilometres
N
Cowal Gold Mine
ML 1535
Bore 1
Bore 2
Bore 3
Bore 4
NERANG COWAL
LAKE COWAL
WAMBOYNE MOUNTAIN
LAKE VIEW
BLOW CLEAR
BILLYS LOOKOUT
Lana
Moora Moora
Wilga Vale
Burcher Road
Condobolin 67km
Wamboyne Dip Road
Wamboyne
Bramboyne
Lake Cowal Road
The Glen
Laurel Park
Coniston
Lakeside (Barrick)
Cowal North
Carrawandool - Warroo Road
Nageen
Forbes 43km
Websters Road
Matiske
HIGHWAY
Wylgarneke
Bimbeen Road
Buttenshaws Lane
WEST WYALONG BURCHER
Clairinch
Baaloo Park
Mc Lintock
Corringle Lane
Lakeview
Lakeview II
Westella
Wamboyne Road
Thistleview
Westla
Wests Lane
Billys Creek
Hillgrove (Barrick)
Lake Cowal (Barrick)
Lookout Creek
Foxham Downs
RAILWAY
Websters Lane
Hillview
Blow Clear
Melrose
Campbells Lane
Lonergans Lane
West Wyalong 24km
Gumbelah
Bungabulla
Koobah
Bewleys Road
Kentucky
Lake Cowal
Bland
NEWELL
Sandy Creek
Billabong Creek
E 540 000
E 560 000
N 6 280 000
30
35
40
45
50
Source: Topographic Base- (Fairholme,Wamboyne, Jemalong and Wirrinya) Department of Lands NSW, 2007, Homesteads- Geoscience Australia, 2006
E42 MODIFICATION
FIGURE F-6
Modified CGM Year 9 Predicted LAeq (15 minute) Intrusive Noise Contours (8°C/ 100 m Temperature Inversion)
HEGGIES
BARRICK COWAL
HAL-06-26 BS NBA_1071

A summary of the privately owned dwellings with predicted exceedances of the Project-specific criteria is given in **Section F6.3** for Year 9 with Lake Cowal full or empty.

As for Year 7, the predicted results indicate that the maximum intrusive noise level at the closest monitored bird breeding area (Bird Breeding Area South [N03]) would be 43 dBA during Year 9 (with the lake full) and and ranging to approximately 38 dBA in northern areas of Lake Cowal. Given the proposed continuation of noise and bird behaviour monitoring in accordance with the FFMP (Barrick, 2003), as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna in accordance with the FFMP, noise emissions from the modified CGM would be unlikely to significantly impact any fauna species.

F6.3 Potential Noise Impact Assessment Summary

A summary of the private (non-Barrick) owned dwellings with predicted exceedances of the Project-specific criteria under strong inversions is given in **Table F-16** for Year 7 with Lake Cowal full or empty.

Table F-16 Year 7 Private (Non-Barrick) Owned Dwellings with Predicted Exceedances within Noise Management and Affectation Zones

Period	**Noise Management Zone**		**Noise Affectation Zone**
	1 to 2 dBA above Project-specific criteria	**3 to 5 dBA above Project-specific criteria**	**>5 dBA above Project-specific criteria**
Daytime Calm	Nil	Nil	Nil
Evening/Night-time and early morning up to 0830 hours strong inversion with Lake Cowal full	Laurel Park The Glen Mattiske	Bungabulla Cowal North Gumbelah Lake Cowal McLintock	Coniston Westlea
Evening/Night-time and early morning up to 0830 hours strong inversion with Lake Cowal empty	Gumbelah Laurel Park The Glen	McLintock	Coniston Westlea

The Year 7 night-time $L_{Aeq(15minute)}$ intrusive noise contours under strong temperature inversion are presented on **Figure F-5**. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2 dBA.

Similarly, a summary of the private (non-Barrick) owned dwellings with predicted exceedances of the Project-specific criteria under strong inversions is given in **Table F-17** for Year 9 with Lake Cowal full or empty.

Table F-17 Year 9 Private (Non-Barrick) Owned Dwellings with Predicted Exceedances within Noise Management and Affectation Zones

Period	Noise Management Zone		Noise Affectation Zone
	1 to 2 dBA above Project-specific criteria	**3 to 5 dBA above Project-specific criteria**	**>5 dBA above Project-specific criteria**
Day Calm	Nil	Nil	Nil
Evening/Night-time and early morning up to 0830 hours strong inversion with Lake Cowal full	Lake Cowal Mattiske	Bungabulla Cowal North Gumbelah Laurel Park The Glen	Coniston Westlea McLintock
Evening/Night-time and early morning up to 0830 hours strong inversion with Lake Cowal empty	Bungabulla Gumbelah	Laurel Park The Glen	Coniston Westlea McLintock

The Year 9 night-time $L_{Aeq(15minute)}$ intrusive noise contours under strong temperature inversion are presented on **Figure F-6**. As above, the calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2 dBA.

The predicted results indicate that the maximum intrusive noise level at the closest monitored bird breeding area (Bird Breeding Area South [N03]) would be 43 dBA during Year 7 and Year 9 and ranging to approximately 38 dBA in northern areas of Lake Cowal. Given the proposed continuation of noise and bird behaviour monitoring in accordance with the FFMP (Barrick, 2003), as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna in accordance with the FFMP, noise emissions from the modified CGM would be unlikely to significantly impact any fauna species.

F7 POTENTIAL BLAST EMISSIONS IMPACT ASSESSMENT

F7.1 Human Comfort and Building Damage Criteria

AS 2187: Part 2-2006 "*Explosives - Storage and Use - Part 2: Use of Explosives*" provides guidance in assessing blast-induced ground (and structural) vibration and airblast effects on buildings and their occupants is presented in detail in Appendix J of AS 2187.

Recommended vibration limits are generally based on international standards (or studies) as presented in Appendix J Tables J4.5(A) and J4.5(B) of AS 2187, for human comfort and structural building damage respectively. Similarly, recommended human comfort and structural damage airblast limits are presented in Appendix J Tables J5.4(A) and J5.4(B) respectively.

However, ground vibration and airblast levels which cause human discomfort are generally lower than the recommended structural damage limits. Therefore compliance with the lowest applicable human comfort criteria ensures that the potential to cause structural damage is minimal.

Hence, the DECC adopts the ANZECC "*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*" dated September 1990 for assessing potential annoyance from blast emissions during daytime hours, as follows:

- The recommended maximum level for airblast is 115 decibels (dB) Linear.
- The level of 115 dBLinear may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dB Linear at any time.

- The recommended maximum for ground vibration is 5 millimetres per second (mm/s), Peak Vector Sum (PVS) vibration velocity. It is recommended however, that 2 mm/s (PVS) be considered as the long-term regulatory goal for the control of ground vibration.
- The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.
- Blasting should generally only be permitted during the hours of 0900 hours to 1700 hours Monday to Saturday, where practicable. Blasting should not take place on Sundays and public holidays.

F7.2 Potential Effects of Airblast on Birds

Blasting overpressure and vibration has the potential to disturb routine activities of vertebrate fauna, particularly birds. For example, disruptions to normal breeding and behaviour patterns may result from birds taking flight as a result of the blasting stimulus (ie blast noise and/or vibration) (North Limited, 1998).

The "*Cowal Gold Project 2005 Annual Environmental Management Report*" (Barrick, 2006) includes a summary of bird observations during the first ten blasts at the CGM. The observation was overseen by Dr Peter Gell from the Geographical and Environmental Studies Department of the University of Adelaide. Dr Peter Gell has been involved in monitoring and reporting on waterbird populations and breeding activities at Lake Cowal since 1992 and has completed over 45 surveys during that time. The four fauna specialists who conducted the monitoring found that there was no abrupt change in the behaviour of any bird species to any blast and no evidence that any bird perceived any blast (Gell, 2005).

F7.3 Modified CGM Blast Design and Prediction Methodology

The average blasting frequency currently employed at the approved CGM would not change for the modified CGM, although there would be some changes to the blast design parameters. The assessment of the potential vibration and airblast emissions arising from the modified CGM blasting has been based on the blast design parameters presented in **Table F-18**.

Table F-18 Approved and Modified CGM Blast Design Parameters

Blast Design Parameter	Approved CGM Typical Dimension	Modified CGM Typical Dimension	Modified CGM Dimension Range
Number of Holes	170	350	200-500
Number of Rows	5	9	3-12
Hole Diameter	165 mm	165 mm	115-200
Hole Inclination (to vertical)	10^0	0^0	$0\text{-}20^O$
Bench Height	10 m	9 m	5-18m
Burden	5 m	4.4 m	3-6m
Spacing	6 m	5.3 m	4-7m
Subdrill	1.5 m	1.3 m	0.6-1.8m
Stemming Depth	3.0 m	3.6 m	3-4.5m
Delay Timing	Nonel (Non-electric)	Nonel (Non-electric)	Nonel (Non-electric)
Column Explosive	ANFO Slurry	Emulsion	ANFO/Slurry/Emulsion
Powder Factor	0.71 kilograms per bank cubic metre (kg/bcm)	0.82 kg/bcm	0.60-1.00kg/bcm
Maximum Instantaneous Charge (MIC)	213 kg	172 kg	50-350 kg

By adopting the design parameters, the vibration and airblast emissions can be predicted using the relevant vibration and airblast formula presented in AS 2187.2-2006.

The relevant formulae are as follows:

$$PVS = 3{,}272\ (R/Q^{1/2})^{-1.60}$$
$$SPL = 173.4 - 24(\log 10R - \log 10Q)$$

where,

PVS = Peak Vector Sum vibration velocity (mm/s)
SPL = Peak airblast noise level (dB Linear)
R = Distance between charge and receiver (m)
Q = Charge mass per delay (kg)

F7.4 Modified CGM Blast Emissions Prediction

The standard formulae have been used to predict maximum vibration and airblast emissions at the nearest potentially affected sensitive receiver areas as presented in **Table F-19**.

Table F-19 Predicted Vibration and Airblast Emissions (MIC 350 kg)

Receiver Area	ID/Location	Nearpoint Distance (m)	PVS Vibration (mm/s)	Peak Linear Airblast (dB re 20µPa)
Privately Owned	Billabong	12413	0.1	95
	Bramboyne	9763	0.1	98
	Bungabulla	6966	0.3	101
	Coniston (N02)	4178	0.6	107
	Cowal North	7988	0.2	100
	Foxham Downs	7794	0.2	100
	Gumbelah (N05)	6884	0.3	102
	Hillview	14989	0.1	93
	Koobah	11336	0.1	96
	Lake Cowal	8697	0.2	99
	Lakeview	8210	0.2	100
	Lakeview II	8366	0.2	100
	Laurel Park	6527	0.3	102
	Mattiske	9160	0.2	99
	McLintock	5699	0.3	104
	Moora Moora	13347	0.1	95
	Melrose	13319	0.1	95
	The Glen	6153	0.3	103
	Thistheview	9223	0.2	99
	Wamboyne	11308	0.1	96
	Westella	7631	0.2	101
	Westlea	5201	0.4	105
	Wilga Vale	13531	0.1	95
Bird Breeding Area	Bird Breeding Area South (N03)	3800	0.7	108
	Bird Breeding Area North (N04)	8200	0.2	100

MIC: maximum instantaneous change

The predicted vibration and airblast emissions are below the most stringent structural damage criterion of 13 mm/s (3 hertz [Hz]) and 133 dB Linear at all residential dwellings. Similarly, the predicted vibration velocities are well below the comfort criteria of 5 mm/s at all receivers and the airblast levels are well below the 115 dB Linear criteria.

The predicted results indicate that the maximum airblast level at the closest monitored bird breeding area (Bird Breeding Area South [N03]) would be 108 dB. Given the proposed continuation of blast and bird behaviour monitoring in accordance with the FFMP, as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna, the modified CGM would be unlikely to significantly impact any fauna species.

F8 TRAFFIC NOISE IMPACT ASSESSMENT

F8.1 Traffic Noise Criteria

The mine access routes described in **Section F2.4** can be classified in accordance with the DECC's ECRTN (EPA, 1999) as presented in **Table F-20**.

Table F-20 Mine Access Routes Applicable Traffic Noise Criteria

Road Classification	Access/Road	General Description	Traffic Noise Criterion	
			Daytime	Night-time
Collector Road	From West Wyalong/ Ungarie Road	Sealed collector road carrying through traffic from West Wyalong to Condobolin. Traffic along this road includes a range of heavy vehicles such as B-Doubles and Road Trains.	$L_{Aeq(1hour)}$ 60 dBA	$L_{Aeq(1hour)}$ 55 dBA
Local Road	From West Wyalong/ Wamboyne Road	Currently sealed (Wamboyne Road) and unsealed local public roads (eg Carrawandool-Warroo Road) carrying predominantly local traffic with periods of grain farming heavy traffic in the relevant seasons.	$L_{Aeq(1hour)}$ 55 dBA	$L_{Aeq(1hour)}$ 50 dBA
	From West Wyalong/ Blow Clear Road			
	From Forbes/ Carrawandool-Warroo Road			
	From Condobolin/ Burcher Road			
	From Condobolin/ West Wyalong Condobolin Road			
	From Condobolin/ Lake Cowal Road			

Note that in all cases where the nominated criteria are already exceeded, traffic associated with the development should not be permitted to lead to an increase in the existing traffic noise levels of more than 2 dBA. As a general rule, traffic noise associated with the modified CGM would not increase the existing traffic noise levels by more than 2 dBA so long as the increase in light and heavy vehicles movements for the modified CGM is no greater than 60%.

F8.2 Traffic Movements

Section F2.4 presents the existing and estimated number of vehicle movements for the E42 Modification. The existing and cumulative traffic passbys are presented in **Table F-21** and **Table F-22** on an average daily and peak hourly basis respectively.

Table F-21 Mine Access Routes - Estimated Annual Average Daily Traffic Passbys

Access	Roads	Existing Traffic	E42 Modification			Cumulative Traffic	Change Traffic
			Light	Heavy	Total		
From West Wyalong	Ungarie Road Limit 100 kilometres per hour (km/hr)	927[1]	16	6	22	949	2%
	Wamboyne Road Limit 100 km/hr	333[1]	16	6	22	355	7%
	Blow Clear Road Limit 100 km/hr	159[2]	16	6	22	181	14%
From Forbes	Carrawandool-Warroo Road Limit 100 km/hr	72[3]	10	0	10	82	14%
	Newell Highway Limit 110 km/hr	2548[4]	10	0	10	2558	0.4%
From Condobolin	Burcher Road Limit 100 km/hr	46[4]	6	0	6	52	13%
	West Wyalong Condobolin Road Limit 100 km/hr	117[5, 6]	6	0	6	123	5%
From Forbes and Condobolin	Lake Cowal Road Limit 100 km/hr	118[7]	16	0	16	134	14%

Note [1]: Existing 5 day Annual Average Daily Traffic (AADT) Count February 2008 (CFE Info. Tech. 2008) inclusive of the approved CGM.

Note [2]: Existing 5 day AADT Count January 2007 (Riverina Road Services, 2007) inclusive of the approved CGM.

Note [3]: Existing 5 day AADT Count November/December 2006 (Forbes Shire Council, 2006) inclusive of the approved CGM.

Note [4]: Existing 5 day AADT Count May 2008 (CFE Info. Tech. 2008) inclusive of the approved CGM.

Note [5]: Existing 5 day AADT Count 2006 (RTA, 2006) inclusive of the approved CGM.

Note [6]: 5 day AADT data from the West Wyalong Condobolin Road south of the Burcher Road intersection.

Note [7]: 5 day AADT data from the Burcher Road and Carrawandool-Warroo Road 5 day AADT data.

Note [8]: Assumed to have an average of the existing percentage of heavy vehicles as Burcher Road and Carrawandool-Warroo Road.

Table F-22 Mine Access Routes - Estimated Peak Hourly Traffic Passbys

Peak Period	Existing Traffic			E42 Modification			Cumulative Traffic		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
West Wyalong: Ungarie Road 100 km/hr[1]									
Night-time 0600 - 0700 hours	84	9	93	1	1	2	85	10	95
Daytime (Morning) 0800 - 0900 hours	74	8	82	1	1	2	75	9	84
Daytime (Afternoon) 1700 - 1800 hours	99	11	110	1	1	2	100	12	112
West Wyalong: Wamboyne Road 100 km/hr[1]									
Night-time 0600 - 0700 hours	50	3	53	3	1	4	53	4	57
Daytime (Morning) 0800 - 0900 hours	21	1	22	1	0	1	22	1	23
Daytime (Afternoon) 1700 - 1800 hours	46	2	48	2	0	2	48	2	50
West Wyalong: Blow Clear Road 100 km/hr[2, 3]									
Night-time 0600 - 0700 hours	38	2	40	4	2	6	42	4	46
Daytime (Morning) 0800 - 0900 hours	25	1	26	3	1	4	28	2	30
Daytime (Afternoon) 1700 - 1800 hours	54	3	57	6	2	8	60	5	65
Forbes: Carrawandool-Warroo Road 100 km/hr[4, 5]									
Night-time 0600 - 0700 hours	3	1	4	1	0	1	4	1	5
Daytime (Morning) 0800 - 0900 hours	4	1	5	1	0	1	5	1	6
Daytime (Afternoon) 1700 - 1800 hours	5	1	6	1	0	1	6	1	7
Condobolin: Burcher Road 100 km/hr[6]									
Night-time 0600 - 0700 hours	1	1	2	1	0	1	2	1	3
Daytime (Morning) 0800 - 0900 hours	2	1	3	1	0	1	3	1	4
Daytime (Afternoon) 1700 - 1800 hours	3	1	4	1	0	1	4	1	5
Forbes/Condobolin: Lake Cowal Road 100 km/hr[5, 7, 8]									
Night-time 0600 - 0700 hours	4	2	6	2	0	2	6	2	8
Daytime (Morning) 0800 - 0900 hours	6	2	8	2	0	2	8	2	10
Daytime (Afternoon) 1700 - 1800 hours	8	2	10	2	0	2	10	2	12

Note [1]: Existing 5 day AADT Count February 2008 (CFE Info. Tech. 2008) inclusive of the approved CGM.

Note [2]: Existing 5 day AADT Count January 2007 (Riverina Road Services, 2007) inclusive of the approved CGM.

Note [3]: Assumed to have the same existing percentage heavy vehicles as Wamboyne Road.

Note [4]: Existing 5 day AADT Count November/December 2006 (Forbes Shire Council, 2006) inclusive of the approved CGM.

Note [5]: Assumed to have the same traffic distribution as Burcher Road.

Note [6]: Existing 5 day AADT Count May 2008 (CFE Info. Tech. 2008) inclusive of the approved CGM.

Note [7]: 5 day AADT data from the West Wyalong Condobolin Road south of the Burcher Road intersection.

Note [8]: Assumed to have an average of the existing percentage of heavy vehicles as Burcher Road and Carrawandool-Warroo Road.

F8.3 Traffic Noise Impact Assessment

Traffic noise predictions are based on the methodology endorsed by the US Environmental Protection Agency Report 550/9-74-004 dated March 1974, but including modifications based on equations in Appendix A-13 and certain amendments recommended in the UK Calculation of Road Traffic Noise (CORTN). The prediction methodology is generally conservative and takes into account vehicle volume, speed, type, passby duration and facade reflection and assumes no intervening barriers or topography with all receivers having a full angle of view to the road.

According to the ECRTN (EPA, 1999) described in **Section F8.1**, traffic associated with the development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA. This is achieved when the project related percentage increase in light and heavy vehicles movements is no greater than 60%.

Predicted noise levels on the Newell Highway and West Wyalong Condobolin Road, (arterial roads) have not been calculated given that the average daily percentage increase in light and heavy vehicles movements on these roads is predicted to be only 0.4% and 5%, respectively, and therefore not of a magnitude which would change the ambient road traffic noise levels discernible (ie the change would be less than 1 dBA)

The calculated peak hourly daytime (morning), daytime (afternoon) and night-time traffic noise levels for other roads along the mine access routes are presented in **Table F-23**.

Table F-23 Estimated Existing and Cumulative Peak Hourly Traffic Noise Levels

Distance from Road	Criteria (Daytime/ Night-time)	LAeq(1hour) (dBA) – Existing Vehicles			Laeq(1hour) (dBA) - Cumulative Vehicles		
		Daytime (morning)	Daytime (afternoon)	Night-time	Daytime (morning)	Daytime (afternoon)	Night-time
Ungarie Road							
10 m	60/55 dBA	64	65	64	64	65	65
30 m	60/55 dBA	57	58	57	57	58	57
50 m	60/55 dBA	53	54	54	53	55	54
75 m	60/55 dBA	51	52	51	51	52	51
100 m	60/55 dBA	49	50	49	49	50	49
Wamboyne Road							
10 m	55/50 dBA	57	60	61	57	61	62
30 m	55/50 dBA	50	53	54	50	53	55
50 m	55/50 dBA	47	50	51	47	50	51
75 m	55/50 dBA	44	47	48	44	47	48
100 m	55/50 dBA	42	45	46	42	45	47
Blow Clear Road							
10 m	55/50 dBA	58	61	60	59	62	61
30 m	55/50 dBA	50	54	53	52	55	54
50 m	55/50 dBA	47	51	49	48	52	50
75 m	55/50 dBA	44	48	47	46	49	48
100 m	55/50 dBA	43	46	45	44	47	46
Carrawandool-Warroo Road							
10 m	55/50 dBA	53	53	53	53	54	53
30 m	55/50 dBA	46	46	45	46	47	46
50 m	55/50 dBA	42	43	42	43	43	42
75 m	55/50 dBA	40	40	39	40	40	40
100 m	55/50 dBA	38	38	37	38	39	38
Burcher Road							
10 m	55/50 dBA	52	53	52	53	53	52
30 m	55/50 dBA	45	45	44	45	46	45
50 m	55/50 dBA	42	42	41	42	42	42
75 m	55/50 dBA	39	39	38	39	40	39
100 m	55/50 dBA	37	37	36	37	38	37
Lake Cowal Road							
10 m	55/50 dBA	56	56	55	56	56	56
30 m	55/50 dBA	48	49	48	49	49	48
50 m	55/50 dBA	45	45	45	45	46	45
75 m	55/50 dBA	42	43	42	43	43	42
100 m	55/50 dBA	40	41	40	41	41	40

West Wyalong: Ungarie Road

Peak hour night-time traffic noise levels increase by up to 0.2 dBA and remain below the 55 dBA $L_{Aeq(1hour)}$ criterion at 50 m (and greater) from the road.

Peak hour daytime traffic noise levels increase by up to 0.2 dBA and remain below the 60 dBA $L_{Aeq(1hour)}$ criterion at 30 m (and greater) in the morning and at 30 m (and greater) in the afternoon.

West Wyalong: Wamboyne Road

Peak hour night-time traffic noise levels increase by up to 0.9 dBA and remain below the 50 dBA $L_{Aeq(1hour)}$ criterion at 75 m (and greater) from the road.

Peak hour daytime traffic noise levels increase by up to 0.1 dBA and remain below the 55 dBA $L_{Aeq(1hour)}$ criterion at 30 m (and greater) in the morning and at 30 m (and greater) in the afternoon.

West Wyalong: Blow Clear Road

Peak hour night-time traffic noise levels increase by up to 1.7 dBA and remain below the 50 dBA $L_{Aeq(1hour)}$ criterion at 50 m (and greater) from the road.

Peak hour daytime traffic noise levels increase by up to 1.8 dBA and remain below the 55 dBA $L_{Aeq(1hour)}$ criterion at 30 m (and greater) in the morning and at 50 m (and greater) in the afternoon.

Forbes: Carrawandool-Warroo Road

Peak hour night-time traffic noise levels increase by up to 0.4 dBA and remain below the 50 dBA $L_{Aeq(1hour)}$ criterion at 30 m (and greater) from the road.

Peak hour daytime traffic noise levels increase by up to 0.4 dBA and remain below the 55 dBA $L_{Aeq(1hour)}$ criterion at 10 m (and greater) in the morning and in the afternoon.

Condobolin: Burcher Road

Peak hour night-time traffic noise levels increase by up to 0.5 dBA and remain below the 50 dBA $L_{Aeq(1hour)}$ criterion at 30 m (and greater) from the road.

Peak hour daytime traffic noise levels increase by up to 0.4 dBA and remain below the 55 dBA $L_{Aeq(1hour)}$ criterion at 10 m (and greater) in the morning and in the afternoon.

Forbes/Condobolin: Lake Cowal Road

Peak hour night-time traffic noise levels increase by up to 0.5 dBA and remain below the 50 dBA $L_{Aeq(1hour)}$ criterion at 30 m (and greater) from the road.

Peak hour daytime traffic noise levels increase by up to 0.4 dBA and remain below the 55 dBA $L_{Aeq(1hour)}$ criterion at 30 m (and greater) in the morning and in the afternoon.

Summary

Potential traffic noise impacts arising from the modified CGM are considered acceptable as the daytime (morning and afternoon) and night-time increase in peak hourly noise levels are no more than 2 dBA on all roads assessed.

F9 SUMMARY OF FINDINGS

F9.1 Operating Noise Criteria

The INP prescribes detailed calculation routines for establishing Project-specific $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity (ie non-transport related) criteria at potentially affected receivers. Ideally, the intrusive noise emission levels should generally not exceed the background level by more than 5 dBA. Similarly, the amenity level should generally not exceed the specified "acceptable" or "maximum" noise level appropriate for the particular locality and land use as shown in **Table F-24**.

In accordance with the INP's Chapter 2 Industrial Noise Criteria and in conjunction with the INP's Application Notes (EPA, 2000; 2006), the Project-specific intrusive and amenity assessment criteria for the rural residential and passive recreational receiver areas are presented in **Table F-24**. These criteria are nominated for the purposes of assessing potential noise impacts from the modified CGM.

Table F-24 Project-specific Noise Assessment Criteria (dBA re 20 µPa)

Receiver Area	Land Use	Intrusive $L_{Aeq(15minute)}$			Amenity $L_{Aeq(period)}$		
		Day	Evening	Night	Day	Evening	Night
Private Dwellings	Rural Residential	35	35	35	50	45	40
Lake Cowal	Passive Recreation	Intrusive noise not applicable			External 50 when in use[2]		

Note [1]: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note [2]: At the most-affected point within 50 m of the area boundary.

The INP states that these criteria have been selected to preserve the amenity of 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, it is unlikely that most people would consider the resultant noise levels excessive.

In those cases where the INP Project-specific assessment criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. Exceedances of 5 dBA or more are generally required before the impact becomes clearly noticeable and appreciable.

F9.2 Operating Noise Modelling and Mitigation

The modified CGM computer model was developed to incorporate the significant noise sources associated with the proposed development, surrounding terrain and nearby receiver areas. Two mine operating scenarios (Year 7 and Year 9) were assessed including all significant fixed plant and mobile equipment operating concurrently to simulate the likely intrusive $L_{Aeq(15minute)}$ emission levels.

The predictive modelling involved the investigation of feasible and reasonable noise mitigation measures, particularly in relation to night-time operations. A number of iterative steps were undertaken to ascertain the potential increase in noise emissions resulting from the modified CGM and assess the practicability of implementing additional noise controls and management measures to minimise those increases.

F9.3 Operating Noise Impact Summary

A summary of the non-Barrick owned dwellings with predicted exceedances of Project-specific criteria is presented in **Table F-25** for Year 7 and/or Year 9 with Lake Cowal full or empty.

Table F-25 Private (Non-Barrick) Dwellings within Noise Management and Affectation Zones

Period	Noise Management Zone		Noise Affectation Zone
	1 to 2 dBA above Project-specific criteria	**3 to 5 dBA above Project-specific criteria**	**>5 dBA above Project-specific criteria**
Daytime Calm	Nil	Nil	Nil
Evening/Night-time and early morning up to 0830 hours strong inversion with Lake Cowal full	Mattiske	Bungabulla Gumbelah Laurel Park The Glen Cowal North Lake Cowal	Coniston Westlea McLintock
Evening/Night-time and early morning up to 0830 hours strong inversion with Lake Cowal empty	Bungabulla Gumbelah	Laurel Park The Glen	Coniston Westlea McLintock

As discussed the **Section F4.3**, depending on the degree of exceedance of the Project-specific criteria, noise impacts in the noise management zone could range from marginal to moderate (in terms of perceived noise level increase) (ie between 1 dBA and 5 dBA). In addition to the noise mitigation measures included in the predictive modelling, noise management procedures would include:

- 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.
- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine which are 3 to 5 dBA above Project-specific noise criteria.

Exposure to noise levels greater than 5 dBA above Project-specific criteria may be considered unacceptable by some landowners. Management procedures for the noise affectation zone would include:

- Discussions with relevant land owners to assess concerns and define responses.
- Implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air-conditioning) at residences where noise monitoring shows noise levels from the mine which are >5 dBA above Project-specific noise criteria.
- Negotiated agreements with land owners where required.

The predicted results indicate that the maximum intrusive noise level at the closest monitored bird breeding area (Bird Breeding Area South [N03]) would be 43 dBA during Year 7 and Year 9 and ranging to approximately 38 dBA in northern areas of Lake Cowal. Given the proposed continuation of noise and bird behaviour monitoring in accordance with the FFMP (Barrick, 2003), as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna in accordance with the FFMP, noise emissions from the modified CGM would be unlikely to significantly impact any fauna species.

F9.4 Blast Impact Summary

The open pit drill and blasting practices currently employed at the approved CGM are generally unaltered by the E42 Modification and the assessment of blast impacts represented in the EIS (North Limited, 1998) therefore remains generally unchanged. However, a review of the on-going blasting operations has been carried out to ensure consistency with contemporary blast assessment procedures.

The predicted vibration and airblast emissions are below the most stringent structural damage criterion of 13 mm/s (3 Hz) and 133 dB Linear at all residential dwellings. Similarly, the predicted vibration velocities are well below the comfort criteria of 5 mm/s at all receivers and the airblast levels are well below the 115 dBLinear criteria.

The predicted results indicate that the maximum airblast level at the closest monitored bird breeding area (Bird Breeding Area South [N03]) would be 108 dB. Given the proposed continuation of blast and bird behaviour monitoring in accordance with the FFMP, as well as the contingency measures in place in the event that assessment and monitoring results indicate that adverse impacts are occurring on fauna, the modified CGM would be unlikely to significantly impact any fauna species.

F9.5 Traffic Noise Impact Summary

The E42 Modification would include an increase in road traffic along the existing mine access road from West Wyalong, as well as road traffic along mine access roads from Forbes and Condobolin.

Where the nominated criteria are already exceeded, traffic associated with the modified CGM should not be permitted to lead to an increase in the existing traffic noise levels of more than 2 dBA. As a general rule, traffic noise associated with the E42 Modification would not increase the existing traffic noise levels by more than 2 dBA so long as the percentage increase in light and heavy vehicles movements for the E42 Modification is no greater than 60%.

Potential traffic noise impacts arising from the modified CGM are considered acceptable as the daytime (morning and afternoon) and night-time increase in peak hourly noise levels are no more than 2 dBA on all roads assessed.

F10 REFERENCES

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THE INDUSTRIAL NOISE POLICY'S RURAL, SUBURBAN, URBAN AND URBAN/INDUSTRAIL INTERFACE NOISE AMENITY ZONES

The NSW Industrial Noise Policy (INP, 2000) prescribes detailed calculation routines for establishing Project-specific $L_{Aeq(period)}$ amenity (ie non-transport related) criteria for a development at potentially affected receivers. The INP's noise amenity criteria are dependent on establishing the appropriate noise amenity zone (ie rural, suburban, urban etc) and the existing industrial noise level which are then used in conjunction with the Table 2.1 and Table 2.2 of the INP respectively.

Section 2.2.1 of the INP, Notes to Support the Noise Level Tables, states:

> ***Rural*** *- means an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic. Such areas may include:*
>
> *- an agricultural area, except those used for intensive agricultural activities*
> *- a rural recreational area such as resort areas*
> *- a wilderness area or national park*
> *- an area generally characterised by low background noise levels (except in the immediate vicinity of industrial noise sources).*
>
> *This area may be located in either a* ***rural***, ***rural-residential, environment protection zone or scenic protection zone****, as defined on a council zoning map (Local Environmental Plan (LEP) or other planning instrument).*
>
> ***Suburban*** *- an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:*
>
> *- decreasing noise levels in the evening period (1800-2200); and/or*
> *- evening ambient noise levels defined by the natural environment and infrequent human activity.*
>
> *This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument.*
>
> ***Urban*** *- an area with an acoustical environment that:*
>
> *- is dominated by 'urban hum' or industrial source noise*
> *- has through traffic with characteristically heavy and continuous traffic flows during peak periods*
> *- is near commercial districts or industrial districts*
> *- has any combination of the above,*
>
> *where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.*

The INP's Application Notes dated July 2006 supersedes the INP's Section 2.2.1 with respect the application of the Urban Industrial Interface and states:

> ***Urban/Industrial Interface -*** *this area may be located in either a rural, rural-residential or residential zone as defined on an LEP or other planning instrument, and also includes mixed land-use zones such as mixed commercial and residential uses.*
>
> *The urban/industrial interface category in the INP recognises that the availability of noise mitigation measures might be limited for existing premises where residences are close to existing industries.*
>
> *The urban/industrial interface amenity category applies only for existing situations (that is, an existing receiver near an existing industry) and only for those receivers in the immediate area surrounding the existing industry, that is, the region that extends from the boundary of the existing industry to the point where the noise level of the existing industry (measured at its boundary) has fallen by 5 decibels.*
>
> *For new developments of a limited nature (such as an extension to existing process or plant or when replacing part of an existing process or plant with new technology) on existing sites (where the urban/industrial amenity category applies) then the urban/industrial amenity category is the appropriate amenity category for the new development.*

SITE SPECIFIC WIND CONDITIONS - SEPTEMBER 2006 TO SEPTEMBER 2007

Table 1: Seasonal Frequency of occurrence Wind Speed Intervals - Daytime

Period	Calm (<0.5m/s)	Wind Direction ±45^0	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	0.8%	SE	4.8%	5.1%	9.8%
Summer	0.2%	NNW	2.5%	5.7%	8.2%
Autumn	1.5%	ESE	7.5%	6.1%	13.6%
Winter	1.3%	SE	6.9%	5.1%	12.0%
Spring	0.1%	SE	1.9%	4.6%	6.5%

Table 2: Seasonal Frequency of occurrence Wind Speed Intervals - Evening

Period	Calm (<0.5m/s)	Wind Direction ±45^0	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	2.3%	S, SSW	5.3%, 5.1%	7.6%, 7.9%	13%, 13%
Summer	0.6%	NE	5.7%	5.1%	10.8%
Autumn	4.1%	SSE	9%	10.3%	19.3%
Winter	2.9%	WSW	7.9%	9.2%	17.1%
Spring	1.5%	WSW	4.7%	5.2%	9.9%

Table 3: Seasonal Frequency of occurrence Wind Speed Intervals - Night-Time

Period	Calm (<0.5m/s)	Wind Direction ±45^0	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	3.5%	SE	9.7%	7.7%	17.5%
Summer	1.8%	E	7.5%	11.4%	19.0%
Autumn	5.5%	SE	14.1%	9.5%	23.6%
Winter	3.8%	W	9.0%	10.5%	19.5%
Spring	2.7%	ESE	8.3%	5.4%	13.7%

Table 4: Summary

Season	Winds ±45^0 ≤3 m/s with Frequency of Occurrence ≥30%		
	Daytime	Evening	Night-Time
Annual	Nil	Nil	Nil
Summer	Nil	Nil	Nil
Autumn	Nil	Nil	Nil
Winter	Nil	Nil	Nil
Spring	Nil	Nil	Nil

Table 5: Frequency of Occurrence of Atmospheric Stability Classes - Evening and Night-time

Stability Class	Frequency of Occurrence					Estimated ELR ^{o}C/100 m	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	0.0%	0.0%	0.0%	0.0%	0.0%	<-1.9	Lapse
B	0.0%	0.0%	0.0%	0.0%	0.0%	-1.9 to -1.7	Lapse
C	0.0%	0.0%	0.0%	0.0%	0.0%	-1.7 to -1.5	Lapse
D	42.1%	51.7%	34.7%	31.5%	52.0%	-1.5 to -0.5	Neutral
E	27.2%	24.5%	27.3%	32.4%	24.3%	-0.5 to 1.5	Weak Inversion
F	19.8%	17.4%	22.2%	23.2%	15.9%	1.5 to 4	Moderate Inversion
G	10.9%	6.4%	15.9%	12.8%	7.9%	>4.0	Strong Inversion

Note: ELR (Environmental Lapse Rate).