



COWAL

SECTION 2 DESCRIPTION OF APPROVED COWAL GOLD MINE

COWAL GOLD MINE EXTENSION MODIFICATION

TABLE OF CONTENTS

2	DESCRIPTION OF APPROVED COWAL GOLD MINE	2-1
2.1	COWAL GOLD MINE APPROVAL HISTORY	2-1
2.2	ORE DEPOSIT DESCRIPTION AND LIFE OF MINE	2-1
2.3	MINING OPERATIONS	2-1
2.3.1	Mining Method Overview	2-4
2.3.2	Open Pit Design	2-4
2.3.3	Mobile Equipment Fleet	2-4
2.3.4	Blasting	2-4
2.4	MINE WASTE ROCK MANAGEMENT	2-4
2.4.1	Waste Rock Geochemistry	2-4
2.4.2	Northern and Southern Waste Rock Emplacements	2-4
2.4.3	Perimeter Waste Rock Emplacement	2-5
2.5	ORE PROCESSING	2-5
2.5.1	Cyanide Use	2-5
2.5.2	Cyanide Destruction	2-5
2.6	TAILINGS MANAGEMENT	2-6
2.7	SITE WATER MANAGEMENT INFRASTRUCTURE	2-6
2.7.1	Lake Isolation System	2-6
2.7.2	Up-catchment Diversion System	2-7
2.7.3	Internal Catchment Drainage System	2-7
2.7.4	Integrated Erosion, Sediment and Salinity Control System	2-7
2.7.5	Open Pit Sump and Dewatering Borefield	2-7
2.8	WATER SUPPLY	2-7
2.8.1	Saline Groundwater Supply	2-9
2.8.2	Eastern Saline Borefield	2-9
2.8.3	Bland Creek Palaeochannel Borefield	2-9
2.8.4	Lachlan River Water Entitlements	2-10
2.9	ELECTRICITY SUPPLY	2-10
2.10	OTHER SUPPORTING INFRASTRUCTURE AND SERVICES	2-10
2.11	WORKFORCE	2-10
2.12	ENVIRONMENTAL MONITORING AND MANAGEMENT	2-10

LIST OF FIGURES

Figure 2-1	Existing Cowal Gold Mine
Figure 2-2	Currently Approved Cowal Gold Mine Layout
Figure 2-3	Existing Environmental Monitoring Locations

LIST OF PLATES

Plate 2-1	Cowal Gold Mine during 2012 Lake-fill Conditions
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2 DESCRIPTION OF APPROVED COWAL GOLD MINE

The existing CGM is shown on Figure 2-1, and the approved layout of the CGM is shown on Figure 2-2.

A summary of existing approvals and operations undertaken at the CGM is provided below. Where relevant, a description of measures incorporated into the existing CGM layout and operation designed to minimise potential environmental impacts, is also provided below.

2.1 COWAL GOLD MINE APPROVAL HISTORY

A study into the compatibility of the CGM with critical conservation values of Lake Cowal over the long-term was completed and reported in the *Cowal Gold Project Environmental Impact Statement* (EIS) (North Limited, 1998). A Commission of Inquiry was held in November 1998 into the environmental aspects of the CGM and related infrastructure.

Development Consent (DA 14/98) for the CGM and Bland Creek Palaeochannel Borefield water supply pipeline (Figure 1-2) was granted by the NSW Minister for Urban Affairs and Planning under Part 4 of the EP&A Act on 26 February 1999.

Separate approvals processes were also undertaken during the same period for the following related infrastructure components for the CGM:

- Upgrade of the mine access road from West Wyalong to the CGM: Approval for the upgrade of the mine access road was granted by the Bland Shire Council on 21 April 1999 under Part 5 of the EP&A Act.
- Temora to Cowal 132 kV ETL: Approval for the ETL (Figure 1-2) was granted by the NSW Minister for Urban Affairs and Planning on 3 August 1999 under Part 5 of the EP&A Act.

The CGM Development Consent (DA 14/98) has been modified on 10 occasions, viz. 11 August 2003, 22 December 2003, 4 August 2004, 23 August 2006, 12 March 2008 (Mod 5), 11 February 2009 (Mod 7), 28 August 2009 (Mod 8), 10 March 2011 (Mod 6), 17 January 2011 (Mod 9) and 6 July 2011 (Mod 10).

The majority of these modifications have involved minor changes to the CGM, and were assessed under section 96 of the EP&A Act.

Three modifications (Mods 6, 9 and 10) have been assessed under section 75W of the EP&A Act. Of these, only Mod 6 (herein referred to as the Modified Request) involved changes to the previously approved CGM mining operations (e.g. open pit extent).

Development Consent (DA 2011/64) for the operation of the eastern saline borefield (Figure 1-2) was granted by the Forbes Shire Council on 20 December 2010. The approved operation of the eastern saline borefield includes the use of two production bores to extract water from the Cowra Formation aquifer and the use of existing associated works (including a pipeline) to deliver the saline water to the Bland Creek Palaeochannel Borefield pipeline.

2.2 ORE DEPOSIT DESCRIPTION AND LIFE OF MINE

The CGM currently mines the E42 ore deposit, which occurs within a sequence of semi-conformable sedimentary, volcanoclastic and volcanic rock, and is overlain by recent sedimentation of the Bland Creek Palaeochannel and lake-fill events.

Two ore types are mined at the CGM:

- primary ore, which constitutes 80 percent (%) of the E42 ore deposit; and
- oxide or weathered ore, which comprises the upper 20% of the orebody.

The two ore types are selectively handled and separated during mining and processing due to the different mineral processing requirements for gold extraction.

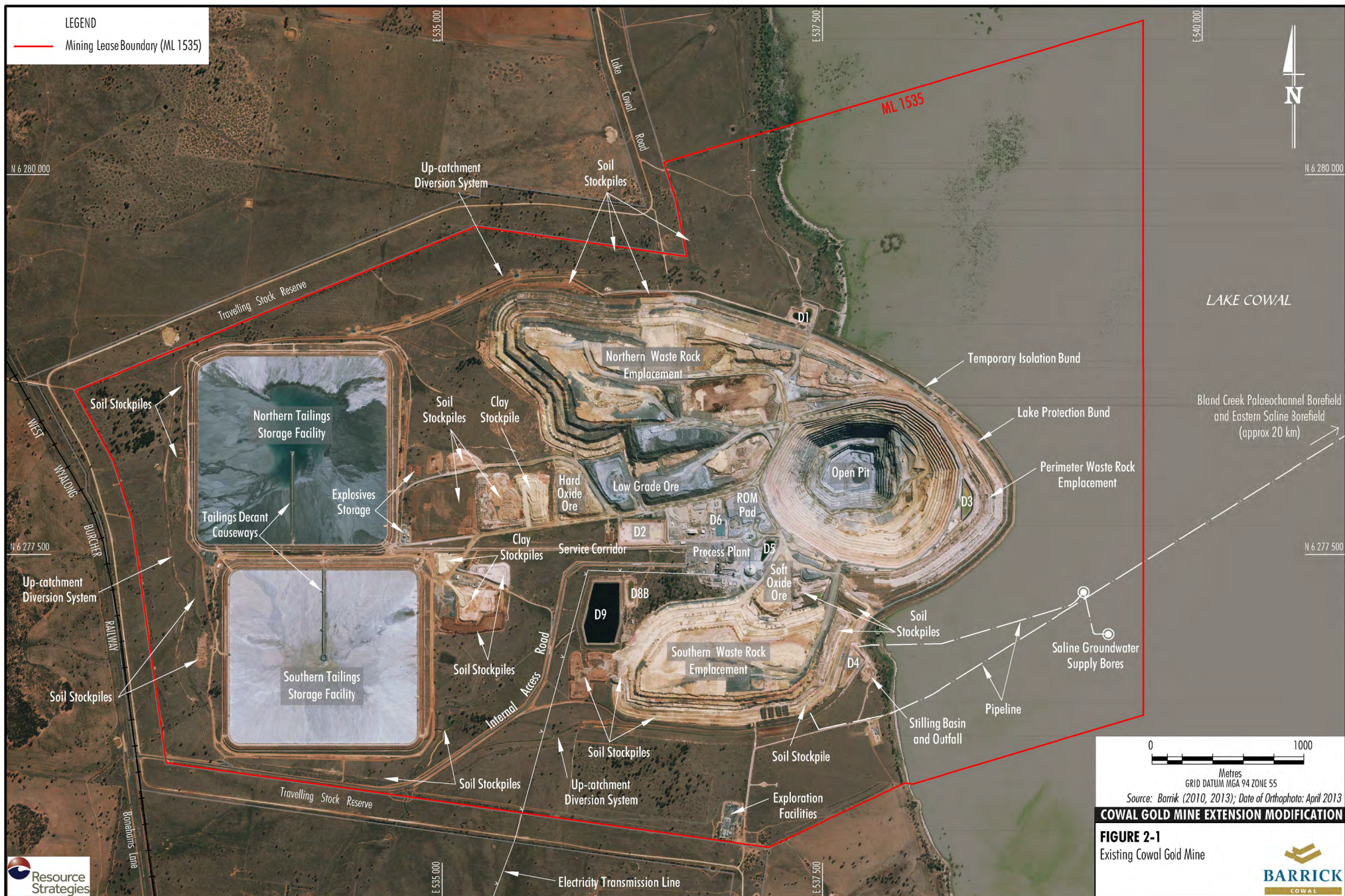
The CGM is approved to produce approximately 99 Mt of ore over the mine life. Based on ore grade estimates, total gold production for the approved CGM is approximately 3.1 Moz.

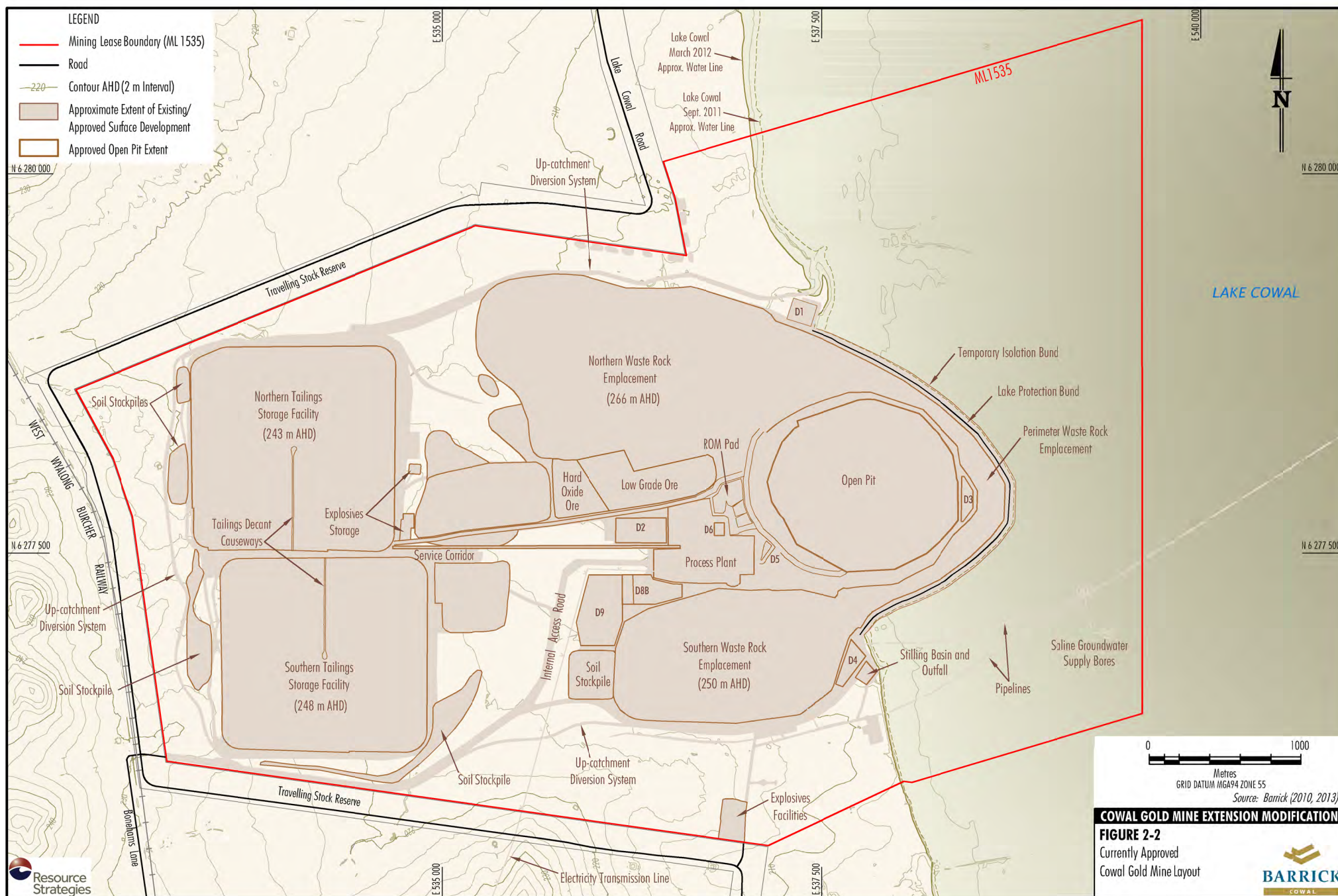
Mining operations at the CGM commenced in 2005, and operations are currently approved to continue until 31 December 2019.

2.3 MINING OPERATIONS

Mining operations at the CGM are currently conducted in accordance with Development Consent (DA 14/98) and the conditions of ML 1535.

The CGM operates 24 hours per day, seven days per week.





2.3.1 Mining Method Overview

Conventional open pit mining methods are used at the CGM. Waste rock and ore is broken through a routine sequence of in-pit drilling and blasting.

Broken waste rock is loaded into large rear dump trucks using hydraulic excavators and is then hauled from the open pit to be placed within the dedicated waste rock emplacements or, in the case of ore, direct to the primary crusher (adjacent to the process plant), ROM pad or to the low grade ore stockpile (Figure 2-2).

The open pit has been developed in stages as the orebody is progressively mined via widening and deepening of the open pit.

2.3.2 Open Pit Design

The current open pit area is shown on Figure 2-1. The final dimensions of the currently approved open pit are a surface area of approximately 107 ha and a depth of approximately 390 m (from the natural surface).

The open pit has been designed to operate in consideration of factors of safety appropriate for operating conditions and for the long-term stability of the lake protection bund. Ongoing review of pit wall stability is conducted at the CGM, and berm widths and slopes angles are reviewed and monitored through on-going geotechnical studies.

The *Cowal Gold Project Monitoring Programme for Detection of any Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit-Void Walls* (LPBMP) (Barrick Australia Limited, 2003) describes a monitoring programme and management measures in the event of detection of any movement of the open pit walls.

2.3.3 Mobile Equipment Fleet

The existing mobile equipment fleet used for ore extraction, waste rock handling and tailings storage facility lift construction includes excavators, haul trucks, dozers, loaders, water trucks, dump trucks, scrapers, compactors, graders and drill rigs.

2.3.4 Blasting

Ore and waste rock material is broken by drill and blasting techniques. The magnitude of blast sizes is typically approximately 172 kilograms (kg) maximum instantaneous charge. The blasting frequency employed at the CGM is generally limited to one blast event per day.

2.4 MINE WASTE ROCK MANAGEMENT

Waste rock is placed in a contiguous waste rock emplacement around the open pit consisting of the following three areas (Figure 2-2):

- northern waste rock emplacement;
- southern waste rock emplacement; and
- perimeter waste rock emplacement.

2.4.1 Waste Rock Geochemistry

Waste rock geochemistry investigations (North Limited, 1998; Environmental Geochemistry International Pty Ltd, 2004; Geo-Environmental Management Pty Ltd [GEM], 2008) have been conducted for the waste rock mined at the CGM and has been classified as non-acid forming (NAF). The results indicate:

- oxide waste rock will typically be saline but NAF; and
- primary waste rock will typically be non-saline and NAF, however sulphate salts will be generated if exposed to surficial weathering processes.

As the waste rock is typically NAF, no specific acid rock drainage management measures have been required at the CGM. However, due to the potential for saline seepage occurring from the waste rock emplacements, the waste rock emplacements have been constructed to facilitate the direction of any permeating waters towards the open pit (Section 2.4.2).

2.4.2 Northern and Southern Waste Rock Emplacements

The northern waste rock emplacement has been designed to contain the majority of the waste rock generated from the CGM. The northern waste rock emplacement and the southern waste rock emplacement are located to the north-west and south-west of the open pit, respectively (Figure 2-1).

The approved maximum height of the northern waste rock emplacement is 266 m AHD, and the approved maximum height of the southern waste rock emplacement is 250 m AHD (Figure 2-2).

The outer batters of the northern and southern waste rock emplacements are designed to have a final profile with an overall 1 vertical (V):5 horizontal (H) slope.

Design configurations for the northern and southern waste rock emplacements are detailed in Mining Operations Plans (MOPs) for the CGM, which are approved by the DRE.

The mine waste rock emplacements have been designed to meet the long-term goal of directing potential seepage generated from waste rock emplacement areas during operation and post-closure toward the open pit.

This has involved construction of a low permeability basal layer for the waste rock emplacement which slopes towards the open pit and would provide drainage control (i.e. the base drainage control zone). Waters permeating through the waste rock emplacements would be intercepted by this low permeability layer and ultimately flow to the open pit.

In accordance with EPL 11912 for the CGM, the waste rock emplacement base drainage control zones have been designed with a minimum slope towards the open pit of 1(V):200(H).

The northern waste rock emplacement also contains segregated mineralised material. If appropriate market conditions allow, the mineralised material would be processed. However, if appropriate market conditions do not prevail, the mineralised material would remain as part of the final northern waste rock emplacement landform (Section 5).

2.4.3 Perimeter Waste Rock Emplacement

The perimeter waste rock emplacement has been constructed to surround the open pit to the north, east and south (Figure 2-1). The perimeter waste rock emplacement forms part of the series of embankments (i.e. temporary isolation bund and lake protection bund) between the open pit and Lake Cowal. The perimeter waste rock emplacement is located behind the lake protection bund (Figure 2-1) and has been constructed from mined oxide waste rock.

The approved maximum height of the perimeter waste rock emplacement is 223 m AHD.

The existing temporary isolation bund and lake protection bund are described further in Section 2.7.

2.5 ORE PROCESSING

Ore at the CGM is differentiated into oxide and primary ore. Gold is extracted from the ore using a conventional carbon-in-leach cyanide leaching circuit in the process plant.

The process plant operates at approximately 890 tonnes per hour (tph) for oxide ore and approximately 925 tph for primary ore on average. The ore processing rate at the CGM is currently approved up to 7.5 Mtpa.

The gold extracted from the ore is recovered and poured as gold bars or doré. The finely ground rock residue left after the leaching process (i.e. tailings) is passed through a cyanide destruction process before being discharged to the tailings storage facilities.

2.5.1 Cyanide Use

The use of cyanide at the CGM is managed in accordance with the existing Cyanide Management Plan. Sodium cyanide is taken from the storage facility at the CGM as required and mixed in a dedicated mixing tank. The cyanide solution (mixed to 30%) is conveyed to a storage tank then to the leaching circuit in the process plant. Cyanide consumption for the primary and oxide circuits is approximately 0.3 and 0.8 kg of cyanide per tonne of ore, respectively.

2.5.2 Cyanide Destruction

As described above, the tailings slurry is passed through a cyanide destruction process before being discharged to the tailings storage facilities.

The CGM Development Consent (DA 14/98) details the approved cyanide concentrations in the aqueous component of the tailings slurry stream at the process plant (measured via an automated sampler), which are:

- 20 mg/L CN_{WAD} (90th percentile over 6 months); and
- 30 mg/L CN_{WAD} (maximum permissible limit at any time).

CN_{WAD} levels in the aqueous component of the tailings slurry stream are monitored twice daily. To date, there has been no exceedance of the approved cyanide concentrations detailed in the CGM Development Consent (DA 14/98).

Cyanide destruction at the CGM is achieved via the use of either Caro's Acid or the INCO process.

Caro's Acid is a mixture of sulphuric acid and hydrogen peroxide. The INCO process involves the introduction of sulphur dioxide as sodium metabisulphite. Similar to Caro's Acid, the main by-product from the INCO destruction process is cyanate which decays through natural processes.

The quantity of reagents added to the tailings (for either the Caro's Acid or INCO processes) is regulated by an on-line free cyanide measurement to monitor the effectiveness of cyanide destruction in the tailings. The most recent independent professional third party re-certification International Cyanide Management Code audit occurred in February 2012, and found that the CGM operations maintained full compliance during the previous 3 years.

2.6 TAILINGS MANAGEMENT

Tailings are delivered from the process plant via a pipeline to two tailings storage facilities located approximately 3.5 km west of the Lake Cowal shoreline (Figure 2-1). The approved maximum heights of the northern and southern tailings storage facilities are 243 m AHD and 248 m AHD, respectively (Figure 2-2).

An initial starter embankment for each tailings storage facility was constructed to provide storage for tailings produced at the commencement of operations at the CGM.

As the tailings storage facilities are filled, the embankments are raised in a series of upstream lifts constructed using waste rock stockpiled during mining operations, with the lift section extending from the existing embankment crest and supported by the dry tailings beach.

The batter angles of each lift are approximately 1(V):3(H), with the overall batter angles of the tailings storage facilities approximately 1(V):5(H).

The tailings storage facilities are constructed using soft oxide waste rock material stockpiled during mining operations.

The tailings storage facilities have been designed with sufficient freeboard to store water from a 1 in 1,000 average recurrence interval (ARI) rainfall event. The required free-board is maintained as the storage fills with tailings via a series of embankment lifts.

Following tailings deposition, supernatant water drains to the central pond and decant towers. The decant tower is accessible via a causeway. An underdrainage pipe network has also been installed to facilitate drainage of the tailings mass. The bulk of the water from each tailings storage drains from the surface of the tailings and collects in the centre of each storage.

This water, as well as underdrainage water, is reclaimed and used within the process plant. The decant system (including access causeway) is progressively raised during development of the tailings storage facilities.

A number of seepage control measures have been incorporated into the tailings storage facilities for the CGM, including:

- the pre-stripping of surficial soils beneath the embankment footprint;
- construction of a moisture-conditioned and compacted-low-permeability storage floor, where necessary, to achieve permeability criteria;
- excavation of a central cut-off trench along the length of the starter embankment to a nominal 2.5 m below surface level or to the depth of a low-permeability clay layer, and backfilled with compacted and moisture-conditioned low permeability clay; and
- installation of an underdrainage and decant network.

2.7 SITE WATER MANAGEMENT INFRASTRUCTURE

The CGM water management infrastructure is designed to contain potentially contaminated water (contained water) generated within the mining area, and to divert all other water around the perimeter of the site. The existing CGM water management infrastructure is comprised of the following major components described below.

2.7.1 Lake Isolation System

The lake isolation system has been constructed to hydrologically isolate the open pit development area from Lake Cowal during mining and post-mining. The lake isolation system is comprised of a series of isolation embankments designed to prevent the inflow of water from Lake Cowal into the open pit development area. The lake isolation system includes the temporary isolation bund, lake protection bund and perimeter waste rock emplacement (Figure 2-1).

Plate 2-1 shows Lake Cowal at its maximum capacity (March 2012) during the recent lake-fill event, as well as the components of the lake isolation system and the separation of the lake and the open pit.

2.7.2 Up-catchment Diversion System

The UCDS conveys upper catchment surface runoff around the western edge of the CGM and into existing drainage line to the north and south of the CGM (Figure 2-1). The function of the UCDS on the northern side of the CGM is shown on Plate 2-1.

2.7.3 Internal Catchment Drainage System

The function of the ICDS is to separate surface runoff external to the CGM from contained waters generated within the CGM disturbance area.

The ICDS is a permanent water management feature that involves a low bund running alongside the UCDS from the western side of the tailings storage facilities extending around the northern and southern perimeter of the northern and southern waste rock emplacements, respectively

Surface water that is collected within the ICDS is managed by a series of contained water storages, bunds and drains.

Contained water storages D1 to D5 and D8B (Figure 2-2) are used to contain surface water runoff from the mine waste rock emplacements and general site area. Water is pumped to contained water storages D6 or D9 (process water supply storages) (Figure 2-2) for use during ore processing. The contained water storages have been designed to contain a minimum 1 in 100 year ARI rainfall event or greater. D6 and D9 have been designed to contain a 1 in 1,000 year ARI rainfall event.

Any overflow from contained water storages within the ICDS would be directed towards the open pit.

Contained water storages are shown on Plate 2-1.

2.7.4 Integrated Erosion, Sediment and Salinity Control System

Sediment control structures, dams and waterways around individual infrastructure components have been constructed at the CGM as part of the ICDS, in accordance with the erosion and sediment control strategies described in the existing Erosion and Sediment Control Management Plan.

2.7.5 Open Pit Sump and Dewatering Borefield

An open pit dewatering programme is currently in operation at the CGM to manage surface water and groundwater inflows to the open pit.

The catchment area draining to the open pit during operation is restricted to the open pit (i.e. incident rainfall) and the small perimeter area enclosed by an external bund.

Water management structures have been installed to divert water from other areas outside the external bund to contained water storages.

The open pit includes water management structures (face seepage collection drains) and an in-pit sump in the floor of the open pit with capacity to contain a 1 in 10 year ARI rainfall event.

The open pit dewatering bores are located on the periphery and within the open pit extent. Individual bores have been located to coincide with structures/features (shear zones, fractured dykes and faults). Saline groundwater generated during open pit dewatering is pumped to the contained water storages for use in ore processing. A network of piezometers has been installed to monitor groundwater draw-down levels over time.

2.8 WATER SUPPLY

Water for the CGM is required mainly for ore processing, as well as dust suppression and potable and non-potable uses.

The total water supply requirement for the process plant is estimated to be approximately 0.9 kilolitres per tonne (kL/t) for primary ore processing and up to approximately 1.7 kL/t for oxide ore processing.

The majority of water used in processing operations is recycled within the process plant. Water losses from the system include tailings pore water and evaporative loss principally from the tailings storage facilities. Water used for ore processing is sourced from the following internal and external sources:

- Internal water sources (within the ICDS):
 - water returned from the tailings storage facilities, which is stored in contained water storage D6 (process water supply storage);
 - water from the open pit sump and dewatering borefield which is stored in contained water storages D6 and/or D9 (process water supply storages); and



- runoff water from the waste rock emplacements, open pit area and other areas within the ICDS which is collected in contained water storages and transferred to the process water supply storages (D6 and/or D9) for re-use in the process plant.
- External water sources (i.e. outside the ICDS):
 - water from the saline groundwater supply bores within ML 1535;
 - water from the eastern saline borefield located approximately 10 km east of Lake Cowal's eastern shoreline;
 - water from the Bland Creek Palaeochannel Borefield, which is pumped from four production located approximately 20 km to the east-northeast of the CGM in accordance with approved extraction limits; and
 - licensed water accessed from the Lachlan River, which is supplied via a pipeline from the Jemalong Irrigation Channel.

Some water from the external water supply sources is treated by a Reverse Osmosis (RO) plant prior to use in the process plant or to satisfy other operational requirements. Brine from the RO plant is disposed of in the tailings storage facilities.

Further description of external water sources is provided below.

2.8.1 Saline Groundwater Supply

The locations of the existing saline groundwater supply bores within ML 1535 are shown on Figure 2-1.

Water extraction from the saline groundwater supply is licensed by Water Access Licence (WAL) 31904 under *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*, which has an annual extraction limit of 3,660 units (~3,660 ML) (cumulatively with the open pit sump and dewatering borefield).

In practice, water extraction from the saline groundwater is currently limited to a maximum of approximately 0.7 ML/day (256 ML/annum) due to the capacity of existing pumping infrastructure.

The existing saline groundwater supply bores are not currently operational due to the inundation of Lake Cowal.

2.8.2 Eastern Saline Borefield

The location of the existing eastern saline borefield is shown on Figure 1-2.

Under Development Consent (DA 2011/64) (issued by the Forbes Shire Council) the eastern saline borefield is approved to operate until the end of 2015.

Water extraction from the bores within eastern saline borefield is licensed under the NSW *Water Act, 1912* by the conditions of bore licences, which provide a zero ML licence allocation with an allowable temporary transfer of up to 750 ML/annum per bore. The conditions of bore licences 70BL233231 and 70BL233233 would prevail until a WAL with a zero unit share allocation is issued under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*.

2.8.3 Bland Creek Palaeochannel Borefield

The location of the existing Bland Creek Palaeochannel Borefield is shown on Figure 1-2.

Water extraction is licensed by WAL31864 under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*, which has an annual extraction limit of 3,650 ML¹. The CGM Development Consent (DA 14/98) currently limits the life of mine extraction from the Bland Creek Palaeochannel Borefield to 30,000 ML and daily extraction to 15 ML/day.

Groundwater Contingency Strategy

In addition to the above, existing extraction from the Bland Creek Palaeochannel Borefield is managed in accordance with groundwater trigger levels developed in consultation with the NOW and other water users within the Bland Creek Palaeochannel, including stock and domestic users and irrigators, as detailed in the CGM Site Water Management Plan.

The trigger levels are as follows:

- Bland Creek Palaeochannel Borefield area: Bore GW036553 (trigger levels of 137.5 m AHD and 134 m AHD).
- Billabong area: Bore GW036597 (trigger level 145.8 m AHD).
- Maslin area: Bore GW036611 (trigger level 143.7 m AHD).

¹ Based on 1 ML per unit share.

Groundwater levels associated with the Bland Creek Palaeochannel Borefield are monitored on a continuous basis by the NOW's groundwater monitoring bore GW036553.

Investigation and mitigation contingency measures have been developed should groundwater levels reach either relative level (RL) 137.5 m AHD (trigger for investigation) or RL 134 m AHD (trigger for mitigation).

To date, the effect of the Groundwater Contingency Strategy is that pumping from the Bland Creek Palaeochannel Borefield ceases when required to meet the trigger levels described above, and water requirements at the CGM are met by alternative internal or external water supplies, including Lachlan River Water Entitlements (Section 2.8.4).

2.8.4 Lachlan River Water Entitlements

Water from the Lachlan River is accessed by purchasing Temporary water available from the regulated Lachlan River trading market in accordance with Barrick's High Security (WAL14981 and WAL13749) and General Security (WAL13748) zero allocation WALs.

When required, water from the Lachlan River is accessed by purchasing temporary water available from the regulated Lachlan River trading market (Appendix B).

During the life of the existing CGM there has been reliable supply of temporary water available from the Lachlan River trading market, including during years of drought.

2.9 ELECTRICITY SUPPLY

Electricity to the site is provided via the existing 132 kV ETL from Temora.

2.10 OTHER SUPPORTING INFRASTRUCTURE AND SERVICES

The CGM has extensive existing infrastructure and services to support its operations, including (in addition to those described in the preceding sub-sections):

- soil stockpiles;
- minor internal roads and haul roads;
- mine access road;
- mineral exploration infrastructure;
- open pit dewatering bores;
- waste storage and transfer facility;
- administration buildings;
- workshop facilities;
- tailings storage facility fence; and
- ML 1535 perimeter fence.

2.11 WORKFORCE

The existing operations at the CGM have an average workforce (including Barrick staff and on-site contractor's personnel) of approximately 385 people. During peak periods, the CGM employs up to 435 people.

2.12 ENVIRONMENTAL MONITORING AND MANAGEMENT

Environmental management at the CGM encompasses a range of management plans and monitoring programmes overseen by statutory planning provisions. Approved and internal management plans/monitoring programmes include:

- Blast Management Plan;
- Bushfire Management Plan;
- Compensatory Wetland Management Plan;
- Cyanide Management Plan;
- Dust Management Plan;
- Emergency Response Plan;
- Erosion and Sediment Control Management Plan;
- Final Hazard Analysis (FHA);
- Fire Safety Study;
- Flora and Fauna Management Plan (FFMP);
- Hazard and Operability Study (HAZOP);
- Hazardous Waste and Chemical Management Plan;
- Heritage Management Plan;
- Implementation of the Threatened Species Management Protocol;
- Indigenous Archaeology and Cultural Heritage Management Plan;
- Land Management Plan (LMP);
- Landscape Management Plan;
- LPBMP;
- Noise Management Plan (NMP);
- Site Water Management Plan;

- Soil Stripping Management Plan;
- Surface Water, Groundwater, Meteorological and Biological Monitoring Programme – Construction Phase;
- Surface Water, Groundwater, Meteorological and Biological Monitoring Programme – Mine Operations;
- Traffic Noise Management Plan; and
- Transport of Hazardous Materials Study.

Barrick maintains an extensive monitoring programme (Figure 2-3) whereby data is collected, analysed and maintained for reporting, future examination and assessment.

