COWAL GOLD OPERATIONS

WATER MANAGEMENT PLAN

March 2022

Revision Status Register

Section/Page/ Annexure	Revision Number	Amendment/Addition	Distribution	DPE Approval Date
All	SWMP October 2003 Document No: SWMP-M (71263)	Original Site Water Management Plan (SWMP)	DLWC, EPA, DIPNR	October 2003
All	Addendum dated September 2004 Document No: 71195	Addendum to reflect temporary management of water from the Bland Creek Palaeochannel borefield and temporary management of saline water during the development of the open pit dewatering bores.	DLWC, EPA, DIPNR	December 2004
All	Addendum dated October 2006 Document No: 71207	Addendum to reflect Development Consent as modified on 23 August 2006.	DNR, DEC, DoP	December 2006
All	Revised SWMP November 2010 Document No: SWMP-Q (373069)	Revised to reflect Development Consent as modified on 10 March 2010.	DP&I, NOW, DECCW	-
All	Revised SWMP November 2011 Document No: SWMP-R (403032)	Revised to reflect comments received from the DP&I in August 2012.	DP&I, NOW and EPA	-
All	Revised SWMP dated August 2013 Document No. SWMP-S (685079)	Revised to address comments received from the NOW and to incorporate the long-term strategy for decommissioning of water management structures at the CGM.	DP&I	Approval of the SWMP remained pending up until the NSW Minister for Planning granted approval of the CGM's modified Development Consent on 22 July 2014.
All	WMP dated May 2015 Document No: WMP-T (679350)	Revised to reflect the approved CGM Extension Modification and the Development Consent as modified on 22 July 2014.	NOW, OEH and DPIE	19 November 2015
All	WMP dated August 2017 Document No: WMP-U (870313))	WMP revised in accordance with Development Consent Condition 9.1(c)(v) to reflect Development Consent as modified on 7 February 2017.	DPI-Water, EPA and DPIE	28 August 2018
All	WMP dated March 2022 (Document No: WMPMAR2022	WMP revised to reflect outcomes of the Underground Development Project EIS and Mod 16.	DPE Water, EPA and DPE	March 2022

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1 INTRODUCTION

The Cowal Gold Operations (CGO) is located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure 1). Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the CGO. Development of the CGO occurs within Mining Lease (ML) 1535.

Development Consent (DA 14/98) for the CGO (including the Bland Creek Palaeochannel Borefield water supply pipeline) was granted by the NSW Minister for Urban Affairs and Planning under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) on 26 February 1999. Development Consent (DA 2011/64) for the operation of the Eastern Saline Borefield was granted by the Forbes Shire Council on 20 December 2010.

More recently, Evolution sought approval from the NSW Government for proposed underground mining via a State-significant Development application No. 10367 and a related modification to DA 14/98 for the *Cowal Gold Operations Underground Development Project Modification No.16* (herein referred to as Mod 16). Approval for these were granted on 30 September 2021. Collectively, these applications related to the surface (Mod 16) and underground (SSD 10367) components of the Underground Development Project (the Project).

DA14/98 generally allows:

- Mining operations until 2040.
- Ore processing at a rate of 9.8 Mtpa.
- Tailings and waste rock emplacement on site.
- Operation of a range of ancillary mining infrastructure.

SSD 10367 generally allows:

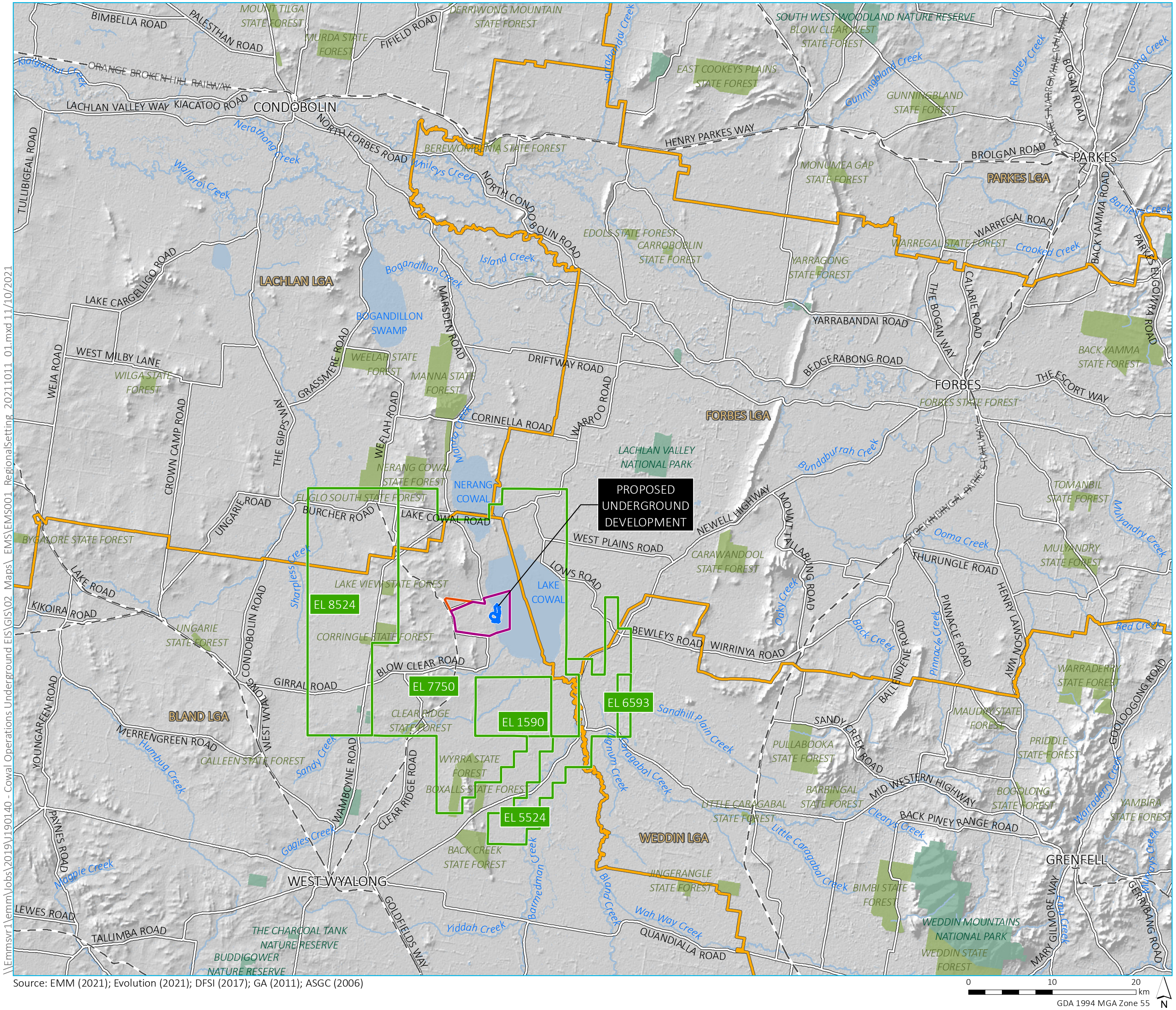
- Underground stope mining until 2040.
- Backfilling the stopes with cemented paste made from tailings.
- Development of ancillary infrastructure including a box-cut to the underground mine and a paste fill plant.

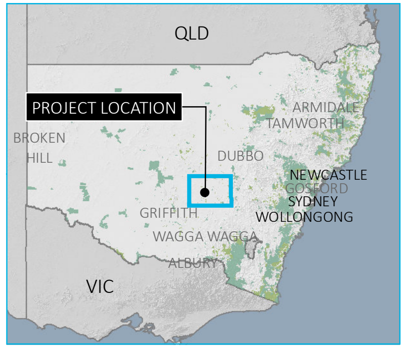
The general arrangement of the approved CGO is provided in Figure 2.

A copy of the CGO's approved development consents (DA 14/98) and SSD 10367 (as approved on 30 September 20121) are available on Evolution's website (www.evolutionmining.com.au).

This revised Water Management Plan (WMP) has been prepared to reflect the DA 14/98 condition 4.4 and SSD 10367 condition B9 as approved on 30 September 2021 and supersedes all former revisions of the WMP.

As required by DA 14/98 condition 4.4(b), DPE Water, EPA, FSC, DPI Fisheries, DSNSW and Resources Regulator; were consulted during the preparation of this WMP.





KEY

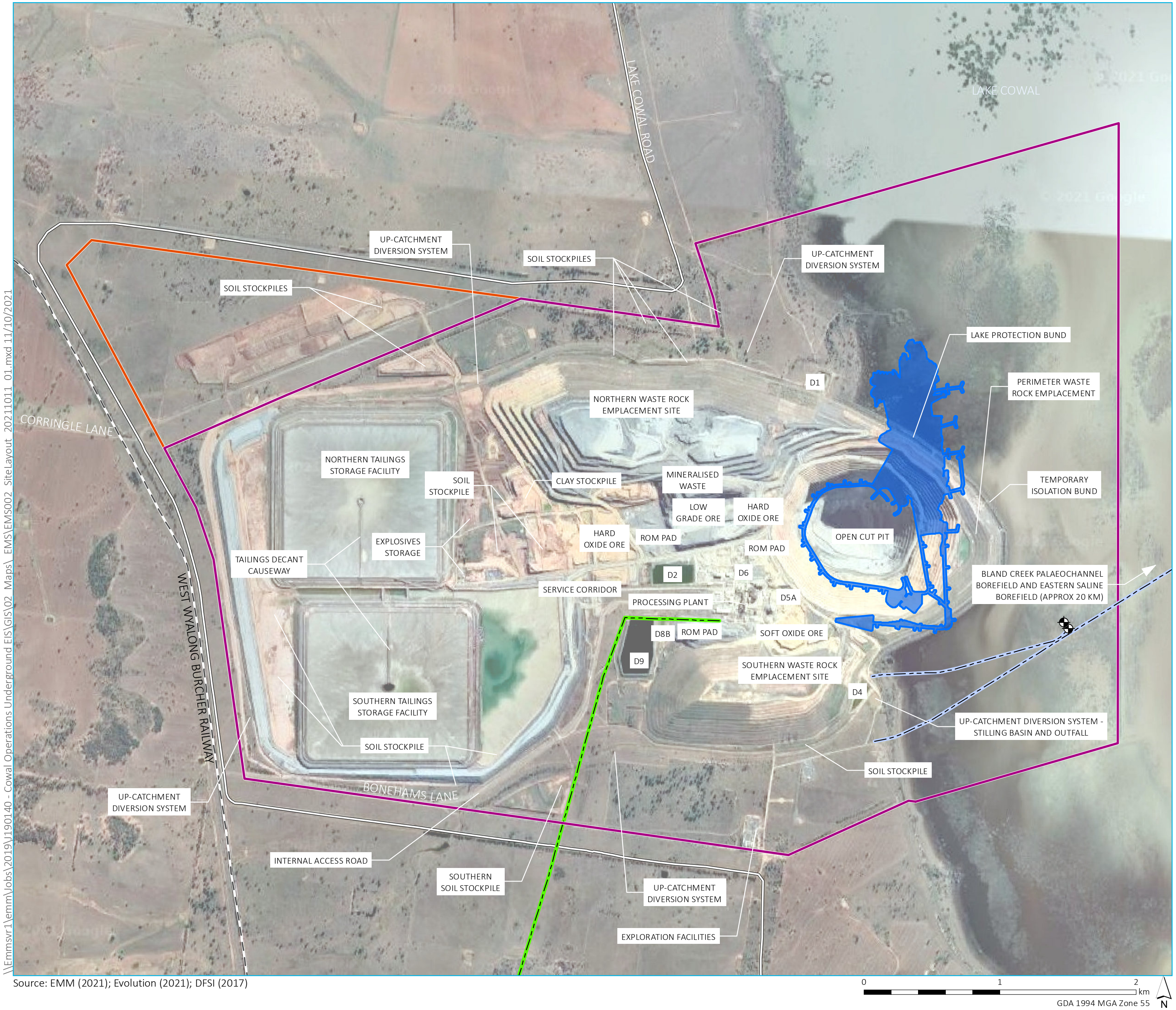
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Exploration licence (EL)
- Rail line
- Main road
- Named watercourse
- Waterbody
- Local government area
- NPWS reserve
- State forest

Source: EMM (2021); Evolution (2021); DFSI (2017); GA (2011); ASGC (2006)

Regional location

Evolution Mining
Cowal Gold Operations
Environmental Management Strategy
Figure 1

creating opportunities



Source: EMM (2021); Evolution (2021); DFSI (2017)

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KEY

- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Approximate exploration focus area
- Electricity transmission line
- Water supply pipeline
- Saline groundwater supply bore
- Rail line
- Main road

Cowal Gold Operations site layout

Evolution Mining
Cowal Gold Operations
Environmental Management Strategy
Figure 2

EMM creating opportunities

1.1 OBJECTIVES AND SCOPE

Objectives

This WMP establishes the following objectives for the CGO site water management system:

- preventing any degradation in the quality of any surface water (including waters within Lake Cowal) and groundwater, through the containment of all potentially contaminated water (contained water) generated within the CGO area and diversion of all other water around the perimeter of the site;
- managing the quantity of surface water and groundwater within and around the mine site through the appropriate design (i.e. sizing), construction and operation of water management structures; and
- establishing a monitoring, review and reporting programme that facilitates the identification of potential surface water and groundwater impacts and the development of ameliorative measures as necessary, including provision of appropriate compensation measures for landholders affected by changes to the flood regime of Nerang Cowal.

A programme for reporting on the effectiveness of water management systems and their performance against these objectives is presented in Section 8.

Scope

In achieving the above objectives, this WMP has been prepared to fulfil the requirements of DA 14/98 condition 4.4 (as presented in Section 2.1) through the collection, analysis (including modelling) and reporting of surface and groundwater data that will enable the identification of potential impacts and the planning and implementation of preventative and mitigating measures to avoid or minimise environmental harm.

This WMP has been revised to reflect conditions of approval on SSD 10367 and the modifications to DA 14/98 approved on 30 September 2021 and to reflect the approved Underground Development Project. This WMP is an outcome of the CGO's Environmental Management Strategy prepared in accordance with DA 14/98 condition 9.1(a).

1.2 STRUCTURE OF THIS WMP

This WMP is structured as follows:

Section 1:	Provides an introduction to the approved CGO and this WMP and outlines the objectives and scope of the WMP.
Section 2:	Defines relevant approval and statutory requirements that apply to this WMP and to water management for the CGO.
Section 3:	Outlines the local hydrological regime.
Section 4:	Presents site water management measures to be implemented during the construction and operation phases of the CGO and outlines the monitoring programmes required by Development Consent Condition 4.5.
Section 5:	Describes measures to be implemented to prevent the degradation of water quality in local watercourses.
Section 6:	Identifies possible adverse effects on environmental and agriculture values associated with changes in the site hydrology, dewatering and potential changes in flood regime and their mitigation.
Section 7:	Outlines the decommissioning and post-closure management of water management structures.
Section 8:	Discusses the reporting, review and notification requirements for this WMP.
Section 9:	Describes community consultation obligations and independent review procedures.

2 STATUTORY REQUIREMENTS

2.1 DEVELOPMENT CONSENT CONDITIONS

SSD 10367 condition B9 and DA 14/98 condition 4.4(a) have identical requirements for this WMP. These requirements and where they are addressed in this WMP are provided in Table 1.

Table 1
Development Consent Conditions for this WMP

Development Consent Condition	Section
4.4 (DA 14/98)/ B9 (SSD 10367) Water Management Plan The Applicant must prepare a Water Management Plan for the Cowal Gold Operations to the satisfaction of the Planning Secretary. This plan must: (a) be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary; (b) be prepared in consultation with DPE Water, EPA, FSC, DPI Fisheries, DSNSW and Resources Regulator; (c) be submitted to the Planning Secretary for approval prior to commencing any construction works associated with the Underground Mine Development and/or Modification 16 as described in the EIS, unless the Planning Secretary agrees otherwise; (d) include a:	
(i) Site Water Balance that: • includes details of:	(d)i Section 4.2.2
o predicted inflows and outflows;	Section 4.2.2,
o sources and security of water supply, including contingency planning for various climate scenarios and allocations;	Section 4.2.2,
o preferential water supply to prioritise internal and poorer quality water supplies over external and higher quality water supplies;	Section 4.2.2,
o measures to ensure that average extraction of water from the borefields does not exceed the relevant performance measures in Table 2.4;	Section 4, Table 8
o water use and management;	Section 4.2.2,
o any off-site water transfers; and	Section 8
o reporting procedures, including the annual preparation of an updated site water balance; and	
• investigates and implements all reasonable and feasible measures to minimise water use;	Section 4.2.2
(ii) Surface Water Management Plan, that includes:	(ii)Sections 4.1 and 4.2
• detailed baseline data on surface water flows and quality in Lake Cowal and other waterbodies (including Bland Creek and Sandy Creek) that could be affected by the Cowal Gold Operations;	See Underground Development Project EIS appendices F and G, Mod 16 appendices (G, H and I)
• a detailed description of the water management system, including the; o Up-Catchment Diversion System (UCDS); o Internal Catchment Drainage System (ICDS); and o Lake Isolation System;	Section 4.1 and 4.2
• detailed objectives and performance criteria, including trigger levels for investigating any potentially adverse impacts associated with the Cowal Gold Operations for: o the water management system; o downstream surface water flows and quality; o downstream flooding impacts; o water supply for other water users; and o lake, stream and riparian health;	Section 5.1
• a program to monitor and evaluate: o compliance with the relevant performance measures in Table 2.4 and the performance criteria established above; o the effectiveness of the water management system; o surface water flows and quality, stream and riparian health in Lake Cowal and other waterbodies (including Bland Creek and Sandy Creek) that could be affected by the Cowal Gold Operations; o downstream flooding impacts; o stability of the Lake Isolation System; and	See Surface Water, Groundwater, Meteorological and Biological Monitoring Programme

o impacts on water users; • reporting procedures for the results of the monitoring program; and • a plan to respond to any exceedances of the performance measures or performance criteria, and mitigate any adverse surface water impacts of the Cowal Gold Operations, including contingency strategies for addressing: o any discharge of pollutants from on-site water storages, tailings dams, emplacements, infrastructure and processing areas (including pipelines and borefield infrastructure); and o any identified impacts to Lake Cowal and other waterbodies;	Section 8 Section 6.4
(iii) Groundwater Management Plan, that includes: • detailed baseline data on groundwater levels, yield and quality in the region that could be affected by the Cowal Gold Operations, including privately-owned groundwater bores and groundwater dependent ecosystems;	Sections 4.1 and 4.2 Appendix D
• a detailed description of the groundwater management system, including measures to ensure that long term average extraction from the borefields remains within the levels predicted in the EIS and/or below applicable trigger levels;	Section 4
• detailed objectives and performance criteria, including trigger levels for investigating any potentially adverse impacts associated with the Cowal Gold Operations for: o the groundwater management system; o local and regional aquifers; o groundwater users bores; o groundwater inflows to the mining operations; o seepage/leachate from water storages, tailings dams, emplacements, infrastructure and processing areas, and final void; and o groundwater dependent ecosystems;	Section 5.1 Section 6
• a program to monitor and evaluate: o compliance with the relevant performance measures listed in Table 2.4 and the performance criteria established above; o the effectiveness of the groundwater management system; o groundwater inflows to the mining operations; o any localised enhanced groundwater inflows associated with faults or other structures; o seepage/leachate from water storages, tailings dams, emplacements, infrastructure and processing areas, and final void, including migration over the short and long term; o background changes in groundwater yield/quality against mine-induced changes;	Section 4.3, Surface Water Groundwater Biological and Meteorological Monitoring Programme
o impacts of the Cowal Gold Operations on: - local and regional aquifers; - Lake Cowal and other waterbodies; - groundwater supply of potentially affected landowners; - groundwater dependent ecosystems; and	Section 6
• reporting procedures for the results of the monitoring program; and	Section 8
• a plan to respond to any exceedances of the performance measures or performance criteria, and mitigate any adverse groundwater impacts of the Cowal Gold Operations, including contingency strategies for addressing: o seepage/leachate of pollutants from on-site water storages, tailings dams, emplacements, infrastructure and processing areas, and final void; o any localised enhanced groundwater inflows associated with faults or other structures; o any exceedance of trigger levels at the borefields; and	Section 6
(iv) a program to validate the water balance and groundwater model for the Cowal Gold Operations every 3 years, and compare against monitoring results with modelled predictions.	Section 4.2.3
Note: The groundwater monitoring program should provide for additional nested monitoring bores within Lake Cowal, as recommended by DPE Water in its advice to the Department dated 29 April 2021, and by the independent groundwater expert engaged by the Department (advice dated 20 May 2021). (e) (DA 14/98) / B10 (SSD 10367) The Applicant must implement the Water Management Plan as approved by the Planning Secretary.	Section 4.3.3

In addition to the above requirements, the following Development Consent conditions are also relevant to water management, including water monitoring, at the CGO. These conditions outlined in Table 2.

Table 2
Additional Development Consent Conditions Relevant to Water Management

Conditions	Section
4. WATER MANAGEMENT	
4.1 Water Supply *(a) The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations on site to match its available water supply.* *Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain all necessary water licences for the development.*	Section 4.2.2 and Appendix A
(b) The Applicant must report on water extracted from the Cowal Gold Operations each year (direct and indirect) in the Annual Review, including water taken under each water licence. *Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain all necessary water licences for the development, including during rehabilitation and post mine closure.*	Section 4.2.2 and Section 8
4.2 Compensatory Water Supply (a) *The Applicant must provide a compensatory water supply to any landowner of privately-owned land whose rightful water supply is adversely and directly impacted (other than an impact that is minor or negligible) as a result of the Cowal Gold Operations, in consultation with DPE Water, and to the satisfaction of the Planning Secretary.* (b) *The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent, in quality and volume, to the loss attributable to the Cowal Gold Operations. Equivalent water supply should be provided (at least on an interim basis) as soon as practicable after the loss is identified, unless otherwise agreed with the landowner.* (c) *If the Applicant and the landowner cannot agree on whether the loss of water is attributed to the Cowal Gold Operations or the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Planning Secretary for resolution.* (d) *If the Applicant is unable to provide an alternative long-term supply of water, then the Applicant must provide compensation, to the satisfaction of the Planning Secretary.* (e) *However, conditions 4.2(a) to 4.2(d) do not apply if the Applicant has a compensatory water agreement with the owner/s of the land and the Applicant has advised the Department in writing of the terms of this agreement.* ***Notes:*** • *The Water Management Plan (see condition 4.4) is required to include trigger levels for investigating potentially adverse impacts on water supplies.* • *The burden of proof that any loss of water supply is not due to mining impacts rests with the applicant.* • *For the avoidance of doubt, the Applicant is not required to provide compensatory water supplies under this consent if equivalent compensatory water supplies are provided under the consent for the Underground Mine Development.*	Section 6.2.3

Table 2 (continued)
Additional Development Consent Conditions Relevant to Water Management

9.3 Notification *(a) Incident Notification* *The Planning Secretary must be notified in writing via the Major Projects website immediately after the Applicant becomes aware of an incident. The notification must identify the development (including the development application number and the name of the development if it has one) and set out the location and nature of the incident. Subsequent notification requirements must be given, and reports submitted in accordance with the requirements set out in Appendix 8.*	Section 8.5
9.3 Notification (continued) *(b) Non-Compliance Notification* *The Planning Secretary must be notified in writing via the Major Projects website within seven days after the Applicant becomes aware of any non-compliance. A non-compliance notification must identify the development and the application number for it, set out the condition of consent that the development is non- compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.* *Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.*	Section 8.6

2.2 CONDITIONS OF AUTHORITY FOR MINING LEASE 1535

The Conditions of Authority for ML 1535 regulated by the Division of Resources and Geoscience (DRG) within the Department of Planning and Environment (DPE) includes requirements that relate to water pollution prevention. Those conditions include:

Prevention of Soil Erosion and Pollution

14. Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operations Plan. For the purpose of this condition, water shall be taken to include any watercourse, waterbody or groundwaters. The lease holder must observe and perform any instructions given by the Director-General in this regard.

This condition is addressed in Sections 4 and 5.

Rehabilitation

12. (a) Land disturbed must be rehabilitated to a stable and permanent form suitable for a subsequent land use acceptable to the Director-General and in accordance with the Mining Operations Plan so that:

- *there is no adverse environmental effect outside the disturbed area and that the land is properly drained and protected from soil erosion.*
- *the state of the land is compatible with the surrounding land and land use requirements.*
- *the landforms, soils, hydrology and flora require no greater maintenance than that in the surrounding land.*
- *in cases where revegetation is required and native vegetation has been removed or damaged, the original species must be re-established with close reference to the flora survey included in the Mining Operations Plan. If the original vegetation was not native, any re-established vegetation must be appropriate to the area and at an acceptable density.*
- *the land does not pose a threat to public safety.*

(b) Any topsoil that is removed must be stored and maintained in a manner acceptable to the Director-General.

This condition is addressed in Sections 4 and 5.

The Conditions of Authority for ML 1535 also include environmental performance reporting requirements associated with the Annual Environmental Management Report (AEMR) and proposed mine development reporting requirements associated with the Mining Operations Plan (MOP) or similar plan.

Condition of Authority 26 for ML 1535 includes environmental performance reporting requirements associated with an AEMR. The Annual Review (Section 8.3) will address the AEMR requirements of ML 1535 Condition of Authority 26.

Condition 25 of the Authority for ML 1535 requires the development of a Mining Operations Plan (MOP) or similar plan. In accordance with Condition 25, Evolution will continue to develop a MOP for the CGO subject to the approval of the DRG.

A new mining lease was granted on 20 June 2019 for the ML 1791 area. Currently, that lease contains no specific requirements for water management; however, as the tenement is contiguous with ML 1535, Evolution will include it in all aspects of planning and implementation of water management principles and practices.

2.3 ENVIRONMENT PROTECTION LICENCE CONDITIONS

The CGO's Environment Protection Licence No. 11912 (EPL) includes requirements relevant to surface water and groundwater monitoring locations and parameters, cyanide monitoring and cyanide concentration limits, incident notification and reporting.

This WMP will be revised as necessary to reflect the requirements of the EPL. The EPL notification and reporting requirements relevant to this WMP are outlined in Sections 8.5 and 8.6.

2.4 RELEVANT LEGISLATION

Evolution will operate the CGO in compliance with DA 14/98, SSD 10367 and other consents and permits issued under legislation for works approved under the EP&A Act*.*

In addition to the EP&A Act, the following NSW Acts are relevant to this WMP:

- *Water Management Act, 2000;*
- *Water Act, 1912;* and
- *Protection of the Environment Operations Act, 1997.*

Relevant licences or approvals required under these Acts will be obtained as required for the modified approved CGO. A summary of the CGO's groundwater monitoring programme bore licence and Water Access Licence (WAL) numbers is provided in Appendix A.

Water Sharing Plans

The Water Sharing Plans relevant to the CGO include the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2020* and the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020*. A summary of the relevant licences associated with these Water Sharing Plans is provided in Section 4.2.2.

3 OVERVIEW OF SITE HYDROLOGY

The following overviews of surface water and groundwater hydrology for the CGO area are sourced from the *Cowal Gold Operations Underground Development Environmental Impact Statement* (Evolution, 2020) which include relevant information from the *Cowal Gold Operations Processing Rate Modification Surface Water Assessment* (Hydro Engineering & Consulting Pty Ltd [HEC], 2018), the *Cowal Underground Development EIS Mine Site Hydrogeological Assessment* (Coffey Services Australia Pty Ltd [Coffey], 2020a), and the *Cowal Underground Development Bland Creek Palaeochannel Borefield and Eastern Saline Borefield Groundwater Assessment* (Coffey, 2020b).

3.1 SURFACE WATER

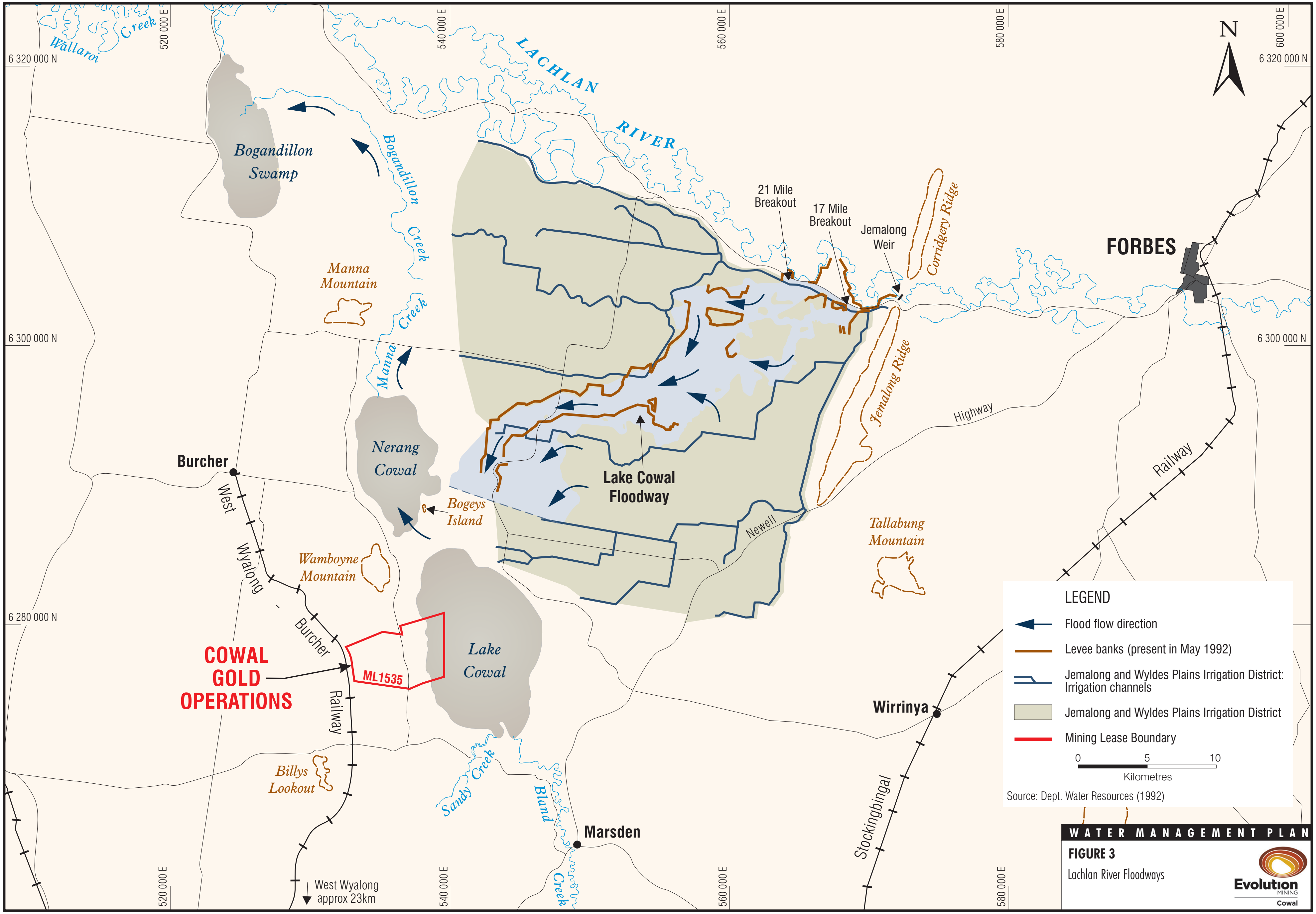
The CGO is located on the western side of Lake Cowal (Figure 3) and extends into the natural extent of Lake Cowal. Lake Cowal is an ephemeral, freshwater lake that forms part of the Wilbertroy-Cowal Wetlands which are located on the Jemalong Plain. Lake Cowal is predominantly filled by runoff from Bland Creek to the south, and flood breakout from the Lachlan River to the north (Figure 3).

The Lachlan River is the major regional surface water system, forming part of the Murray Darling Basin. Flows in the Lachlan River are regulated by releases from Wyangala Dam (HEC, 2018). Breakout from the Lachlan River to Lake Cowal occurred in late 2010, in the first half of 2012 and again in 2016. No breakouts occurred between the period 1998 and 2010.

Lake Cowal is a large oval shaped lake which, when full, occupies an area of some 105 square kilometres (km^2), holds some 150 gigalitres of water and has a maximum depth of approximately 4 metres (m). When inflows are sufficient, Lake Cowal overflows into Nerang Cowal, a smaller lake to the north-west (Figure 3). The lakes ultimately drain to the Lachlan River via Bogandillon Creek (Figure 3).

Bland Creek drains a catchment of approximately 9,500 km^2 which at its southern end reports to Lake Cowal (HEC, 2018).

Bland Creek and all other tributaries of Lake Cowal (including the drainage lines surrounding the CGO) are ephemeral. Flow records for Bland Creek indicate that runoff in the Bland Creek catchment is low, averaging approximately 5% of rainfall (HEC, 2018).



WATER MANAGEMENT PLAN

FIGURE 3

Lachlan River Floodways

HAL-02-07 CGO MP 2017_WMP_001A

Meteorology
The region experiences a semi-arid climate which is dominated by cool, wetter conditions in winter and hot and relatively dry conditions in summer (HEC, 2018). Table 3 summarises regional monthly and annual rainfall totals from the Bureau of Meteorology (BoM) stations nearest to the CGO (Wyalong, Ungarie and Burcher Post Offices [PO]), as well as rainfall recorded at the CGO since 2002.

Table 3
Rainfall Data Summary

	Wyalong PO (073054*)		**Ungarie PO** (050040)**		**Burcher PO (050010)**		**CGO**	
	Jun-1895 – Sep-2021		**Oct-1895 – Sep 2021**		**Jun-1937 – Sep-2021**		**Jan-2002 – Aug-2017†**	
	Mean Total (mm)	**Mean No. Rain days**	**Mean Total (mm)**	**Mean No. Rain days**	**Mean Total (mm)**	**Mean No. Rain days**	**Mean Total (mm)**	**Mean No. Rain days**
Jan	41.4	4.8	41.1	3.7	43.6	4.0	28.0	5.6
Feb	39.2	4.5	37.9	3.7	43.1	3.9	55.7	6.4
Mar	39.8	4.7	38.7	3.8	42.3	3.9	33.8	5.3
Apr	34.5	4.8	31.8	3.8	33.5	4.1	20.2	4.5
May	38.6	6.6	36.5	5.5	37.0	5.8	24.7	6.1
Jun	43.4	8.7	41.9	6.6	37.1	6.5	46.9	11.0
Jul	41.8	9.8	36.4	7.2	38.7	7.5	41.2	10.7
Aug	38.5	9.0	34.5	6.9	37.2	6.5	30.6	8.5
Sep	36.7	7.3	31.6	5.7	34.5	5.3	35.4	6.6
Oct	44.7	6.9	38.9	5.5	44.8	5.5	29.1	6.3
Nov	36.7	5.5	36.7	4.2	37.3	4.6	33.9	5.9
Dec	43.7	5.5	40.4	4.3	42.3	4.1	48.2	7.4
Annual	**478.2**	78.4	443.4	60.7	471.4	62.2	427.5	84.2

Source: (BOM, 2021)
* BoM Station Number.
** Data contains numerous gaps in recent years and early in the 20th century.
† Manual gauge to December 2006, automatic weather station thereafter.
mm = millimetres.
Note: Statistically, the sum of monthly means does not necessarily equal the annual mean.

Long-term regional rainfall averages approximately 456 mm per annum. Average annual rainfall recorded at the CGO from 2002 to August 2017 averages 428 mm, which compares with an annual average of 478.2 mm recorded at Wyalong PO and 471.4 mm at Burcher PO for the same period.

Lake Cowal Water Quality
Baseline water quality in Lake Cowal was typically slightly to moderately alkaline (pH 8.27 to 8.67) with low to moderate suspended solids concentrations (total suspended solids concentrations of 24 to 222 milligrams per Litre [mg/L]) (North Limited, 1998a).

Electrical conductivity (EC) was also low, varying between 222 and 1,557 microSiemens per centimetre (μS/cm) (North Limited, 1998a) and appeared to be inversely related to lake volume (i.e. solute concentrations increased as lake volumes decreased through evaporation).

Baseline cadmium, arsenic, lead, mercury and zinc levels were low, and mostly below relevant detection limits, however, copper concentrations were found to be higher than the ANZG (2018) limit for the protection of aquatic ecosystems (HEC, 2018).

Review of water quality monitoring results to date indicates the following (HEC, 2018):

- the range of pH was high relative to ANZG (2018) default triggers and baseline ranges, however has been similarly elevated at sites near and distant to the CGO;

- average copper, lead and zinc concentrations were high relative to both ANZG (2018) default triggers and baseline ranges however, these have been similarly elevated at sites on the opposite (eastern) side of Lake Cowal;
- average turbidity was significantly higher than the ANZG (2018) default trigger value and higher than baseline levels, however turbidity levels have occurred uniformly at sites close to and distant from the CGO; and
- total phosphorous concentrations were significantly higher than the ANZG (2018) default trigger value for freshwater lakes however concentrations have been similar at sites both close to the CGO and on the other side of Lake Cowal (it is also noted, measured total phosphorus is less than the baseline average).

Because runoff and water within the existing CGO is fully contained within the ICDS, there is no obvious causal link between the mining operations and the water quality in the lake (HEC, 2018). Given that groundwater, including any seepage from on-site storages, will flow toward the mine pit (Coffey, 2016), the only plausible links between mining activity at the CGO and lake water quality will be overflow from dams D1 and/or D4 (which are outside the ICDS), mine site dust fall-out onto the lake, or runoff/wash-off from the outside batters of the perimeter waste emplacement when the Temporary Isolation Bund is inundated. Both D1 and D4 storages are fitted with pump back systems and Evolution has advised[1] that they have never overflowed to date (HEC 2018). The data supports that there is no evidence that the existing CGO has resulted in changes to water quality in Lake Cowal (HEC, 2018).

3.2 GROUNDWATER

Existing Groundwater Regime

The Water Sharing Plans relevant to the CGO include the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2020* and the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020*.

A conceptual groundwater model of the existing groundwater regime was developed by Coffey (2020a) based on review of available hydrogeological data to support the two groundwater systems identified in the relevant Water Sharing Plans, which are as follows:

- alluvial groundwater system; and
- fractured rock groundwater system.

Alluvial Groundwater System

Alluvial groundwater resources within the region are generally associated with two geological formations (Coffey, 2020a):

- the Cowra Formation (i.e. Eastern Saline Borefield and saline supply bores within ML 1535), which comprises aquifers of isolated sand and gravel lenses in predominantly silt and clay alluvial deposits, with perched groundwater of generally higher salinity; and
- the Lachlan Formation (i.e. Bland Creek Palaeochannel), which comprises an aquifer of quartz gravel with groundwater of generally low salinity.

The CGO open pit intersects the Cowra Formation but does not intersect the Lachlan Formation (Figure 4). The saline groundwater supply bores within the ML 1535 extract water from the Cowra Formation. The Bland Creek Palaeochannel Borefield extracts water from the Lachlan Formation, while the eastern saline borefield extracts water from the Cowra Formation.

Fractured Rock Groundwater System

[1] Pers comm., Evolution Mining (Cowal) Pty Limited (February 2019).

The fractured rock groundwater system underlies the alluvial groundwater system, and consists of the following geological formations (Evolution, 2018):

- the Ordovician aged Lake Cowal Volcanics Complex, which comprise massive and stratified non-welded pyroclastic debris, overlying a partly brecciated lava sequence, overlying volcanic conglomerate interbedded with siltstone and mudstone; and
- overlying Siluro-Devonian Group and Ooth Formation, which comprise shallow to deep marine sedimentary units.

The CGO open pit intersects the Lake Cowal Volcanics Complex.

Groundwater Quality

Mine Site (ML 1535)

Assessment of baseline groundwater salinity levels undertaken for the EIS by Coffey Partners International (1997) reported that:

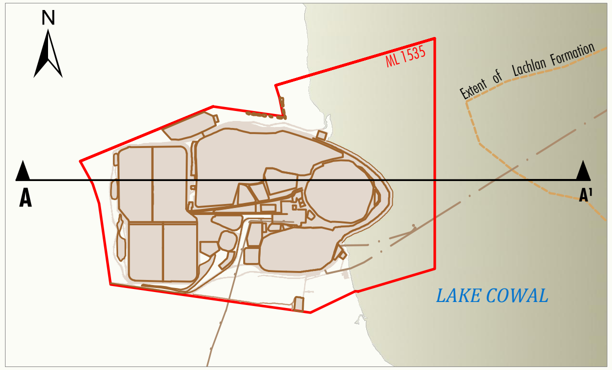
- The alluvial groundwater system had very high salinity in the range of 19,000 to 72,000 μS/cm within the open pit extent and 6,000 to 44,400 μS/cm beneath the tailings storage facilities area.
- The fractured rock groundwater system also had very high salinity in the range of 50,900 to 63,700 μS/cm.

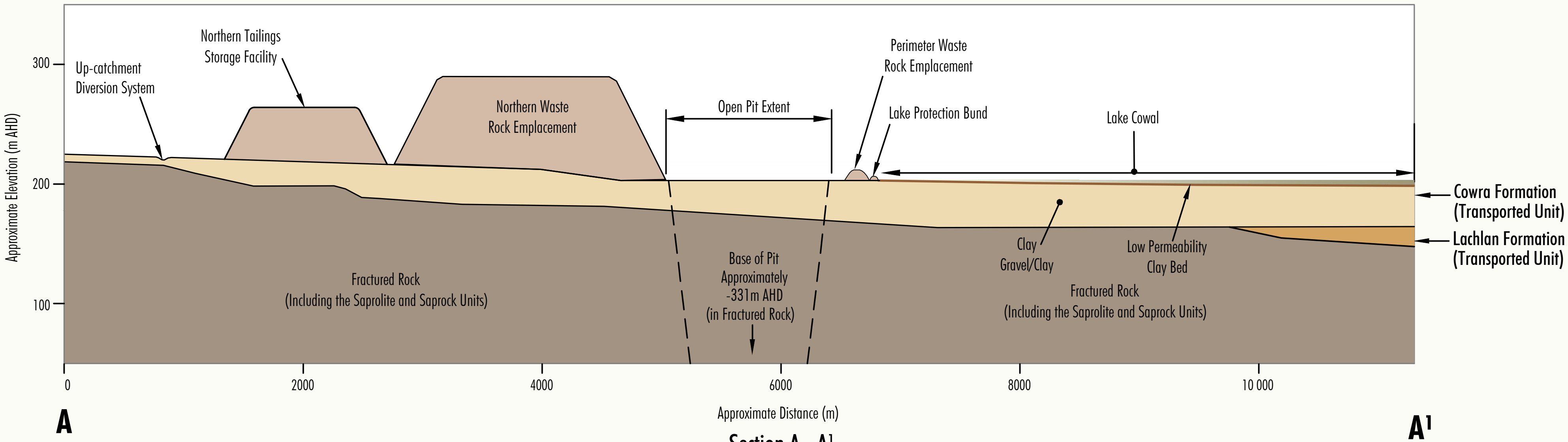
Monitoring data indicates that, while open pit dewatering is causing a localised reduction in groundwater levels, no changes in groundwater chemistry appear to be associated with this drawdown (Coffey, 2020a).

Bland Creek Palaeochannel

Groundwater quality records from monitoring bores in the Bland Creek Palaeochannel Borefield indicate decreasing salinity with depth (Coffey, 2020b). Salinity levels in the Cowra Formation are high in the Upper Cowra (i.e. up to approximately 30,000 μS/cm), lower in the Lower Cowra and approximately 2,000 μS/cm in the Lachlan Formation (Coffey, 2020b).

EC records from groundwater monitoring bores in the Bland Creek Palaeochannel indicate that salinity levels have remained reasonably constant within the three alluvial sequences since monitoring commenced in 2004 (Coffey, 2020b). While fluctuations at BLPR2 have been recorded, salinity levels fell substantially in late 2013 before indicating an overall upward trend since late 2014 (Coffey, 2020b).





Section A - A1

Not to Scale

Vertical Scale Exaggerated

LEGEND

Host units for the Lachlan Unregulated and Alluvial Water Sources

Host units for the NSW Murray Darling Basin Fractured Rock Groundwater Sources

Source: Coffey (2013)

WATER MANAGEMENT PLAN

FIGURE 4
Conceptual Hydrogeological Cross Section Across ML 1535

Evolution Mining Cowal

HAL-02-07 CGO MP 2017_WMP_103A

4 MANAGEMENT OF QUALITY AND QUANTITY OF SURFACE AND GROUNDWATER

As required by DA 14/98 condition 4.3(a) this WMP addresses the management of the quality and quantity of surface and groundwater within and around the CGO.

The CGO water management system has been designed to contain all potentially contaminated water (contained water) generated within the CGO area while diverting all other water around the perimeter of the site. The water management system includes both permanent features that will continue to operate post-closure (e.g. diversions of surface water around the site, creation of new catchment divides and isolation of the lake from the open pit), and temporary structures (servicing the life of mine requirements only). The water management system will be progressively developed during the construction and operation of the mine as diversion and containment requirements change (North Limited, 1998a).

The quantity of surface water within and around the CGO continues to be managed through a number of water management structures. The UCDS (Section 4.1.1), lake isolation system (Section 4.1.2) and ICDS (Section 4.1.3) are designed to minimise the volume of surface water within the mine site through the isolation of the mine site from Lake Cowal and the catchment above the UCDS. The quantity of surface water within and around the mine site has been managed through the sizing of these structures according to the design criteria presented in the following sections.

Surface water runoff from mine landforms and disturbed areas could potentially contain sediment, salinity, oil and grease and process reagents. Potential sources of surface water quality contamination are summarised in Table 4.

Table 4
Potential Sources of Surface Water Contamination

Source of Contamination	Type of Contamination
Waste rock emplacements	Runoff and/or seepage containing sediment, increased salinity.
Run-of-mine (ROM) and low-grade ore stockpiles and soil stockpiles	Runoff and/or seepage containing sediment, increased salinity.
Tailings storages/pipeline	Runoff and/or seepage containing dissolved salts, cyanide, other reagents and potential heavy metals.
Pit dewatering/pipeline	High salinity groundwater, direct rainfall.
Process water/pipeline	High salinity (pit dewatering make-up water) and dissolved salts.
Bore 4 pump station	Runoff containing fuel, oil, hydraulic fluid and sediments.
Saline groundwater supply borefield/pipeline	High salinity groundwater.
Process plant	Cyanide, process reagents, fuel, oil, other chemicals.
Sewage treatment area	Untreated or partially treated sewage containing bacteria, organic matter and nutrients.
Relocated explosives facility and magazine	Runoff containing chemicals.

As part of the EIS (North Limited, 1998a) and relevant subsequent modifications, detailed water studies have been undertaken in order to design a comprehensive water management system to reduce any potential surface water and groundwater impacts. Water management strategies have been developed in conjunction with the mine waste and soil management strategies to mitigate the potential impacts described above.

Management strategies for the construction and operation phases involve the following principles (North Limited, 1998a):

1. *Minimising Disturbance Areas*

   The general arrangement design has been developed to minimise the potential environmental impacts of the CGO. Specific design criteria used included the creation of a compact site layout that minimises the overall disturbance area as well as ore and waste haulage distances.
2. *Containment of Potentially Contaminated Water*

   The UCDS and ICDS provide for the diversion of upper catchment runoff and the containment of potentially contaminated water respectively. These systems are described in Sections 4.1.1 and 4.1.3 of this plan. Following the period of advance pit dewatering, the site will operate under a negative water balance.
3. *Recycling of Contained Water*

   The Internal Catchment Drainage System, a series of sediment control structures, catchment dams and waterways have been constructed around individual infrastructure components. The erosion, sediment and salinity controls for the CGO are described in the Erosion and Sediment Control Management Plan (ESCMP) and summarised in Section 4.1.4.

Surface waters that are collected within the ICDS are managed by a series of contained water storages, bunds and drains. ICDS contained water storages for CGO runoff comprise storages D1, D2, D3, D4, D5A and D8B[2]. Contained water storages D1 to D5A and D8B are used to contain runoff from the waste emplacements and general site area. Water is pumped to contained water storages D6, D9 or D10 (once constructed) (process water storages) for consumption during ore processing. A summary of the capacity and function of each of these contained water storages is provided in Section 4.2.1.

Drains have been constructed around the perimeter of the process plant and collect and channel surface waters to contained water storage D5A. Any incident rainfall, spilt process water or other substances (including spilt process chemicals in the unlikely event of a tank rupture or other accidental spill) report to this storage (North Limited, 1998a).

Upslope diversion drains and/or bunds and a sediment dam have been constructed to manage surface water runoff around the perimeter of the soil stockpiles located in the north of ML 1535 and in ML 1791 (outside the Internal Catchment Drainage System) (Figure 2). Similarly, for the southern soil stockpile (south-east of the IWL) upslope diversions and/or bunds have been constructed to manage surface water runoff. However, drainage on the eastern side of the southern soil stockpile is facilitated by the existing internal access road and ultimately drains towards the UCDS (Figure 2).

Upslope diversion drains and sediment traps have also been constructed around the perimeter of the relocated explosives compound and magazine to manage runoff and/or spills from these facilities, as required. The explosives compound is also bunded.

[2] Contained water storage D8A was filled once the open pit encroached on the D8A footprint.

During the operations phase, contained water storage D6 is the main source of make-up water for the process plant. Inputs to D6 include:

- water from the tailings storage facilities/IWL;
- water pumped from contained storages around the waste emplacements and lake protection bund (i.e. D1 to D4 and D8B);
- process plant area runoff (i.e. D5A);
- water from the open pit;
- water from the open pit dewatering borefield;
- water pumped from the saline groundwater supply borefield within ML1535; and
- waters pumped from contained water storages D9 and D10 (includes water from the Bland Creek Palaeochannel borefield, Lachlan River water source and eastern saline borefield).

Residual cyanide levels in storage D6 are expected to be well below those levels expected in the tailings storage facilities. Recycled waters from the tailings thickener will go directly to the process plant (North Limited, 1998a).

D9 contains make-up water from the Bland Creek Palaeochannel borefield and eastern saline borefield groundwater, site catchment water, pit dewatering water, incidental rainfall and Lachlan River water entitlements but does not contain supernatant water from the tailings storage facilities/IWL. Water within contained water storage D9 is pumped to D6 as required.

D10 (once constructed) will contain water from the Bland Creek Palaeochannel borefield and eastern saline borefield groundwater and Lachlan River water entitlements. The D10 process water storage will be constructed to provide additional water supply security for the first oxide ore processing campaign. Water from D10 will be pumped to D9 prior to use in the processing facilities.

Toe drains and contained water storages D1, D2, D4 and D8B have been constructed in stages around the waste emplacements and ore stockpile areas, as required. These structures are designed to capture any potentially saline surface runoff or seepage emanating from the waste emplacement areas.

Any contained water generated on the top surface and internal batters of the perimeter waste emplacement will be directed to a contained water storage located adjacent to the eastern edge of the open pit (contained water storage D3).

The contained water storages are managed in such a manner to minimise potential water quality impacts. Containment storages have been sized to contain all water to at least a 1 in 100 year average recurrence interval (ARI) rainfall event (or a 1 in 1,000 year ARI rainfall event for those storages containing runoff from the plant site and tailings storages). The 1 in 100 year and 1 in 1,000 year ARI events are quantified in Section 4.2 of this WMP.

4. *Progressive Stabilisation and Revegetation of Disturbed Areas*

   Areas disturbed during mining operations are progressively rehabilitated during the mine life. Rehabilitation involves re-profiling of mine landforms, where necessary, to provide the required long-term landform stability. Following stabilisation, the available areas are revegetated with appropriate plant species. It is anticipated that once rehabilitated areas become fully established, surface runoff will be of comparable quality to neighbouring (non-mined) areas.

Rehabilitation works will be undertaken in accordance with the CGO Rehabilitation Management Plan (RMP) and Condition 12 of the Authority for ML 1535 (Section 2.2) and will be described in the MOP in accordance with Condition of Authority 25(4)(b).

Regard shall also be had to the general principles of vegetation stabilisation contained within Managing Urban Stormwater – Soils and Construction Volume 2E Mines and Quarries (Department of Environment and Climate Change [DECC], 2008), and the DPE Water's relevant Guidelines for *Controlled Activities*.

The above principles guide the management of the quantity of water at the CGO. The minimisation of areas of disturbance and the progressive stabilisation and revegetation of disturbed areas minimises the volume of water to be managed at the CGO, while the containment of potentially contaminated water and the recycling of contained water reduces the quantity of water required for the CGO from the Bland Creek Palaeochannel borefield and eastern saline borefield and the Lachlan River (via the Jemalong irrigation channels).

These principles also contribute directly to the management of water quality through the minimisation of potential for contamination of waters. Minimising the area of disturbance and progressive stabilisation and revegetation of disturbed areas reduces the potential for contamination of surface waters through contact with exposed soils (e.g. suspended solids). The potential for off-site water quality impacts is also minimised through the isolation, containment and reuse of contaminated waters.

Surface water quality will also be managed through the construction and operation of the water management structures described in Sections 4.1 and 4.2. The isolation of the mine site from the lake and upper catchment is designed to minimise the potential for mine-related impacts on surface waters around the mine site, including Lake Cowal. Within the mine site and around areas of disturbance associated with the development of the CGO, surface water quality will be managed through the operation of the integrated erosion, sediment and salinity control system (Section 4.1.4). The site water management system is designed to contain and manage saline surface water in order to manage river salinity as described in the ESCMP.

Management of the quantity and quality of groundwater within and around the mine site is primarily related to the operation of the Bland Creek Palaeochannel borefield and saline groundwater supply borefields, which are discussed in Section 4.2.2 and the pit dewatering system, which is described in Section 4.2.3. The pit dewatering system is designed to isolate saline groundwater in order to manage industrial and river salinity as described in the ESCMP.

Mining Operations Plan

The *Cowal Gold Operations Mining Operations Plan 1 September 2021 – 2 July 2022* relevant to the commencement of development of the approved Processing Rate Modification activities, was approved by the DRG Resources Regulator on 30 September 2021.

Since a mining lease has now been granted for the ML 1791, any water management requirements of the new tenement is also incorporated into this WMP, as required.

In accordance with Condition of Authority 14 for ML 1535, operations will be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with the MOP.

4.1 CONSTRUCTION PHASE

The following major components of the CGO water management system were constructed during CGO's initial construction phase:

(i) UCDS.

(ii) Lake isolation system (comprising the temporary isolation bund, lake protection bund and perimeter waste emplacement).

(iii) Internal Catchment Drainage System.

(iv) Integrated erosion, sediment and salinity control system.

(v) Pit dewatering system.

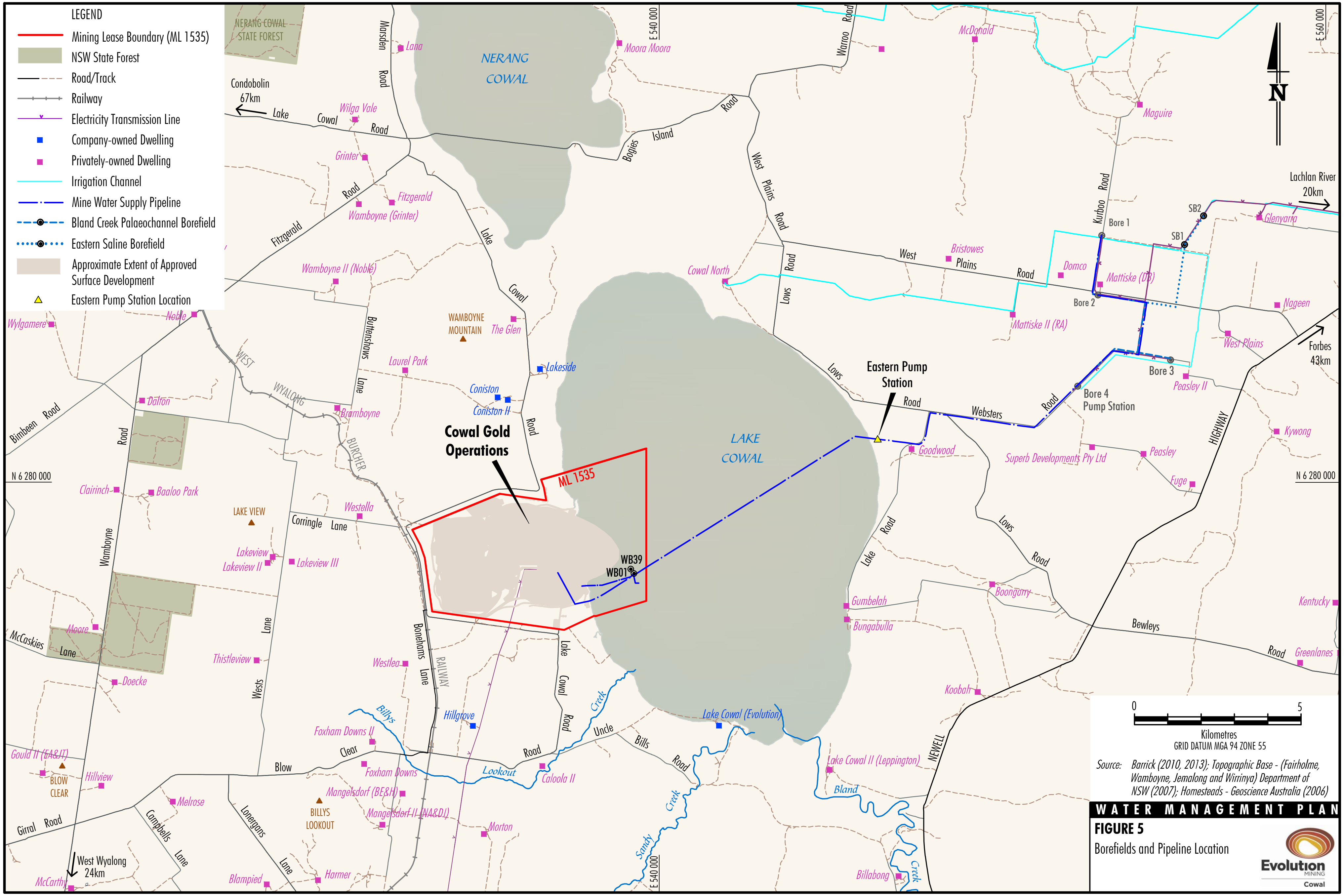
These structures have been designed to provide a stabilised surface water management system for the CGO and are described in the following subsections.

In addition to these structures, the Bland Creek Palaeochannel borefield, the Bore 4 pump station and existing water supply pipeline (Figure 5) has also been established.

While not a water management structure, the boundary fence required in accordance with Development Consent Condition 2.3 has the potential to affect the local flood regime. The boundary fence is described in Section 4.1.7, along with measures designed to minimise potential impacts on the quality of surface waters and the local flood regime.

As required by earlier (now redundant) development consent conditions, the lake protection bund, contained water storages and existing tailings storage facilities were constructed to the requirements of DPE Water, EPA and the NSW Dams Safety Committee (DSC).

As required by Condition of Authority 25(9), an initial MOP was submitted prior to the commencement of construction on site. This initial MOP was prepared as required by Condition of Authority 25(9) and included plans for the construction and maintenance of site water management structures. Ongoing maintenance of site water management structures will be conducted with regard to both the *Volume 1 of Managing Urban Stormwater – Soils and Construction* (Landcom, 2004) and *Managing Urban Stormwater – Soils and Construction Volume 2E Mines and Quarries* (DECC, 2008).



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4.1.1 Up-catchment Diversion System

The UCDS is a permanent feature that has been developed in stages throughout the mine life and has been designed to convey upper catchment water around the western edge of the CGO (near the existing tailings storage facilities) and into existing drainage lines to the north and south. During the construction phase of the CGO the western edge of the diversion surrounding the existing tailings storage facilities was formed, while the section around the southern waste emplacement was constructed in Year 3 (North Limited, 1998a).

The UCDS assists in managing of the quantity of surface water within and around the mine site by conveying upper catchment water around the site. In this way the UCDS minimises the quantity of surface water requiring management within the mine site. The quantity of water to be managed by the UCDS has been set through the adoption of the enhanced “greenhouse” 1 in 1,000-year ARI design criterion (Gilbert and Sutherland, 1997). The critical duration of the 1 in 1,000-year ARI event has been used to determine the required peak flow capacity for each reach of the UCDS.

The diversion of clean water runoff from upland slopes around the CGO is consistent with the provisions of the Landcom (2004) *Volume 1 of Managing Urban Stormwater – Soils and Construction* and contributes to the management of both quality and quantity of surface waters within and around the site.

Development of the UCDS involved the reinstatement of natural stream features to enhance long-term stability of the system and compatibility with the existing hydrology of the area. These include features such as a low flow drainage path within a wider floodplain (approximately 65 m wide), meanders and pool/riffle sequences (North Limited, 1998a).

The UCDS has been constructed to simulate endemic drainage features that are known to be stable in the prevailing hydrological regime. Riparian vegetation species have also been incorporated into the diversion system (Gilbert and Sutherland, 1997).

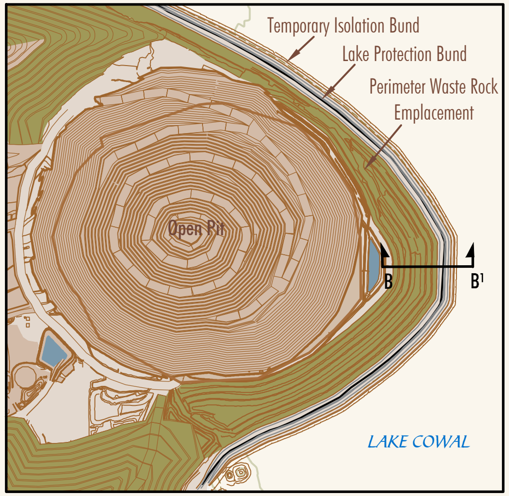
Where the UCDS coincides with existing drainage lines, works have been focused on the reinstatement of natural stream features to enhance long-term stability and compatibility with existing hydrology of the area and includes constructed rock outfalls at confluences with existing natural drainage lines to minimise erosion. In the absence of suitable existing drainage paths, development of the UCDS required the construction of a channel containing a low flow drainage path within a wider floodplain. Construction in these sections included the reinstatement of natural stream features to enhance long-term stability and compatibility with existing hydrology of the area.

4.1.2 Lake Isolation System

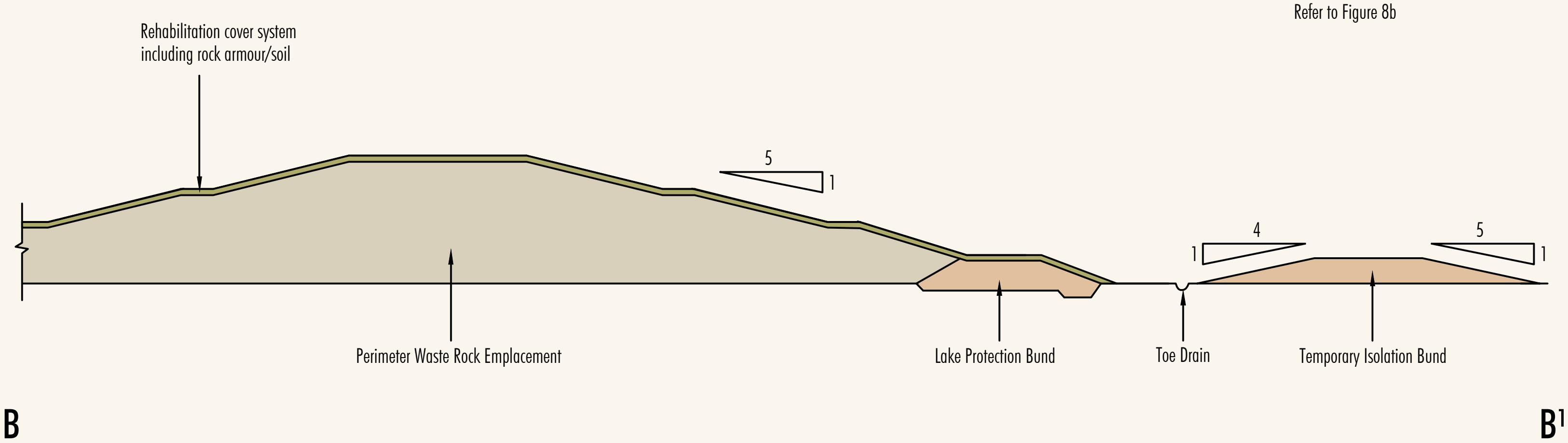
The lake isolation system has been designed to hydrologically separate the open pit and Lake Cowal during development, mining and post-closure of the CGO (North Limited, 1998a). Figure 6 presents a conceptual cross-section of the lake isolation system. The lake isolation system provides for the management of the quantity of surface waters by limiting the volume of water requiring management within the ICDS (Section 4.1.3).

The lake isolation system comprises a series of isolation embankments that are designed to prevent the inflow of water from Lake Cowal into the open pit development area during periods of high-water levels. The lake isolation system comprises the following components (North Limited, 1998a) (Figure 6):

- temporary isolation bund;
- lake protection bund; and
- perimeter waste rock emplacement.



INSET
Refer to Figure 8b



Not to Scale

Source: Barrick (2013)

WATER MANAGEMENT PLAN

FIGURE 6
Conceptual Section through the Lake Isolation System

Evolution Mining Cowal

HAL-02-07 CGO MP 2017_WMP_105A

The lake isolation system has been concurrently rehabilitated as was developed to re-establish the lake foreshore. Once the outer surface of the lake isolation system was stabilised and revegetated, the runoff from these surfaces has become comparable quality to that from undisturbed areas (North Limited, 1998a).

The lake isolation system contributes to the management of surface water quality around the mine site (and in particular within Lake Cowal) by isolating the mine site from its downslope catchment. As described below, the lake isolation system prevents the discharge to the lake of surface water runoff from disturbed areas.

The temporary isolation bund, lake protection bund and perimeter waste rock emplacement are illustrated on Figure 6 and described below.

Temporary Isolation Bund

The temporary isolation bund was designed to control water inflow to the pit development area from the lake during construction of the lake protection bund. Prior to the construction of the temporary isolation bund, a continuous silt fence was erected around the construction zone of the temporary isolation bund. The silt fence was installed prior to construction commencing to trap fine sediment and prevent suspended material migrating into the main body of the lake (North Limited, 1998a).

The temporary isolation bund was constructed using inert rock material sourced during pre-stripping of the waste emplacement and open pit. Fill used for construction was tested for geochemical and geotechnical suitability prior to construction commencing. Suitable fill was sufficiently impermeable, with low dispersiveness, low salinity and non-acid forming (North Limited, 1998a). Borrow pits were also used to source suitable material where necessary.

The temporary isolation bund was developed by end-tipping fill, working at both ends of the temporary isolation bund/shoreline intersection in an arc toward the centre. The movement of trucks during construction was used to achieve the required compaction levels of the bund (North Limited, 1998a).

The bund has batter slopes of 1(V):5(H) and 1(V):4(H) on the lake and open pit walls, respectively. The height of the bund increases from zero at the edges of the arc to a maximum of up to 2 m in the centre (North Limited, 1998a). Figure 6 shows a typical cross section of the temporary isolation bund.

Evolution received approval from the DRG (via approval of a variation to the *Cowal Gold Mine Mining Operations Plan [January 2011 – September 2012]* [Barrick, 2011] on 14 May 2012) to raise the height of the temporary isolation bund by 0.5 m to provide for future lake level rises and rock armouring the lake side outer batter slope of the bund to minimise erosion from wave action.

The management and disposal of waters captured behind the temporary isolation bund during construction and operations is described in Section 5.4.

The temporary isolation bund is a short-term feature that was used to isolate the pit from the lake during the construction phase while the lake protection bund is constructed. Accordingly, since the lake protection bund was constructed and revegetated, the isolation function of the temporary isolation bund has been superseded (North Limited, 1998a).

Lake Protection Bund

The lake protection bund is a low permeability embankment designed to prevent water inflow (during periods of high lake water level) from the lake into the open pit development area over the life of the mine and over the long term (North Limited, 1998a).

The design of the lake protection bund was intended to meet the following objectives:

- provision of a low permeability barrier between the open pit and Lake Cowal;
- development of a revegetated, low profile stable permanent landform; and
- revegetation of the embankment and remnant isolation bund as early as possible in the mine life to permit early re-establishment of the foreshore ecotone.

The lake protection bund was constructed approximately 10 m behind the temporary isolation bund (closer to the pit) (Gilbert and Sutherland, 1997) and was constructed to relative level (RL) 208.25 m (North Limited, 1998a), to a maximum height of 4 m (Gilbert and Sutherland, 1997). Below RL 207.75 m it was built as a two-zone, earth-filled embankment and to meet specific engineering criteria for compaction to ensure that the required compaction densities are achieved (North Limited, 1998a).

Topsoils within the footprint of the bund were excavated to a depth of approximately 1 m (North Limited, 1998a).

The lake protection bund was constructed from suitable low-salinity lake sediments sourced from within the open pit development area. Once the structure was constructed to its final height, topsoil (organic lakebed sediments previously stripped from the open pit development area) was applied to the surface to provide a suitable growth medium for reformation of the foreshore habitat and ecotone (North Limited, 1998a). Consistent with the approved long-term rehabilitation concepts for the outer batters of the waste rock emplacements and tailings storage facilities (Sections 4.2.5 and 4.2.9) and based on the results of rehabilitation trials conducted to date, the rehabilitation cover system for the outer batter of the lake protection bund includes cross-ripping primary waste rock mulch with topsoil to provide long-term slope stability and reduce erosion potential.

Perimeter Waste Rock Emplacement

ROM oxide waste rock taken from the open pit during the pre-stripping phase has been placed behind the lake isolation bund to form the perimeter waste rock emplacement, which is the third component of the lake isolation system.

The perimeter waste rock emplacement has been constructed to RL 223 m and surrounds the pit to the north, east and south. The emplacement was constructed from oxide mine waste rock with the outer face constructed using low salinity topsoils/soils (North Limited, 1998a). The approved rehabilitation cover system for the outer batters of the perimeter waste rock emplacement has been revised based on the results of rehabilitation trials conducted to date and includes cross-ripping primary waste rock mulch with topsoil to provide long-term slope stability and to reduce erosion potential.

The perimeter waste rock emplacement was constructed in approximately 5 m lifts built up to a maximum height of approximately 18 m above ground level. The outer batter profiles are 1(V):5(H) with reverse-graded berms installed at vertical height intervals of approximately 5 m. Development of the emplacement commenced during pre-stripping with the eastern portion reaching the final RL of 223 m and other parts being built up to RL 213 m. During Year 1 the embankment was lengthened and raised to the final RL on the northern and southern sides of the open pit. This completed the shielding of the open pit to the east, north and south.

Following stabilisation and revegetation of the outer batters of the lake isolation system, any runoff from these surfaces is anticipated to be of suitable quality (comparable to runoff from undisturbed areas) to enable release to the lake (Gilbert and Sutherland, 1997).

4.1.3 Internal Catchment Drainage System

The ICDS is a permanent water management feature designed to operate during the life of mine and after mine rehabilitation and closure. It was built, in the form of a permanent low mound running from Cowal West Hill, surrounding the tailings storage facilities and extending to the process plant area, separating the mine from the rest of the catchment. The mound effectively divides catchment into two;

water external to the CGO site and waters contained within the area of disturbance (i.e., waters that could contain increased sediment loads, salinity or other substances). Where the topography of the site is such that water will flow alongside the mound, permanent waterways have been developed to direct surface flows (North Limited, 1998a). The Cowal West Hill has since been covered as a result of construction of the northern waste rock emplacement, with surface water runoff managed via perimeter toe drains and/or bunds (Section 4.3.3).

The management of surface water within the ICDS has been achieved through the operation of the UCDS, the lake isolation system and dividing mounds that have been sized for extreme hydrological conditions (1 in 1,000-year ARI) (Gilbert and Sutherland, 1997). This is approximately equivalent to a total of 216 mm of rainfall over 48 hours (Gilbert & Associates, 2003). Surface waters that collect within the ICDS are managed by a series of contained water storages, bunds and drains as described in Section 4.2.1. The water management structures that form the ICDS are inspected on a regular basis as detailed in the ESCMP.

Isolation of groundwaters within the ICDS has been achieved by virtue of the permanent groundwater sink formed by open pit dewatering. The effect of the open pit has been to locally depress the groundwater table (potentiometric surface) such that all groundwater movement in the surrounding area is now towards the void (Gilbert and Sutherland, 1997).

Disposal of Excess Water

Table 2.4 in DA 14/98 condition 4.3 includes reference to the need that ‘:

> *Storages are suitably designed, installed and maintained to ensure no discharge of mine water or sediment-laden water outside the ICDS*
> .

Surface water collected within the limits of the ICDS are directed to the process water storage dam (D6) for use as process water, dust suppression and conditioning of construction materials (North Limited, 1998a).

4.1.4 First Flush Systems

In accordance with earlier conditions on DA 14/98 (conditions since removed by DPE), contained water storages D1 and D4 were constructed to operate as first flush systems to capture initial runoff waters from the outer batters of the northern and southern waste emplacements and the outer batters of the IWL.

As it relates to the construction and operation of contained water storages D1 and D4, a first flush system is a system designed to capture the initial runoff generated by a 1 in 100-year 48 hour ARI rainfall event (North Limited, 1998a).

As described in Section 4.2.5, toe drains and storages (contained storages D1 and D4) (sized to contain runoff from a 1 in 100-year 48 hour ARI rainfall event) have been constructed in stages around the northern waste emplacement and the southern waste emplacement as the waste emplacements have been developed. Toe drains have also been constructed around the perimeter of the IWL (Section 4.2.9). A temporary pond (adjacent to the eastern edge of the open pit) constructed during the construction/pre-production phase as part of the first flush capture system (Section 4.1.4) has since been removed following construction of the lake protection bund.

Rainfall runoff from the outer batters of the mine waste emplacements and the IWL is intercepted by toe drains (sized to contain runoff from a 1 in 100-year 48 hour ARI rainfall event) and gravity transferred to either D1 or D4.

Seepage and runoff intercepted by this system (i.e. D1 and D4) will ultimately report to the process plant contained water storage D5A. Contained water storages D1 and D4 have been fitted with pumps capable of transferring the first flush of initial captured runoff waters from the outer batters of the northern and southern waste emplacements and the IWL to D6. Waters collected in D1 and D4 will be transferred to the process water dam via a dedicated pumping system. The pumps have been sized to transfer waters generated by the 1 in 100-year 48 hour ARI rainfall event within a period of 5 days, consequently these dams are emptied between rainfall events. Mobile standby pumps will be maintained on-site at all times to facilitate the transfer of waters to or from dams D1, D4 or D6 in the case of pump failure.

4.1.5 Integrated Erosion, Sediment and Salinity Control System

As described above, surface water runoff from mine landforms and disturbed areas could potentially contain sediment, salinity, trace hydrocarbons and process reagents.

The CGO integrated erosion, sediment and salinity control system is presented in the ESCMP and is designed to prevent the discharge of runoff from the mine site to the lake.

The ESCMP identifies both temporary and permanent measures that have been applied at the CGO to manage the quality of surface waters within and around the site. These measures focus on the control of surface water runoff from mine landforms and disturbed areas and the minimisation of the potential for sediment generation.

Measures adopted include:

- minimising the area disturbed by the CGO and restricting access to non-disturbed areas;
- ripping and rehabilitation of hardstand areas and roads no longer required for access;
- avoidance of soil stripping operations during particularly wet or dry periods, minimising compaction during soil excavation and movement and the use of ameliorants where required (e.g. gypsum application to dispersive soils);
- use of silt fences and temporary sediment traps to minimise sediment movement;
- use of diversion banks, channels and rip-rap structures to divert surface water around disturbed areas and to control runoff velocity;
- maintaining soil stockpile slopes at a maximum acceptable angle to resist erosion;
- constructing all access roads at an appropriate slope along the contour, where practicable;
- the use of spoon drains, table drains and concrete culverts to control surface runoff from access roads; and
- leaving the more saline and dispersive soil horizons *in-situ* beneath mine landforms, where possible.

The quantity and quality of surface water runoff from mine landforms and disturbed areas will be managed through the selection of appropriate design criteria for the sizing of sediment control structures as described in the ESCMP.

The ESCMP identifies three different types of salinity that are considered relevant to the CGO (i.e. dryland, river and industrial salinity). A summary of the salinity management measures described in the ESCMP that are applied as necessary at the CGO is presented below.

Dryland Salinity

There is no known dryland salinity in Lake Cowal (Australian Water Technologies Pty Ltd, 1999). Notwithstanding, measures to manage the risk of dryland salinity as discussed in the ESCMP include:

- *Minimising the areas disturbed by the Project components and restricting access to non-disturbed areas.*
- *Identification of saline soils (infill testing) and selective soil resource management.*
- *Identification of low-salinity construction material (construction fill testing) and selective resource management.*
- *Fencing ML 1535 to restrict stock and prevent overgrazing and erosion.*
- *Implementation of appropriate erosion and sediment control systems and ongoing monitoring and maintenance.*

River Salinity
Measures to be adopted for the CGO to manage river salinity include:

- *Containment and management of saline surface water runoff.*
- *Open pit/final void salinity sink.*

Industrial Salinity
Measures to be adopted for the CGO to manage industrial salinity include:

- *Isolation of saline groundwaters in the open pit by the change in groundwater gradients around the open pits, the LPB, the ICDS and UCDS.*
- *Containment of potentially saline seepage generated from waste rock emplacement areas.*
- *Containment and management of saline surface water runoff.*
- *Final void management and monitoring.*

4.1.6 Pit Dewatering System

The operation of the pit dewatering system is described in Section 4.2.3.

4.1.7 Bland Creek Palaeochannel Borefield and Water Supply Pipeline

The construction and operation of the Bland Creek Palaeochannel borefield is described in Section 4.2.2.

4.1.8 Boundary Fence and Security Fence

Fencing and signposting has been erected around the ML 1535 and ML 1791 boundary to secure the mine site in accordance with DA 14/98 condition 2.3. The fence comprises a standard four-strand farm fence.

A full description of the fence design to minimise the potential risks to water birds and aquatic species in accordance with DA 14/98 condition 2.3 is provided in the Compensatory Wetland Management Plan (CWMP).

As described in Section 4.1.4, erosion and sediment controls at CGO are described in the ESCMP. Erosion and sediment control measures specific to the ML 1535 fences are represented below:

Erosion and sediment control measures for the ML 1535 boundary fence and security fence to be adopted to mitigate potential impacts on soils will include (North Limited, 1998a):

- *Minimising the area disturbed by the above Project component and restricting access to non-disturbed areas.*

> *The alignment of the boundary fence will be clearly delineated with survey pegs prior to the commencement of construction of each section. Unrestricted vehicular plant access to undisturbed areas will not be permitted. Vegetation in close proximity to the fence alignment will be demarcated with flagging tape (or similar) so as to prevent disturbance. All employees undertaking the site induction/training programme will be made aware of the importance of remaining within the defined works areas.*
>
> *Any access tracks or other land disturbances resulting from construction of the fence will be ripped, topsoiled and revegetated with a cover crop as soon as they are no longer required in accordance with condition 18 of the Conditions of Authority*.

In addition to these measures, the ML 1535 boundary fence and security fence are the subject to regular inspections and maintenance, which includes the removal of debris along the fences. The removal of debris reduces the potential for the fences to affect the local flood regime.

Now that a mining lease has been granted for the ML 1791 area, any requirements regarding construction of boundary fences/security fences for that tenement are now incorporated into this WMP.

4.2 OPERATIONS PHASE

The operations phase of the CGO included some changes to the construction phase water management system, including:

- augmentation of the external water supply, including the development of a saline groundwater supply borefield within ML 1535;
- development of the eastern saline borefield;
- changes to the alignment of a minor portion of the UCDS;
- changes to the number and size of the contained water storages;
- changes to the Internal Catchment Drainage System; and
- relocation of some of the existing erosion and sediment control structures.

Any changes in future will be undertaken in accordance with the same design principles for the existing CGO water management system (i.e., to provide a stable surface water management system) as described in the following subsections.

The main water management issues relevant to the operational phase of the CGO are:

- supply of suitable quantities and qualities of water for ore processing and potable use;
- maximising the use of incident rainfall and the reuse of seepage from pit dewatering;
- provision of full containment for mine site water through the UCDS and Internal Catchment Drainage Systems (described in Sections 4.1.1 and 4.1.3); and
- control of runoff from major mine landforms (waste rock emplacements and the tailings storage facilities/IWL) in a manner consistent with efficient and safe mining operations.

The water management plans for Years 16, 20, and 26 (2020, 2024 and 2030 respectively) of the approved CGO are presented on Figures 7a, 7b and 7c.

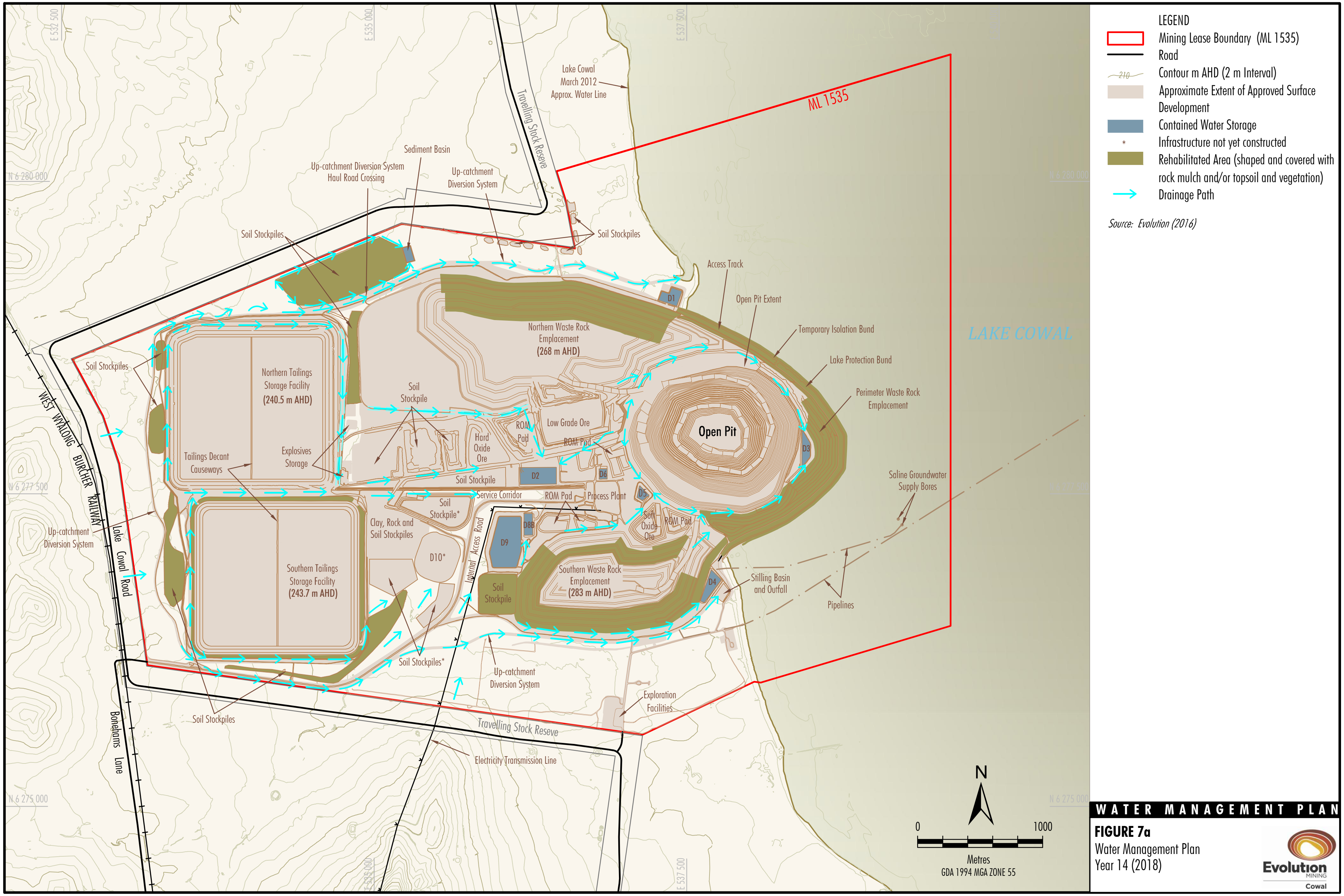
Selection of design criteria for the various components of the operational water management system have been based on consideration of the factors below (Gilbert and Sutherland, 1997):

- criteria used or recommended by the regulatory authorities;

- accepted good practice and criteria recommended by industry groups; and
- consideration of hazards and acceptable or reasonable risk.

In general, a criterion of 1 in 1,000 ARI 48 hour event has been selected for containment of process water or other waters likely to contain process water during the mine life. In the event of a spill, any waters which escape from a containment storage will be fully contained within the Internal Catchment Drainage Systems and will ultimately report to the open pit (Figures 7a, 7b and 7c). A criterion of 1 in 1,000 year ARI has been selected to ensure that there will be a low risk of spill during the mine life but in the knowledge that any spill will be fully contained and will not impact Lake Cowal (Gilbert and Sutherland, 1997). A 1 in 1,000 ARI 48 hour event is approximately equivalent to a total of 216 mm of rainfall over 48 hours (Gilbert & Associates, 2003).

A summary of the hydrological design criteria for the CGO's water management system is provided in Table 5 below.

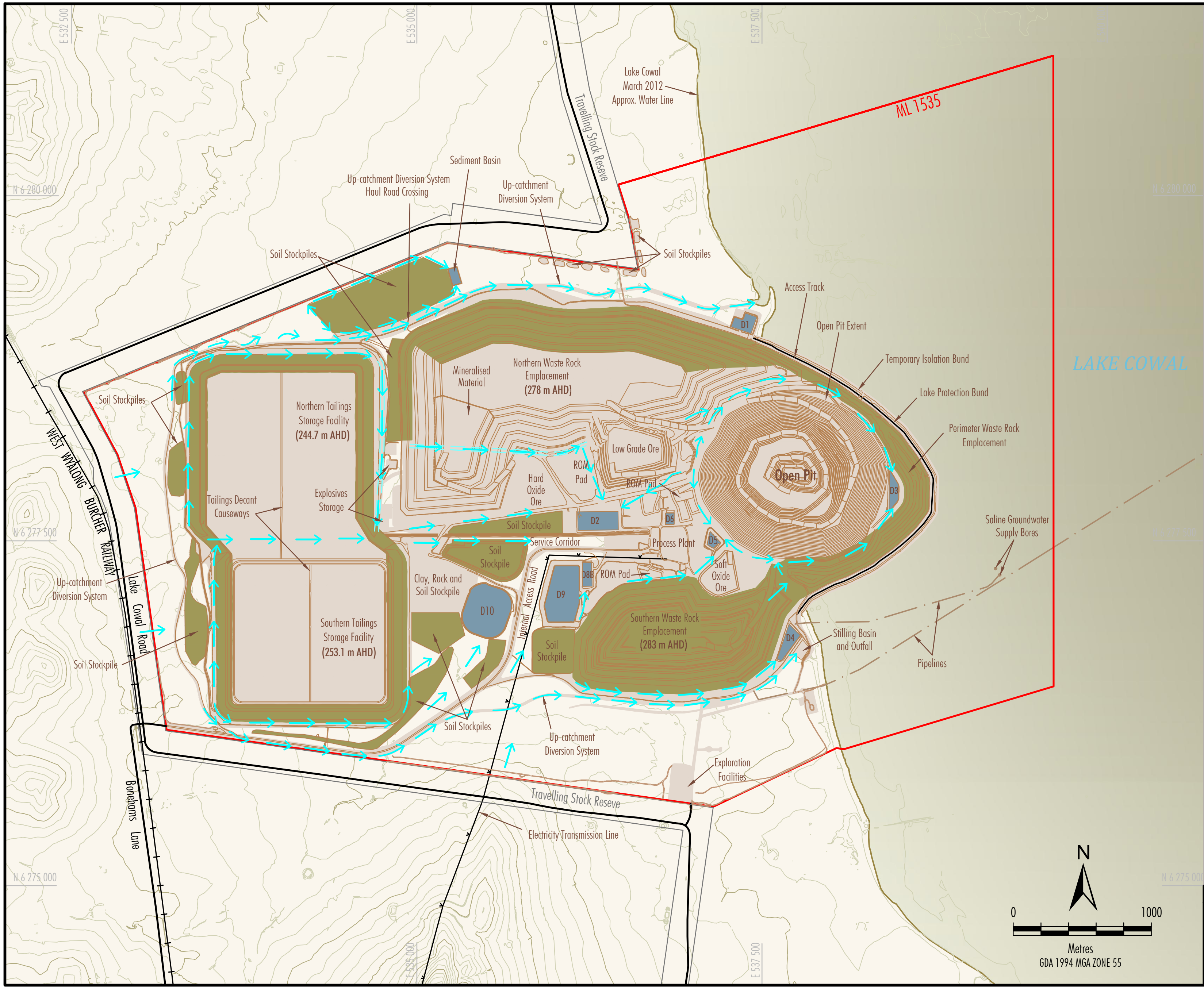


WATER MANAGEMENT PLAN

FIGURE 7a
Water Management Plan
Year 14 (2018)

Evolution MINING Cowal

HAL-02-07 CGO MP 2017_WMP_107A



LEGEND

- Mining Lease Boundary (ML 1535)
- Road
- Contour m AHD (2 m Interval)
- Approximate Extent of Approved Surface Development
- Contained Water Storage
- Rehabilitated Area (shaped and covered with rock mulch and/or topsoil and vegetation)
- Drainage Path

Source: Evolution (2016)

WATER MANAGEMENT PLAN

FIGURE 7b
Water Management Plan
Year 18 (2022)

Evolution MINING Cowal

HAL-02-07 CGO MP 2017_WMP_106A

INSERT FIGURE 7c

Table 5
Water Management System – Hydrological Design Criteria

Component	Aspect	Design Criteria	Consequence of Design Event Exceedance
Tailings Storage Facilities/IWL	Containment Capacity	Max. net accumulation of water from a 1 in 1,000 year ARI event of 3 months duration	Controlled overflow to contained water storages or open pit
Process Plant Contained Water Storage (D5A)	Containment Capacity	Runoff from a 1 in 1,000 year ARI storm of 48 hours duration	Controlled overflow to contained water storage D3 or open pit
Temporary Diversion Bund/Toe Drains (around waste emplacements)	Conveyance Capacity	Peak discharge from the critical duration 1 in 100 year event	Short duration or overflow to adjacent drainages/lake foreshore
Waste Rock Emplacement Contained Water Storages (D1, D2, D3, D4, and D8B)	Storage Capacity	Runoff from contributing catchment resulting from a 1 in 100 year ARI rainfall event of 48 hours duration	Overflow to adjacent drainage/lake foreshore
Temporary Sediment Dams	Storage Capacity	Runoff from the 1 in 20 year 1 hour rainfall event	Controlled overflow to contained water storages or open pit
Northern Soil Stockpile Sediment Basin	Storage Capacity	In accordance with Landcom (2004) *Volume 1 of Managing Urban Stormwater – Soils and Construction* and DECC (2008) *Managing Urban Stormwater – Soils and Construction Volume 2E Mines and Quarries* guidelines.	Runoff to local drainages ultimately reporting to Lake Cowal following settling of sediment in accordance with Landcom (2004) and DECC (2008) guidelines.
Process Water Storage (D6)	Containment Capacity	1 in 1,000 year ARI storm of 48 hours duration above normal operating level	Controlled overflow to contained water storages D5A, D3 or open pit
Process Water Storage (D9)	Containment Capacity	1 in 1,000 year ARI storm of 48 hours duration above normal operating level	Controlled overflow to contained water storages D8B, D2, D5A or open pit
Process Water Storage D10 (not yet constructed)	Containment Capacity	1 in 1,000 year ARI storm of 48 hours duration above normal operating level	Controlled overflow to contained water storages D9 and open pit (subject to detailed design)
UCDS	Conveyance Capacity	Peak discharge from enhanced 'green house' 1 in 1,000 year ARI rainfall event	Controlled overflow to contained water storages or open pit

Source: After Barrick (2009a); Barrick (2013); and pers.comm, P. Greenhill, 20 April 2015, Evolution (2018) and HEC (2018).

The construction and operation of these structures according to the design criteria presented in Table 5 guides the management of the quantity of surface water and groundwater within and around the mine site through the establishment of appropriate storage and drainage capacities.

4.2.1 Realignment of Up-catchment Diversion System

Following the Processing Rate Modification realignment of the UCDS to facilitate the transfer of up-catchment water around the IWL (Figures 2 and 7a to 7c), the modified sections of the UCDS now includes sections to the south, west and north of the IWL. The realigned sections have been constructed using the same design criteria as the existing UCDS (Section 4.1.1) (Table 5).

4.2.2 Water Supply

The main water usage for the CGO is as a transport media during ore processing. Other water supply requirements include water for dust suppression on haul roads and roads, tailings storage facilities/IWL embankment construction, and potable and non-potable uses around the mine site (North Limited, 1998a).

Average daily process plant water demand is approximately 20.4 ML/day . Earlier assessments (Hydro Engineering & Consulting, 2018) had flagged a variation in water consumption for primary ore and secondary ores however, this is no longer regarded as a real issue (D. Maxwell pers. comm 2021).

A water supply system to make up losses from evaporation and tailings entrainment) includes collection of internal site runoff and surface and groundwater resources. That system and water supply arrangements for the approved CGO are described below and shown on Figure 8.

In accordance with DA 14/98 condition 4.3(a) and SSD 10367 condition B8, CGO will:

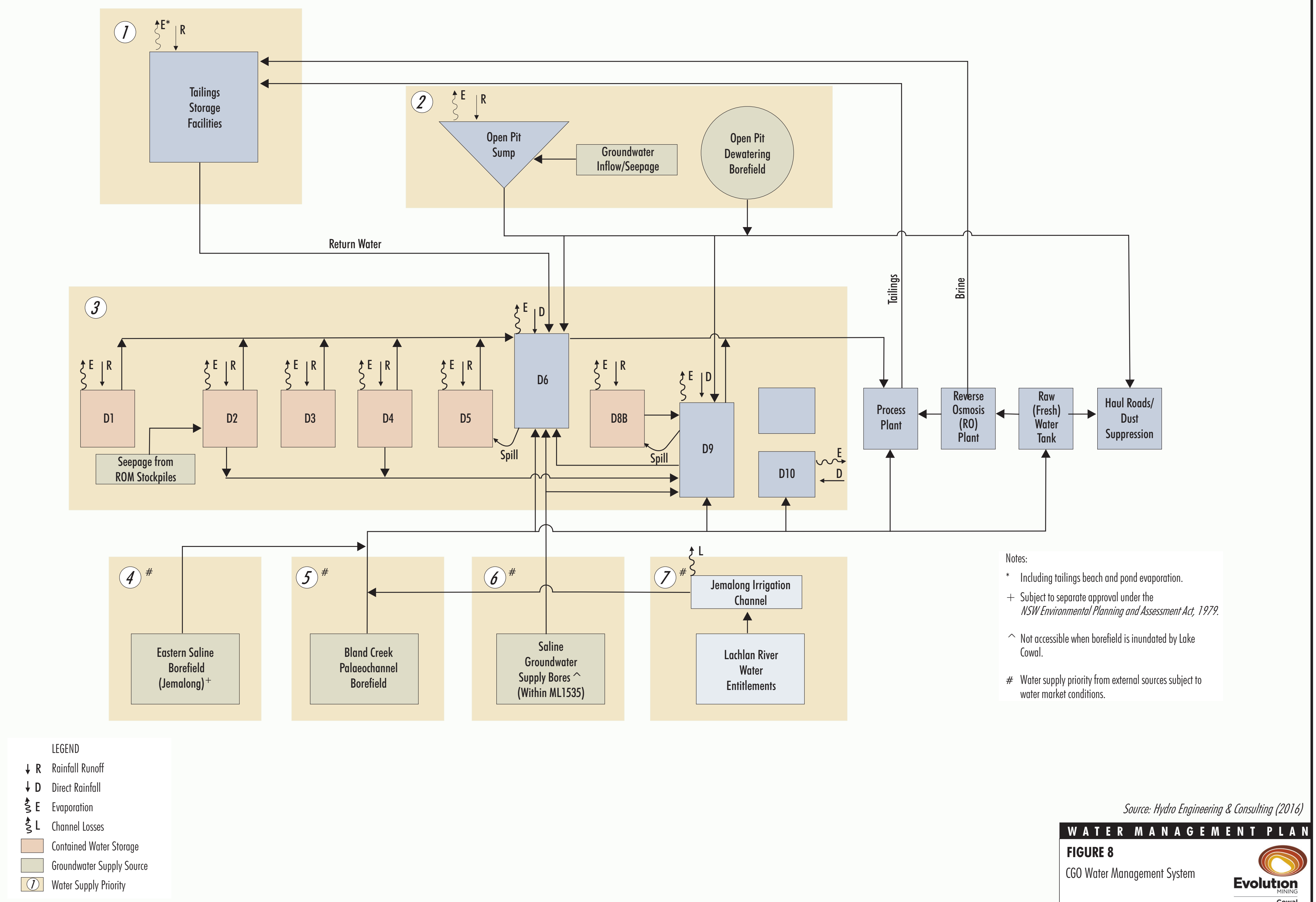
… *Maximise water recycling, reuse and sharing opportunities*
Minimise the need for make-up water from external supplies, particularly the use of higher quality water used by other land users.

Water will be preferentially sourced from internal water sources before external water sources are accessed. As such, CGO water requirements are met through the use of waters from the following sources in order of priority use (Figure 8):

- *Site water supply:*
  1. Return water from the tailings storage facilities/IWL.
  2. Open pit sump and dewatering borefield.
  3. Incident rainfall captured from mine waste emplacements and other areas that are part of the ICDS.
- *External water supply:*
  4. Eastern saline borefield located approximately 10 km east of Lake Cowal's eastern shoreline.
  5. Bland Creek Palaeochannel borefield which comprises four production bores within the Bland Creek Palaeochannel located approximately 20 km to the east-northeast of the CGO.
  6. Saline groundwater supply borefield located in the south-east of ML 1535.
  7. Licensed water accessed from the Lachlan River which is supplied via a pipeline from the Jemalong Irrigation Channel (i.e. Bore 4 pump station).

In addition to the above water supply sources, Evolution has identified additional potential external sources with a preference for saline groundwater aquifers to reduce potential environmental impacts and competition with other groundwater users. These options include:

- development of additional bores or borefields in saline aquifers in the region;
- the purchase of rights to existing licensed groundwater entitlements from the alluvial aquifer associated with the Lachlan River in an area disconnected from the Bland Creek Palaeochannel;
- the purchase of additional Lachlan River surface water rights via purchase or trade of High Security and/or General Security water licences; and
- development of a surface water collection system which could be installed using Evolution's harvestable water rights.



Source: Hydro Engineering & Consulting (2016)

WATER MANAGEMENT PLAN

FIGURE 8

CGO Water Management System

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Further investigation and feasibility assessments will be undertaken for these options. Relevant approvals will be obtained should these options be identified as feasible.

Bland Creek Palaeochannel Borefield and Water Supply Pipeline

As described above, the Bland Creek Palaeochannel borefield and water supply pipeline forms part of the CGO water supply. The following section describes the operation of the Bland Creek Palaeochannel borefield and water supply pipeline, including measures designed to manage groundwater quality and quantity.

The Bland Creek Palaeochannel consists of an alluvial sequence subdivided into an upper and lower geological unit (Coffey, 2006; 2018b, 2020b):

- **Upper Cowra Formation:** this sequence generally occurs from ground surface to an average depth of approximately 45 m to 50 m over most of the CGO site and surrounding area. The average depth to groundwater is approximately 7 m, giving an average saturated thickness of just over 40 m (Coffey, 2006). The data suggest the Upper Cowra sequence generally shows decreasing hydraulic conductivity with depth and greater stratification than that found in deeper layers.
- **Lower Cowra Formation:** this sequence generally occurs from ground surface to an average depth interval of approximately 50 m to 90 m over most of the CGO site and surrounding area. This layer appears to have lower horizontal hydraulic conductivity values than the Upper Cowra Formation.
- **Lachlan Formation:** this sequence generally occurs over an average depth interval of around 90 m to 120 m in the Bland Creek Palaeochannel. Within this formation there were assessed to be two distinct sequences, including:
  - High permeability sands and minor gravels close to, and within, the deeper parts of the palaeochannel.
  - Lower permeability sediments that generally occur further away from the deeper parts of the palaeochannel and surround the high permeability sands and minor gravels. The average hydraulic conductivity of this sequence appears similar to the Lower Cowra Formation.

The interpreted extents of the Lachlan and Cowra Formations are shown on Figure 9. Pump tests have indicated that there is poor hydraulic connection between the upper and lower zone aquifers.

Extraction Limits

Water extraction from the Bland Creek Palaeochannel is licensed by WAL 31864 under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2020*[3]. The maximum daily volume of water approved to be extracted is subject to a Trigger Action Response Plan monitored by DPE Water in conjunction with a Bland Creek Palaeochannel users group.

Four production bores have been developed within the Bland Creek Palaeochannel located approximately 20 km east-northeast of the CGO (Figure 9). The borefield reticulation system includes a break pressure/balancing storage after the final bore, a buried 600 mm diameter pipeline to the CGO site and power supply along existing road reserves. The bores and pipeline route are shown on Figure 9. As described later in this section, the water supply pipeline has been duplicated up to Bore 4 of the Bland Creek Palaeochannel borefield.

[3] Based on 1 megalitre (ML) per unit share.

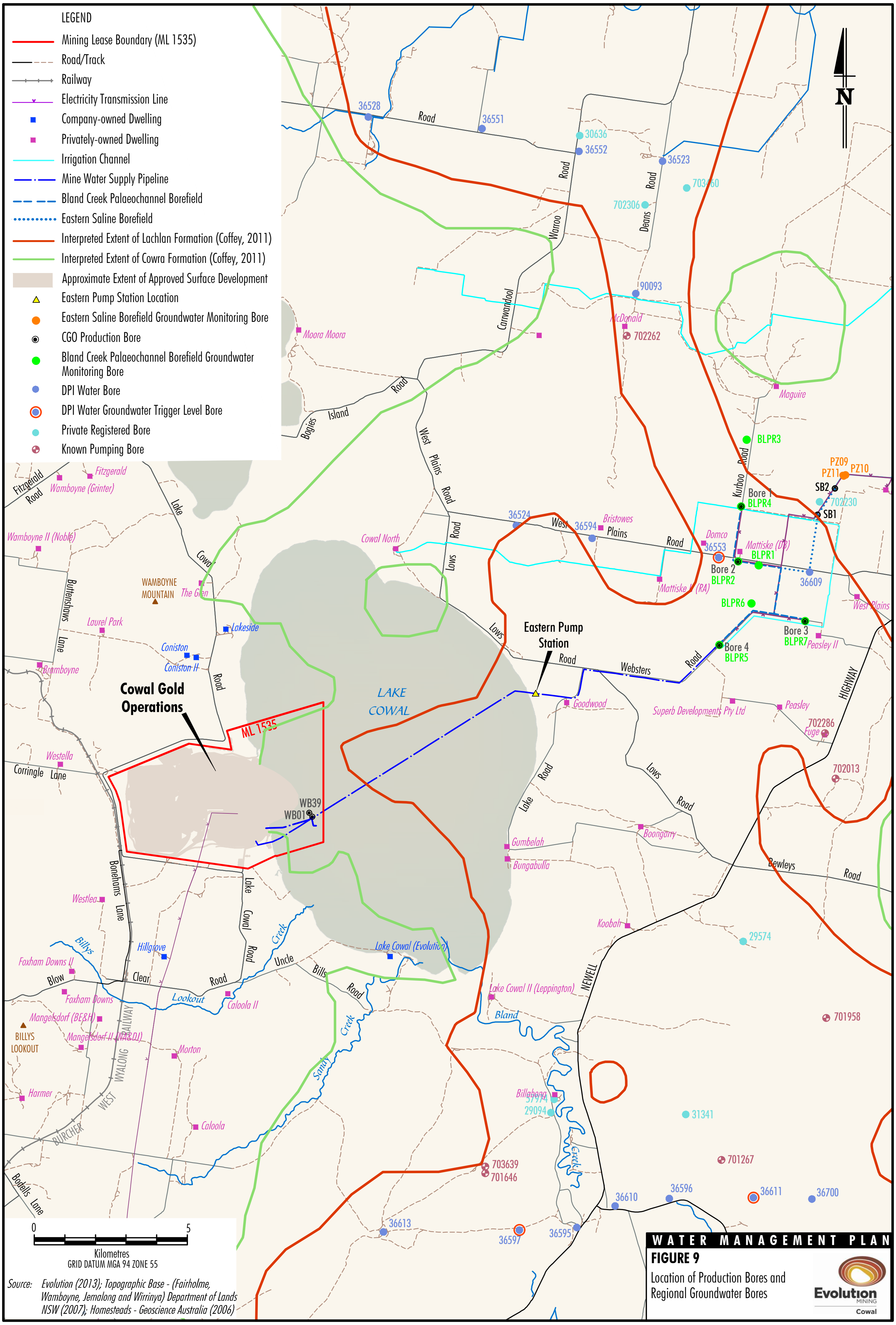

FIGURE 9

Location of Production Bores and Regional Groundwater Bores

Source: Evolution (2013); Topographic Base - (Fairholme, Wamboyne, Jemalong and Wirrinya) Department of Lands NSW (2007); Homesteads - Geoscience Australia (2006)

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All bores from the Bland Creek Palaeochannel borefield are metered to ensure the quantity of groundwater extracted from the Bland Creek Palaeochannel borefield does not trigger the response limits.

Groundwater Contingency Strategy

In addition to the above, extraction from the Bland Creek Palaeochannel Borefield is managed in accordance with groundwater trigger levels developed in consultation with DPE Water and other water users within the Bland Creek Palaeochannel, including stock and domestic users and irrigators.

The trigger levels are as follows:

- Bland Creek Palaeochannel Borefield area: Bore GW036553 (Figure 9) (trigger levels of 137.5 m Australian Height Datum [AHD] and 134 m AHD).
- Billabong area: Bore GW036597 (Figure 9) (trigger level 143.5m AHD).
- Maslin area: Bore GW036611 (Figure 9) (trigger level 145.7 m AHD).

Groundwater levels associated with the Bland Creek Palaeochannel Borefield are monitored on a continuous basis by DPE Water’s groundwater monitoring bore GW036553 (Figure 9).

Investigation and mitigation contingency measures have been developed should groundwater levels reach either RL 137.5 m AHD (trigger for investigation) or RL 134 m AHD (trigger for mitigation) (Section 6.2.2).

A key measure in the Groundwater Contingency Strategy is that pumping from the Bland Creek Palaeochannel Borefield ceases when required, to meet the trigger levels. Well before that point, Evolution would consider its options, including alternate supplies (internal and external to CGO, including Lachlan River water entitlements) based on a cost-benefit analysis and, reduction or cessation of ore treatment as described in Section 6.4.

Extraction will continue to be managed to maintain groundwater levels above the established trigger levels (Evolution, 2018).

Existing Water Pipeline from the Bland Creek Palaeochannel Borefield to the CGO

The pipeline route was designed so that it did not disturb bird breeding areas, important habitat or similar sensitive areas. No vegetation was cleared without prior assessment and approval from DPI – Water (Commissioners of Inquiry for Environment and Planning, 1999). A permit under the *Water Management Act, 2000* was obtained prior to the installation of the water supply pipeline across the bed of Lake Cowal.

The water pipeline from the Bland Creek Palaeochannel borefield to the CGO was constructed in accordance with the requirements of former DPI – Water and in consultation with the former DPI-Fisheries (now Fisheries NSW). Potential impacts on surface water quality during the construction of the pipeline were minimised through the adoption of the soil stripping and erosion and sediment controls as described in the Soil Stripping Management Plan (SSMP) and ESCMP respectively.

Soil stripping field practices and techniques that were undertaken during the construction of the borefield and pipeline are described in the SSMP and are summarised below:

> *Prior to initiation of soil stripping activities, the site supervisor will ensure that the appropriate protocols (e.g., Aboriginal Heritage and land clearance requirements in accordance with Consent Conditions 3.3 and 3.4(b)) have been followed and the recommended stripping depths are confirmed ahead of stripping.*
>
> *During pipeline burial, soil will be removed to one side of the pipeline trench alignment. Topsoil and subsoil (where present and identifiable) will be separately stockpiled. Pipeline burial will be conducted progressively, with each section completed and backfilled as the next section is excavated. Upon completion of each section of the trench works, subsoils will be replaced in the trench, followed by topsoil.*
>
> *The control of soil erosion and dust along the pipeline and borefield areas will be in accordance with the DMP and ESCMP and will include the adoption of measures such as:*
>
> *(i) watering of works areas when necessary;*
>
> *(ii) installation of soil/sediment control measures where necessary (e.g., the installation of silt fencing); and*
>
> *(iii) regular inspection of works and stockpile areas and enactment of any remedial or response measures with respect to dust and soil/sediment control.*
>
> *The water pipeline will be buried at a time when conditions are suitable to allow access by heavy vehicle (i.e., pipeline burial within the high-water mark of Lake Cowal will be undertaken when the lake is dry). Soil stockpiles will be short term features during pipeline burial and soils will be promptly replaced during the progressive rehabilitation of the pipeline burial route.*

Erosion and sediment controls implemented during the construction of the borefield and pipeline are described in the ESCMP and are summarised below:

> *Disturbance areas will be minimised during construction by restricting construction vehicles to designated access roads/tracks or along the pipeline corridor construction area itself.*
>
> *During the burial of the pipeline, a temporary silt curtain will be erected around the disturbed area to trap fine sediment and prevent suspended material migrating into the main body of the lake (North Limited, 1998a). The temporary silt curtain will be installed in accordance with Chapter 6.3.4 of Managing Urban Stormwater – Soils and Construction (Department of Housing, 1998).*
>
> *Temporary sediment traps and sediment filters (e.g., straw bale sediment filter, sediment fences) will be installed where necessary in accordance with Sections 3.4.2 and 3.4.3 respectively, of the Urban Erosion and Sediment Control Handbook (Department of Conservation and Land Management, 1992).*
>
> *The temporary erosion and sediment control systems will remain in place until all earthwork activities are completed and the buried pipeline corridor is rehabilitated.*

The pipeline was laid so that it does not impede the passage of fish or other animals or interfere with flood behaviour or the passage of boats and vehicles.

Duplication of Water Pipeline from the Bland Creek Palaeochannel Borefield to the CGO

As a part of the Processing Rate Modification, the existing water supply pipeline from the Bland Creek Palaeochannel Borefield (up to Bore 4) was duplicated. The pipeline (with a nominal diameter of up to 600 mm) was buried within the existing 40 m pipeline corridor to a nominal depth of approximately 1 m (Evolution, 2018).

The pipelines supply all the external water for the CGO, with the existing pipeline retained to provide additional contingency capacity (Section 8).

Automatic Shut Down in the Event of Pipe Rupture
An automatic shutdown device was installed on both the existing and duplicate pipelines so that pumping ceases immediately in the event of a pipeline rupture. This system is intended to negate the risk of significant impact on lake surface water quality (Department of Urban Affairs and Planning, 1998).

Leases or Private Agreements
Evolution negotiated leases/private agreements with the relevant landholders for the land requirement for the pipeline infrastructure (in accordance with former [now redundant] requirements of the CGO's development consent.

Eastern Pump Station
To improve the capacity and flow of the CGO's existing water supply pipeline (and the duplicated pipeline) a booster pump was approved for the eastern side of Lake Cowal (i.e., the eastern pump station) (Figures 5 and 9). The booster pump will assist to return the capacity of the existing water supply pipeline to its original design capacity of approximately 14 ML/year.

A diesel generator will be used to power the booster pump. Diesel will be listed in the CGO's Fuel and Oil Register and stored in a 10,000-litre double-skinned storage tank, with diesel delivered by a licensed contractor.

The eastern pump station and associated diesel generator and storage tank will be constructed on a gravel and concrete pad (Figure 10), which will be raised above the surrounding cultivated paddock to avoid potential flooding impacts.

Lachlan River Water Entitlements
Water from the Lachlan River is accessed (when required) by purchasing temporary water available from the regulated Lachlan River trading market in accordance with Evolution's High Security (WAL 14981 and WAL 13749) and General Security (WAL 13748) zero allocation WALs.

In accordance with DA 14/98 condition 4.3, site water requirements will however be preferentially sourced from internal water sources followed by external groundwater sources and then Lachlan River water. Notwithstanding, since the commencement of operations at the CGO there has been a reliable supply of temporary water available from the Lachlan River trading market, including during periods of drought. DPE Water trading records show that between approximately 4,000 ML and 274,000 ML of temporary water has been traded annually since records began in the 2004 to 2005 season (Hydro Engineering & Consulting, 2018).

It is expected there will be continued reliable supply of water available from the Lachlan River trading market for the life of the approved CGO (Hydro Engineering & Consulting, 2018) nevertheless, the NSW Government has made clear its preference that Evolution prioritises the use of low-quality water sources.

Jemalong Irrigation Channel Pump Station
Licensed water accessed from the Lachlan River is supplied via a pipeline from the Jemalong Irrigation Channel (i.e. Bore 4 pump station) (Figure 9). The Bore 4 pump station includes:

- an intake sump structure with two submersible pumps and a duty standby pump arrangement to inject water into the existing buried water supply pipeline from the Bland Creek Palaeochannel borefield;
- two tanks (i.e. balancing storage) with a combined capacity of approximately 100 kilolitres; and
- a paddle wheel (or flow meter) at the canal in order to meter the pumping/transfer rate.

Obtaining surface water from the Jemalong irrigation channels also required some modifications to the existing water supply infrastructure, including the construction and operation of a surface water intake structure, pumps and balancing storage adjacent to the Bore 4 pump station (Figure 9) and a pump station within ML 1535.

The Bore 4 pump station has been modified to serve both water supply pipelines.

Saline Groundwater Supply Borefield within ML 1535

As described in Section 4.2 above, the saline groundwater supply borefield within ML 1535 forms part of the CGO water supply. The following section describes the construction and operation of the ML 1535 saline groundwater supply borefield, including measures designed to manage groundwater quality and quantity.

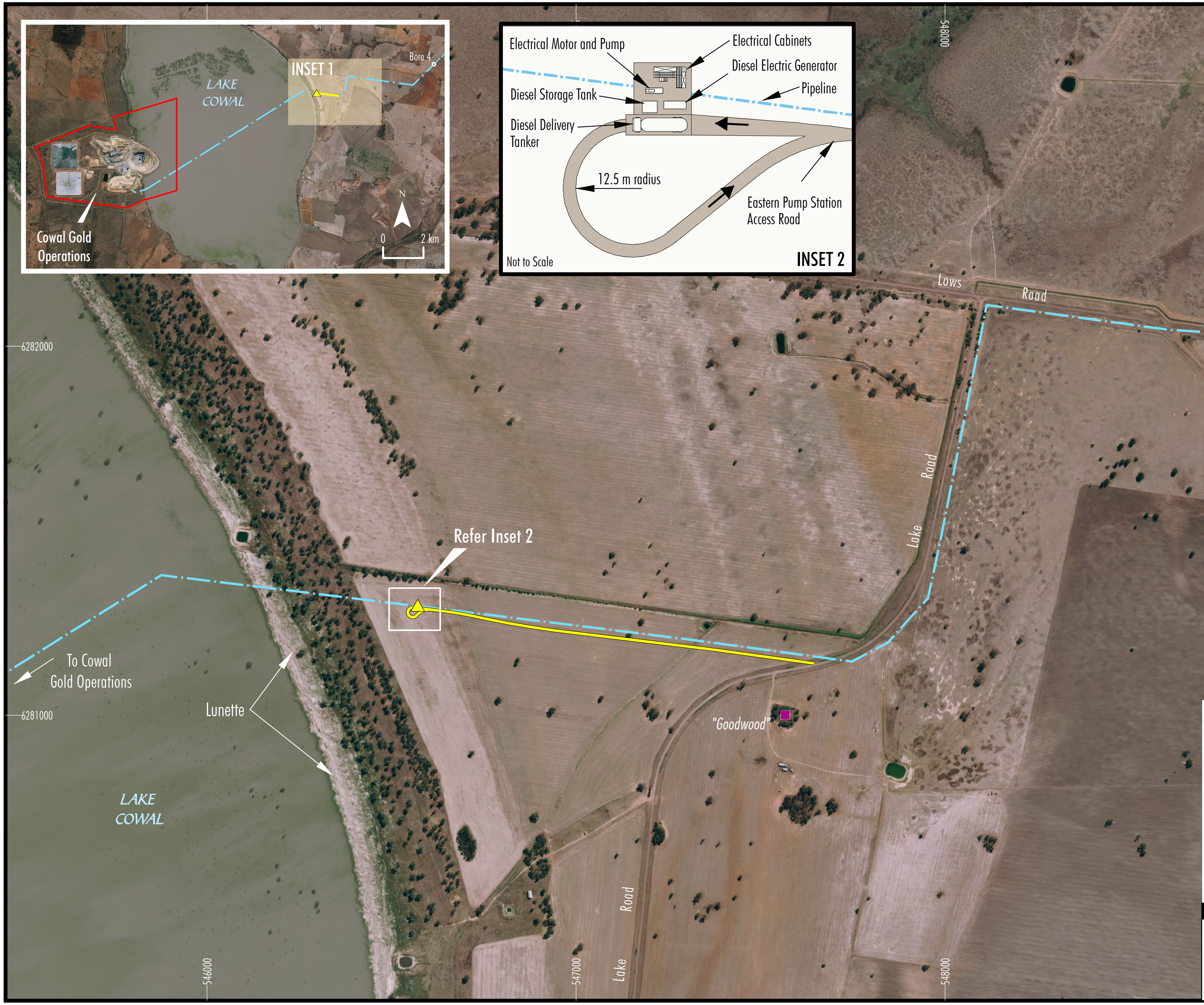
A review of mineral drilling records identified a prospective local saline alluvial aquifer located within ML 1535 to the east and south of the approved CGO open pit. Pump tests on this aquifer (Coffey Geotechnics, 2009) indicate that a borefield of approximately four bores could supply approximately 1 ML/day of saline water (i.e. EC of approximately 40,000 μS/cm) to the process plant (HEC, 2018). Testing on two licensed test bores indicated that sustainable yields from these bores would be in the order of 0.7 ML/day for a period of approximately 5 years. In 2021, this borefield continues to supply CGO with 1 ML/day.

Two groundwater production bores have been constructed within the ML1535 borefield (Figure 9). The borefield will be operated during times when the borefield is not inundated by Lake Cowal.

Water accessed by the saline groundwater borefield within ML 1535 is licensed by WAL 36615 under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources*.

In accordance with DA conditions at the time, the water pipeline from the saline groundwater supply borefield to the CGO was constructed in accordance with the requirements of the DPI – Water (and in consultation with then DPI-Fisheries) and laid in such a way so as not to impede the passage of fish or other animals or interfere with flood behaviour or the passage of boats and vehicles.

A small area of the lakebed of Lake Cowal was disturbed for the saline groundwater supply borefield and associated pipeline. The absence of trees meant that pipeline installation did not require the removal of native trees (FloraSearch, 2008). Further, the area had been previously cleared for livestock grazing and, in some areas, cropping (FloraSearch, 2008).



Source: Barrick (2010, 2013); Date of Orthophoto: April 2013

WATER MANAGEMENT PLAN

FIGURE 10

Eastern Pump Station

Evolution MINING

HAL-02-07 CGO MP 2017_WMP_201A

Operation of the borefield includes the following control and mitigation measures:

- shut-down and removal of pumps during periods when the borefield is inundated by Lake Cowal;
- prominent signage at the well-heads to minimise the potential for accidental collision or damage (when the lake is full);
- a pipeline laid on the ground surface (i.e. above ground level) in a V-drain for potential spill containment and a generator to power the pumps; and
- leak detection mechanisms including automatic shut-down capability (i.e. a pressure-based shut-down system).

In accordance with DA 14/98 conditions at the time, an automatic shut-down device has been installed on the pipeline to halt pumping in the event of a pipeline rupture. In the unlikely event of pipeline failure and leakage of saline water, the spill will be controlled, contained and cleaned-up in accordance with the spill response procedures described in the Hazardous Materials Management Plan (HMMP).

Eastern Saline Borefield

The Eastern Saline Borefield (ESB) is located approximately 10 km east of Lake Cowal's eastern shoreline, and north-east of the Bland Creek Palaeochannel borefield (Figure 5).

Pump tests on this aquifer (Groundwater Consulting Services, 2010) indicated that two bores could supply approximately 1.5 ML/day of saline water (i.e. EC of approximately 12,000 μS/cm) for use in the process plant for approximately five years.

Water from this borefield is pumped to CGO via the Bland Creek Palaeochannel borefield water supply pipelines.

Monitoring of groundwater abstraction and water levels for the ESB is undertaken to ensure the proper management of the Cowra aquifer system as part of Evolution's ongoing water supply strategy.

Water accessed by the ESB is licensed by WAL 36569 under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources.* The ESB licenses have a zero ML licence allocation with an allowable temporary transfer of up to 750 ML/year per bore.

Groundwater quality monitoring for the ESB is undertaken on a quarterly basis in parallel with monitoring of groundwater quality in the Bland Creek Palaeochannel borefield.

Open Pit Dewatering Infrastructure

Groundwater inflow to the open pit is managed by dewatering bores and in-pit sumps (which also collect incidental rainfall). Horizontal drains/bores in the pit wall accelerate depressurisation of the aquifer system by draining groundwater into the pit sumps.

Prior to 2017, groundwater inflow to the open pit was also managed by a ring of vertical dewatering bores around the open pit perimeter however, these have been progressively decommissioned as it was demonstrated the horizontal drains/bores successfully depressurise the pit wall without the need for vertical dewatering bores (Evolution, 2018).

Current groundwater inflow to the open pit is estimated to be approximately 159 ML/year, with approximately 10% of groundwater inflows from the alluvial groundwater system and 90% of groundwater inflows from the fractured rock groundwater system (Coffey, 2018a).

The 10% of groundwater inflows from the alluvial groundwater system is licensed by WAL 36615 under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources*. The 90% of groundwater inflows from the fractured rock groundwater system is licensed by WAL 36617 under the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020.*

Groundwater inflow to the open pit is estimated to have generally decreased since 2008 as the adjacent aquifers surrounding the CGO have become depressurised (Coffey, 2018a). No material increase in groundwater inflow to the open pit occurred during and following the 2010, 2012, 2016 or 2020 lake-fill events, based on monitored pit dewatering records (Coffey, 2018a).

The groundwater inflow to in-pit sumps is highly saline and is not suitable for use as potable water.

Total predicted groundwater inflows to the open pit and management of the open pit dewatering infrastructure are described in Section 4.2.3.

Groundwater Licensing Summary

A summary of groundwater licensing requirements relevant to the CGO's groundwater supply sources under the relevant Water Sharing Plans is provided in Table 6.

Comparison of Evolution's licence entitlements against predicted annual licensing requirements (Table 6) indicates adequate licences are available to account for the potential take of water associated with the approved CGO within the alluvial and fractured rock aquifers (Evolution, 2018).

Table 6
Groundwater Licensing Requirement Summary

Water Sharing Plan/Relevant Legislation	Management Zone/ Groundwater Source	Relevant Licence	Existing Licensed Volume[1] (ML/year)	Predicted Maximum Annual Licensing Requirements (ML/year)[1,2]
Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2020	Upper Lachlan Alluvial Zone 7 Management Zone	Pit dewatering (including pit inflows) and saline bores in ML 1535 (WAL 36615)	366	282
		Bland Creek Palaeochannel Borefield (WAL 31864)	3,650	3,650
		Eastern Saline Borefield (WAL 36569)	750[3] (per bore)	548
Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020	Lachlan Fold Belt Murray Darling Basin Groundwater Source	Pit dewatering (WAL 36617)	3,294	277

Source: Evolution (2018) and Coffey (2018a).

1 Assuming 1 ML per unit share.

2 Coffey (2018a)

3 Eastern saline borefield licenses have zero ML licence allocation with an allowable temporary transfer of up to 750 ML/annum per bore.

Internal Runoff Collection

Surface water runoff within the CGO area is collected by a series of bunds and collection ponds. Runoff from the waste emplacements, open pit area and other disturbed areas is collected during rainfall events and transferred to the process water storages (Table 5) or other retention ponds for re-use in the process plant or to satisfy other operational requirements. This also contributes to the management of surface water quality by minimising the potential for contamination of off-site waters.

The ESCMP describes the integrated erosion, sediment and salinity structures, including collection drains and sediment basins that will be utilised to manage CGO area runoff in conjunction with the mine water management system shown on Figure 8. Surface water runoff collected by ESCMP structures will be transferred to the process water storage (D6). Runoff from the soil stockpiles located in the north of ML 1535 and within ML 1791 will be released into local drainages ultimately reporting to Lake Cowal following settling of sediment within a sediment basin, in accordance with Landcom (2004) *Volume 1 of Managing Urban Stormwater – Soils and Construction* and DECC (2008) *Managing Urban Stormwater – Soils and Construction Volume 2E Mines and Quarries* guidelines.

Surface water runoff from the southern soil stockpile (south-east of the IWL) is facilitated by an existing internal access track located to the east of the soil stockpile. Ultimately, surface water runoff from the southern soil stockpile collects within the UCDS, with settling of sediment within the stilling and outfall basin (Figures 7a to 7c) prior to reporting to Lake Cowal.

The mine water management system includes nine containment storages which taken together provide for control of site water. The function of these contained water storages is summarised in Table 7.

Decant water and rainfall that accumulates on the surface of the tailings storage facilities/IWL is progressively reclaimed and pumped to D6 for use in the process plant. The allowance to maintain freeboard is based on a 1 in 1,000-year ARI 48-hour storm event across the tailings storage facilities/IWL.

Contained water storages D5A and D6 have been lined (with a plastic liner, compacted clay or equivalent) to the satisfaction of the EPA.

Table 7
Summary of Contained Water Storages

Storage Number	Catchment/Function	Approximate Storage Capacity (ML)*
D1 (existing)	Runoff from northern perimeter of the northern waste rock emplacement. Collected water is pumped to D6.	57.8
D2 (existing)	Runoff/seepage from ROM and low-grade stockpile areas from the northern waste rock emplacement area, the batters of the northern tailings storage facility and other areas within the Internal Catchment Drainage system (ICDS). Collected water is pumped to D6 or D9.	198.2
D3 (existing)	Runoff from perimeter catchment surrounding the open pit and the perimeter waste rock emplacement areas. Collected water is pumped to D6.	38.1
D4 (existing)	Runoff from the southern perimeter of the southern waste rock emplacement. Collected water is pumped to D6 or D9.	62.3
D5A (existing)	Process plant area drainage collection. Water is pumped to D6.	78.6*
D6 (existing)	Process water supply storage. Main source of process plant make-up water requirements.	19.3
D8B (existing)	Runoff from southern waste rock emplacement, the batters of the southern tailings storage facility and other areas within the ICDS (including ROM areas). Water is pumped to D9.	30.4
D9 (existing)	Process water supply storage. Storage for raw water. Water is pumped to D6. Some water used for tailings storage facilities lift construction.	730.7
D10 (approved)	Process water supply storage. Storage for raw water. Water is pumped to D9.	1,500

Source: After Hydro Engineering & Consulting (2018).

* Calculated from as-built plans confirmed by Evolution

Site Water Balance

A revised site water balance for the approved CGO has been prepared as part of the *Cowal Gold Operations Underground Development Project EIS* (Evolution, 2020a). The model involved simulating the performance of the modified water management system under 'dry', 'median' and 'wet' conditions based on 128 years of daily rainfall and pan evaporation data.

A summary of the simulated water balance for the life of the approved CGO under the "dry", "median" and "wet" climatic scenarios is shown in Table 8. It is expected that the majority of total water requirements for the approved CGO will continue to be supplied from internal water sources, with the remainder supplied from external water sources.

Table 8
Simulated Water Balance for the Life of the Approved CGO

Expected Water Demand/Supply	10th Percentile Rainfall Sequence (Dry)	Median Rainfall Sequence	90th Percentile Rainfall Sequence (Wet)
	(ML/year)		
Inflows* (ML/year)			
Internal Water Sources			
Catchment Runoff	1,114	1,380	1,443
Tailings water return	2,579	2,579	2,579
Open Pit Groundwater	685	685	685
Subtotal – Internal Water Sources	*4,378*	*4,644*	*4,707*
External Water Sources			
Saline Groundwater Supply Bores within ML 1535	52	43	49
Bland Creek Palaeochannel Borefield	1,777	1,628	1,597
Eastern Saline Bores	438	430	421
Lachlan River Licensed Extraction**	754	686	676
Subtotal – External Water Sources	*3,021*	*2,787*	*2,743*
Total Inflow	***7,399***	***7,430***	***7,449***
Outflows* (ML/year)			
Evaporation	960	1,011	1,037
Haul Road Dust Suppression	223	222	221
IWL Embankment Construction Water	93	93	93
Process Plant Supply	5,880	5,880	5,880
Underground mine vent loss	134	134	134
Spills	0	0	0
Total Outflows	**7,290**	**7,340**	**7,364**

Source: After Hydro Engineering & Consulting (2018).

Note: Discrepancies in totals due to rounding.

ML/year = megalitres per year

* Runoff recovered from the outside batters of the perimeter waste rock emplacement has not been simulated. Recovery will increase catchment runoff and will reduce by a corresponding amount the demand of water from external sources

** Modelled volume of water actually reaching CGO – excludes irrigation channel losses

Interaction with Lake Cowal

As part of the EIS (North Limited, 1998a), a model of Lake Cowal and its catchment was used to investigate the potential effects that the mine will have on the water balance dynamics of Lake Cowal, including changes to average water levels in the lake and changes to the frequency and volume of spills from Lake Cowal to Nerang Cowal downstream. The water balance model provides a means of assessing how the water management system as a whole will perform under various conditions (Gilbert and Sutherland, 1997).

The CGO mine area is physically isolated from Lake Cowal by the lake isolation system (Section 4.1.2). The outer face of the isolation system extends approximately 1 km into Lake Cowal and forms a new lake foreshore.

As the lake isolation system will exist during and beyond the operations phase, the EIS predictions regarding changes to lake volume and the potential effects on runoff water quality remain the same (Gilbert & Associates, 2009).

No spills were predicted in the site water balance model from either of the contained water storages (D1 and D4) that could spill to Lake Cowal in any of the 128 possible climate sequences modelled. This outcome is contingent upon pumped dewatering of these storages in between rainfall events (*ibid*.). Pump extraction rates of 100 litres per second (L/s) and 105 L/s for storages D1 and D4 were assumed respectively (*ibid*.).

Water storage D10 has been approved but has not yet been built. If it is, it will have a 1:1,000 ARI storm of 48 hours duration above its normal operating level and will be drained via a pump back system to contained water storage D9 located within the ICDS (Table 5).

4.2.3 Pit Dewatering

During CGO operations, water will accumulate within the open cut from incident rainfall and groundwater seepage (North Limited, 1998a). This water will be captured for reuse elsewhere within the mining leases, in accordance with a pit dewatering program outlined in the following sections.

Dewatering Bores

An open pit dewatering program is currently in operation at the CGO to manage surface water and groundwater inflows. Earlier vertical dewatering bores have been decommissioned in favour of horizontal bores (Coffey, 2018a). Use of the horizontal bores has provided sufficient depressurisation of the pit wall (*ibid.)*. The last vertical bores were decommissioned in December 2017 (*ibid.*).

Saline groundwater generated during open pit dewatering is pumped to the process plant for use in ore processing. A network of monitoring bores/piezometers has been installed to monitor draw-down levels during the life of the mine.

Surface Water Inflows

Significant surface water inflow can occur following occasional heavy rainfall events. The catchment area draining to the open pit during operation is restricted to the pit itself and a small perimeter area enclosed by an external bund. Water management structures have been installed to divert water from other areas outside this bund to site runoff collection ponds. Any water entering the open pit eventually makes its way to sump pumps in the floor of the pit sized to handle a 1 in 10 year ARI rainfall event. The pumps have sufficient capacity to remove the ponded water from the design event to contained water storages D6 or D3 within 48 hours (Gilbert & Associates, 2008).

The contained water storage D6 has capacity to store runoff from the 1 in 1,000 year ARI, 48 hour event above its normal operating level (Gilbert & Associates, 2008).

Groundwater Inflows

The open pit will ultimately comprise an oval shaped hole with a surface area of approximately 131 hectares and a maximum depth at approximately -331 m AHD (i.e., approximately 540 m below the natural surface level (Evolution, 2018).

No significant difference between groundwater inflows has been observed predicted between Lake Cowal in its inundated state and its dry state (Coffey, 2020a), indicating the hydraulic separation of the CGO open pit and Lake Cowal.

The monitoring and reporting of groundwater inflows into the CGO has been established for some years. This will continue for the life of the mine and, in accordance with DA 14/98 4.4(d)(iv), the review and correlation of groundwater modelling with monitoring data will be undertaken every three years. Where the model does not have an acceptable correlation with actual values, the model will be revised.

Groundwater Quality

Assessment of baseline groundwater salinity levels undertaken for the EIS by Coffey Partners International (1997) reported that:

- The alluvial groundwater system had very high salinity in the range of 19,000 to 72,000 μS/cm within the open pit extent and 6,000 to 44,400 μS/cm beneath the tailings storage facilities area.
- The fractured rock groundwater system also had very high salinity in the range of 50,900 to 63,700 μS/cm.

Monitoring data indicates that, while open pit dewatering is causing a localised reduction in groundwater levels, no changes in groundwater chemistry appear to be associated with this drawdown (Coffey,2018a). Monitored groundwater pH levels and EC concentrations within ML 1535 are generally consistent with the background (i.e. pre-mining) monitored levels.

As the orebodies anticipated to be mined through to the end of mine life are essentially the same (i.e., oxide ore and primary ore), no change to the geochemistry of tailings is expected, therefore no change to the quality of seepage from the tailings storages and IWL is expected (Coffey, 2018a). Therefore, no additional impacts to groundwater quality associated with seepage from the tailings storages/IWL are expected. Evolution has begun planning to install groundwater interception bores adjacent to the IWL to prevent salinisation of the ground surface.

4.2.4 Integrated Erosion, Sediment and Salinity Control System

The CGO integrated erosion, sediment and salinity control system is presented in the ESCMP. The ESCMP identifies the prevention of sediment-laden runoff from the mine site discharging into the lake as the primary objective of the erosion and sediment control system.

A summary of the integrated erosion, sediment and salinity control system for the construction phase of the CGO is presented in Section 4.1.4. The implementation of these integrated control measures will continue for the life of the mine with localised variation as required by the surrounding mining infrastructure, the topography and the catchment. For example, the additional erosion and sediment control system associated with the soil stockpiles located in the south of ML 1535 and in the north of ML 1535 and in ML 1791 will involve upslope diversion drains and/or bunds and sediment/stilling basins to manage surface water runoff and provide erosion and sediment control.

4.2.5 Waste Emplacements

Mine waste recovered during the open cut mining operations has been emplaced in three areas comprising the northern, southern and perimeter waste emplacements (Figure 2). The northern and southern waste emplacements are integral with the perimeter waste emplacement and is a component of the permanent lake protection bund. The outside faces of the northern and southern waste emplacements form part of the perimeter catchment limits of the CGO.

The original natural surface contours underlying the northern waste emplacement sloped to the north and away from the open pit. The design objective was to facilitate containment of seepage from saline generating components in the waste rock within the mine site area. Construction works associated with the site included construction of a low permeability basal layer beneath the northern waste emplacement area - sloping inward toward the open pit. A conceptual cross-section of the northern waste emplacement is shown on Figure 11. The basal layer was intended to provide control over the direction of internal seepage such that it will emerge from the internal rather than the external toe of the waste emplacement area where it will report to contained water storage D2. Any runoff from the external face of the northern waste emplacement will report to the external contained water storage D1 which has been constructed below the external (north-eastern) toe of the northern waste emplacement area (Gilbert & Associates, 2008).

The extension of the northern waste emplacement up to where it will integrate with the IWL will be constructed in accordance with the same design principles for the existing northern waste emplacement described above.

The southern waste emplacement was constructed over a low ridge line such that seepage will have naturally reported to both the southern and northern sides of the emplacement. A low permeability basal layer sloping to the north was incorporated into the pre-development construction works to facilitate drainage of seepage waters toward the open pit. The basal layer was intended to provide control over the direction of internal seepage such that it will emerge from the internal rather than the external toe of the waste emplacement area where it will report to contained water storage D8B.

Any runoff from the external face of the southern waste emplacement will report to the external contained water storage D4 which has been constructed below the external (south-eastern) toe of the southern waste emplacement area (Gilbert & Associates, 2008).

Based on the results of rehabilitation trials conducted to date, the outer batters of the waste emplacements will be rock armoured with primary waste rock mulch (Figure 11) to provide long-term slope stability, control surface water runoff downslope and reduce erosion potential. The approved rehabilitation concept/method will also include cross-ripping the rock mulch and topsoil along the contour of the slope to create ‘troughs and banks’ to minimise the potential for erosion downslope.

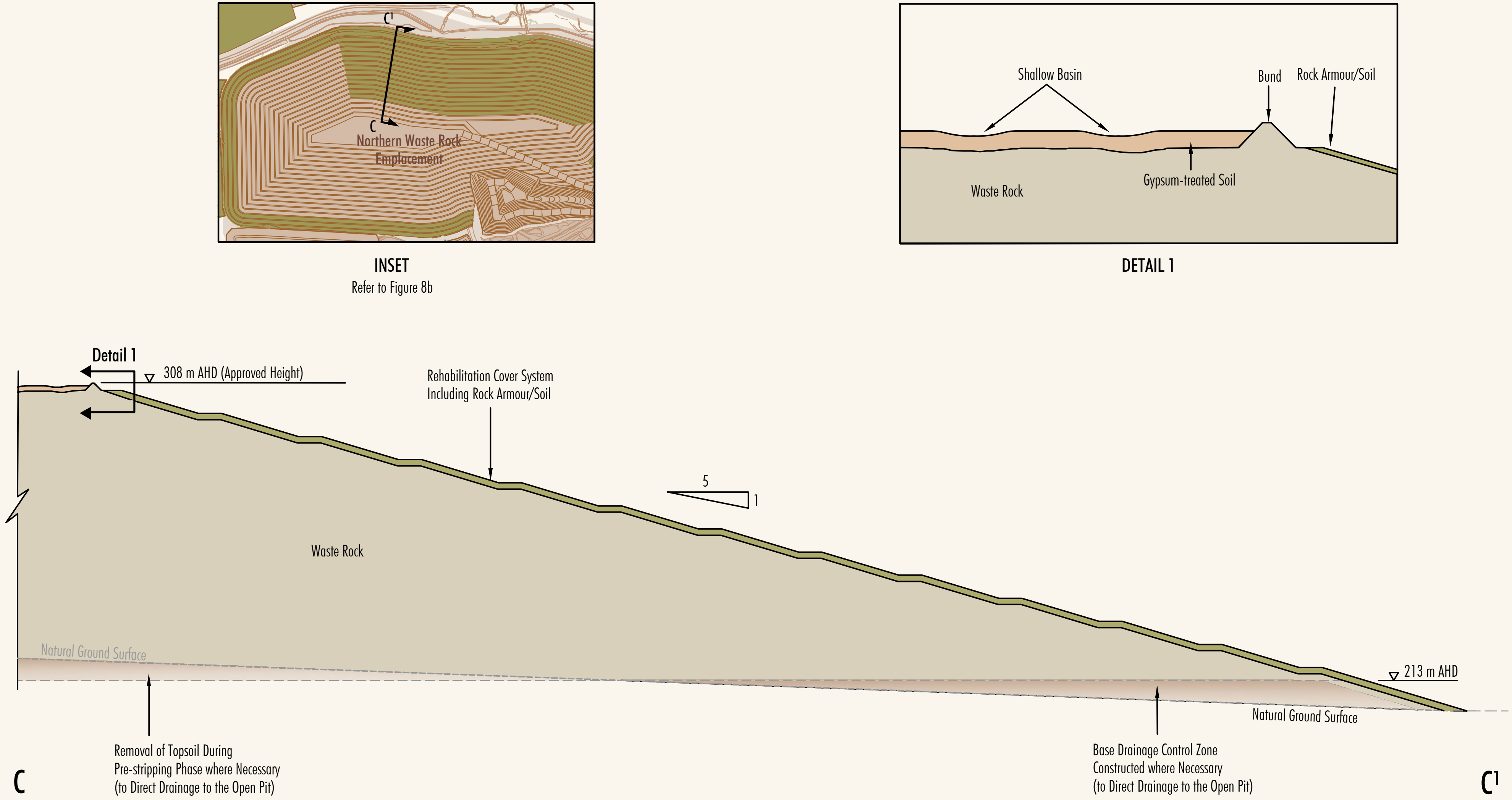
The perimeter waste emplacement area forms part of the permanent lake isolation bund system. It provides a continuous elevated landform linking the northern and southern waste emplacement areas.

4.2.6 Process Plant Area

The process plant area has been bunded so that any accidental spills of processing water or other potentially hazardous liquids are retained internally and will report to the processing plant bund/ sump network. Runoff from ran events around the process plant report to localised catchments as part of the ICDS.

The quantity of water in the process plant area is managed in the following manner:

- the storage water level in D5A is kept low by the regular transfer of accumulated water to the process water storage (D6); and
- the process plant contained storage (D5A) has sufficient storage capacity for a 1 in 1,000-year ARI, 48-hour duration event (Table 5). This is approximately equivalent to a total of 216 mm of rainfall over 48 hours (Gilbert & Associates, 2003).



Not to Scale

Source: Barrick (2014)

WATER MANAGEMENT PLAN

FIGURE 11
Conceptual Embankment Section of Northern Waste Rock Emplacement

Evolution MINING Cowal

4.2.7 Infrastructure Located Outside of the Up-catchment Diversion System

The CGO's explosives compound and magazine is located to the south-east of the southern waste emplacement, outside of the UCDS (Figures 2 and 7a to 7c) and have been constructed in accordance with relevant Australian Standards. This includes fencing around the perimeter of the facilities. Surface water runoff from these facilities is managed using bunds and drains, with any potentially contaminated water pumped to contained water storage D9 (or D10, once constructed).

4.2.8 Cyanide Management

The management of cyanide at the CGO is in accordance with the Cyanide Management Plan (CMP). The CMP (includes a cyanide monitoring programme) has been prepared in accordance with Development Consent Condition 5.3(b) and in consultation with the then DRG, NSW Office of Environment and Heritage, DPE Water and EPA, and to the satisfaction of the DPE, and will continue to be implemented during the operational phase of the CGO.

Development Consent Condition 5.3(a) establishes limits for the aqueous component of the tailings slurry (as monitored at the process plant via an automated sampler), such that cyanide levels in the tailings storages/IWL do exceed 20 milligrams (mg) weak acid dissociable cyanide per litre (CN_{WAD}/L) (90 percentile over six months) and 30 mg CN_{WAD}/L (maximum permissible limit at any time). The CMP details how this will be achieved.

4.2.9 Tailings Management

As required by Development Consent Condition 5.2, the existing tailings storage facilities have been constructed to the requirements of the DRG, EPA and DSC and in consultation with DPE Water. The floor of the existing tailings storage facilities has been constructed and compacted as required to the permeability required by Development Consent Condition 5.2(b) as accepted by the DRG and EPA, in consultation with DPE Water.

Additional lifts of the IWL will continue to be constructed in accordance with these same requirements.

As described in Section 4.2, the tailings storage facilities/IWL are part of the site water management system. Tailings water is the primary source of process water (Section 4.2.2) and also has the potential to impact surface water and groundwater within the mine site.

The UCDS (Section 4.1.1) and lake isolation system (Section 4.1.2) effectively isolate the mine site, including the tailings storage facilities/IWL, from Lake Cowal and the surrounding area.

The following section describes the management of the quantity and quality of tailings water.

Approximately 167 million tonnes of ore will be produced over the life of the CGO (Evolution, 2018). The approximate final heights of the IWL, including the southern tailings storage facility are 246 m AHD and 248.4 m AHD, respectively (*ibid*.).

Tailings are deposited into the tailings storage facilities/IWL as a slurry under sub-aerial conditions. Free water liberated during settling and runoff from incident rainfall accumulates in an internal decant pond and pumped to water storage D6 for re- use in the processing plant. The tailings storage facilities/IWL are designed to maintain a minimum freeboard in the tailings storage facilities/IWL sufficient to store a 1 in 1,000 year ARI rainfall event at all times (Evolution, 2018). This is approximately equivalent to a total of 216 mm of rainfall over 48 hours (Evolution, 2018). The required freeboard will be maintained during the CGO life as the IWL storage fills with tailings via a series of embankment lifts.

The modified UCDS (Section 4.2.1) diverts runoff from the catchment area upslope of the IWL to drainage lines which flank both the northern and southern sides of the CGO (Figure 2). Prior to construction of the existing tailings storage facilities/IWL, temporary toe drains and containment bunds were constructed around the tailings storage facility embankments to collect runoff from the external batters and any accidental spills from the tailings reticulation lines (Gilbert and Sutherland, 1997). Construction of the IWL also includes toe drains and containment bunds to collect runoff from the IWL external batters for collection in either contained water storages D1 or D4 (Figures 7a-c).

Consistent with the rehabilitation cover system concept for the waste rock emplacement outer batters, the outer batters of the IWL are rock armoured with primary waste rock mulch.

Cyanide from the CGO process plant can arrive at the tailings storage facilities/IWL in three forms *viz*. as free cyanide, as a range of cyano-metal complexes or as thiocyanate. These forms are interchangeable depending on the chemical make-up of the liquor in the tailings storage facilities/IWL. The bulk of decay in the tailings storage facilities/IWL will happen through the process of volatilisation. Other significant decay paths include: association/disassociation of metal complexes; anaerobic biodegradation to relatively innocuous non-cyanide species and degradation of iron cyanide complexes by UV radiation to CN_{WAD} and free cyanide species (North Limited, 1998a).

During the EIS, it was predicted that the CN_{WAD} concentrations in the reclaim water when processing oxide ore will range from 5 to 10 mg/L and from 10 to 15 mg/L when processing primary ore (North Limited, 1998a). It was also predicted that within 2 to 3 months after discharge ceases the CN_{WAD} complexes in the ponded decants (oxide and primary tailings) will decay to very low concentrations (Environmental Geochemistry International [EGi], 1997).

Actual concentrations of CN_{WAD} in the ponded oxide tailings liquor during operations have been measured at an average of approximately 5.5 mg/L and measured at an average of approximately 4.4 mg/L in the ponded primary tailings liquor (i.e. the CN_{WAD} concentrations in the ponded tailings water at the CGO are within the range predicted in the EIS). The rate of CN decay from the liquor entrained within the tailings and the ponded decant liquor for the CGO is not expected to differ from the EIS predictions for the CGO tailings storage facilities (Geo-Environmental Management Pty Ltd, 2016).

The monitoring program for the IWL (including cyanide monitoring) is described in Section 4.3.

Tailings storage facility/IWL water management at the CGO will continue to involve maximising water re-use through the under-drainage pipe network, decant towers and water return pipeline to the contained water storage (D6).

An underdrainage system along the eastern perimeter embankment of the IWL will be constructed to assist in water recovery and the mitigation of seepage (CMW Geosciences, 2018). The underdrainage system will recover water at multiple locations through inclined bores or similar (Evolution, 2018). The underdrainage lines comprises slotted pipe surrounded by clean aggregate, wrapped in geotextile and stabilised by select rock (Evolution, 2018). The underdrainage lines grade to sumps with water collected in the underdrains to flow under gravity to the sumps (CMW Geosciences, 2018).

Successive groundwater assessments of seepage from the tailings storages and IWL to the underlying aquifers predicts that it will slowly migrate towards the open pit (i.e. the open pit will continue to act as a sink for seepage flows from the tailings storage facilities/IWL) (Coffey, 2020a).

Similarly, post-closure, cyanide and dissolved heavy metals within the IWL will not move beyond 2.2 km from the IWL and will ultimately migrate to the mine void.

4.2.10 Sewage and Associated Waste Management

In accordance with Development Consent Condition 5.6, a site sewage treatment facility has been installed. Treated sewage and sullage will continue to be disposed of to the satisfaction of Bland Shire Council (BSC) and the EPA and in accordance with the requirements of the NSW Department of Health.

4.3 MONITORING PROGRAMMES

A Surface Water, Groundwater, Meteorological and Biological Monitoring Programme (SWGMBMP) has been prepared for the CGO (for all stages of the development) in accordance with Development Consent Condition 4.4. The following subsections provide a summary of those programmes.

The objectives of the SWGMBMP are to:

a) fulfil the relevant development consent conditions;

b) provide a description of baseline water, meteorological and biological monitoring and therefore, information against which operational monitoring results can be compared;

c) establish a programme which contributes to the assessment of the effectiveness of environmental impact mitigation measures during the construction and operation phases of the CGO;

d) outline a process by which administering authorities and stakeholders can regularly assess and confirm the effectiveness of the management strategies; and

e) provide details of the surface water, groundwater, meteorological and biological monitoring programmes during the construction and operation phases of the CGO.

The information presented below and in the following sections has been taken from the SWGMBMP in order to address the requirements of DA 14/98 condition 4.4(d)(ii) and (iii).

The results from the monitoring programmes presented in the SWGMBMP will be used to assist in the management of the quality and quantity of surface and groundwater within and around the mine site. This will be achieved through the implementation of the following review procedure for each of the monitoring programmes. It will be the responsibility of the Sustainability Manager in consultation with the Mining Manager to implement the review procedure, as described below.

SWGMBMP Monitoring Data Review Procedure

Data Validation

All data will be validated to ensure that it has been obtained in accordance with the requirements of the SWGMBMP including, but not limited to:

- samples being taken by a suitably qualified and experienced staff or consultants to the satisfaction of DPE- Water and EPA and in the case of biological monitoring, DPE Fisheries (DA 14/98 condition 4.4(b));
- samples handled and transported, correct sampling equipment and container used in accordance with AS/NZS 5667.1:1998 *Water quality - Sampling - Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples*; and
- samples have been analysed by a National Association of Testing Authorities (NATA) accredited laboratory.

Where a comparison with baseline monitoring data is required, data validation will also involve a review of the relevant baseline data so as to detect any anomalous results.

Data Management

Validated data from each of the monitoring programmes detailed in the SWGMBMP will be entered onto a digital database by the Sustainability Manager (or delegate) as described in the SWGMBMP. This will render the data in a form suitable for analysis.

Data Analysis and Investigation

Data from each of the monitoring programmes detailed in the SWGMBMP will be analysed by suitably qualified and experienced staff or consultants. Data analysis will include, but not be limited to:

- **Surface Water Monitoring**: Surface water quality data will be compared to investigation trigger values described in Section 5.1. Where monitoring results indicate values in excess of the relevant trigger values, an investigation will be conducted to assess the need to implement management measures in addition to those described below (e.g. treatment of contaminated waters or alteration of upstream land management practices). The investigation will involve the consideration of the monitoring results in conjunction with mining operations being undertaken at the time, water quality results in nearby locations (including lake inflow sites), the prevailing and preceding meteorological conditions and changes to the land use/activities being undertaken in the contributing catchment. The investigation will also involve consideration of baseline data results collected to date. The scope and timeframe of the investigation will be developed in consultation with the relevant authorities. The results of the investigation will be presented to the relevant authorities and the Community Environmental Monitoring and Consultative Committee (CEMCC) within the agreed timeframe.
- **Groundwater Monitoring**: Groundwater volume, level and quality data will be compared to relevant baseline data, data collected since the commencement of operations and assessment data presented in the EIS and subsequent CGO environmental assessments. Where the data analysis indicates that an adverse impact is occurring to the efficiency of surrounding bores, an investigation will be undertaken to determine the need and type of ameliorative measures. The scope and timeframe of the investigation will be developed in consultation with the relevant authorities. The results of the investigation will be presented to the relevant authorities and the CEMCC within the agreed timeframe.
- **Biological Monitoring**: The SWGMBMP describes how the CGO's potential impact on fish and aquatic invertebrates will be assessed. This includes assessment of impacts associated with change in Lake water quality, removal/modification of habitat and movement of dust away from active areas to Lake environs. In addition, the SWGMBMP describes how the assessment of the concentration of metals in sediment taken from lake monitoring sites will be assessed against the recommended trigger values and compared with results collected to date. If the sediment trigger values are exceeded, a preliminary assessment will be conducted. If the preliminary assessment shows that impacts may be potentially associated with the CGO, further investigation will be conducted in accordance with the methodology described in ANZG (2018) to assess the need and type of ameliorative measures.

The scope and timeframe of the investigation will be developed in consultation with the relevant authorities (e.g. requirement for toxicity testing). The results of the investigation will be presented to the relevant authorities and the CEMCC within the agreed timeframe.

Ameliorative/Contingency Measures
Ameliorative/contingency measures will be developed in consultation with the relevant authorities based on the results of the above investigations. Additional monitoring programmes will also be implemented to measure the effectiveness of the ameliorative/contingency measures.

Investigations will subsequently be triggered where necessary and mitigation measures (measures to control/reduce/remove impacts) implemented where necessary. The type and detail of the investigation will be determined on a case-by-case basis in consultation with the CEMCC and relevant regulators.

In addition to the above, all data obtained from the surface water, groundwater and biological monitoring programme is progressively reviewed and a trend analysis undertaken to aid in the detection of any gradual changes in water quality. The results of these analyses is reported in the Annual Review (Section 8.3).

4.3.1 Meteorological Monitoring

The results of the meteorological monitoring programme is used in the on-going review and improvement of the site water management systems presented in Sections 4.1 and 4.2. In particular meteorological monitoring results such as evaporation and rainfall rates are used in the validation of the site water balance, which is discussed in Section 4.2.2.

An automatic weather station has been installed at the CGO in accordance with DA 14/98 condition 6.2. Monitoring parameters recorded by the station are listed in Table 9. Meteorological data is also available from several local BoM stations listed in Table 10.

Meteorological monitoring will continue for the duration of the CGO mine life to provide site specific meteorological data for the on-going assessment of the site's water balance and effectiveness of relevant impact mitigation strategies (such as erosion and sediment control – see ESCMP).

Table 9
Meteorological Monitoring Parameters

Parameter	Units
Rainfall	mm
Temperature	^{0}C
Relative Humidity	%
Wind Direction	degrees
Wind Velocity	km/h
Barometric Pressure	hPa
Solar Radiation	W/m^2

Source: North Limited (1998a).
ºC = degrees Celsius.
km/h = kilometres per hour.
hPa = hectopascals.
W/m^2 = watts per square metre.

Table 10
Bureau of Meteorology Station Locations

BoM Station	Station Number	Approximate Location Relative to CGO	Period of Record
Forbes (Camp Street)	065016	55 km north-east	1873 - 1998
Forbes (Airport AWS)	065103	55 km north-east	1995 - Present
Quandialla Post Office	073032	55 km south-east	1925 – Present
Wyalong Post Office	073054	38 km south-west	1895 - Present

Source: BOM (2017a, 2017b, 2017c, 2017d)

4.3.2 Surface Water Monitoring

In accordance with DA 14/98 condition 4.4(d)(ii), a surface water monitoring programme for the operations phase of the CGO has been developed. Surface water monitoring is undertaken at specific areas within the mine area including the contained water storages, UCDS, ICDS, soil stockpiles, open pit and tailings storage facilities/IWL (Figure 12).

A summary of the surface water monitoring programme is provided in Table 11 which outlines the monitoring locations, frequency of monitoring and surface water parameters that will be monitored. Trigger levels have not been included as the waters in an around Lake Cowal as there are no permanent flows or waterbodies. The majority are fed by floodwaters which is inherently variable in its chemistry as it enters Lake Cowal and the water quality continues to vary as flood sediments settle out and water evaporates or further affected by periodic rainfall. Cyanide of any level outside of the process plant and IWL is subject to immediate investigation.

The surface water monitoring locations within the ML area are shown on Figure 12, with the regional surface water monitoring locations presented on Figure 13.

Table 11
Surface Water Monitoring Programme

CGO Component	Site	Monitoring Frequency	Parameter/Analyte
UCDS	Up-catchment diversions north and south (UCD north and UCD south)	Monthly and following rainfall events of 20 mm or greater in a 24 hour period	Suspended Solids, EC, pH.
Internal Catchment Drainage System	Contained water storages D1 and D4	Monthly and following rainfall events of 20 mm or greater in a 24 hour period	Suspended Solids, EC, pH.
	Contained water storages D2, D3, D5A, D6, D8B, D9 and D10	Quarterly	Oil and grease, EC, pH, dissolved oxygen. Total hardness, TSS and total dissolved solids (TDS). Ca, Mg, K, sodium, chloride, sulphate. Dissolved As, Cd, Cu, Mo, Ni, Pb, Sb, Se, Zn.
	Sediment control structures	Monthly and following rainfall events of 20 mm or greater in a 24 hour period	Structural integrity, Suspended Solids.
		Overflow event	Suspended Solids, pH, EC.
Pit/Void Water	Pit sumps	Monthly	Suspended Solids, EC, pH.
Tailings Storage Facilities/IWL	Decant	Weekly	EC, pH.
Lake Cowal Water Level	Lake Cowal gauge board	Monthly (when lake water is present)	Lake water level.
Lake Cowal Chemical Monitoring	P1, P3, L1, C1	Weekly and following rainfall events of 20 mm or greater in a 24 hour period (when lake water is present and the lake water level is at or above 204.5 m AHD)	Suspended Solids, EC, pH.

Table 11 (cont'd)
Surface Water Monitoring Programme

	Lake Cowal transect sampling sites (refer to Figure 13): Lachlan Floodway transect – L1, L2, L5, L8, L9, L11 and L13 Irrigation Channel transect – I1, I3 and I4 East Shore transect – E1, E3 and E5 Bland Creek transect – B1, B2, B4 and B6 CGO transect – P1 to P3 Control sites transect – C1 to C3	Monthly (when lake water is present and the lake water level is at or above 204.5 m AHD)	EC, pH, turbidity, dissolved oxygen, temperature, lake water level.
		Quarterly (when lake water is present and the lake water level is at or above 204.5 m AHD)	Suspended Solids, Alkalinity, cations and anions. Total Fe, Ca, Mg, K, sodium, chloride, sulphate, total phosphate, ortho phosphate, ammonium, nitrogen as nitrate and nitrite. Total As, Cd, Cu, Mo, Ni, Pb, Sb, Se and Zn. Dissolved As, Cd, Cu, Mo, Ni, Pb, Sb, Se and Zn.
Lake Cowal Inflow Sites	Lake inflow sites: Lachlan Floodway, Irrigation Channel, Bland Creek and Sandy Creek inflow sites (refer to Figure 13)	Monthly (when lake water is present and the lake water level is at or above 204.5 m AHD)	EC, pH, turbidity, dissolved oxygen, temperature.
		Quarterly (when lake water is present and the lake water level is at or above 204.5 m AHD)	Suspended Solids, Alkalinity, cations, anions. Total Fe, Ca, Mg, K, sodium, chloride, sulphate, total phosphate, ortho phosphate, ammonium, nitrogen as nitrate and nitrite. Total As, Cd, Cu, Mo, Ni, Pb, Sb, Se and Zn. Dissolved As, Cd, Cu, Mo, Ni, Pb, Sb, Se and Zn.
Other Waters	Lachlan River - Jemalong Weir Stream Gauge	Continuous (data to be obtained from DPE Water every 6 months)	Flow.

Surface water monitoring will continue to be undertaken in Lake Cowal at monitoring sites along the six transects used during the baseline monitoring programme (described in the SWGMBMP) to enable evaluation of water quality data against records of baseline monitoring, in accordance with DA 14/98 condition 4.4(a)(ii). A summary of the Lake Cowal baseline surface water quality results is provided in

Section 5.1. Monitoring is conducted at the monitoring locations as determined by the Sustainability Manager (or delegate) when the water level in Lake Cowal is at or above 204.5 m AHD.

Monitoring within the lake both close to and distant from the CGO is carried out. Monitoring at sites in the eastern section of the lake, some 3 to 6 km from the CGO area, have been shown to be less susceptible to the potential effects the mine (i.e. potential mine effects are most likely to be detectable in close proximity to the source [impact sites P1, P2 and P3] before they will be detectable at a distance [control sites C1, C2 and C3]) (Figure 13).

Monitoring data is entered into the CGO monitoring database (Section 8.1) to assist reporting and enable trends to be easily identified. Data collected from the above monitoring is used to validate the predicted performance of the site water management system and/or to determine the need for any augmentation of the system (Section 8.1). Surface water monitoring results are interpreted and reported in the Annual Review (Section 8.3) and posted on Evolution's website in accordance with DA 14/98 condition 9.4(a).

The results of the surface water monitoring programme are used in the ongoing review and improvement of the site water management systems presented in Sections 4.1 and 4.2.

4.3.3 Groundwater Monitoring

In accordance with DA 14/98 condition 4.4(d)(iii), a groundwater monitoring programme for the operations phase of the CGO has been developed. Groundwater monitoring will continue to be undertaken at monitoring sites used during the baseline monitoring programme (described in the SWGMBMP) (where those sites are still operational) in accordance with DA 14/98 condition 4.4(d)(iii) and at additional monitoring sites specifically related to CGO potential groundwater impacts. Additional groundwater monitoring bores have been established to replace those displaced by construction of the IWL (Table 12, Figure 12).

The groundwater monitoring programme relates to groundwater monitoring in aquifers beneath the ML area and regionally within the Bland Creek Palaeochannel aquifer. Groundwater monitoring will continue to be used to validate predictive modelling, particularly in the vicinity of the open pit, IWL and ML 1535 saline groundwater borefield (when in use). Continued monitoring of groundwater salinity will be undertaken in the Bland Creek Paleochannel Borefield to assess potential saline migration.

Groundwater monitoring commenced upon licences being obtained under Part 5 of the *Water Act, 1912.* A list of the CGO's groundwater monitoring bore licence numbers and water access licence numbers for the CGO's production bores is provided in Appendix A.

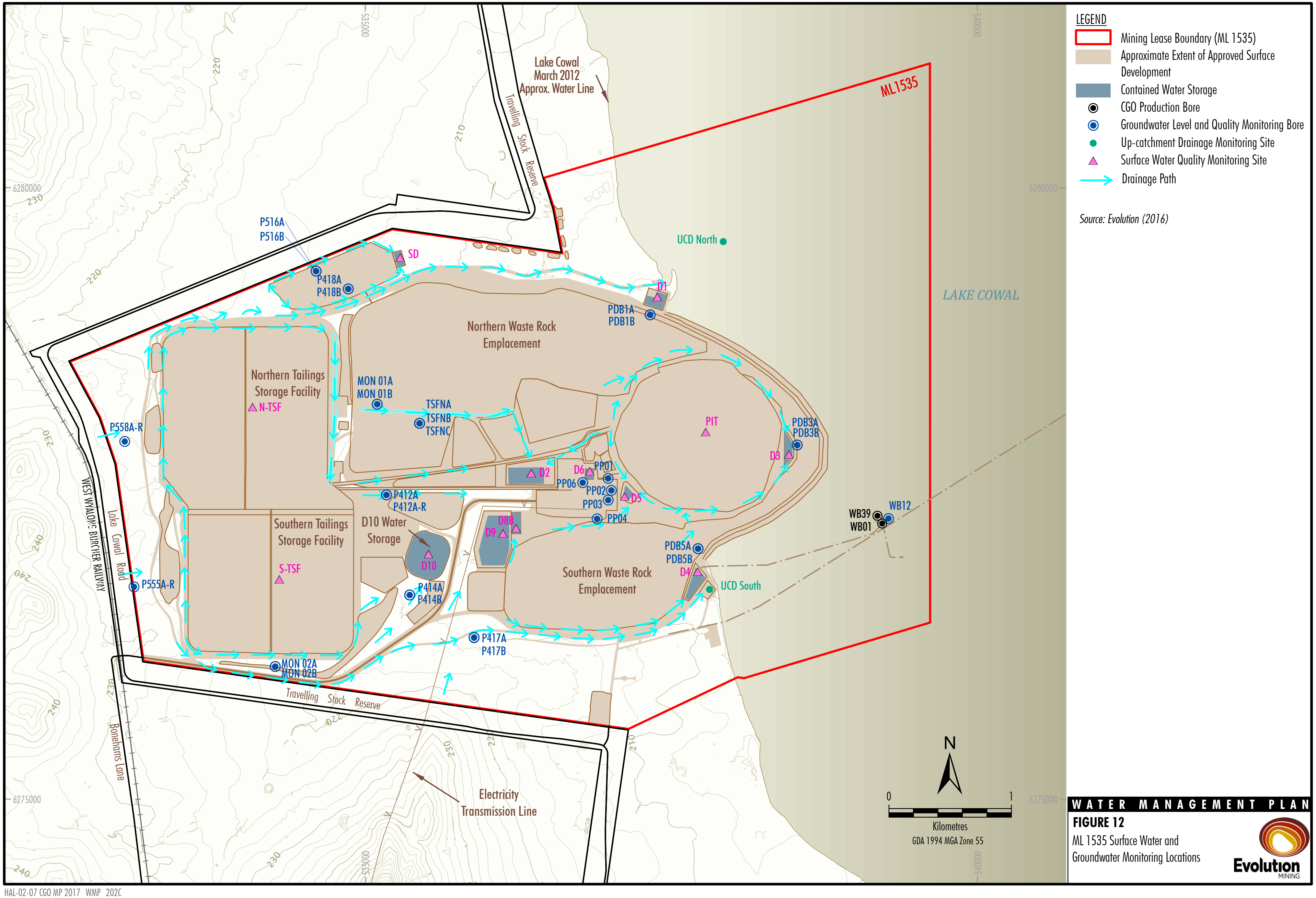
Daily/monthly meter reading will be taken for water pumped out of the underground mine. Date collected from the meter reading will be assessed during the annual review each year to monitor and evaluate groundwater inflows into the mining operations.

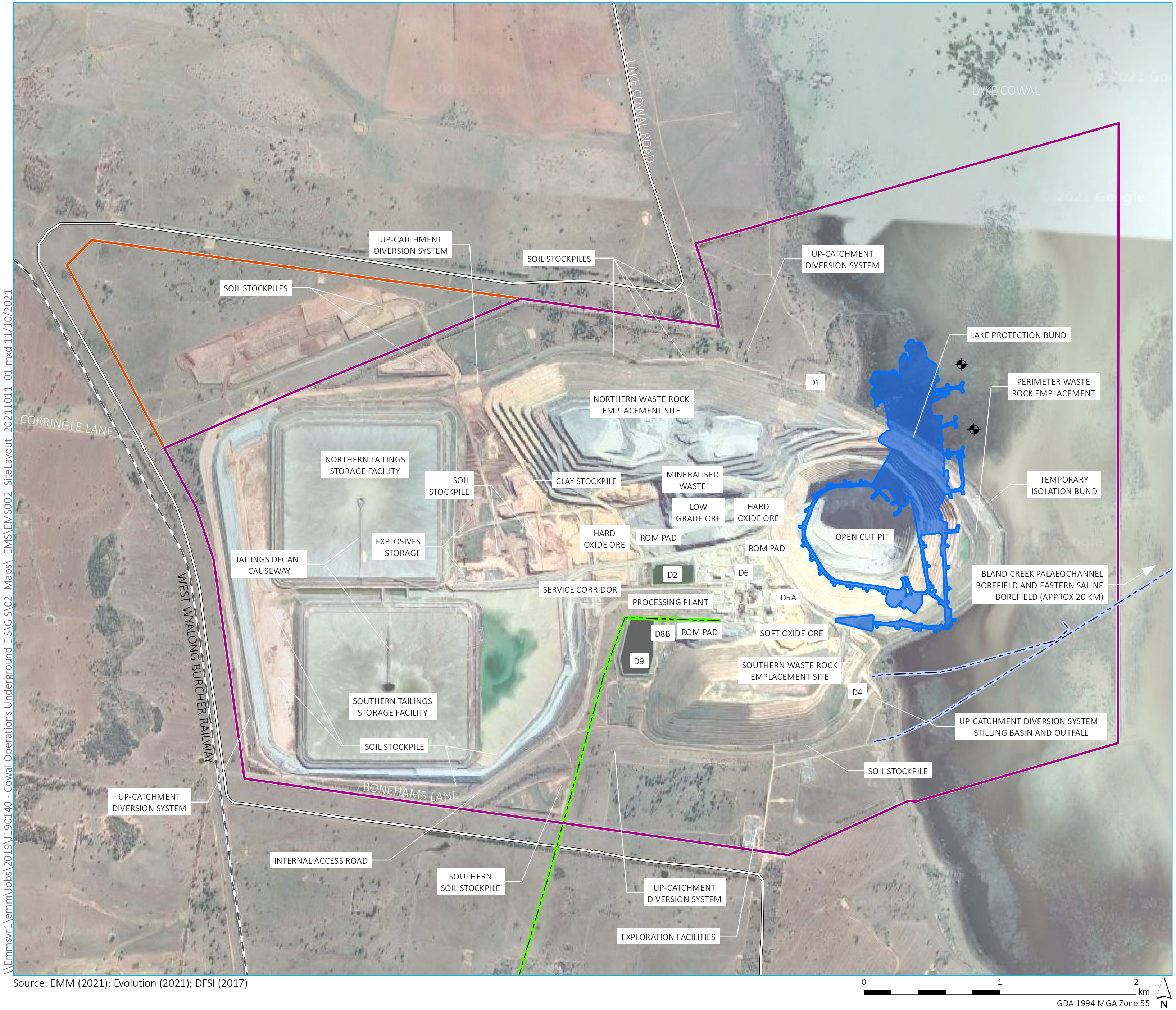
The monitoring locations, frequency of monitoring and groundwater parameters for the operations phase is provided in Table 12. The groundwater monitoring locations within ML 1535 are shown on Figure 12, with the regional groundwater monitoring locations shown on Figures 9 and 13.

In accordance with the notes to DA 14/98 4.4(d)(iv) the CGO will install two additional nested monitoring bores in specifically to monitor for potential hydraulic connection between an inundated Lake Cowal and the future underground development. These bores are included in Table 12 and shown in Figure 12.

Evolution will prepare a scope of works within a month of approval of this plan to install the additional nested monitoring bores so that **reliable baseline data** needs to be collected for the required period prior to the commencement of any underground activities. The scope of works should be prepared in consultation with DPE Water and the independent groundwater expert and should include a risk assessment.

Indicative locations of proposed monitoring bore as outlined in figure 12a.

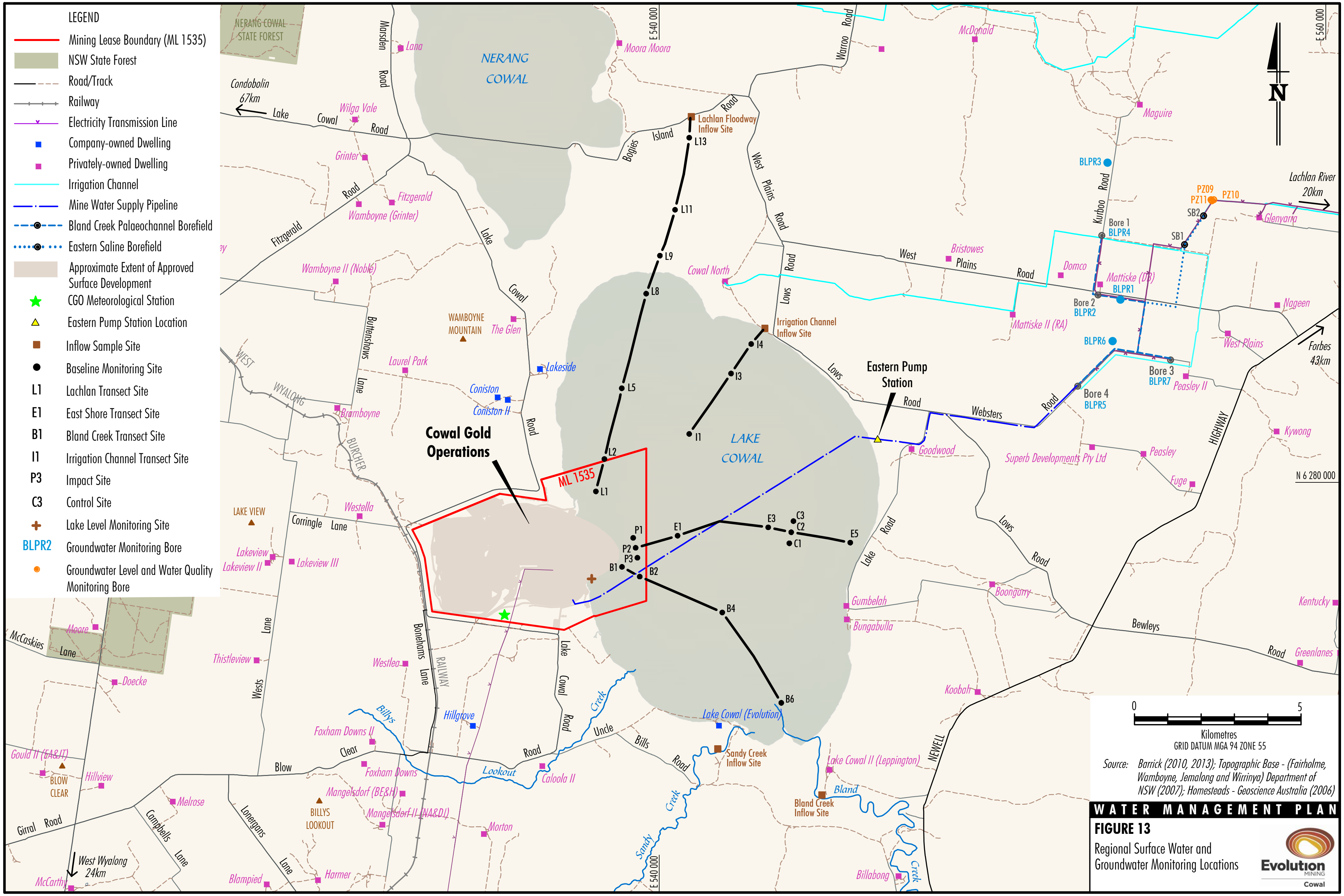

LEGEND
Mining Lease Boundary (ML 1535)
Approximate Extent of Approved Surface Development
Contained Water Storage
CGO Production Bore
Groundwater Level and Quality Monitoring Bore
Up-catchment Drainage Monitoring Site
Surface Water Quality Monitoring Site
Drainage Path
Source: Evolution (2016)
Lake Cowal March 2012 Approx. Water Line
ML1535
LAKE COWAL
Travelling Stock Reserve
UCD North
UCD South
Northern Waste Rock Emplacement
Northern Tailings Storage Facility
Southern Tailings Storage Facility
D10 Water Storage
Southern Waste Rock Emplacement
N-TSF
S-TSF
PIT
SD
D1
D2
D3
D4
D5
D6
D8B
D9
D10
P516A
P516B
P418A
P418B
PDB1A
PDB1B
MON 01A
MON 01B
TSFNA
TSFNB
TSFNC
P558A-R
P555A-R
PDB3A
PDB3B
PP01
PP02
PP03
PP04
PP06
P412A
P412A-R
P414A
P414B
P417A
P417B
PDB5A
PDB5B
MON 02A
MON 02B
WB39
WB01
WB12
WEST WYALONG BURCHER RAILWAY
Lake Cowal Road
Bonehams Lane
Electricity Transmission Line
Kilometres
GDA 1994 MGA Zone 55
N
WATER MANAGEMENT PLAN
FIGURE 12
ML 1535 Surface Water and Groundwater Monitoring Locations
Evolution MINING
HAL-02-07 CGO MP 2017_WMP_202C



\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02_Maps_EMS\EMS002_SiteLayout_20211011_01.mxd 11/10/2021

Source: EMM (2021); Evolution (2021); DFSI (2017)

Evolution Mining
Cowal Gold Operations
Figure12a



WATER MANAGEMENT PLAN

FIGURE 13
Regional Surface Water and Groundwater Monitoring Locations

HAL-02-07 CGO MP 2017_WMP_110B

Table 12
Groundwater Monitoring Programme

CGO Component	Site[1]	Monitoring Frequency	Parameters
ML Area	Open pit area (PDB1A & PDB1B, PBD3A & PDB3B, and PDB5A & PDB5B).	Monthly.	Standing Water Level (SWL), EC, pH.
		Quarterly.	Total hardness, Alkalinity, total dissolved solids (TDS). Chloride, sulphate, Ca, Mg, K and Na. Dissolved metals – As, Cd, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se and Zn.
	Processing plant area (PP01 PP02, PP03, PP04 and PP06).	Monthly	SWL, EC, pH.
		Quarterly.	Total hardness, Alkalinity, TDS. WAD and total cyanide. Chloride, sulphate, Ca, Mg, K and Na. Dissolved metals – As, Cd, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se and Zn.
	Underground area (UG-BH-01 and 02)	Monthly	equivalent groundwater elevation
	Northern and Southern tailings storage facilities/IWL (P417A, P417B IWL01 A & B, IWL02 A & B, IWL03 A & B, IWL04 A & B, IWL05 A & B, IWL06 A & B, P418 A & B, P516 A & B and P555A-R) Northern Tailings Storage Facility Area (P418A & P418B, MON01A^ & MON01B^, TSFNA^, TSFNB^ & TSFNC^). Southern Tailings Storage Facility Area (P412A^, P412A-R^, P414A^ & P414B^, P417A & P417B, MON02A^ & MON02B^). Up-gradient of the northern and southern tailings storage facilities (P558A-R^ and P555A-R).	Monthly	SWL, EC, pH.
		Quarterly.	Total hardness, Alkalinity, TDS. WAD and total cyanide. Chloride, sulphate, Ca, Mg, K and Na. Dissolved metals – As, Cd, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se and Zn.
	Northern, Southern and Perimeter Waste Rock Emplacement (External toe drain).	Monthly.	EC, pH.
		Quarterly.	Total hardness, Alkalinity, TDS. Chloride, sulphate, Ca, Mg, K and Na. Dissolved metals – As, Cd, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se and Zn.

[1] Relevant bore licence and water access licence numbers are provided in Appendix A.
^ These bores will continue to be monitored until approximately June 2019, when they will be decommissioned to facilitate development of the IWL.

Table 12 (cont'd)
Groundwater Monitoring Programme

CGO Component	Site[1]	Monitoring Frequency	Parameters
BCPC	BLPR1, BLPR2, BLPR3, BLPR4 BLPR5, BLPR6 and BLPR7.	Monthly	SWL, EC, pH.
		Quarterly	Total hardness, Alkalinity, TDS. Chloride, sulphate, Ca, Mg, K and Na. Dissolved metals: Fe and Mn.
	Private registered bores 29094, 57974, 702230, 29574, 31341, 702306, 703460 and 30636.	As provided by private groundwater users	Bore water level.
	DPE Water piezometers 36551, 36552, 36553, 36523, 36524, 36528, 36594, 36595, 36596, 36597, 36609, 36610, 36611, 36613, 36700, and 90093.	Monthly	Bore water level.
Water Supply Pipeline from BCPC Borefield (including duplication)	Above ground sections of the pipeline.	Monthly	Visual inspection.
Saline Groundwater Supply Borefields	WB12 (saline borefield within ML 1535) PZ09, PZ10 & PZ11 (Eastern Saline Borefield)	Monthly.	SWL, EC, pH.
		Quarterly.	Total hardness, Alkalinity, TDS. Chloride, sulphate, Ca, Mg, K, Na Dissolved metals: Fe and Mn.
Water Supply Pipelines from Saline Groundwater Supply Borefields	Above ground sections of the pipeline.	Monthly.	Visual Inspection (where available).

[1] Relevant bore licence and water access licence numbers are provided in Appendix A.

Groundwater monitoring results will be interpreted and reported in the Annual Review (Section 8.3) which will be made available on Evolution's website in accordance with DA 14/98 condition 9.4(a). Monitoring data will be entered into the CGO monitoring database (Section 8.1) to assist reporting and enable trends to be easily identified. Results from the groundwater monitoring programme[4] will determine the need for any augmentation of the water management system (Section 8.1). Groundwater level monitoring data collected at the DPE Water Monitoring Bore GW036553 will be compared to the trigger levels developed for management of the Bland Creek Palaeochannel to determine the need for implementation of any groundwater contingencies (Section 6.2.2).

The results of the groundwater monitoring programme will be utilised in the on-going review and improvement of the site water management systems presented in Sections 4.1 and 4.2.

Additionally, ongoing monitoring will continue post-closure of the CGO to confirm that solutes associated with seepage from the IWL are flowing towards, and ultimately terminate within, the final pit void.

[4] Groundwater monitoring results or trends identified from analysis of the groundwater monitoring data that may indicate the need for augmentation of the system include changes in groundwater chemistry or groundwater levels.

4.3.4 Biological Monitoring

The DA 14/98 Development Consent was modified in 2008 to remove the requirement for continued baseline biological monitoring and enabled the monitoring programme to adopt an approach that is consistent with the ANZECC and ARMCANZ water quality guidelines (ANZG 2018). As such, the biological monitoring programme was revised to:

a) focus monitoring so it is relevant to the potential impact pathways from the CGO to Lake Cowal biology;

b) adopt an approach to the assessment of potential impacts on Lake Cowal resulting from the CGO that is consistent with the ANZG (2018) Water Quality Guidelines; and

c) provide a more useful and effective biological monitoring programme.

The biological monitoring programme will be used to assess the CGO's potential impact on fish and aquatic invertebrates and will be undertaken by suitably qualified and experienced personnel to the satisfaction of Fisheries NSW as required by DA 14/98 condition 4.4(d)(ii). This will include the assessment of impacts associated with change in lake water quality, removal/modification of habitat and movement of dust away from active areas to lake environs. In addition, the concentration of metals in sediment taken from lake monitoring points will be assessed against the recommended trigger values.

The biological monitoring programme is described in the SWGMBMP and summarised below.

To assess the CGO's potential impact on fish and aquatic invertebrates, the following parameters will be monitored for each of the potential impact pathways:

Change in Lake Water Quality

Water quality of Lake Cowal will be monitored for a number of parameters along the Lake Cowal transects and lake inflow sites in accordance with the surface water monitoring programme (Section 4.3.2) and the monitoring procedures described in the SGWMBMP.

Removal/Modification of Habitat

The impact of removal/modification of habitat on fish fauna and aquatic invertebrates will be monitored in accordance with the surface water monitoring programme (described above) and the CWMP, as described below.

The new lake foreshore has been constructed and rehabilitated in accordance with the CGO's CWMP (and RMP) and consistent with the rehabilitation objectives defined in DA 14/98 condition 2.4(a). Revegetation concepts for the new lake foreshore were designed to improve habitats for wildlife including fish fauna (Section 6.4.2 of the CWMP). Further to the rehabilitation of the new lake foreshore, the CWMP also includes wetland enhancement initiatives to improve existing habitats for fish fauna, namely the Compensatory Wetland and enhancement of wetland areas in the remaining areas of ML 1535 (refer Section 6.2 of the CWMP for detail).

A monitoring programme has been implemented to assess the success of the wetland rehabilitation (i.e. new lake foreshore) and enhancement measures (i.e. Compensatory Wetland and remaining areas of wetland in ML 1535) in improving wetland habitats for fish fauna. The rehabilitation monitoring programme is described in the Rehabilitation Management Plan.

Fish fauna surveys will be conducted within the Compensatory Wetland, new lake foreshore and remaining wetland areas within ML 1535, no more than annually, when the lake is full (i.e. at full storage level) to assess fish fauna usage of these areas. Monitoring will also be conducted to assess natural regeneration and the progress of revegetation in the wetland areas.

Movement of Dust Away from Active Areas to Lake Environs
Dust deposition levels surrounding the CGO and Lake Cowal will continue to be monitored in accordance with the Air Quality Management Plan (AQMP).

Lake Sediments
Analyses of sediment taken from lake monitoring points will be undertaken to assess the bio-availability of metals within the bed of Lake Cowal. The water quality monitoring programme and sediment monitoring programme will combine to provide data relevant to the bio-availability of metals.

The sediment monitoring will be relevant to potential surface water quality and dust deposition impacts and will be undertaken when the lake water level is at or above 204.5 m AHD, where practicable[5].

Biological monitoring results will be interpreted and reported in the Annual Review (Section 8.3) which will be made available on Evolution's website in accordance with Development Consent Condition 9.4(a).

4.3.5 Cyanide Monitoring

As described in Section 4.2.7, a cyanide monitoring programme as described in the CMP will continue to be implemented during the operations phase of the CGO.

4.3.6 Detection of Movement of Water Management Structures

DA condition 2.4(c)(ii) requires the preparation of a monitoring programme for the detection of any movement of the lake protection bund, water storage and tailings structures and pit/void walls during the life of the CGO, with particular emphasis on monitoring after any seismic events. The *Monitoring Programme for the Detection of any Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls* was prepared prior to the commencement of construction of the CGO in consultation with the then DLWC and Department of Mineral Resources and to the satisfaction of the Director-General of the then DIPNR. This programme has been revised to reflect the approved CGO and will continue to be implemented during the operations and decommissioning phases of the CGO (Section 4.3.6).

[5] Given the ephemeral nature of Lake Cowal, sediment monitoring will not be possible at all times. For example, sediment monitoring will not be possible when the water level within the lake does not permit access or sediment cores to be taken safely.

5 MEASURES TO PREVENT THE DEGRADATION OF SURFACE WATER QUALITY

As stated in Section 4, the overall objective of the CGO water management system is to contain all potentially contaminated water (contained water) generated within the CGO area while diverting all other water around the perimeter of the site (Evolution, 2018).

The long-term compatibility assessment studies presented in the EIS (North Limited, 1998a) provide the following guidance on the relevant classification of waters at Lake Cowal.

> *Lake Cowal has high conservation value, of national and international significance.*

The long-term compatibility assessment studies (Resource Strategies, 1997) also identified a number of critical conservation values of Lake Cowal including those described below.

Hydrological Cycle

The hydrological cycle of Lake Cowal is characterised by seasonal fluctuations. The lake itself is considered ephemeral in nature and as such, the volume of water contained at any time is governed by rainfall patterns. Accordingly, its hydrological regime introduces many variables which are critical to the aquatic ecosystem. The critical conservation values of Lake Cowal are closely linked to the quality and quantity of the water entering it. The hydrological cycle largely determines changes in lake volume and depth as well as any seasonal variance in water quality. The hydrological cycle generates changes in the productivity of the lake as well as corresponding changes in species diversity and abundance.

The hydrological cycle can produce variations in:

- numbers of waterbirds, fish and amphibian species;
- the area of vegetative cover and vegetation composition;
- the abundance of aquatic biota (both as a food source for waterbird species and as an integral part of the food chain);
- groundwater levels and associated changes in the salt balance;
- water quality as a function of flush effects; and
- inundation and exposure of agricultural land.

Additionally, as part of this hydrological cycle, refuge is provided for waterbird species during times of drought, as Lake Cowal is located within a predominantly semi-arid region. Land use changes also occur in response to the lake's hydrological cycle. For example, in drier times, the lakebed is used for agricultural production.

Water Quality

Good water quality (generally to aquatic protection standard) has been maintained in Lake Cowal over time. This has occurred despite the surrounding agricultural land use. Changes in water quality can occur in response to the hydrological cycle although no accumulation of extractable salt has been observed as a result of seasonal filling and drying cycles. Natural variability in water quality can have direct and indirect impacts on components of the lake ecosystem. For example, the composition of flora and fauna at any one time can reflect the influence of current or recent changes in water quality.

The standard of water quality is considered to contribute significantly to the conservation value of the lake, as it enables the survival of an array of biota including benthos, zooplankton, crustaceans, bivalves, fish and waterbirds, all of which play key roles in the food chain. The survival and health of vegetation associated with the lake also depends largely on water quality. Species such as Lignum and River Red Gum are important examples of riparian plant species which provide habitat for a number of fauna species, particularly waterbirds. Changes in the composition of vegetation associated with the lake can alter fauna species composition. For example, a change in water quality which affects the survival of Lignum (which in turn can be replaced with an alternate species) may result in a reduced diversity of waterbirds which rely on Lignum areas at certain stages throughout their life cycles.

Ecosystem – Wetland Habitat

The conservation value of Lake Cowal as a wetland habitat is determined by a number of factors including:

- the diversity and size of suitable waterbird habitats (i.e. habitat resources suitable for roosting, breeding, foraging);
- the diversity and abundance of flora and fauna species (including common and endangered or vulnerable species) known to utilise the Lake environs;
- the geographical location of the Lake within a predominantly semi-arid environment;
- the ephemeral nature of the Lake (i.e. hydrological cycle);
- the significance of the habitat in a local and regional sense (primarily a function of land use practices in the surrounding areas); and
- the standard of water quality.

Lake Cowal is widely accepted as having major regional, national and international ecological and conservation significance as a wetland system used by many species of avifauna. A number of significant migratory (*Environment Protection and Biodiversity and Conservation Act, 1999* (EPBC Act)/Chinese Australian Migratory Bird Agreement (CAMBA)/Japanese and Australian Migratory Bird Agreement (JAMBA) listings) and threatened waterbirds have been recorded at Lake Cowal. As such, it is listed on the *Directory of Important Wetlands in Australia* (Environment Australia, 2001).

The influences on the populations of waterbirds in the region of Lake Cowal are as diverse as those that drive the system. The importance of the Lake Cowal System to waterbird populations is exemplified by:

- providing refuge in times of drought with good water quality and an adequate food source for waterbirds;
- the diversity of habitat within a complete wetland ecosystem; and
- the physical size of the system which provides habitation for large numbers of waterbirds at any one time.

All these factors are integrated and as such, no one factor may be considered more important than another when considering its conservation value as a waterbird habitat.

5.1 PRE-CONSTRUCTION WATER QUALITY CLASSIFICATION

The ANZG (2018) guidelines arise from a revision of the ANZECC (1992) and ANZECC and ARMCANZ (2000) guidelines. The objective of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) are as follows:

> *provide authoritative guidance on the management of water quality in Australia and New Zealand. Our guidance includes setting water quality and sediment quality objectives designed to sustain current, or likely future, community values for natural and semi-natural water resources.*

The Water Quality Guidelines provide:

- *a platform for consistent water quality management and planning;*
- *technical support for Australia's National Water Quality Management Strategy and New Zealand's National Policy Statement for Freshwater Management; and*
- *sound tools for governments and the community to assess and manage ambient water and sediment quality.*

The ANZG (2018) guidelines will be used to assist in the management of waters within Lake Cowal and surrounding surface waters. The application of these guidelines to the CGO is summarised below.

A range of environmental values are recognised by the ANZG (2018) guidelines, including:

- aquatic ecosystems;
- primary industries; and
- drinking water.

The Long-Term Compatibility Assessment Studies presented in the EIS (North Limited, 1998a) described Lake Cowal as being of high conservation value. The aquatic ecosystems environmental value is therefore considered to apply to Lake Cowal. Consequently, the pre-construction water quality classification of water within the lake was assessed to be that of "aquatic protection standard" (North Limited, 1998a) under the ANZECC (1992) guidelines.

The ANZG (2018) guidelines specifies biological, water and sediment quality monitoring guidelines for protecting the range of aquatic ecosystems, from freshwater to marine.

The ANZG (2018) guidelines recognise three ecosystem conditions:

1. High conservation/ecological value systems.
2. Slightly to moderately disturbed systems.
3. Highly disturbed systems.

The long-term compatibility assessment classification of Lake Cowal as being of high conservation value and the identification of the Lake's hydrological cycle, water quality and ecosystem (wetland habitat) as critical conservation values suggests that Lake Cowal should be classified as a high conservation/ecological value system.

This classification was supported by the then DLWC who have advised (pers. comm., 31 July 2003) that the pre-construction classification (ecosystem condition) of "High conservation/ecological value" will apply to the lake and surface waters reporting to it. This is described in ANZG (2018) as follows:

> *High conservation/ecological value systems attributes — effectively unmodified or other highly-valued ecosystems, typically (but not always) occurring in national parks, conservation reserves or in remote and/or inaccessible locations.*

While there are no aquatic ecosystems in Australia and New Zealand that are entirely without some human influence, the ecological integrity of high conservation/ecological value systems is regarded as 'intact'.

The classification of Lake Cowal as being of high conservation/ecological value means that the default trigger values for physical and chemical stressors and toxicants corresponds to the most conservative trigger levels, and hence the highest level of protection.

The then DLWC advised (pers. comm., 31 July 2003) that appropriate water quality trigger values for toxicants within freshwater aquatic ecosystems of high conservation/ecological value are the 99% protection level triggers previously provided in Chapter 3 of ANZECC and ARMCANZ (2000).

The default high conservation/ecological value protection level triggers (including the 99% protection level for toxicants) provided in ANZG (2018) will be used to trigger surface water investigations, as described in Section 8, until such time as CGO specific triggers (based on lake water quality monitoring results across a range of storage and seasonal conditions) are developed in accordance with the procedures presented in ANZG (2018) and in consultation with the relevant authorities.

A summary of Lake Cowal baseline surface water quality results is provided in Table 13, including a comparison with the ANZG (2018) guideline values.

Table 13
Summary of Lake Cowal Baseline Water Quality

Parameter#	Aquatic Ecosystems^~	Livestock Watering^	Lake Cowal Baseline Water Quality (1991 - 1992)
pH	6.5 to 8.0 for freshwater lakes	No trigger values given	8.27 – 8.67
EC/TDS	EC triggers for slightly disturbed ecosystems – lakes 20 – 30 μS/cm[1]	TDS triggers 4,000 mg/L beef cattle, 5,000 mg/L sheep	EC 222 – 1557 μS/cm
NTU/SS (mg/L)	Turbidity triggers for slightly disturbed ecosystems – lakes 1 – 20 NTU[2]	No trigger values given	22 – 224 mg/L
As (mg/L) (total)	0.008	0.5	0.0026(3)
Cd (mg/L) (total)	0.0006	0.01	0.000055(3)
Cu (mg/L) (total)	(total)0.001	1.0 cattle, 0.4 sheep	0.006(3)
Hg (mg/L) (total)	0.00006	0.002	>50% of samples less than Method of Detection Limit
Pb (mg/L) (total)	0.001	0.1	0.0029(3)
Zn (mg/L) (total)	0.0024	20.0	0.012(3)

After: North Limited (1998a)

^ Guideline values in accordance with ANZG (2018).

~ 99% protection level trigger values for toxicants.

1 ANZG (2018) notes that conductivity in lakes is generally low, but will vary depending upon catchment geology.

2 ANZG (2018) notes that lakes in catchments with highly dispersible soils will have high turbidity.

3 Average value.

As described in Section 4.3, a detailed surface water quality monitoring programme has been implemented at the CGO. Where monitoring results indicate values in excess of the ANZG (2018) default 99% protection level triggers, an investigation will be conducted to assess the need to implement management measures in addition to those described in Section 5.2. As described in Section 4.3 the review procedure will involve validation of data, management of data, analysis and investigation, and where necessary development of ameliorative measures. Ameliorative measures will be developed in consultation with the relevant authorities based on the results of the investigative process.

The investigation will involve the consideration of the monitoring results in conjunction with site activities being undertaken at the time, water quality results in nearby locations, the prevailing and preceding meteorological conditions and changes to the land use/activities being undertaken in the contributing catchment. The investigation will also involve consideration of baseline data. The scope and timeframe of the investigation will be developed in consultation with the relevant authorities. The results of the investigations will be presented to the relevant regulator and the CEMCC within the agreed timeframe.

5.2 LAKE COWAL

As described in Section 4, management strategies for the construction and operation phases involve the following principles (North Limited, 1998a):

1. *Minimising disturbance areas.*
2. *Containment of potentially contaminated water.*
3. *Recycling of contained water.*
4. *Progressive stabilisation and revegetation of disturbed areas.*

These principles and the water management measures presented below have been developed with regard to the goals of the JLWMP (Section 7), in particular:

- *To minimise the adverse effects of local agricultural practices on soil and water quality;*
- *To minimise adverse downstream effects of local agricultural practices.*

5.2.1 Construction

The water management measures that were adopted to prevent the degradation of waters within Lake Cowal during CGO construction, as required by DA 14/98 condition 4.4(d)(ii), are described in Section 4.1.

Potential water quality impacts arising from dust generated by CGO construction and operation activities were also considered in the EIS (North Limited, 1998a):

> *The baseline water quality monitoring programme has demonstrated variable but significant levels of total suspended solids in lake waters (24 mg/L to 224 mg/L) depending on factors such as lake volume, rainfall patterns and local catchment runoff, wind velocity and wave effects, etc. Potential increases in total suspended solids in lake waters as a result of mine-generated dust outfall have been assessed utilising dust deposition predictions in Appendix I and assuming conservatively that mine-generated dust will preferentially concentrate near the lake protection bund and not mix with lake waters in general. Results indicate that the affect of mine-generated dust on the level of total suspended solids typically found in lake waters is negligible and will not be measurable in the context of the natural variation observed in baseline studies.*

Potential increases in lake water metal concentrations due to mine-generated dust outfall are also expected to be negligible (North Limited, 1998a). Dust management and monitoring measures to minimise the potential for dust related impacts are presented in the AQMP in accordance with DA 14/98 condition 6.1. Lake sediment monitoring is described in Section 4.3.4.

Soil and waste rock characterisation programmes have identified materials to be disturbed during the construction phase that have the potential to generate salinity (North Limited, 1998a). Accordingly, the water management strategy incorporates design elements to contain surface runoff or seepage likely to have increased salt concentrations. As described in Section 4.1.2, the materials used to construct the temporary isolation bund and lake protection bund were of low salinity in order to mitigate potential salinity increases in the lake. A layer of primary waste rock mulch (or rock armour) will be used to stabilise the external batters of the waste emplacements, tailings storage facilities/IWL and lake protection bund to assist in controlling surface water runoff and reduce erosion potential. The water management strategy for the emplacements involves minimising runoff and directing any runoff from disturbed areas or seepage towards the open pit thereby minimising the potential for increased salinity in the lake.

The potential for shallow seepage occurring from the lake to the open pit will be overcome by the construction of the lake protection bund. As described in Section 4.1.2, the bund was constructed as a low permeability embankment and to meet specific engineering criteria for compaction to ensure the required low permeability barrier is in place. In addition, soils within the footprint of the bund were sub-excavated and replaced with compacted fill in order to restrict shallow migration under the embankment. Deep water loss, if any, from Lake Cowal to the underlying aquifer and thence to the final void will be negligible and impossible to measure (North Limited, 1998a). Subsequent assessments continue to support this view (Coffey 2020a).

Construction and operation of the Bland Creek Palaeochannel borefield and water supply pipeline including the proposed pipeline duplication is described in Section 4.2.2.

5.2.2 Operations

The water management measures to be adopted to prevent the degradation of waters within Lake Cowal during CGO operations are described in Section 4.2.

These measures include erosion, sediment and salinity control measures (Section 4.1.4) and monitoring programmes (Section 4.3).

Operations will be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an approved MOP (Condition 14 of the Conditions of Authority for ML 1535).

5.3 OTHER SURFACE WATERS

The construction phase and operations phase water management measures (Sections 4.1 and 4.2 respectively) that have been implemented to prevent the degradation of waters within Lake Cowal, are also effective in preventing the degradation of surface waters outside the ICDS. These measures include erosion, sediment and salinity controls described in the ESCMP and that are applicable to any CGO-related surface disturbance.

Operations are generally carried out in a manner that does not breach compliance criteria for air pollution, water pollution (including sedimentation), soil contamination or erosion subject to an approved MOP (Condition 14 of the Conditions of Authority).

5.4 MANAGEMENT AND DISPOSAL OF WATERS CAPTURED BEHIND THE TEMPORARY PERIMETER BUND

As described in Section 4.1.2, the temporary isolation bund was designed to control water inflow to the pit development area from the lake. The temporary isolation bund was developed by end-tipping fill, working at both ends of the temporary isolation bund/shoreline intersection in an arc toward the centre.

The movement of trucks during construction was used to achieve the required compaction levels of the bund (North Limited, 1998a).

Prior to the construction of the temporary isolation bund, a continuous silt curtain was erected around the construction zone of the temporary isolation bund. The silt curtain was installed prior to construction commencing in order to trap fine sediment and prevent suspended material migrating into the main body of the lake (North Limited, 1998a). During the construction of the temporary isolation bund a number of erosion and sediment control measures were in place. These measures are described in the ESCMP and are presented below.

Erosion and sediment control measures included (Gilbert and Sutherland, 1997):

- *Erection of continuous silt curtain around construction zone.*
  In the construction phase of the Lake Isolation System, a continuous silt curtain was erected around the construction zone of the temporary isolation bund. The silt curtain was installed prior to construction commencing in order to trap fine sediment and prevent suspended material migrating into the main body of the lake.

  The silt curtain was installed in accordance with details provided in the ESCMP.

- *Provision of clean water diversion and settlement storages for runoff control at borrow areas.*
  Temporary sediment basins for the provision of settlement storages were designed and constructed where runoff could concentrate (as determined by the ESR Manager or delegate) in accordance with details provided in Section 3.4.1 of the *Urban Erosion and Sediment Control Handbook* (CALM, 1992) and in accordance with details provided in Chapter 6.3.3 of *Managing Urban Stormwater – Soils and Construction* (Department of Housing, 1998). Sediment basins were used for the temporary containment of runoff from disturbance areas to facilitate the settlement of suspended solids. Flocculants were used as required when the rate in which the suspended solids settle is slowed by the suspension of dispersive soils. Post construction, sediment basins were either retained as permanent erosion and sediment control structures or backfilled, topsoiled and revegetated once no longer required for erosion and sediment control as determined by the ESR Manager or delegate.

  Temporary diversion banks were designed and constructed upslope of disturbance areas where necessary (as determined by the ESR Manager or delegate) for borrow areas in accordance with details provided in Section 3.3.4.2 of the *Urban Erosion and Sediment Control Handbook* (CALM, 1992) (Appendix B of the ESCMP). Any future works would apply similar methods as defined in *Volume 1 of Managing Urban Stormwater – Soils and Construction* (Landcom, 2004) and *Managing Urban Stormwater – Soils and Construction Volume 2E Mines and Quarries* (DECC, 2008).

- *Stabilisation and revegetation to occur in parallel with construction.*
  As described in Section 3.3.2 of the ESCMP, the batters of the temporary isolation bund were revegetated in accordance with details provided in Section 3.3.6 of the *Urban Erosion and Sediment Control Handbook* (CALM, 1992) (Appendix B of the ESCMP). Rehabilitation of the temporary isolation bund (part of the new lake foreshore) will continue to be undertaken in accordance with the CWMP with suitable revegetation species and in consideration of revegetation concepts within the DPE Water’s *Guidelines for Controlled Activities on Waterfront Land*.

In accordance with DA 14/98 condition 4.3(a), there will be no disposal of water from the ICDS to Lake Cowal.

6 POSSIBLE ADVERSE EFFECTS ON ENVIRONMENTAL AND AGRICULTURAL VALUES

6.1 SURFACE WATER

Lake Cowal

As stated in Section 4, the overall objective of the CGO water management system is to contain all potentially contaminated water (contained water) generated within the CGO area while diverting all other water around the perimeter of the site (North Limited, 1998a).

As described in Section 4, a comprehensive water management system has been developed for the CGO. It is based on the permanent isolation of surface waters and groundwater on the mine site from Lake Cowal (Gilbert and Sutherland, 1997). This is achieved by the UCDS (Sections 4.1.1 and 4.2.1), to route runoff from areas unaffected by mining around the perimeter of the site, the ICDS (Section 4.1.3) and integrated erosion and sediment control system (Section 4.2.4), which capture all site runoff and seepage for re-use in the process plant and in the longer term isolation in the final void (Gilbert and Sutherland, 1997).

The CGO has not caused any measurable effect on the water balance of Lake Cowal (North Limited, 1998a; HEC, 2018). No spills from contained water storages have occurred to date or were predicted for the revised site water balance for the approved CGO including for contained water storages D1 and D4, which capture runoff from the outer batters of the northern and southern waste rock emplacements (Hydro Engineering & Consulting, 2018). The CGO does not directly use water from the lake for any purpose. Rainfall runoff intercepted by the ICDS reduces (to a very small degree) the contributing catchment area of Lake Cowal (North Limited, 1998a; Gilbert & Associates, 2009).

As described in Section 3.1, a review of available surface water quality monitoring data was undertaken by Hydro Engineering & Consulting (2018) and compared to the (pre-mining) baseline data. The monitoring data review indicated that there is no evidence the existing CGO has resulted in changes to water quality in Lake Cowal (Hydro Engineering & Consulting, 2018).

Lachlan River Water Entitlements

Water from the Lachlan River will continue to be accessed for the CGO by purchasing temporary water available from the regulated Lachlan River trading market.

The predicted average water requirement from the Lachlan River under a 10th percentile (dry) rainfall sequence is 754 ML over the life of the approved CGO (Table 8) , however, volumes to be purchased will vary annually in accordance with the performance of the Bland Creek Palaeochannel, availability of water within the Lachlan River and availability of supply from the contained water storages within the ML.

DPE Water trading records show that volumes between 4,000 ML and 274,000 ML of temporary water have been traded annually since records began in the 2004 to 2005 season (Hydro Engineering & Consulting, 2018). Throughout the operating history of the CGO, the Lachlan River regulated source has proven to be a reliable supply of temporary water (Hydro Engineering & Consulting, 2016)

The CGO therefore will not affect any licensed surface water users.

6.2 GROUNDWATER

6.2.1 Surrounding Landholders

Predicted Groundwater Drawdown due to Open Pit Dewatering

Within ML 1535, monitoring data shows some drawdown in the Cowra Formation due to groundwater inflow to the CGO open pit (Coffey, 2020a). The monitoring data indicates that this drawdown is localised and is considered to have not significantly affected groundwater levels in the Cowra Formation or Lachlan Formation outside of ML 1535 (Coffey, 2020a).

The maximum predicted groundwater drawdown contours for the approved CGO in the alluvial and fractured rock groundwater systems are shown on Figure 14, along with drawdown contours for the existing CGO.

As shown on Figure 14, the change in groundwater drawdown associated with the approved CGO will be generally limited to ML 1535.

There are no other known users of the saline aquifers surrounding ML 1535 (i.e. other than Evolution). Given this and given that potential groundwater impacts are predicted to be generally contained within ML 1535, no impacts to other groundwater users surrounding the CGO are predicted.

Hydraulic Relationship between Lake Cowal and Groundwater Systems

Previous studies indicate that Lake Cowal is hydraulically separated from the underlying aquifers, due to the very low permeability of the clay pan deposits that form the lakebed (Evolution, 2020a). Based on this, it was predicted there will be very low potential for significant quantities of water to infiltrate from Lake Cowal to the underlying aquifers (i.e. associated with the Cowra Formation) (Evolution, 2020a).

Monitoring data collected since the 2010, 2012 and 2016 lake-fill events indicates that no increase in groundwater inflow to the open pit has occurred and therefore supports the predictions of previous assessments regarding the hydraulic separation of Lake Cowal from the underlying aquifers (Coffey ,2020a). Further, monitoring data indicates that inflow to the open pit has generally been lower during lake-fill conditions compared with when the lake was dry (Coffey, 2020a).

Potential Impacts to Lake Cowal

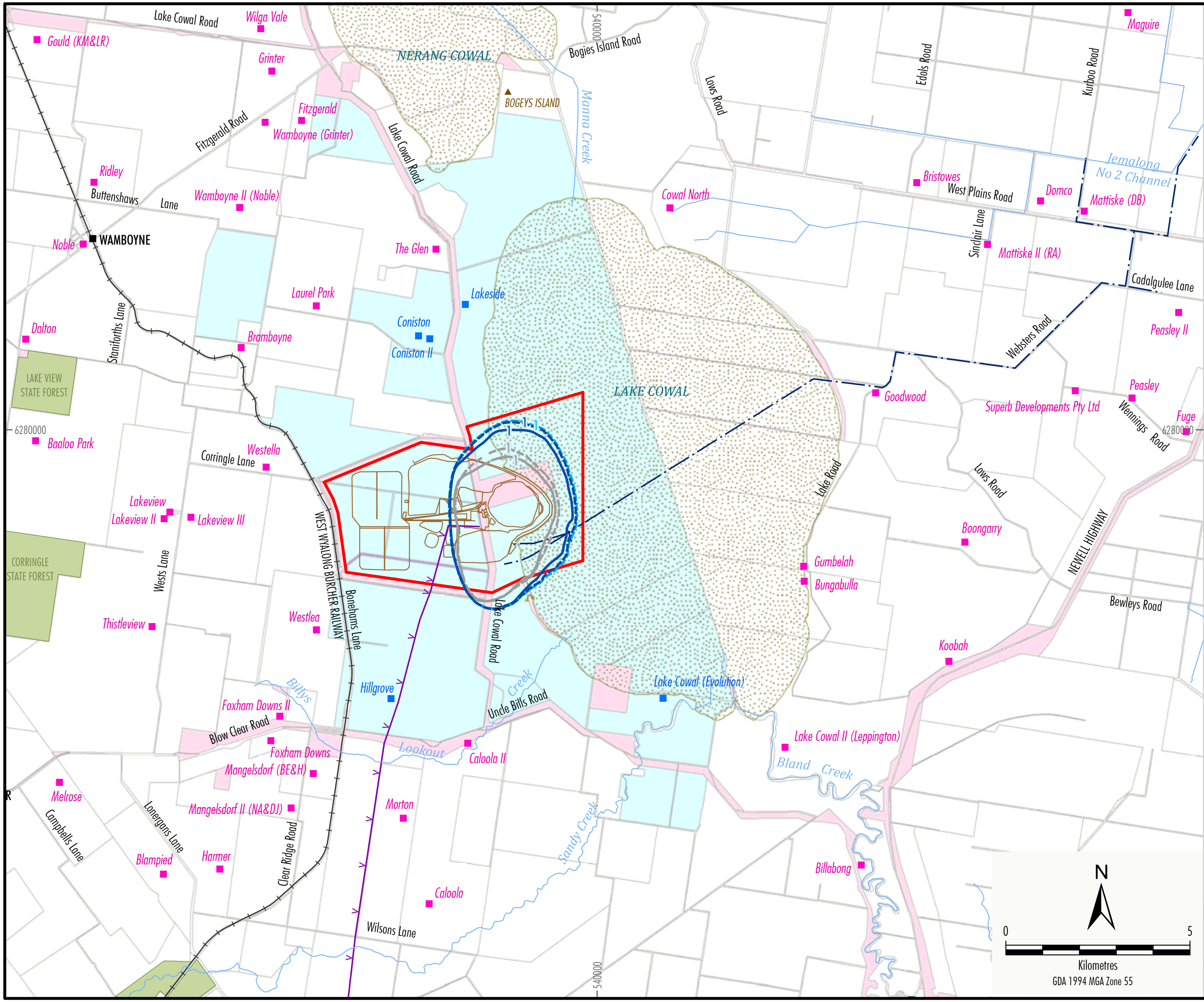
Existing monitoring data indicates that groundwater inflow to the CGO open pit has not changed significantly during lake-fill conditions due to the hydraulic separation of the open pit and Lake Cowal.

Development of the approved CGO will not affect the impermeable clay layers that act to isolate Lake Cowal from the underlying aquifers. Coffey (2020a) concludes that the total impact to Lake Cowal associated with open pit dewatering at the approved CGO will be negligible.

Groundwater Users

Evolution is the only known user of the saline alluvial aquifers that surround the CGO mining operations.

In the region, there is reliance upon groundwater bores as a source of water for agricultural enterprises and other uses. The majority of the privately-owned pumping bores in the area are within the Lachlan Formation with a small number in the Cowra Formation (Coffey, 2020a). No privately-owned bores have been identified in the fractured rock groundwater system surrounding the CGO (Coffey, 2020a).



LEGEND

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

Alluvial Groundwater

- Approved CGO Predicted Maximum Drawdown (m)
- Modification Predicted Maximum Drawdown (Transported Unit) (m)

Fractured Rock Groundwater

- Approved CGO Predicted Maximum Drawdown (m)
- Modification Predicted Maximum Drawdown (Saprolite Unit) (m)
- Modification Predicted Maximum Drawdown (Saprock Unit) (m)

Source: Evolution (2016); Land and Property Information (2016); Coffey (2016); Barrick (2013)

WATER MANAGEMENT PLAN

FIGURE 14
Predicted Maximum Watertable Drawdown Contours at the end of the Approved CGO Mine Life

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HAL-02-07 CGO MP 2017_WMP_203A

Potential Groundwater Quality Effects from IWL

An assessment of potential impacts to groundwater quality due to seepage from the tailings storages and IWL using an analytical particle tracking approach was undertaken for the Processing Rate Modification by Coffey Services Australia Pty Ltd as a part of their *Cowal Gold Operations Processing Rate Modification (MOD 14) Mine Site Hydrogeological Assessment* (Coffey, 2018a).

Consistent with the findings of previous assessments for the approved CGO, seepage from the tailings storages and IWL to the underlying aquifers was predicted to slowly migrate towards the open pit (i.e. the open pit will continue to act as a sink for seepage flows from the tailings storage facilities/IWL) (Coffey, 2018a).

As discussed in Section 4.2.9, in addition to the modelling and analyses undertaken by Coffey (2018a) for the Processing Rate Modification, further modelling of contaminant transport from the IWL at 20, 50, 100 and 200 years post-closure has been undertaken by Coffey (2019) in accordance with the requirements of Development Consent Condition 4.4(a1). Coffey (2019) concluded particles released at mine closure tended to travel downwards due to the initial vertical gradient from the water within the IWL. Particles released at 100 years post mine closure tended to travel closer to the top of the rock layers (Coffey, 2019). Subsequently, Coffey (2019) concluded that over the 200 year period, cyanide and dissolved heavy metals within the IWL will not move beyond 2.2 km from the IWL and will ultimately migrate to the mine void.

As the Processing Rate Modification will not change development of the open pit, no change to the geochemistry of tailings is expected, therefore no change to the quality of seepage from the tailings storages and IWL is expected (Coffey, 2018a). Further, no additional impacts to groundwater quality associated with seepage from the tailings storages/IWL are expected due to the Underground Development Project (Coffey, 2020a).

Notwithstanding, groundwater quality monitoring at the CGO, particularly within the vicinity of the open put, IWL and ML 1535 saline groundwater supply borefield (when in use), will continue to be used to verify modeling results.

Monitoring of groundwater inflows

The CGO has a well-established groundwater system of groundwater monitoring bores.

6.2.2 Landholders near the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield

Predicted Groundwater Drawdown due to Continued Use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield

Groundwater levels in the Lachlan Formation (i.e., Bland Creek Palaeochannel) have lowered over the last decade, due to a rise in groundwater use by irrigators during drought conditions that occurred for most of the last decade (Coffey, 2018b). Approved use of the Bland Creek Palaeochannel Borefield by Evolution has also contributed to this drawdown (Coffey, 2020b).

The approved CGO will involve the continued use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield in accordance with existing daily and annual extraction limits.

In addition, Evolution proposes no change to the existing Groundwater Contingency Strategy (i.e. trigger levels and contingency measures for the management of groundwater use in the Bland Creek Palaeochannel) (refer below).

Coffey (2020b) considered the potential cumulative drawdown effects associated with the continued use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield for the approved CGO and the continued extraction of groundwater by other users (e.g. irrigators).

It is estimated that a yield of approximately 5.9 ML/day from the Bland Creek Palaeochannel could be sustained for the life of the approved CGO such that groundwater levels do not fall below relevant trigger levels at Bores GW036553, GW036597 and GW036611 (Coffey, 2020b) (Figure 15). This includes a yield of 1.5 ML/day from the Eastern Saline Borefield, and the continued extraction of groundwater by other users based on historic rates (Coffey, 2020b).

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 as shown on Figure 15.

As there be will no change to the existing Groundwater Contingency Strategy for the Underground Development (i.e. agreed trigger levels) for the ongoing management of groundwater use in the Bland Creek Palaeochannel, and no change to existing daily and annual extraction limits, no additional impacts to other groundwater users are predicted due to the continued use of the Bland Creek Palaeochannel Borefield during the life of the approved CGO (Evolution, 2020a).

Mitigation Measures

The priority in which the CGO water supply will be drawn from the various sources is described in Section 4.2.2. Groundwater from the Bland Creek Palaeochannel will be used where make-up water from all on-site sources (e.g. tailings storage facilities/IWL, pit dewatering and reuse of site runoff captured in the various site collection storages) is inadequate (Evolution, 2020). Supply from this source will also continue to be alternated with the Lachlan River source, to manage groundwater levels and provide flexibility with respect to extraction rates and supply sources (Evolution, 2020).

Evolution has maintained a very strong community consultation programme in relation to groundwater use from the Bland Creek Palaeochannel and meets regularly with a community group representing both irrigators and stock/domestic groundwater users.

In order to monitor important background and predicted future water level drawdowns, monitoring piezometers have been installed. The number and location of piezometers is presented in the SWGMBMP. In the event that disruption to the efficiency of the closest registered stock and irrigation bores occurs, as indicated by monitoring, ameliorative measures will be implemented (North Limited, 1998a).

Ameliorative measures will be developed in accordance with the review procedure presented in Section 4.3, which involves validation and management of data followed by a process of analysis and investigation. In relation to groundwater monitoring and potential impacts on groundwater users in the vicinity of the Bland Creek Palaeochannel, the review procedure provides:

- **Groundwater Monitoring**: Groundwater volume, level and quality data will be compared to relevant baseline data, data collected since the commencement of operations and assessment presented in the EIS. Where the data analysis indicates that an adverse impact is occurring to the efficiency of surrounding bores an investigation will be undertaken to determine the need and type of ameliorative measures. The scope and timeframe of the investigation will be developed in consultation with the relevant authorities. The results of the investigation will be presented to the relevant authorities and the CEMCC within the agreed timeframe.

Ameliorative measures such as bore reconditioning, pump lowering and/or refitting will be implemented in consultation with DPE Water and affected registered bore owners. The lowering of the pump will be designed to maintain the pressure head available to the pump following the lowering of the water table. This may require deepening of existing bores or construction of new bores.

Groundwater Contingency Strategy

As described in Section 4.2.2, groundwater levels in the Bland Creek Palaeochannel are managed in accordance with the existing Groundwater Contingency Strategy, which involves the monitoring of groundwater levels, and the implementation of response measures should groundwater levels reach trigger levels developed in consultation with DPE Water and other groundwater users.

The trigger levels are as follows:

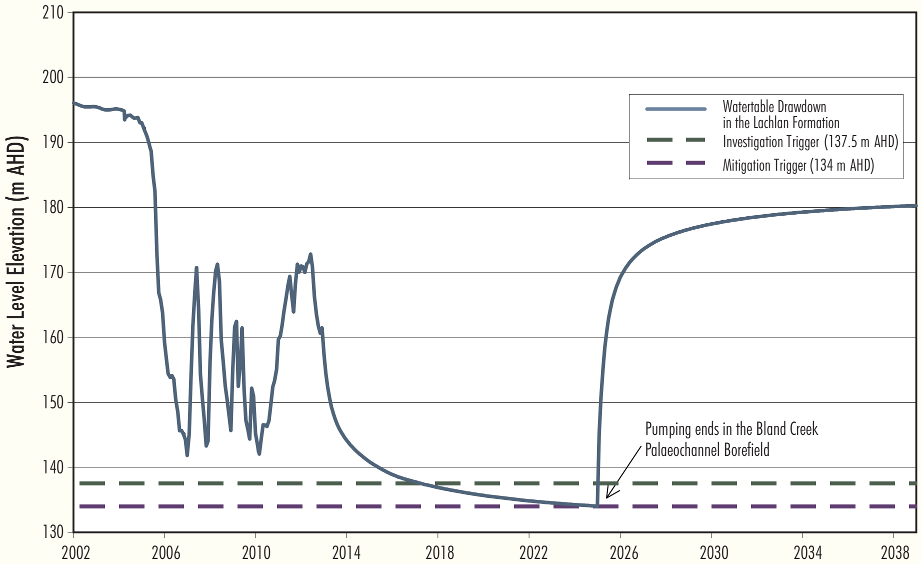
- Bore GW036553 (Figure 9) (Bland Creek Palaeochannel Borefield area) – trigger levels of 137.5 and 134 m AHD.
- Bore GW036597 (Figure 9) (Billabong area) – trigger level 143.5 m AHD.
- Bore GW036611 (Figure 9) (Maslin area) – trigger level 145.7 m AHD.

Groundwater levels at Bore GW036553 (Figure 9) are monitored on a continuous basis by DPE Water.

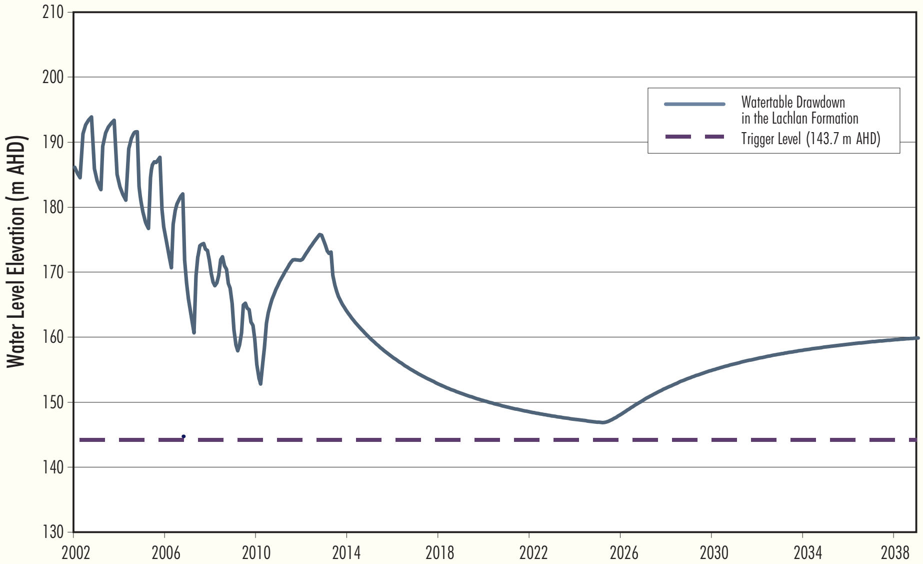
The trigger levels for these bores were set by the then Department of Natural Resources at the request, and on behalf, of the Bland Creek Palaeochannel Water Users Group.

The monitoring data for GW036553 is monitored via the website http://realtimedata.water.nsw.gov.au/water.stm with the data downloaded at least weekly (or daily should levels be trending close to the trigger levels) by the CGO's Processing Manager.

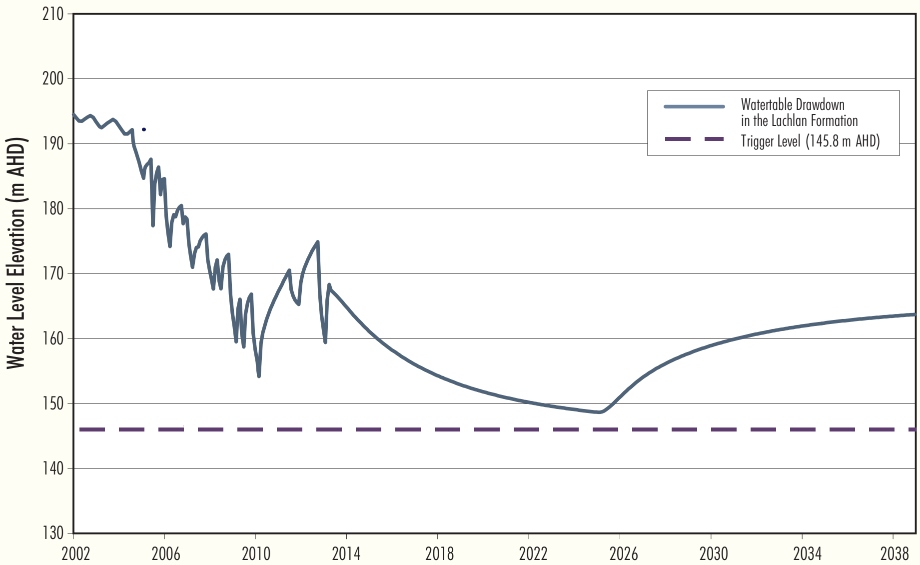
Investigation and mitigation contingency measures have been developed should groundwater levels reach either 137.5 m AHD (trigger for investigation) or 134 m AHD (trigger for mitigation) in the monitoring bore closest to Evolution's Bland Creek Palaeochannel Borefield (i.e. GW036553).



Modelled Water Levels in the Lachlan Formation at GW036553



Modelled Water Levels in the Lachlan Formation at GW036597



Modelled Water Levels in the Lachlan Formation at GW036611

Source: Coffey Geotechnics (2016)

WATER MANAGEMENT PLAN

FIGURE 15

Predicted Watertable Drawdown with the Bland Creek Palaeochannel Borefield pumping at 7.2ML/day during the Approved CGO Mine Life

Evolution MINING Cowal

HAL-02-07 CGO MP 2017_WMP_004A

Contingency Measures at RL 137.5 m AHD

In the event that the groundwater level in GW036553 is below RL 137.5 m AHD, one or more of the following contingency measures will be implemented in consultation with DPE Water:

- investigate the groundwater level in the Trigalana bore (GW702286) (Figure 9) or any other impacted stock and domestic bores;
- determine the pump setting in relevant stock and domestic bores;
- determine the drawdown rate in GW702286 and other impacted stock and domestic bores;
- develop an impact mitigation plan for impacted stock and domestic bores; and/or
- set up an alternative water supply for the owner of GW702286 and other owners of stock and domestic bores, if necessary.

Contingency Measures at RL 134 m AHD

In the event that the groundwater level in GW036553 is below RL 134 m AHD, one or both of the following contingency measures will be implemented in consultation with DPE Water:

- alter the CGO's pumping regime to maintain the water level in the impacted stock and domestic bores; or
- maintain a water supply to the owner/s of impacted stock and domestic bores.

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 CGO are met by alternative internal or external water supplies, including Lachlan River Water Entitlements.

It is noted that groundwater levels at Bore GW036597 (Figure 9) (Billabong area) and Bore GW036611 (Figure 9) (Maslin area), which are located some 6 km from the Bland Creek Palaeochannel Borefield, are largely influenced by groundwater use by other users (e.g. for irrigation) (Coffey, 2018b).

6.2.3 Compensatory Water Supply

In accordance with the DA 14/98 condition 4.2(a) and SSD 10367 B3-7, should the CGO directly and adversely impact any person's basic landholder water rights (as defined in the *Water Management Act, 2000*), a compensatory water supply will be provided. The compensatory water source should provide a long-term water source equivalent to the loss attributable to the CGO. Equivalent water supply will be provided (at least on an interim basis) as soon as loss is identified, unless otherwise agreed with the landholder.

The compensatory water supply will be agreed to with the affected landholder in consultation with DPE Water, and to the satisfaction of the Secretary.

Should Evolution and the landholder not reach an agreement regarding the compensatory measures to be implemented, or there is a dispute about the implementation of the measures, either party may then refer the matter to the Secretary for resolution.

In accordance with the DA 14/98 condition 4.2(d) and SSD 10367 B3-7 if Evolution is unable to provide an alternate long-term water supply, then Evolution will provide alternative compensation to the satisfaction of the Secretary.

6.2.4 Groundwater-dependent Ecosystems

The potential risks to groundwater-dependent ecosystems (GDE) have been assessed in Coffey's groundwater study (Coffey 2020a) included as Appendix F of the Underground Development Project

EIS. Coffey concluded that as the nearest high potential aquatic GDE was at Lake Cowal immediately east of the CGO and that groundwater modelling and observations reported in the EIS indicated that seepage from Lake Cowal arising from mining operations during periods of inundation would be negligible.

In regard to high potential terrestrial GDE, comprising Grey Box-White Cypress Pine woodland the nearest is located 4.5 km north of the CGO, Coffey regards it as unlikely to be groundwater dependent and unlikely to be affected by mining operations.

6.3 IMPACTS OF POTENTIAL CHANGES TO FLOOD REGIME

Lake Cowal forms part of the Wilbertroy-Cowal wetlands located on the Jemalong Plain which is a fluvial landform formed in the lower reaches of Bland Creek. The plain extends to the Lachlan River in the north and is bounded by ridgelines to the east and west. Lake Cowal receives inflow from Bland Creek, which drains into the lake at its southern end. Bland Creek commands a catchment area of some 9,500 km^2 upstream of the lake. Inflows also occur from the Lachlan River via break-out flows during major flood events in the Lachlan causing back-flooding to Lake Cowal. The break-out flows enter the lake via modified floodways at the north-eastern side of the lake. The lake also receives inflow from incident rainfall (North Limited, 1998b).

When full Lake Cowal overflows into Nerang Cowal to the north which in turn overflows to Manna Creek, Bogandillon Creek and ultimately into the Lachlan River (Figure 3). The lake is substantially inundated approximately seven years out of ten, with relatively small increases in lake water depth leading to significant increases in the area of inundation due to the flat, shallow nature of the lake. Without inflows, drying of the lake is driven predominantly by evaporative losses with a period of approximately three years taken to reduce the lake from a full storage to minimal storage levels (North Limited, 1998b).

There is expected to be a very slight increase in the volume of spill from the Lake to Nerang Cowal as a result of the isolation embankment’s intrusion into the Lake (North Limited, 1998a). When a spillover event from Lake Cowal to Nerang Cowal occurs but, does not result in the complete filling of Nerang Cowal, the effect of the lake protection bund will be to transfer more water into Nerang Cowal. Such events will fill Nerang Cowal to a higher level and access to affected land may be reduced while this water evaporates (North Limited, 1998b). The lake protection bund will have no effect on land access in Nerang Cowal for spillover events that will have completely filled Nerang Cowal in any case.

Historical records of Lake Cowal spills to Nerang Cowal, and Nerang Cowal spills to Manna Creek indicate that over the past 100 years, Lake Cowal has spilled to Nerang Cowal on 20 occasions. Of these 20 occasions, both Lake Cowal and Nerang Cowal have spilled 16 times which indicates that for around 80% of Lake Cowal spill events, Nerang Cowal is filled and spills as well (Commissioners of Inquiry for Environment and Planning, 1999).

6.3.1 Affected Landholders

Lands within Nerang Cowal that may be affected by the changed flood regime will be limited to those below the level at which Nerang Cowal overflows to Manna Creek (Section 7.1). The level at which Nerang Cowal overflows to Manna Creek represents the full storage level of Nerang Cowal, consequently any land above this level will not be affected by the changed flood regime.

6.3.2 Appropriate Compensation Measures

6.3.2.1 Event Based Investigation and Compensation

Evolution will provide compensation to affected landholders as described in Section 7.2, based on an assessment of the economic impact of any additional inundation of productive land.

An investigation of the economic impact of any additional inundation of productive land will be conducted in accordance with the process outlined below. This process may lead to the provision of appropriate compensation to affected landholders.

1. Spill of waters to Nerang Cowal.
2. Evolution to contact landholders to advise of commencement of investigation process. The scope and timeframe of the investigation is to be developed in consultation with DPE Water and EPA and to the satisfaction of the Secretary of the DPE.
3. Investigation of the economic impact of any additional inundation of productive land.
   (a) Where the investigation concludes that there is no economic impact arising from the changed flood regime, the results of the investigation will be provided to DPE Water and EPA for consideration and to the Secretary for approval. Once the Secretary is satisfied the relevant landholder will be advised of the outcome of the investigation.
   (b) Where the investigation concludes that there is the potential for economic impact arising from additional inundation of productive land the following steps will apply:
      (i) Independent valuation conducted, to the satisfaction of the Secretary, to assess economic impact arising from additional inundation of productive land. Factors to be considered include:
         - extent of inundation;
         - timing of inundation in relation to the cropping cycle; and
         - prevailing market value of the affected crop (where grazing land is inundated, compensation will be based on the cost of a suitable replacement feed).
      (ii) Evolution to present offer of appropriate compensation based on the independent valuation for consideration by DPE Water and the EPA and for the approval of the Secretary of the DPE.
      (iii) Evolution to provide compensation to affected landholder.

6.3.2.2 Long-term Compensation

As the lake protection bund is a permanent structure that protrudes into Lake Cowal the effect of the bund, as described in Section 7.1, will be permanent. Therefore, a long-term compensation package will be developed that replaces the above event-based compensation (i.e. once the long-term compensation is made to the affected landholders no further compensation will be made).

The long-term compensation package will be developed in consultation with DPE Water and the EPA and to the satisfaction of the Secretary of the DPE. Empirical data (e.g. measured changes to the Nerang Cowal flood regime and the consequent measured effect of the inundation of productive land) obtained from investigations undertaken to determine appropriate event based compensation will be utilised to determine an appropriate one-off long-term compensation package.

The process for the development and presentation of the long-term compensation will include:

(i) Independent valuation conducted, to the satisfaction of the Secretary of the DPE, to assess economic impact arising from the additional inundation of productive land. Factors to be considered include:
   - potential extent of inundation; and
   - potential loss in income due to periodic loss of access to productive land.

(ii) Evolution to present offer of appropriate compensation based on the independent valuation for consideration by DPE Water and the EPA and for the approval of the Secretary of the DPE.

(iii) Evolution to provide compensation to affected landholder.

6.4 MITIGATION OF POTENTIAL ADVERSE IMPACTS

6.4.1 Water Supply Shortfalls

As a part of the *Cowal Gold Operations Processing Rate Modification Surface Water Assessment* (HEC, 2018) Hydro Engineering and Consulting Pty Ltd completed a site water balance (in consideration of the Processing Rate Modification) for the CGO.

HEC (2018) concluded that non-negligible (>20 ML) supply shortfalls were simulated in 13% of the 128 climatic sequences simulated (HEC, 2018). These climatic sequences were simulated to occur either towards the end of early stage of the IWL (2023 – 2024), or towards the end of the planned predominantly oxide ore processing period (2031) (HEC, 2018).

In accordance with DA14/98 condition 4.1(a), the CGO implements a number of strategies which mitigate the potential for water supply shortfalls on site (including under adverse climatic conditions).

Water supply for the CGO involves re-use of mine process water, capture and re-use of runoff from areas within the Internal Catchment Drainage System, utilisation of groundwater seepage to the open pit and groundwater sourced from the Saline Groundwater Borefield (when Lake Cowal is dry).

Additionally, as described in Section 4.2.2, the CGO's water requirements are met through local water sources in order of priority use for the CGO. This process prioritises the use of all water available on site, and then draws from external sources if required.

No additional surface water access licences beyond those already held by Evolution (i.e. WAL 14981, WAL 13749 and WAL 13748) from the Lachlan River will be required for the Underground Development Project (Evolution, 2020a). However, Evolution continues to explore for additional lower quality groundwater resources to reduce its reliance on freshwater sources.

Should monitoring results indicate a potential shortfall in water supply, in accordance with the contingency measures outlined in Section 4.2.2, the Sustainability Manager in conjunction with the Mining Manager will develop and implement any or all suitable mitigation measures as required. The choice of mitigation measures would ultimately be the result of a cost-benefit analysis that takes into consideration the cost of each available supply option, the potential for associated adverse impact (e.g. the need to maintain stock and domestic supply for the surrounding community), the economic cost of scaling back or temporarily halting ore treatment (i.e., job losses and lost revenue) and the ability of each option to provide the necessary quantity of water for the required timeframe.

6.4.2 Groundwater Recharge or Contamination

In the event of serious impacts to groundwater by way of recharge or contamination, Evolution will consult with the relevant government agencies to agree on an appropriate course of action.

In regard to groundwater recharge, localised recharge due to the downward hydraulic head of the saturated tailings mass in the IWL has been noted by Coffey in various reports (Coffey 2018, Coffey 2020a). The CGO proposes to install one of more dewatering bores to keep the groundwater level away the fertile growth layer and maintain that until the issue has dissipated (that may be some time after mine closure).

Contamination of groundwater by soluble metals, ions or acidity is unlikely due to the strong groundwater drawdown cone centred on the E42 open pit that underlies all constructed dams and the process plant. This drawdown cone will continue in perpetuity while the pit exists. The area of the future underground mine will also be dewatered, increasing the geographic area and depth of the drawdown cone. This will only further reduce the negligible probability of groundwater contamination extending beyond the current mining licence boundary. Waste rock emplacements will not have a significant hydraulic head or hydraulic connection with groundwater and their porosity and permeability mean that the path of least resistance for any incident rainfall will be outwards from the base of the emplacement at which point it will be either evapo-transpirated by vegetation, evaporated or captured by the permanent ICDS which directs surface flows into E42 where it will evaporate below the spill level (Coffey 2020a).

6.4.3 Interception of Unexpected Groundwater Volumes

Repeated groundwater investigations by Coffey (Coffey 2018 and Coffey 2020a) have examined the potential for interception of large volumes of groundwater in previously unknown aquifers- most likely associated with faults or potentially, through connection with a flooded Lake Cowal. Both these issues have been examined at length, most recently in the 2020 Underground Development Project EIS. Of the contingency measures proposed below, it should be noted that where serious incidents occur (in keeping with DA 14/98 condition 9.3 and EPL 11912 condition R2), Evolution will only implement that response as may be agreed with relevant government agencies.

Contingences for connection with a flooded Lake Cowal:

- Installation of nested groundwater bores as required by DA 14/98 condition 4.4(d)(iv). This task will be completed in April 2022.
- Monitoring of groundwater seepage volumes from the underground
- Depending on the nature of the connection, geotechnical solutions may include:
  - Grouting the water pathway
  - Sealing off and abandoning the affected stope/drive
  - For small, stable flows of water, installation of additional pumping infrastructure to return the water to the lake

Contingencies for the interception of unexpectedly large or unknown aquifers:

- Monitoring of groundwater seepage volumes from the underground
- Depending on the nature of the connection, geotechnical solutions may include:
  - Grouting the water pathway
  - Sealing off and abandoning the affected stope/drive
  - For small, stable flows of water, installation of additional pumping infrastructure to capture the water for use in the process water system.

6.4.4 Surface Water Run-off

The potential for impacts associated with surface water run-off are extremely limited and were most prominent in the initial construction of the various components of the lake protection bund (LPB), particularly the temporary isolation bund.

Contingencies that were present during the construction of the temporary isolation bund:

- Avoidance of construction during unusually wet conditions as far as is practicable.
- Construction of any required extensions of the UCDS and ICDS ahead of the temporary isolation bund to reduce the potential volume of water reaching the temporary bund construction area
- Scheduling the construction of the bund in sections to avoid wetter parts of the year
- Construction of temporary erosion and sediment control measures that may include silt fences, hay bales, cut-off drains and dams, coir rope logs, additional planting of vegetation or inflatable weirs.

Contingencies that were present during the construction of the lake protection bund:

- Construction of the temporary isolation bund. (this measure alone is the single most important mitigation measure as its sole purpose is to prevent surface water flows reaching Lake Cowal)
- Avoidance of construction during unusually wet conditions as far as is practicable.
- Construction of any required extensions of the UCDS and ICDS ahead of the temporary isolation bund to reduce the potential volume of water reaching the temporary bund construction area

- Scheduling the construction of the bund in sections to avoid wetter parts of the year

The following contingencies have been developed and implemented during the operational phase of the CGO.

Contingencies during operations:

- Regular scheduled monitoring for signs of erosion or water flows from the surface of, through or under the LPB.
- Remedial revegetation, rock armouring, revegetation or earthworks as necessary (e.g., to address sodic soils with gypsum or lime)
- Where necessary and feasible to do so, a cut-off drain and sump could be constructed to intercept flows and sediment and allow its capture and return to the CGO for disposal in the IWL or reuse in the process water circuit.

Contingencies for the Bland Creek Palaeochannel borefield: see Section 6.2.2.

7 DECOMMISSIONING AND POST-CLOSURE MANAGEMENT OF WATER MANAGEMENT STRUCTURES

7.1 STRATEGY FOR THE DECOMMISSIONING OF WATER MANAGEMENT STRUCTURES

The strategy is consistent with the existing closure concepts presented in the ESCMP, the CGO RMP and the *Monitoring Programme for the Detection of any Movement of the Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls* (Section 4.3.6).

The strategy aims to provide a stabilised surface water management system post-closure and will be refined and developed over the life of the CGO as part of mine closure planning in consultation with DPE Water, EPA, DRG and the CEMCC.

7.1.1 Water Management Structures

The permanent water management structures for the CGO comprise:

- UCDS;
- ICDS (including the permanent catchment divide structures); and
- lake isolation system (lake protection bund and perimeter waste rock emplacement).

Rehabilitation monitoring of the permanent surface water diversion systems within ML 1535 will continue to be undertaken post-closure to determine whether the relevant rehabilitation completion criteria have been met. During the rehabilitation works phase, and until satisfactory surface stability is achieved, silt fences and flow retention structures will be maintained to minimise the potential for off-site migration of sediments. Rehabilitation monitoring will continue post-closure until stability of these systems can be demonstrated (i.e. a stabilised surface water management system has been achieved resulting in an acceptably low risk of environmental harm to Lake Cowal).

Long-term management of the lake protection bund is described further in Section 7.

Water Storages at the CGO

During closure, the contained water storages (i.e. D1 to D10) will be dewatered and liners removed (i.e. unless otherwise requested to be retained for local landholder use, see below). Decommissioning of the water management infrastructure will be undertaken to the satisfaction of the DRG and EPA in consultation with DPE Water.

Alternatively, the contained water storages may be retained for local landholder use upon agreement by Evolution and in consultation with DPE Water and the DRG.

7.1.2 Mine Water Supply Bores and Pipeline

Water Pipelines from the Bland Creek Palaeochannel Borefield

In consultation with the CEMCC, Evolution will identify and discuss post-mining issues during the life of the CGO, which will be specifically reviewed in consultation with the CEMCC at the commencement of the final year of mine operations. During this review process, Evolution will identify opportunities for consultation with local and regional landholders and specifically, the local water users group (Section 6.2.2) regarding possible alternative uses for the Bland Creek Palaeochannel Borefield bores, associated pump stations (including the eastern pump station) and pipelines. Subject to the outcomes of consultation, the Bland Creek Palaeochannel Borefield bores and associated pump stations may be transferred to regional landholders upon agreement by Evolution and in consultation with DPE Water (Evolution, 2018). Alternatively, the Bland Creek Palaeochannel Borefield bores and associated pump stations may be dismantled and the bores plugged and capped (*viz)*. All works associated with bore decommissioning will be conducted in consultation with DPE Water and in accordance with the guideline *Minimum Construction Requirements for Water Bores in Australia* (National Uniform Drillers Licensing Committee, 2012).

Options for Alternate Uses of the Water Pipelines

If no alternative use for the pipelines can be agreed following the consultation process described above, the pipelines will be raised and dismantled for recycling. The sections of pipelines in the bed of Lake Cowal will be raised when the lake is dry, subject to strict environmental management procedures and in accordance with relevant DPE Water requirements. For example, in undertaking the works associated with removal of the pipelines, Evolution will seek to:

- minimise disturbance to soil and vegetation communities;
- maintain the existing/natural hydraulic, hydrologic, geomorphic and ecological functions of Lake Cowal; and
- rehabilitate disturbed areas post pipeline removal as appropriate and in consideration of the revegetation principles within the DPE Water's *Guidelines for Controlled Actions on Waterfront Land*.

If this is not possible due to successive high rainfall seasons, any decision to remove the pipelines will be discussed with DPE Water (Evolution, 2018). However, given the maintenance period for rehabilitation at the CGO, it is likely that the lake will be sufficiently dry at some stage during this period.

ML 1535 Saline Groundwater Supply Bores

Given the water supply from these bores is highly saline, it is unlikely that these bores will be suitable and/or requested for ongoing future use by regional landholders post-closure of the CGO. Notwithstanding, consultation will include discussions between Evolution and local and regional landholders regarding potential transfer of the saline groundwater supply borefield infrastructure within ML 1535 for private use.

It is likely, however, that the saline groundwater supply bores, piezometers/monitoring bores and associated pipeline will be dismantled and the bores plugged and capped following the cessation of mining operations at the CGO (Evolution, 2018). Works associated with decommissioning of the saline groundwater bores and associated pipeline within ML 1535 will be undertaken during dry conditions in consultation with DPE Water and will be subject to the same environmental management procedures as described above for the sections of the Bland Creek Palaeochannel pipelines located within Lake Cowal.

Eastern Saline Borefield

Given the water supply from the eastern saline borefield bores is highly saline, it is unlikely that these bores will be suitable and/or requested for ongoing future use by regional landholders post-closure of the CGO. As described in Section 6.2.1, prior to development of the eastern saline borefield, there was only one known bore installed within the Cowra aquifer in the region and this bore had never been used for production purposes due to the elevated salinity levels that made it unsuitable for agricultural or domestic use. Notwithstanding, consultation will include discussions between Evolution and local landholders regarding potential transfer of the eastern saline borefield infrastructure for private use.

It is likely, however, that the eastern saline borefield groundwater supply bores, piezometers/monitoring bores and associated pipeline will be dismantled and the bores plugged and capped following the cessation of mining operations at the CGO in consultation with DPE Water. Settlement monuments will likely remain.

7.2 LONG-TERM MANAGEMENT OF THE FINAL VOID AND LAKE PROTECTION BUND

7.2.1 Final Void

The specific rehabilitation objectives for the final void are to (Evolution, 2018):

- create habitat opportunities for waterbirds at the approximate level at which void water will reach equilibrium, where feasible; and
- leave the void surrounds safe (for humans and stray stock).

A bund will be constructed around the perimeter of the final void which will be planted with an initial cover crop if necessary (to assist in stabilising the bund following construction) and will then be seeded with native and/or endemic Eucalypt Woodland species (Evolution, 2018). The final void will be screened from public views on Lake Cowal Road by the IWL and waste rock emplacements and will be fenced upon completion of mining. Signposted warnings to the public will also be placed along the fence (*ibid.)*.

Long-term Monitoring of Water Quality in the Final Void

Geochemical studies have concluded that the void water quality will not be acidic due to the characteristics of the void wall rock and will be dominated by the overriding influence of saline groundwater to the void (EGi, 1998). Predictions of average void salinity based on a solute balance between inflows and outflows confirm that salt concentrations in void waters will slowly increase – reaching about 70,000 mg/L after about 200 years (Gilberts & Associates, 2009). The approved final void water quality will reflect the influence of the high salinity in the groundwater (Hydro Engineering & Consulting, 2018). Salinity of the final void water is predicted to continue to increase trending to hyper-salinity, as was predicted in the EIS (Hydro Engineering & Consulting, 2018).

Monitoring of the water quality (salinity and other dissolved analytes) in the final void will be undertaken to confirm the water quality predictions. The surface water quality monitoring programme during mine closure (including monitoring of water quality in the final void) will be developed in consultation with DPE Water, EPA, Fisheries NSW and to the satisfaction of the DPE.

Long-Term Monitoring of Water Levels in the Final Void

At the completion of mining (and hence dewatering), the final void will be a permanent sink to local groundwater (Kalf and Associates, 1997) and will gradually fill with water from incident rainfall, runoff from adjacent mine areas and seepage from the intercepted aquifers. These flow directions will be fundamentally maintained during and post-mining, as the water level in the open pit recovered and reached an equilibrium level lower than the current potentiometric surface level at the open pit (Coffey Partners International, 1997).

Modelling indicates that the approved final void will reach an estimated equilibrium water level between approximately 125 and 135 m AHD (approximately 80 m below spill level) over several hundred years (Hydro Engineering and Consulting, 2018). The void water is not predicted to spill and will be hydrogeologically isolated from and lower than water in Lake Cowal (Hydro Engineering and Consulting, 2018), even allowing for adverse future climate change predictions. A final void water balance will be conducted post-closure to assess long-term water levels and groundwater quality in the immediate vicinity of the void.

Water levels will be recorded when monitoring of the water quality in the final void is undertaken following the cessation of mining. This will be incorporated as part of the closure surface water quality monitoring programme to be developed in consultation with DPE Water, EPA, Fisheries NSW and to the satisfaction of the DPE.

Groundwater water licensing entitlements will be maintained post closure of the CGO during the void filling period, in consultation with DPE Water, for groundwater inflows to the final void (and for replacing evaporative loss at equilibrium).

Long-Term Monitoring of the Stability of the Final Void Walls
The geotechnical stability of the final void will be reviewed by an appropriately qualified and experienced person in consultation with the DRG as part of the mine closure process. The stability of the final void will continue to be surveyed from the cessation of mining until lease relinquishment (i.e. until the final void walls can be demonstrated to be geotechnically stable and present an acceptably low risk of environmental harm).

Final Void Water Balance Modelling
Consistent with Coffey (2018a) recommendation, Evolution will conduct a final void water balance post-mine closure to assess long-term water levels in the final void and the potential impact on groundwater quality in the immediate vicinity of the pit void.

7.2.2 Lake Protection Bund

The following landforms together comprise the new lake foreshore:

- the temporary isolation bund;
- the lake protection bund and the lower batter of the perimeter waste rock emplacement; and
- the intervening section of lakebed between the temporary isolation bund and the lake protection bund.

The rehabilitation objectives for the CGO's rehabilitation programme include (Evolution, 2018):

- The water quality of Lake Cowal is not detrimentally affected by the new landforms.
- Revegetating the new landforms with selected native and/or endemic vegetation that is suited to the physiographic and hydrological features of each landform, and which expand on the areas of remnant endemic vegetation in the surrounding landscape.
- Designing final landforms so that they are stable and include revegetation growth materials that are suited to the landform and support self-sustaining vegetation.
- The placement (wherever possible) of soils on final landforms to enable the progressive establishment of vegetation.
- The expansion of habitat opportunities for wetland and terrestrial fauna species. This includes the design and implementation of rehabilitation works at the New Lake Foreshore in a manner consistent with the *NSW Wetlands Policy* (NSW Department of Environment, Climate Change and Water, 2010).
- The selection of revegetation species in accordance with accepted principles of long-term sustainability (e.g. genotypic variation, vegetation succession, water/drought tolerances).
- Grazing of land within ML 1535 and ML 1791 area to be excluded during operations and during rehabilitation of the mine site. At lease relinquishment, rehabilitated final landforms to be fenced with grazing excluded, with some areas suitable for grazing surrounding the rehabilitated final landforms.

Rehabilitation concepts for the Lake Protection Bund are described in the CGO's CWMP and RMP.

Rehabilitation monitoring of the lake protection bund will continue post-closure until the lease relinquishment criteria as described in the RMP have been satisfied (i.e. acceptably low risk of environmental harm to Lake Cowal). The CGO's RMP includes rehabilitation concepts and measures which consider the revegetation concepts for waterfront land described in the *Guidelines for Controlled Actions on Waterfront Land* (NOW, 2012).

Long-term Monitoring of the Stability of the Lake Protection Bund
Survey assessments will be undertaken annually to determine and quantify any movement of the lake protection bund until permanent stability is demonstrated (i.e. until the lake protection bund can be demonstrated to be geotechnically stable and presents an acceptably low risk of environmental harm).

8 REPORTING AND NOTIFICATION PROGRAMME

8.1 SITE WATER DATABASE

As described in Section 1.1, this WMP and the EIS establish the following objectives for the CGO site water management system:

- prevent the quality of any surface water (including waters within Lake Cowal) or groundwater being degraded, through the containment of all potentially contaminated water (contained water) generated within the CGO area and diversion of all other water around the perimeter of the site (North Limited, 1998a);
- manage the quantity of surface water and groundwater within and around the mine site through the appropriate design (i.e. sizing), construction and operation of water management structures; and
- establish a monitoring, review and reporting programme that facilitates the identification of potential surface water and groundwater impacts and the development of ameliorative measures as necessary, including provision of appropriate compensation measures for landholders affected by changes to the flood regime of Nerang Cowal.

As described in Section 4.3, the results from the monitoring programmes presented in the SWGMBMP will be maintained in a database for examination and assessment and used to assist in the management of the quality and quantity of surface and groundwater within and around the mine site. Section 4.3 also establishes a review procedure for each of the monitoring programmes.

8.2 MONITORING REPORTS

Annual lake surface water and groundwater monitoring programme reports are prepared by independent specialists to review and analyse the surface water and groundwater monitoring database results.

The lake surface water monitoring reports compare water quality results with baseline data and the data set collected to date. Lake surface water monitoring reports will be prepared when lake monitoring commences (i.e. when the water level of the lake is at or above 204.5 m AHD).

Groundwater monitoring reports analyse trends in groundwater quality, analyse relationships between short-term variations in groundwater levels, update the site water balance and review compliance with relevant groundwater trigger levels to verify the predicted groundwater modelling including modelling of hydraulic heads and the transport of contaminants beneath the IWL.

Conclusions and any recommendations from the lake surface water and ground water monitoring reports are used to review the surface water and groundwater monitoring programmes to determine if further monitoring is necessary (e.g. additional monitoring locations) and review the effectiveness of the water management system and the performance against the WMP objectives (Section 8.2.1). The monitoring report results and any specialist interpretations of trends observed in the monitoring data or recommendations will be reported annually in the Annual Review (Section 8.3).

8.2.1 Effectiveness of Water Management System and Performance against Objectives

In accordance with DA 14/98 conditions 4.4(d)(ii) and (iii), the effectiveness of the CGO water management system will be assessed by comparing the results of the CGO monitoring programmes against the objectives presented in Section 8.1. The review procedure established in Section 4.3 will be utilised to identify areas where the effectiveness of the CGO water management system could be improved and to develop ameliorative measures as necessary.

A schematic of the key components of the water management system is presented on Figure 8. In addition to the above monitoring, the mine water system will be monitored on a regular basis by the Sustainability Manager or delegate, including:

- quantity of water transferred between the key components of the water management system;
- quantity of water stored in the tailings storage facilities/IWL;
- quality of waters stored in containment storages (Section 4.3.2); and
- climatic conditions.

The status of the mine water balance and groundwater model will be reviewed on a 3-year basis by a suitably qualified person. Data collected from the above monitoring will be used to validate the predicted performance of the site water management system and/or to determine the need for any augmentation of the system. Additionally, the periodic review will include a review of measured groundwater monitoring data against the modelled outcomes and be used to update the model to reflect the actual measured values if there is significant difference or notable concern raised by stakeholders.

8.3 ANNUAL REVIEW

An Annual Review is prepared in accordance with the requirements of DA 14/98 condition 9.1(b) and SSD 10367 condition C9 submitted to the Secretary of the DPE by the end of March each year, or as otherwise agreed with the Secretary. DA 14/98 condition 9.1(b) is reproduced below:

9.1 Environmental Management

...

b) <u>Annual Review</u>

By the end of March each year, or as otherwise agreed with the Planning Secretary, the Applicant shall review the environmental performance of the Cowal Gold Operations to the satisfaction of the Planning Secretary. This review must:

(i) describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;
(ii) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against the:

- *the relevant statutory requirements, limits or performance measures/criteria;*
- *the monitoring results of previous years; and*
- *the relevant predictions in the EIS;*

(iii) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
(iv) identify any trends in the monitoring data over the life of the development, including the ongoing interaction between the Cowal Gold Mine and Lake Cowal;
(v) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
(vi) describe what measures will be implemented over the next year to improve the environmental performance of the development.

...

SSD 10367 condition C9 states:

By the end of March each year after the date of commencement of development under this consent, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the Cowal Gold Operations, to the satisfaction of the Planning Secretary. This review must:

a) describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;
b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the:
   (i) relevant statutory requirements, limits or performance measures/criteria;
   (ii) requirements of any plan or program required under this consent;

(iii) *monitoring results of previous years; and*

(iv) *relevant predictions in the document/s listed in condition A2(c);*

c) *identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;*

d) *evaluate and report on compliance with the performance measures, criteria and operating conditions of this sent;*

e) *identify any trends in the monitoring data over the life of the development;*

f) *identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and*

g) *describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.*

Condition 26(1) of the Conditions of Authority for ML 1535 also has requirements for annual reporting (formerly the AEMR) which are generally consistent with the requirements of DA 14/98 condition 9.1(b). The requirements of Condition 26(a) are detailed below.

Annual Environmental Management Report (AEMR)

26. (1) Within 12 months of the commencement of mining operations and thereafter annually or, at such other times as may be allowed by the Director-General, the lease holder must lodge an Annual Environmental Management Report (AEMR) with the Director-General.

(2) The AEMR must be prepared in accordance with the Director-General's guidelines current at the time of reporting and contain a review and forecast of performance for the preceding and ensuing twelve months in terms of:

(a) the accepted Mining Operations Plan;

(b) development consent requirements and conditions;

(c) Environment Protection Authority and Department of Land and Water Conservation licences and approvals;

(d) any other statutory environmental requirements;

(e) details of any variations to environmental approvals applicable to the lease area; and

(f) where relevant, progress towards final rehabilitation objectives.

(3) After considering an AEMR the Director-General may, by notice in writing, direct the lease holder to undertake operations, remedial actions or supplementary studies in the manner and within the period specified in the notice to ensure that operations on the lease area are conducted in accordance with sound mining and environmental practice.

(4) The lease holder shall, as and when directed by the Minister, cooperate with the Director-General to conduct and facilitate review of the AEMR involving other government agencies and the local council.

The Annual Review will also address the above requirements of Condition 26 for ML 1535.

The Annual Review will report on the following issues related to the WMP:

- surface water and groundwater monitoring results;
- details of any trends observed in the monitoring data;
- effectiveness of the water management systems and the performance of CGO activities against the objectives of this WMP (Section 1.1) (as required by Development Consent Condition 4.4(d)(ii) and (iii);
- any proposed improvements to site water management systems that will better meet the site water management objectives;
- details of investigations and consultation with regulatory agencies;

- review of the performance of control measures and the monitoring programme; and
- interpretation and discussion of the monitoring programme results and management measures by a suitably qualified person.

In accordance with DA 14/98 condition 9.4(a)(vii), the last five Annual Reviews will be made available on Evolution's website (www.evolutionmining.com.au).

8.4 EPL REPORTING REQUIREMENTS

In accordance with the CGO's EPL Conditions, an Annual Return will be prepared including monitoring results from the EPL surface water and groundwater monitoring locations, and a statement of compliance with the relevant EPL water monitoring requirements.

In addition, in accordance with Section 66(6) of the *Protection of the Environment Operations Act, 1997* (POEO Act) and written requirements issued by the EPA, Evolution will publish surface water and groundwater monitoring data collected in accordance with EPL condition requirements, on Evolution's website (www.evolutionmining.com.au).

8.5 INCIDENT REPORTING AND NOTIFICATION REQUIREMENTS

Incidents are defined in DA 14/98 as:

> *A set of circumstances that causes or threatens to cause material harm to the environment*

SSD 10367 has a slightly different definition for an incident:

> *An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance*

In accordance with DA 14/98 condition 9.3(a) and SSD 10367 condition C7, Evolution will notify the Planning Secretary in writing to the Major Projects website, and any other relevant agencies, immediately after becoming aware of an incident. Evolution will provide the relevant agencies with a detailed report on the incident, and any further reports that may be requested. These reports will outline as a minimum, the development (including the development application number), the location and the nature of the incident which has occurred.

8.6 NON-COMPLIANCE REPORTING AND NOTIFICATION REQUIREMENTS

A non-compliance is defined within DA14/98 as:

> *An occurrence, set of circumstances or development that is a breach of this consent but is not an incident.*

SSD 10367 defines it as:

> *An occurrence, set of circumstances or development that is a breach of this consent*

In accordance with DA 14/98 condition 9.3(b) and SSD 10367 condition C8, Evolution will notify the DPE in writing via the Major Projects website within seven days after becoming aware of any non-compliance with the development consent conditions. Evolution will provide in writing to the DPE a detailed report of the non-compliance which identifies, the development application number for the CGO, the development consent condition of which the CGO is non-compliant, the way in which the CGO does not comply and the reason for the non-compliance. The CGO will also provide details around any actions which have been or will be taken, to address the non-compliance.

8.7 REVIEW OF THIS WMP

In accordance with DA 14/98 condition 9.1(c), this WMP will be reviewed, within three months of the submission of:

> *(i) the submission of an annual review under condition 9.1(b) above;*
> *(ii) the submission of a non-compliance or incident notification under condition 9.3(a) or 9.3(b) below;*
> *(iii) the submission of an audit under condition 9.2 (a) below;*
>
> *(iv) the approval of any modification to the conditions of this consent; or*
> *(v) a direction of the Planning Secretary under condition 1.1(b) of this consent;*

Where this review leads to revisions of the WMP, then within six weeks of the review, the revised WMP will be submitted for the approval of the Secretary of the DPE (unless otherwise agreed with the Secretary). The revision status of this WMP is indicated after the title page of each copy.

The requirements of SSD 10367 C5 are very similar but different:

Within three months of:

a) the submission of an incident report under condition C7;
b) the submission of an Annual Review under condition C9;
c) the submission of an Independent Environmental Audit under condition C11; or
d) the approval of any modification of the conditions of this consent (unless the conditions require otherwise);
e) notification of a change in development phase under condition A5; or
f) a direction of the Secretary under condition A3 of Schedule 2

the suitability of existing strategies, plans and programs required under this consent must be reviewed by the Applicant.

This WMP will be made publicly available on Evolution's website (www.evolutionmining.com.au), in accordance with Condition 9.4(a)(iii) of DA 14/98 and SSD 10367 C14(a)(iii). A hard copy of the WMP will also be kept at the CGO.

9 COMMUNITY CONSULTATION AND AUDITING

9.1 COMMUNITY ENVIRONMENTAL MONITORING AND CONSULTATIVE COMMITTEE

A CEMCC has been established for the CGO in accordance with DA 14/98 condition 9.1(d) and SSD 10367 condition A11. DA 14/98 condition 9.1(d) is reproduced below:

> ***9.1 Environmental Management***
>
> *...*
>
> *(d) <u>Community Environmental Monitoring and Consultative Committee</u>*
>
> *(i) The Applicant shall establish and operate a Community Environmental Monitoring and Consultative Committee (CEMCC) for the Cowal Gold Operations to the satisfaction of the Planning Secretary. This CEMCC must:*
>
> - *be comprised of an independent chair and at least 2 representatives of the Applicant, 1 representative of BSC, 1 representative of the Lake Cowal Environmental Trust (but not a Trust representative of the Applicant), 4 community representatives (including one member of the Lake Cowal Landholders Association);*
> - *be operated in general accordance with the Department's Community Consultative Committee Guidelines: State Significant Projects (2019 or its latest version); and*
> - *monitor compliance with conditions of this consent and other matters relevant to the operation of the Cowal Gold Operations during the term of the consent.*
>
> *Note: The CEMCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Applicant complies with this consent.*
>
> *(ii) The Applicant shall establish a trust fund to be managed by the Chair of the CEMCC to facilitate the functioning of the CEMCC, and pay $2000 per annum to the fund for the duration of gold processing operations. The annual payment shall be indexed according to the Consumer Price Index (CPI) at the time of payment. The first payment shall be made by the date of the first Committee meeting. The Applicant shall also contribute to the Trust Fund reasonable funds for payment of the independent Chairperson, to the satisfaction of the Planning Secretary*
>
> *(iii) At least four years prior to mine closure the Applicant shall, in consultation with the CEMCC, identify and discuss post-mining issues, particularly in relation to reduced employment and consequent impacts on West Wyalong, and develop a mine workforce phase out plan. This plan shall be reviewed and updated in consultation with the CEMCC at the commencement of the final year of mining operations.*
>
> *(iv) The Applicant shall, in consultation with the CEMCC, develop appropriate strategies to support activities which promote special interest tourism related to the co-existence of mining and the Lake Cowal environment. ..*

The CEMCC will continue to provide opportunities for members of the community to attend CEMCC meetings to discuss specific issues relevant to them. This will be achieved by landholders making a request to the CEMCC regarding a particular issue, or by the landowner registering a complaint in the complaints register. Landowners who register complaints may be invited to join in discussion of the issue at the next CEMCC meeting. Items of discussion at these meetings will include mine progress, reporting on environmental monitoring, complaints, rehabilitation activities and any environmental assessments undertaken.

9.2 COMPLAINTS REGISTER

A complaints register will be maintained by the Sustainability Manager in accordance with EPL Condition M5.1.

Information recorded in the complaints register with respect to each complaint will include:

- date of complaint;
- the method by which the complaint was made;

- nature of complaint; and
- response action taken to date (if no action was taken, the reasons why no action was taken).

An initial response will be provided to the complainant within 24 hours. Preliminary investigations into the complaint will commence within 48 hours of complaint receipt.

A summary of the complaints register will be displayed on Evolution's website in accordance with Development Consent Condition 9.4(a)(v) and will be updated on a monthly basis.

Dispute Resolution

In the event that dispute resolution is necessary, the resolution process will be one of informed discussion involving the complainant and Evolution. Evolution may also refer the dispute (with the complainant's agreement) to the CGO's CEMCC for mediation (Section 14.1). In the event that the complainant is still dissatisfied, the matter may be referred to the DPE for consideration of further measures. Every effort will be made to ensure that concerns are addressed in a manner that results in a mutually acceptable outcome.

9.3 INDEPENDENT ENVIRONMENTAL AUDIT

Independent Environmental Audit

An independent environmental audit will be conducted in accordance with DA 14/98 condition 9.2(a) and SSD 10367 condition C11. The audit may include water-related issues. DA 14/98 condition 9.2 is reproduced below.

9.2 Independent Auditing and Review

(a) Independent Environmental Audit

(i) By the end of July 2016, and every 3 years thereafter, unless the Planning Secretary directs otherwise, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the Cowal Gold Operations. This audit must:

- *be prepared in accordance with the Independent Audit Post Approval Requirements (2020 or as amended from time to time);*
- *be led and conducted by a suitably qualified, experienced and independent team of experts (including ecology and rehabilitation experts, and in field's specified by the Planning Secretary) whose appointment has been endorsed by the Secretary;*
- *be carried out in consultation with the relevant agencies, BSC and the CEMCC;*
- *assess whether the development complies with the relevant requirements in this consent, and any strategy, plan or program required under this consent; and*
- *recommend appropriate measures or actions to improve the environmental performance of the development and any strategy, plan or program required under this consent.*

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APPENDIX A

GROUNDWATER MONITORING PROGRAMME
BORE LICENCE AND WATER ACCESS LICENCE NUMBERS

Groundwater Monitoring Programme - Bore Licence and Water Access Licence Numbers

Bore ID	Licence Number
Open Pit Dewatering Bores[1]	
PD1 to PD26	Water Access Licence (WAL) 36615 (upper 10%, 366 units, Lachlan Alluvial Zone 7) Approval Number 70WA614090
	WAL 36617 (lower 90%, 3,294 units, Upper Lachlan Fold Murray-Darling Basin) Approval Number 70WA614090
Open Pit Area	
PDB1A	70BL232565
PDB1B	70BL232567
PDB3A	70BL230583
PDB3B	70BL232572
PDB5A	70BL229747
PDB5B	70BL230584
Processing Plant Area	
PP01	70BL232327
PP02	70BL232329
PP03	70BL232328
PP04	70BL232330
PP06	70BL232332
Northern Tailings Storage Facility Area	
P418A	N/A
P418B	N/A
MON01A^	70BL230064
MON01B^	70BL230058
TSFNA^	70BL229727
TSFNB^	70BL232569
TSFNC^	70BL232568
P412A^	N/A
P412A-R^	70BL232570
P414A^	N/A
P414B^	N/A

1 Not all licensed pit dewatering bores are permanently operational. All vertical pit dewatering bores were decommissioned in December 2017.

^ These bores will continue to be monitored until approximately June 2019, when they will be decommissioned to facilitate development of the IWL.

Groundwater Monitoring Programme - Bore Licence and Water Access Licence Numbers

Bore ID	Licence Number
Up-gradient of the Northern and Southern Tailings Storage Facilities	
P555A-R	70BL226558
P558A-R^	Pending
IWL Monitoring Bores	
IWL01A	N/A
IWL01B	N/A
IWL02A	N/A
IWL02B	N/A
IWL03A	N/A
IWL03B	N/A
IWL04A	N/A
IWL04B	N/A
IWL05A	N/A
IWL05B	N/A
IWL06A	N/A
IWL06B	N/A
Bland Creek Palaeochannel Supply Bores	
Bore 1	WAL 31864 Approval Number 70WA614076
Bore 2	
Bore 3	
Bore 4	
Bland Creek Palaeochannel Monitoring Bores	
BLPR1	70BL229648
BLPR2	70BL229647
BLPR3	70BL229649
BLPR4	70BL229651
BLPR5	70BL229653
BLPR6	70BL229652
BLPR7	70BL229650
ML 1535 Saline Groundwater Borefield Supply Bores	
WB01	WAL 36615 Approval Number 70WA614090
WB39	
ML 1535 Saline Groundwater Borefield Monitoring Bore	
WB12	Pending
Eastern Saline Borefield Supply Bores	
SB1	WAL 36569 Approval Number 70WA614933
SB2	
Eastern Saline Borefield Monitoring Bores	
PZ09	70BL232972
PZ10	
PZ11	

APPENDIX B

DEVELOPMENT CONSENT DA 14/98

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APPENDIX C

STATE-SIGNIFICANT DEVELOPMENT NO. 10367

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APPENDIX D

BASELINE GROUNDWATER DATA

Bland Creek Palaeochannel Baseline Groundwater Analysis

Parameter	Results 1994	
pH	6.9	6.8
Conductivity (μS/cm)	1,350	1,500
Total Dissolved Solids (mg/L)	900	970
Hardness (mg/L)	225	225
Sodium (mg/L)	255	295
Potassium (mg/L)	2.8	2.9
Calcium (mg/L)	44	44
Magnesium (mg/L)	28	28
Chlorine (mg/L)	390	460
Carbonate (mg/L)	<1	<1
Bicarbonate (mg/L)	210	220
Sulphate (mg/L)	59	63
Iron (mg/L)	0.08	0.09
Manganese (mg/L)	0.08	0.08
Silicate (mg/L)	15	14

Source: Coffey Partners International (1995a)

Baseline Groundwater Monitoring Results (1995) – ML 1535 Area

Analysis	Units	P556	P557	P560	P561	P561 duplicate
pH		6.85	7.03	6.92	6.99	7.04
Conductivity	μS/cm	47800	47900	16400	40900	41300
Calcium	mg/L	529	352	268	424	421
Magnesium	mg/L	1300	1080	918	1040	1030
Sodium	mg/L	8230	8400	8010	7410	7450
Potassium	mg/L	88	86	48	34	30
Bicarbonate	mg/L	595	460	339	530	536
Sulphate	mg/L	3070	3620	3380	3740	3730
Chloride	mg/L	14900	13800	12700	12100	12300
Iron	mg/L	<1	<1	<1	<1	<1
Silver	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.022	0.023	0.01	0.037	0.039
Manganese	mg/L	0.049	0.030	0.232	0.056	0.058
Lead	mg/L	0.004	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.030	0.065	0.03	0.057	0.058

Source: Coffey (1997a)

APPENDIX E

SURFACE WATER GROUND WATER METEOROLOGICAL AND BIOLOGICAL MONITORING PROGRAMME

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