

Cowal Gold Operations – Modification 16
Modification Report

Prepared for Evolution Mining (Cowal) Pty Limited
October 2020

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Cowal Gold Operations - Modification 16

Modification Report

Report Number

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Client

Evolution Mining (Cowal) Pty Limited

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14 October 2020

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Executive Summary

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the Cowal Gold Operations (CGO), an open-cut gold mine located approximately 38 kilometres (km) north-east of West Wyalong, in the central west region of New South Wales (NSW). The mine has been operating since 2005 under the authority of Ministerial Development Consent DA 14/98 and within mining leases (ML) ML 1535 and ML 1791.

Evolution is now seeking approval to construct and operate an underground mine at CGO, known as the CGO Underground Development Project that will allow production of a further 1.8 million ounces (Moz) of gold. In order to operate, the Underground Development Project requires two separate approvals:

- a State Significant Development (SSD) an application under Section 4.38 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and an environmental impact statement (EIS) must be prepared for the **underground** components; and

- a modification of DA 14/98, pursuant to Section 4.55(2) of the Act, for new or modified **surface** facilities ancillary to the Project.

The application to modify DA 14/98 (this document) is the sixteenth such application and is referred to hereafter as Mod 16. The proposal includes the following key components:

- transport of ore by truck from the underground mine to the run-of-mine (ROM) stockpile, a primary crusher and/or temporary ore stockpiles;

- an extension of the planned life of the currently approved operations from 2032 to 2040. Ore processing from the open-cut pit (E42 mineral deposit) will continue with the operational life extended by processing ore from the underground mine (GRE46 mineral deposit);

- modification of the existing ore processing facility to accommodate ore from the underground mine. This will include a tailings deslimer, tailings pipeline, ore receival hopper and conveyor and upgrades to the elution circuit;

- transport and emplacement of waste rock produced from the Underground Development Project within the existing waste rock emplacement areas;

- increasing the final rehabilitated height of the integrated waste landform (IWL) by one vertical metre; and

- minor upgrades to the existing mine infrastructure area, including a new control room, administrative buildings, bathhouse and cribroom.

All the new and modified facilities will be built within the existing approved disturbance footprint of the mine and no additional land will be affected by Mod 16.

While there were no formal assessment requirements issued for Mod 16, the Department of Planning, Industry and Environment (DPIE) consulted agencies for guidance on the level of assessment required. This has resulted in a range of technical studies being prepared to assess the potential impacts of the proposal as it relates to the SSD project. The main findings of those studies are summarised below.

- Mod 16 will not affect the established surface water management system at the CGO site and no new water storages or additional water supply sources are required. More water from existing sources will be consumed up until the year 2024 when ore from the open-cut and the underground are being processed concurrently however, this will be from existing, approved water licence allocations.

- Groundwater recharge from the additional tailings mass stored in the IWL is not expected to measurably change previously approved impacts to groundwater resources. This impact is expected to be temporary and to dissipate once mining ends. There will also be no impact to groundwater dependent ecosystems or the water in Lake Cowal from Mod 16.

- There will be no additional impacts to Aboriginal cultural heritage, historic heritage or biodiversity, as Mod 16 will not disturb any new land or require any vegetation to be cleared.

- Noise and air quality impacts will remain within existing limits for CGO, as the ore processing rate of 9.8 million tonnes per annum and the waste rock material handling processes are unchanged.

- Traffic to and from site will increase during the 18-month construction period. Continued higher traffic volumes will be likely during ongoing operation of the Underground Development Project (higher than current open pit operations but, less than during the construction period). These increases can be accommodated by the current local and State road network and no road upgrades are required. The use of worker shuttle buses to and from the CGO site to local towns will continue for the extended mine life to limit traffic impacts.

- The change in the height of the IWL will not be discernible from those residences that have visibility of the site. Further mitigations such as the use of vegetation screening and shielding of lights on the IWL will be discussed with affected landowners.

- The management of waste and public safety will continue to be effectively managed under existing systems and the existing rehabilitation strategy remains unchanged.

- CGO has broad acceptance in the community. The net impact to the local community from Mod 16 is positive overall. While some adverse impacts, such as increased traffic are anticipated, the beneficial impacts should the Underground Development Project proceed (jobs, wealth generation etc.) are believed to outweigh the adverse impacts.

- The investment in the Underground Development Project by Evolution will facilitate the extension of the life of the existing site operations and sustain existing economic benefits such as the purchase of goods and services and employment in the local community. This will have little or no economic opportunity cost due to other opportunities foregone.

Overall, the anticipated environmental impacts of Mod 16 are generally within the levels currently approved for the site. Any residual impacts, ie those that remain despite the application of new avoidance or mitigation measures, will be closely monitored and managed by Evolution under a suite of existing approved management plans and the provisions of Environmental Protection Licence (EPL) 11912.

The proposed modification will facilitate the access to new gold resources and extend the mine life by eight years and the associated economic benefits (investment, job creation and wealth generation) with only marginal changes to existing environmental or social impacts. Management of the expected impacts will be incorporated into the mine's existing environmental management systems.

In conclusion, Evolution considers that Mod 16 is in the public interest, as it will facilitate the continued production of gold at CGO and would result in a range of socio-economic benefits to the local area, the region and the State. Key operating functions at CGO will remain unchanged by Mod 16, which would remain substantially the same development for which consent was originally granted. It is therefore proposed that DA 14/98 Mod 16 should be approved, pursuant to Section 4.55 (2) of the EP&A Act.

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Chapter 1 Introduction

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1 Introduction

1.1 Background

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the Cowal Gold Operations (CGO), an open-cut gold mine located approximately 38 kilometres (km) north-east of West Wyalong, in the central west region of New South Wales (NSW). The location of CGO is shown at a regional scale in Figure 1.1 and at a local scale in Figure 1.2.

The mine has been operating since 2005 under Ministerial Development Consent (DA) 14/98 and within mining leases (ML) ML 1535 and ML 1791 (refer Appendix A). Under DA 14/98 Evolution is approved to:

- extract 167 million tonnes (Mt) of ore by open-cut methods until 2032;
- process this ore at on-site processing facility at a rate of 9.8 million tonnes per annum (Mtpa);
- produce up to 6.1 million ounces (Moz) of gold;
- emplace tailings and waste rock on site in an Integrated Waste Landform (IWL) – which includes the current Northern and Southern Tailings Storage Facilities, and in waste rock emplacement areas;
- operate a water supply pipeline to the Bland Creek Palaeochannel Borefield (BCPB); and
- progressively rehabilitate the site.

DA 2011/64, issued by Bland Shire Council (BSC), provides approval to develop and operate the Eastern Saline Borefield (ESB) that supplies process water to the mine.

The current open-cut mine and surface infrastructure is wholly contained within ML 1535. Part of the IWL and soil stockpiles are located in ML 1791.

The CGO site also hosts a range of ancillary infrastructure to support the open-cut mine. This includes an ore processing facility, the IWL, waste rock emplacements, ore stockpiles, water storages, workshops, offices, reagent storage and explosives magazine.

The site is directly adjacent to Lake Cowal in the Lachlan Catchment, which is an ephemeral inland wetland system. Lake Cowal is the largest natural inland lake in NSW, and when full is approximately 21 km long (north to south) and 9.5 km wide (east to west) covering an area of over 13,000 hectares (ha).

1.2 Modification 16

Evolution is seeking approval to construct and operate an underground mine at CGO, the CGO Underground Development Project (the Underground Development Project), to provide access to another 1.8 Moz of gold. Modified and new surface facilities are also required in support of the Underground Development Project. A summary of existing operations at CGO, proposed modified and new surface facility components and the approvals approach is provided in the following sub-sections.

1.2.1 Existing CGO overview

CGO is an existing open-cut gold mine that has been operating since 2005. It is located on the land listed in Appendix 1 of development consent DA14/98, which is attached in Appendix A. The site sits within ML 1535 and ML 1791. The current open-cut pit is located within ML 1535 and will progressively expand its disturbance area, within approved limits, as the pit deepens. When the current mine plan has been completed, the total pit area will be approximately 131 ha with a final depth of -331 metres Australian Height Datum (m AHD), or around 531 m below the ground surface.

As per current approvals, CGO will mine approximately 167 Mt of ore over the 28-year life span of the mine, processing at a rate of up to 9.8 Mtpa. Gold extraction is undertaken using a conventional carbon-in-leach (CIL) cyanide leaching circuit.

Waste rock disposal presently occurs in three rock emplacement sites within the mine site, the 'northern', 'southern' and 'perimeter' waste rock emplacements (refer Figure 1.3). The northern waste rock emplacement is licenced to be constructed to a maximum height of 308 m AHD, the southern to a maximum of 283 m AHD and perimeter 223 m AHD.

Approved heavy vehicle access to the site is via the designated route between the CGO site and West Wyalong (refer Figure 1.2) with light vehicle access also available via Condobolin and Forbes. Hazardous goods are transported to site by truck either from Port Botany or their point of production via the approved local road network.

Open-cut pit mining operations at the CGO are currently supported by the on-site facilities summarised in Table 1.1. Existing operations at CGO are described in more detail in Chapter 2.

Table 1.1 Summary of existing CGO site facilities

Facility	Description / components
Process plant	• primary crusher; • float tails leach circuit; and • carbon in-leach cyanide leaching circuit.
Stockpiles	• run-of-mine (ROM) pads; • low-grade and high-grade ore stockpiles; • mineralised material stockpiles; and • soil and clay stockpiles.
Tailings storage facilities (TSF)	• IWL (currently under construction); • Northern TSF; and • Southern TSF.
Waste rock emplacements surrounding the open-cut pit	• northern waste rock emplacement; • southern waste rock emplacement; and • perimeter waste rock emplacement.

Table 1.1 Summary of existing CGO site facilities

Facility	Description / components
Water management structures	• lake protection bund; • temporary isolation bund; • water supply pipeline; • saline groundwater supply bores within ML 1535; • eight water storages (and one (D10) yet to be constructed); and • water diversion systems (including Up-Catchment Diversion System (UCDS) and Internal Catchment Drainage System (ICDS)) and drainage. Evolution also operates the BCPB, which is approved under DA 14/98. The BCPB consists of four bores within the Bland Creek Palaeochannel (north-east of Lake Cowal), which are connected to the water supply pipeline. Part of the CGO water supply is sourced from the BCPB.
Ancillary facilities	• access roads, internal roads and haul roads; • electricity transmission lines; • waste storage and transfer facility; • workshop facilities; and • administration and bathhouse buildings.

Modification 14 to the CGO consent, approved by NSW Department of Planning and Environment (DPE[1]) in October 2018, included (among other aspects) the modification of the existing TSFs into one larger facility which will also accommodate mine waste rock, and be referred to as the IWL. The works associated with development of the IWL have commenced.

1.2.2 Modification overview

Evolution is now seeking approval for modified and new surface facilities under Modification 16 of DA 14/98 (referenced hereafter as 'Mod 16'). Mod 16 is the latest in a sequence of changes to the open-cut gold mining project first proposed in 1999 but is the first modification relating specifically to underground mining. The current open-cut operations will be unaffected by Mod 16, however the additional 1.8 Moz of gold produced over the estimated 17 year mine life of the underground mine will be treated in the same ore processing plant and will be reliant on the same infrastructure as the open-cut.

The key components of the proposal include:

- transport of ore by truck from the underground mine to the ROM stockpile and to the primary crusher or temporary ore stockpiles;
- continued processing of ore from the open-cut pit (E42 Mineral deposit) with the addition of processing ore from the underground mine (GRE46 Mineral Deposit), extending the expected life of the mine from 2032 to 2040;
- modifications to the existing processing facility allowing receipt and processing of ore from the underground mine, including addition of a tailings deslimer, tailings pipeline, ore receival hopper and conveyor;

[1] Now the Department of Planning, Infrastructure and Environment (DPIE)

- transport and emplacement of waste rock produced from the Underground Development Project within the existing waste rock emplacement areas; and

- increasing the final rehabilitated height of the IWL by one vertical metre.

Importantly, Mod 16 does not involve clearance of additional land, and will not increase the existing approved disturbance footprint.

Further detail of the proposed modification components is provided in Chapter 3.

1.2.3 Approvals approach

The Underground Development Project requires various changes to the current surface infrastructure at CGO. It also requires consequential developments off-site to facilitate development of the underground mine, for example, development of an accommodation village to house the construction and specialised underground operational workforce.

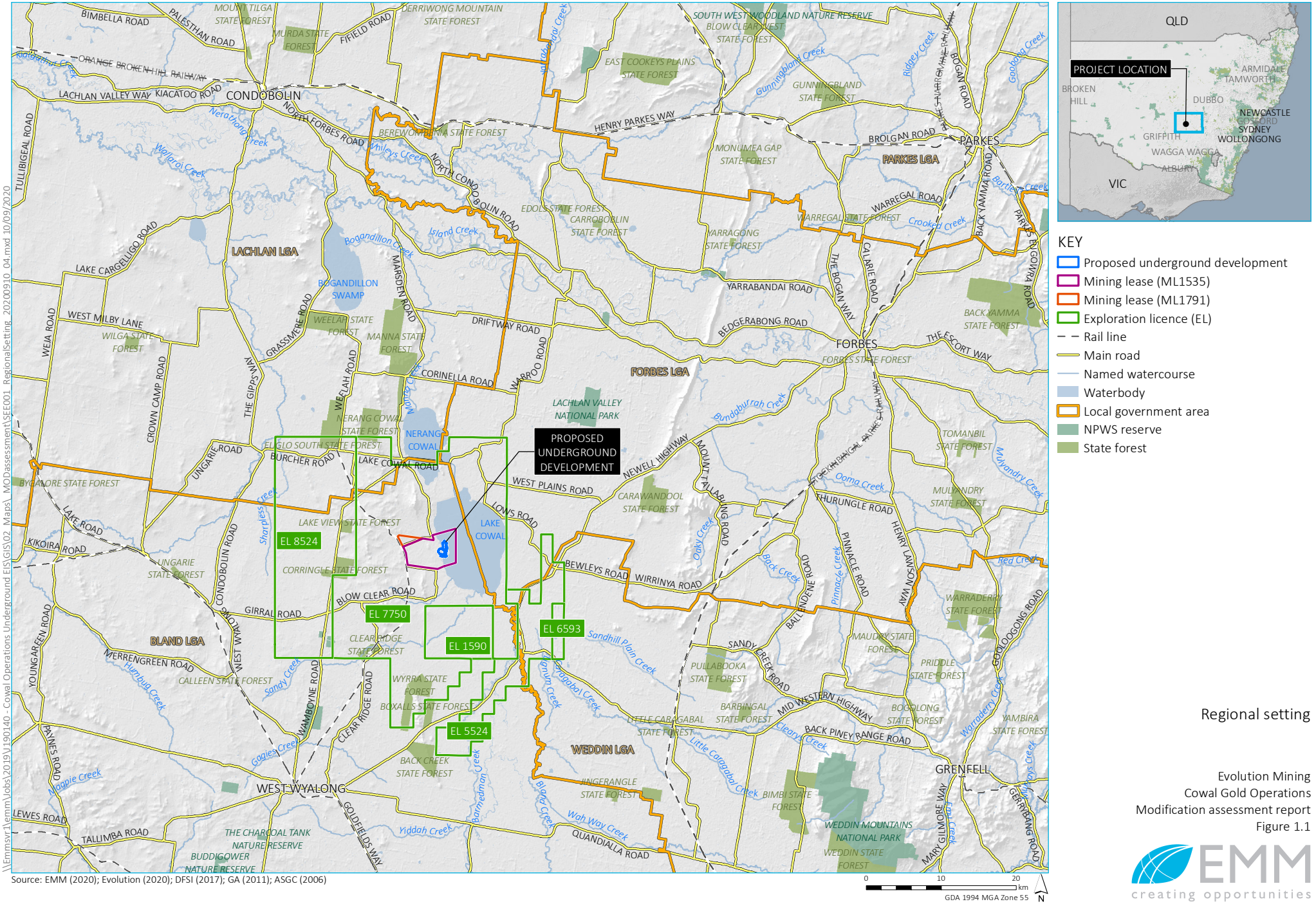
As a result of the anticipated Underground Development Project configuration and scheduling, , the full execution of the Underground Development Project will require a State significant development consent and a modification to the existing development consent at CGO. This document supports the modification application. The consents required to facilitate the Underground Development Project are outlined below and discussed in further detail in Chapter 4.

1. For underground mining and supporting activities, Evolution is seeking approval under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for two separate but inter-related applications:

    - **Underground development Environmental Impact Statement (EIS)** – a State significant development (SSD) application under section 4.38 of the EP&A Act for the new underground component of the Underground Development.

    - **Surface changes modification (this document)** – a request for modification (Mod 16) to the existing CGO development consent (DA 14/98) under section 4.55(2) of the EP&A Act for the ancillary surface changes associated with the Underground Development Project.

2. To house the construction workforce and specialised underground workforce in the early years of production, Evolution is considering options which include developing an accommodation village in West Wyalong. The accommodation village application will be the subject of a separate development application to BSC. This application will run in parallel with those for the underground development and surface changes modification approval processes.



Source: EMM (2020); Evolution (2020); DFSI (2017); GA (2011); ASGC (2006)

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Regional setting

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Figure 1.1

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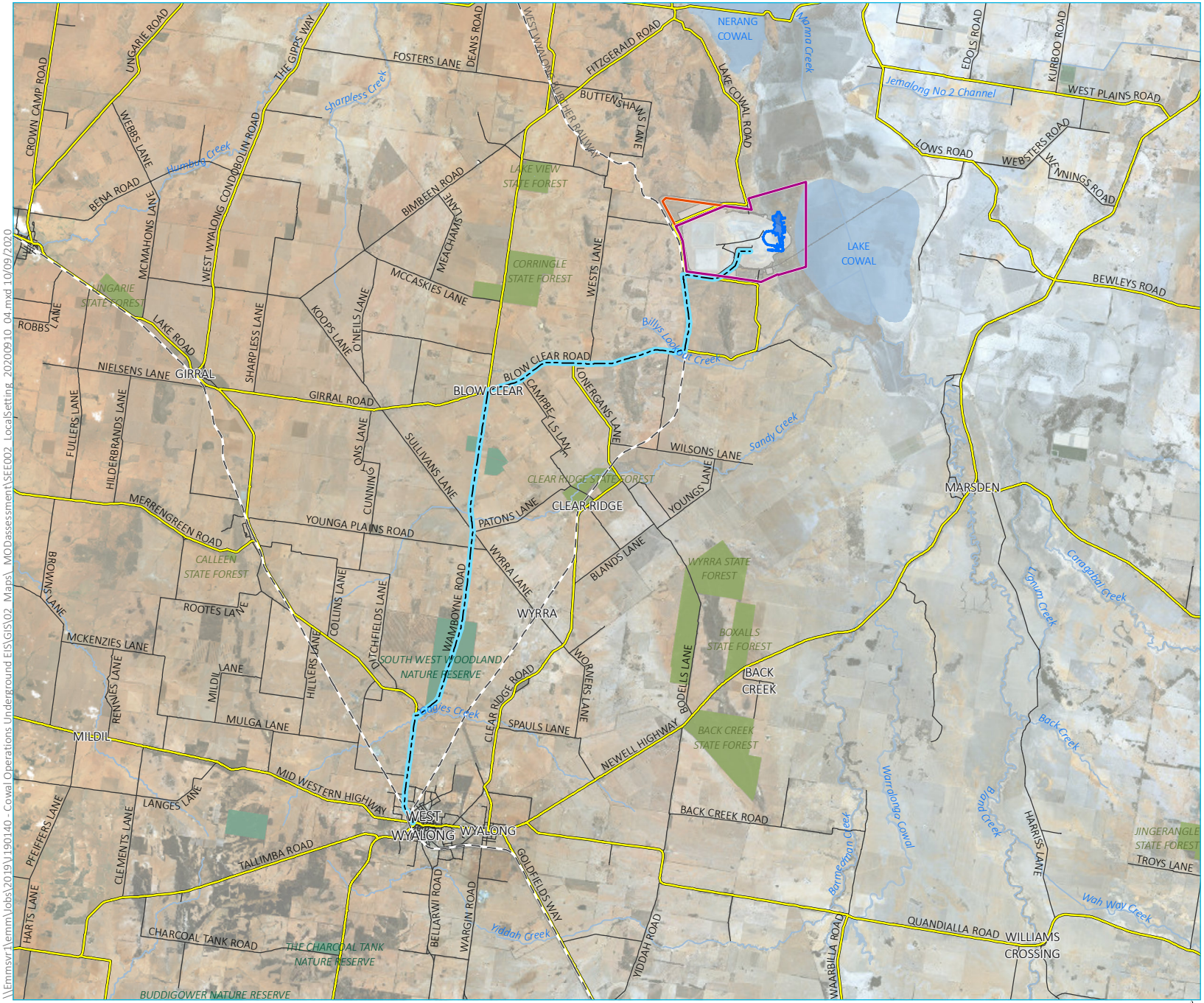

Source: EMM (2020); Evolution (2020); DFSI (2017)

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Local setting

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Figure 1.2

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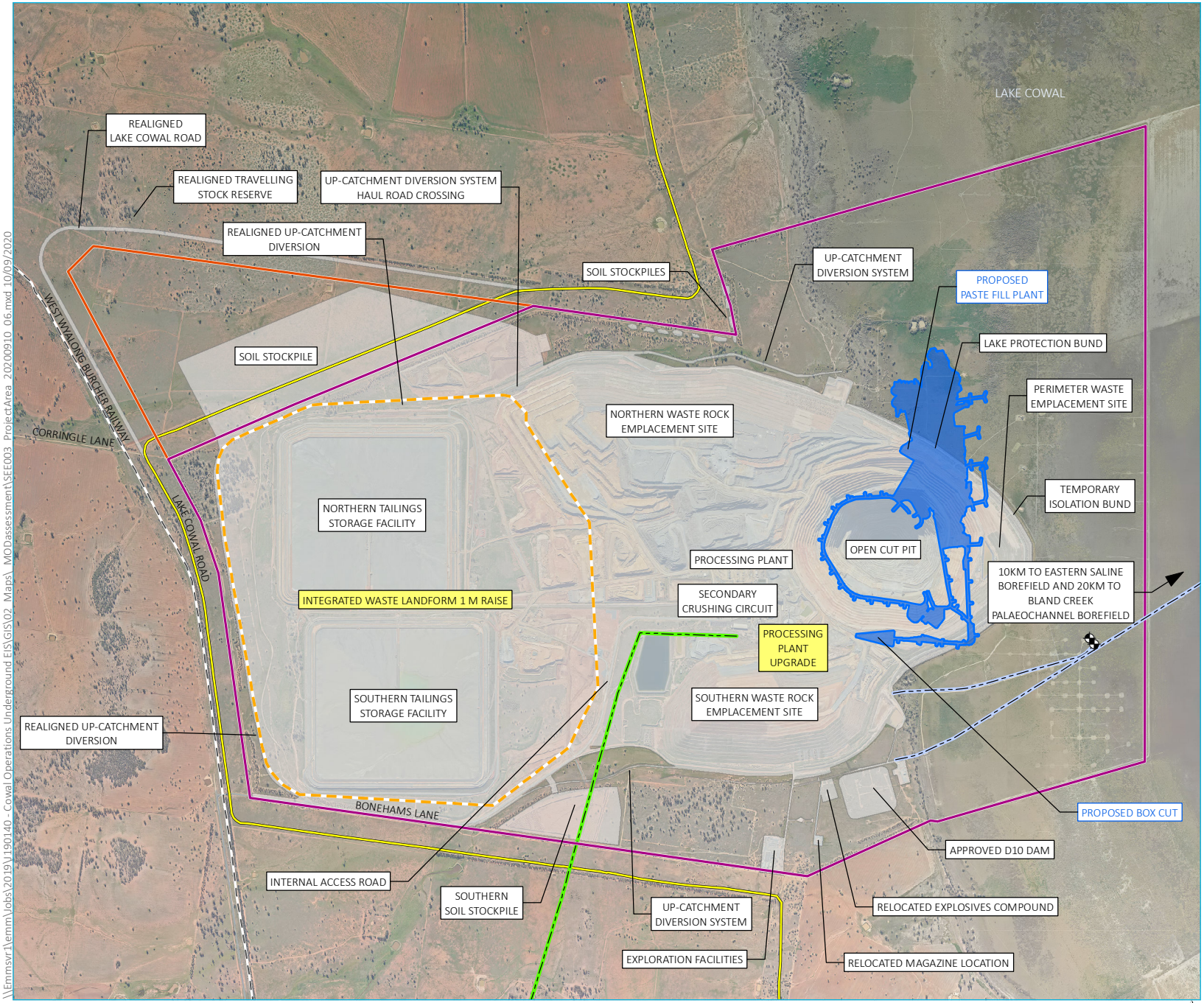

KEY

- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- DA14/98 approved surface disturbance
- Indicative integrated waste landform perimeter
- Electricity transmission line
- Water supply pipeline
- Saline groundwater supply bore
- Rail line
- Main road
- xxx Underground development elements
- xxx Mod 16 surface elements
- xxx Approved surface elements

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Source: EMM (2020); Evolution (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 55

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Project area

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Figure 1.3

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1.3 Purpose of this document

Modified and new surface facilities are required in support of the Underground Development Project. Accordingly, approval is required to modify DA 14/98 pursuant to Section 4.55(2) of the EP&A Act. This modification assessment report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Evolution.

The primary objective of this Modification Report is to inform government authorities and other stakeholders about the proposed surface facility changes and the measures that will be implemented to minimise, mitigate, manage and monitor potential impacts, together with a description of the remaining social, economic and environmental impacts.

1.4 Modification objectives

In general, the objectives of Mod 16 are to:

- ensure the Underground Development Project is fully supported;
- allow additional ore to be processed to produce a further 1.8 Moz of gold;
- ensure the continued efficient transportation of ore to the processing facility;
- continue the safe emplacement of tailings and waste rock produced at the site; and
- secure the continued operations of the mine beyond 2032.

1.5 Need for the modification

The modification serves two key purposes. Firstly, it ensures that the Underground Development Project is appropriately supported so it can operate safely and efficiently. Secondly, it allows the CGO to maintain continuity of ore and gold production at the site beyond 2032.

The proposed modification realises a range of socio-economic benefits for the region and the State of NSW. The modification facilitates the continuity of long-term employment for the existing workforce and provides job security for local mine employees and contractors.

The modification will assist the Underground Development Project to achieve net production benefits to Australia and NSW (over and above the economic benefits of the approved CGO). The Underground Development Project will result in additional contributions to regional and State (NSW) output and business turnover and household incomes.

The modification will continue the employment of the existing workforce at the mine for a further eight years. Continued contributions to the regional economy will include direct employment and wages, expenditure by the CGO on inputs to production that can be sourced from the region such as repairs and maintenance and flow-on expenditure of employee wages in the regional economy.

1.6 Report structure

This document has been prepared in consideration of Section 4.15(1) of the EP&A Act and Clause 115 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation). The chapters are summarised in Table 1.2.

Table 1.2 Report structure

Chapter	Description
Chapter 1 Introduction	This chapter provides an introduction of the proposed modification, including an overview of the approvals approach, existing operations and need for the proposed modification. The objectives and applicant of the proposed modification are also noted in this chapter.
Chapter 2 Existing operations	This chapter provides a description of existing operations as part of CGO, including the workforce, mine design, waste rock and ore management and processing, water supply and sources, electricity usage, access and waste management.
Chapter 3 Proposed modification	This chapter provides a description of the proposed modification.
Chapter 4 Legislation and policy	This chapter provides a description of the State and Commonwealth legislation relevant to the proposed modification.
Chapter 5 Stakeholder engagement	This chapter provides a description of the stakeholder and community engagement completed as part of the proposed modification.
Chapter 6 Assessment of impacts	This chapter provides a description of the environmental assessment of the potential impacts associated with the proposed modification and outlines associated mitigation measures (where required).
Chapter 7 Conclusion	This chapter provides a summary of the modification report and concluding statements.

1.7 Terminology

A summary of the key terminology used throughout this modification assessment report is provided in Table 1.3. A list of abbreviated terms are provided at the end of this document.

Table 1.3 Key terminology

Full component name	Abbreviated name	Brief component description
Cowal Gold Operations	CGO or 'the site'	Existing **open-cut mine** and associated processing plant, IWL, TSFs, waste rock emplacement areas, ore stockpiles and ancillary facilities (refer Figure 1.3).
Underground Development Project	The Underground Development Project	The proposed **underground** development at CGO.

Table 1.3 Key terminology

Full component name	Abbreviated name	Brief component description
Environmental Impact Statement	EIS	The documentation supporting the **SSD application** for the Underground Development Project under section 4.38 of the EP&A Act.
Modification 16 to DA 14/98	Mod 16	The proposed **surface** changes to the existing CGO development consent (DA14/98) supporting the Underground Development Project, as shown in Figure 1.3 and as described in Chapter 3.

1.8 The applicant

Evolution is the owner and operator of CGO and the applicant for Mod 16. Evolution is a publicly-listed gold, silver and copper mining company trading on the Australian Stock Exchange (ASX:EVN). Evolution's head office is located at Level 24, 175 Liverpool Street, Sydney, NSW 2000. Evolution's company details, including Australian Company Number (ACN) and Australian Business Number (ABN) are detailed below:

- ACN: 084 669 036; and
- ABN: 74 084 669 036.

Evolution wholly owns the following assets across Australia and Canada:

- CGO in NSW;
- Mount Carlton Open Pit and Underground Gold Operation in Queensland (QLD);
- Mount Rawdon Open Pit Gold Operation in QLD;
- Mungari Open Pit and Underground Gold Operation in Western Australia (WA); and
- Red Lake Underground Gold Operation in Western Ontario, Canada.

Evolution also partly owns the Ernest Henry Copper-Gold Operation in QLD, Australia, operated by Glencore.

Further details about Evolution's assets, leadership team, corporate governance, sustainability and investor information is available from the company's website: https://evolutionmining.com.au/.

1.9 Study team

This modification assessment report has been prepared by EMM on behalf of Evolution. Technical environmental assessments to inform this report have been completed by EMM and other external sub-consultants, including:

- Elton Consulting (Elton) – social impact assessment;
- AEC Group Pty Ltd (AEC) – economic impact assessment;
- Geo-Environmental Management Pty Ltd (GEM) – geochemistry impact assessment;
- Hydro Engineering & Consulting Pty Ltd (HEC) – surface water impact assessment; and
- Coffey Services Australia Pty Ltd (Coffey) – groundwater impact assessment.



Chapter 2 Existing operations

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2 Existing operations

2.1 Approvals and development history

The original development application and EIS for open-cut mining at CGO was submitted for approval in 1998. A Commission of Inquiry was held in November 1998 into the environmental aspects of the CGO and its related infrastructure, which recommended the approval of the project.

On 26 February 1999, the then NSW Minister for Urban Affairs and Planning granted Development Consent (DA 14/98) for the CGO and the BCPB water supply pipeline, under Part 4 of the EP&A Act.

A subsequent modification for expansion of CGO was subject to proceedings in the Land and Environment Court. This modification was ultimately approved subject to court-imposed conditions of consent.

Development Consent DA 14/98 has been modified on 15 occasions since it was granted (refer Table 2.1) to facilitate continued development at CGO.

Table 2.1 Summary of approvals history for DA 14/98

Modification number	Approval date	Description
1	11 August 2003	Amendment to Condition 3.3(b) to remove unexpected finds requirements if previously unidentified artefacts are discovered within the project area.
2	22 December 2003	Amendment to the alignment of the transmission line.
3	4 August 2004	Minor amendments to the CGO.
4	23 August 2006	Amendments to water sources for use at CGO.
5	12 March 2008	Amendment to Condition 4.1, 4.2 and 8.2 to remove requirements for ongoing baseline biological monitoring in Lake Cowal and reporting of all fauna deaths at CGO within 24 hours.
6	10 March 2010	Increase of the production rate from 6.9 to 7.5 Mtpa, expansion of the open-cut pit to extract an additional 23 Mt of ore and extension of the life of mine by two years.
7	11 February 2009	Amendment to Condition 1.1 and 6.4 to amend the allowed noise exceedances during operation of CGO.
8	28 August 2009	Amendment to Condition 1.1 to allow for modification to the waste emplacement areas, ore processing and external water supply sources.
9	17 January 2011	Update to reflect an increase of the life of mine, as approved under Mod 6.
10	6 July 2011	Introduction of saline groundwater from the ESB to the existing water supply of CGO.
11	22 July 2014	Extension of life of mine for five years to allow an additional production of 0.7 Moz of gold.
12	13 May 2016	Amendment of various conditions and the biodiversity offset strategy.
13	7 February 2017	Extension of life of mine for eight years to allow an additional production of 1.7 Moz of gold.
14	4 October 2018	Increase of the ore processing rate from 7.5 Mtpa to 9.8 Mtpa and develop the IWL.
15	23 August 2019	Removal of Condition 9.2(b) relating to the independent monitoring panel.

Most of the approved modifications related to minor site infrastructure upgrades and all were considered either under the former Section 75W (now repealed) or Section 96 (now Section 4.55) of the EP&A Act.

More substantial optimisation of operations was approved under Mod 11, Mod 13 and Mod 14. Mod 11 increased pit depth and area, waste rock emplacements, soil stockpiles, TSFs and water storage. Mod 13 extended the life of the project and Mod 14 increased the ore processing rate and included a life of mine tailings strategy which included the formation of the IWL.

Other planning approvals related to the site include:

- an approval to upgrade the mine access road from West Wyalong to the CGO which was granted by BSC on 21 April 1999 under Part 5 of the EP&A Act;
- an approval for the Temora to Cowal 132 kV electricity transmission line which was granted by the then NSW Minister for Urban Affairs and Planning on 3 August 1999, also under Part 5 of the EP&A Act; and
- a development consent (DA 2011/64) for the operation of the ESB, which was granted by Forbes Shire Council on 20 December 2010.

The mining activities at CGO are authorised under two mining leases, ML 1535 and ML 1791.

2.2 Ore deposit and reserves

On 23 July 2020, Evolution released an ASX announcement detailing the Maiden Underground Ore Reserve for the Underground Development Project, inclusive of an updated Mineral Resource for CGO, prepared in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, (Joint Ore Reserves Committee (JORC), 2012). A Maiden Underground Ore Reserve has been estimated at 804,000 ounces (oz), supporting the development of the Underground Development Project. The total Underground Mineral Resource is estimated at 2.9 Moz, with mineralisation remaining open at depth and along strike with ongoing drilling expected to result in significant additional growth to both Mineral Resources and Ore Reserves.

As at 30 April 2020, the Cowal Underground Mineral Resources and Ore Reserves were estimated as follows:

- Underground Mineral Resources of 36.5 Mt grading 2.48 grams per tonne (g/t) for 2.912 Moz gold; and
- Underground Ore Reserve of 10.0 Mt grading 2.51 g/t for 804,000 oz gold.

Total Cowal Mineral Resources and Ore Reserves at 30 April 2020 (inclusive of open-cut and underground) were estimated at:

- Mineral Resources of 264.6 Mt grading 1.06 g/t for 9.0 Moz gold; and
- Ore Reserves of 142.2 Mt grading 0.97 g/t for 4.4 Moz gold.

In the April 2020 geological model update, 1.5 Moz of the total 2.9 Moz Underground Mineral Resource has been classified as Indicated under the JORC (2012) code. Surface drilling is planned through the September 2020 quarter, which is designed to further define the Mineral Resource, particularly the Dalwhinnie area which remains open along strike and at depth. Additional reserve growth is expected from ongoing underground drilling which is designed to upgrade resources within and adjacent to the footprint of the underground design. The results of ongoing drilling will be reflected in the next model update as part of Evolution's Annual Mineral Resources and Ore Reserves Statement for the period ending 31 December 2020.

Evolution currently mines the 'E42' deposit at CGO and has approval to produce 167 Mt of ore over the life of the open-cut mine. The targeted ore deposit at CGO lies within the Lake Cowal Volcanics, which comprise massive and stratified non-welded pyroclastic debris, overlying a partly brecciated lava sequence, overlying volcanic conglomerate interbedded with siltstone and mudstone (Coffey 2020a). The stratigraphic units at the site consistently strike at 215° and dip 50° to the north-west (Miles and Brooker 1998).

Within the Lake Cowal Volcanic Complex are diorite and gabbro intrusions, one of which is intersected by the CGO open-cut pit. Within the ore body there are several north-south oriented, near vertically dipping faults and fractured dykes.

Overlying the Ordovician host rock is a Tertiary age laterite, which averages approximately 20 m and varies in thickness across the CGO site, from approximately 15 m to 55 m. Quaternary age sediments of predominantly lacustrine clay characteristically cover the Tertiary laterite. The depth of sediments across the CGO site and surrounds ranges from approximately 14 m to 55 m.

Primary ore and oxide (or weathered) ore is mined at CGO. Primary ore makes up approximately 80 per cent of the targeted ore deposit and the oxide ore constitutes the remaining 20%. Both ore types are handled and processed separately on site, due to the different mineral processing requirements for gold extraction.

2.3 Open-cut pit design

The design of the existing E42 open pit at CGO (refer Figure 1.3) has been optimised to allow the most economic extraction of the gold ore. The pit will, when extraction is complete, have a total area of approximately 131 ha and a final depth of -331 m AHD (678 RL[2]), or around 531 m below the ground surface. Currently, the pit floor level is at approximately -252 m AHD (757 RL), or around 452 m below the ground surface.

The pit has also been designed to isolate it from Lake Cowal and provide protection to mine personnel, mine assets in the event of infiltration through the pit wall or overtopping by floodwaters. A lake protection bund (LPB) has been constructed around the eastern perimeter of the pit, which provides a separation area between the pit and the lake (refer Figure 1.3). The pit has been designed to ensure long-term stability of the LPB. Stability is regularly monitored in accordance with the strict management procedures contained within the approved Lake Protection Bund, Water Storage and Tailings Structures and Pit Void Walls Monitoring Program.

An exploration decline was developed by Evolution from the E42 open pit to explore conditions adjacent to the GRE46 Mineral Deposit. This exploration decline was used to inform the design of underground mining operations and various technical and environmental assessments supporting the Underground Development Project. The exploration decline is not connected to the underground mining operations.

Current open-cut pit design parameters are as follows:

- Batter angles:
  - Oxide – 45°.
  - Primary – 90°.

- Batter heights:
  - Oxide – 9 m.
  - Primary – 18 m.

[2] CGO has established a local datum (CGM) for the purposes of establishing survey levels across the site, with this measurement referred to as reduced level (RL) in metres. 1009 RL = 0 m AHD.

- Pit wall angles (Inter-Ramp Angles):
  - Oxide – 25°.
  - Primary – 61°.

- Berm widths:
  - Oxide – 10.3 m.
  - Primary – 10 m.

- Road widths:
  - Dual lane – 35 m.
  - Single lane – 21 m.

2.4 Ore extraction and transport

Ore is mined using conventional drill and blast mining methods. Following blasthole drilling and assay of the drill cuttings, a pattern of holes is set out in the pit floor and holes are filled with explosives and fired, usually once a day. The blast sizes are approximately 172 kilograms (kg) maximum instantaneous charge (MIC).

Once the ore (or waste) has been blasted, it is loaded on to trucks. Ore is transported directly from the pit to either the primary crusher, ROM pads or low-grade ore (primarily the oxide or weathered ore) stockpile before it is processed at the processing facility (refer Figure 1.3). Waste rock is transported by truck directly to the waste rock emplacements.

2.5 Ore processing

Gold extraction is undertaken using a conventional CIL cyanide leaching circuit in the ore processing facility. The facility has an operating capacity of approximately 890 tonnes per hour (tph) of oxide ore and 950 tph of primary ore. The process flowsheet is as follows:

- crushing and grinding;
- cyanidation; and
- gold recovery.

Importantly, water is used as the transport media for the ore during the gold treatment process, including in the delivery of the barren tailings to the TSF and IWL. The CGO uses saline bore water for its process water.

Sodium cyanide and other reagents used during the gold recovery process and are stored and mixed in a dedicated storage facility and mixing tank. Other reagents include hydrated lime for pH control and activated carbon for gold capture.

Evolution has approval under DA 14/98 to introduce a secondary ore-crushing circuit within the existing processing facility, which would allow its throughput to increase.

Use of the cyanide leaching circuit is carried out in accordance with the approved CGO Cyanide Management Plan. Concentrations of cyanide in the tailings slurry stream at the process facility must not exceed the following parameters:

- 20 milligrams per litre (mg/L) weak acid dissociable cyanide (CN_{WAD}) (90^{th} percentile over 6 months); and
- 30 mg/L CN_{WAD} (maximum permissible limit at any time).

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

Cyanide destruction at the CGO is achieved via the use of either Caro's Acid or the INCO (sulfur dioxide) process.

Caro's Acid is a mixture of sulphuric acid and hydrogen peroxide. The INCO process involves the introduction of sulfur dioxide as sodium metabisulfite. Similar to Caro's Acid, the main by-product from the INCO destruction process is cyanate which decays through natural processes. The quantity of reagents added to the tailings (for either the Caro's Acid or the INCO process) is regulated by an online free cyanide measurement to monitor the effectiveness of cyanide destruction in the tailings.

The gold product is recovered and poured as gold bars or doré (semi-pure alloy of gold and silver) and transported from the site to a refinery for further purification before being sold on the open market as gold bullion.

Approximately 39.3 Mt of mineralised material is approved for processing on site over the life of the mine. This material is stockpiled separately in a temporary stockpile on the northern waste rock emplacement. This material is processed if appropriate market conditions allow. If market conditions are not appropriate, the mineralised material is approved to remain as part of the waste rock emplacement.

2.6 Tailings management

Following the extraction of gold through the CIL process, the barren ore slurry (known as tailings) is pumped to a cyanide destruction circuit before being emplaced via a pipeline in either the Northern or Southern TSF, within the IWL (refer Figure 1.3).

Tailings are discharged from a series of spigots around the perimeter of the TSF and the solids left to settle. Supernatant water is drained from the TSF to a central pond and decant tower, leaving behind the tailings solids which progressively dewater and consolidate. The supernatant water is recycled for re-use in the processing facility.

The TSF and IWL are the permanent repositories for all tailings produced at the mine and have been designed to ensure their stability and to minimise the risk of seepage. The embankments of the TSFs are constructed using a mix of clay-rich oxidised rock to seal the impoundment and primary waste rock to provide strength. As needed, each embankment can be progressively raised to provide additional tailings storage capacity up to the maximum approved height of 248.4 m AHD (Southern TSF). Each new level added is known as a lift. Six lifts have been approved for the IWL.

To ensure the risk of tailings seepage is minimised, the following design and management measures are implemented:

- pre-stripping of soil and use of a low-permeability compacted clay basement layer;
- use of a cut-off trench constructed of compacted, moisture conditioned and compacted clay;
- use of an underdrainage and decant network; and
- use of a seepage drainage system consisting of perimeter collector pipes and sumps.

2.7 Integrated Waste Landform

The IWL is approved to be constructed to facilitate life-of-mine tailings storage. The IWL will combine the current Northern TSF, the Southern TSF and the northern waste rock emplacement. A key design objective of the IWL is to provide optimum return of water from the facility for re-use in ore processing.

Construction has commenced on the embankments of the IWL, and involves a starter embankment incorporating an upstream zone of low permeability roller-compacted oxide (clayey) mine waste and a downstream waste zone, which are progressively developed as waste rock and tailings are produced. The waste materials will be sourced from the open-cut pit area.

The starter embankment is approved to approximately 8 m high and incorporates a cut-off trench excavated into medium plasticity clay which reduces seepage losses.

The IWL starter embankments will be raised in a minimum of four stages and the staged embankment raises will vary in height depending on waste production scheduled from the open-cut pit. Currently, the Stage 1 embankment raise is complete in the south-eastern portion of the IWL.

Tailings material will continue to be deposited into the IWL as a slurry. Water decanted from the tailings and incident rainfall are currently recovered via a temporary pump system. In the near future, a permanent central internal decant pond will be commissioned which will allow decant water to be pumped to the processing plant for reuse.

Tailings deposition is controlled to promote the deposition of solids on the perimeter and the flow of the carrier water towards the centre of the IWL where it is collected for recycling. The resultant beaches of deposited solids require regular rotation of the on-duty tailings discharge spigot to ensure even distribution of tailings around the TSF circumference and continued decant of water towards the central decant pond.

2.8 Other site infrastructure

There is a range of supporting infrastructure on-site which is ancillary to the pit and processing facility, including:

- ROM and soil stockpiles;
- mine access road, minor internal roads and haul roads;
- mineral exploration infrastructure;
- open-cut pit dewatering bores (when required);
- waste storage and transfer facility;
- reagents storage;
- explosive magazine;
- administration buildings, workshop facilities and laydown areas; and
- TSF fence and ML 1535 perimeter fence.

2.9 Waste rock management

Waste rock is transported from the open-cut pit to the emplacement sites using dump trucks. Approximately 299 Mt of waste rock is expected to be emplaced over the life of the open-cut mine and distributed across three waste rock emplacement sites: the northern waste rock emplacement, the southern waste rock emplacement and the perimeter waste rock emplacement (refer Figure 1.3).

The northern waste rock emplacement will be constructed to a maximum height of 308 m AHD, the southern waste rock emplacement to a maximum of 283 m AHD and the perimeter waste rock emplacement to 223 m AHD. Prior to processing, mineralised material is temporarily stockpiled on the northern waste rock emplacement site to a maximum height of 320 m AHD.

Incident water permeating from the waste rock emplacement sites is captured in low bunds surrounding the perimeter of the waste rock emplacement site as part of the ICDS. This water is then directed to a series of water storages for use during ore processing.

The waste rock has been classified as either oxide waste rock which is non-acid forming (NAF) and saline or primary waste rock which is also NAF and non-saline. Therefore, no management measures for acid mine drainage are required at the waste rock emplacement sites.

2.10 Water and the CGO

Water is used at the CGO for a variety of reasons, from a variety of internal and external sources, primarily as a transport media during ore processing with lesser amounts used in reagent preparation, dust control and potable water supply. While the volume of water consumed is high, the water consumed is largely very low quality (highly saline bore water). Bore water used at CGO typically has an electrical conductivity (EC) of around 19,000 to 72,000 microsiemens per centimetre (µS/cm). This EC converts to total dissolved solids (TDS) of approximately 12,750 to 48,250 mg/L[3], typically only suitable for industrial and some stock watering use. The proportion of water recycled on-site is also very high at around 50 per cent.

The ore processing facility uses approximately 0.9 kilolitres (kL) of water per tonne of primary ore and approximately 1.7 kL of water per tonne of oxide or weathered ore.

Most water used in processing operations is recycled within the process plant. Water losses from the system include tailings pore water and evaporative loss principally from the TSFs.

The various CGO water management system components and their linkages (via system transfers) are shown in schematic form in Figure 2.1.

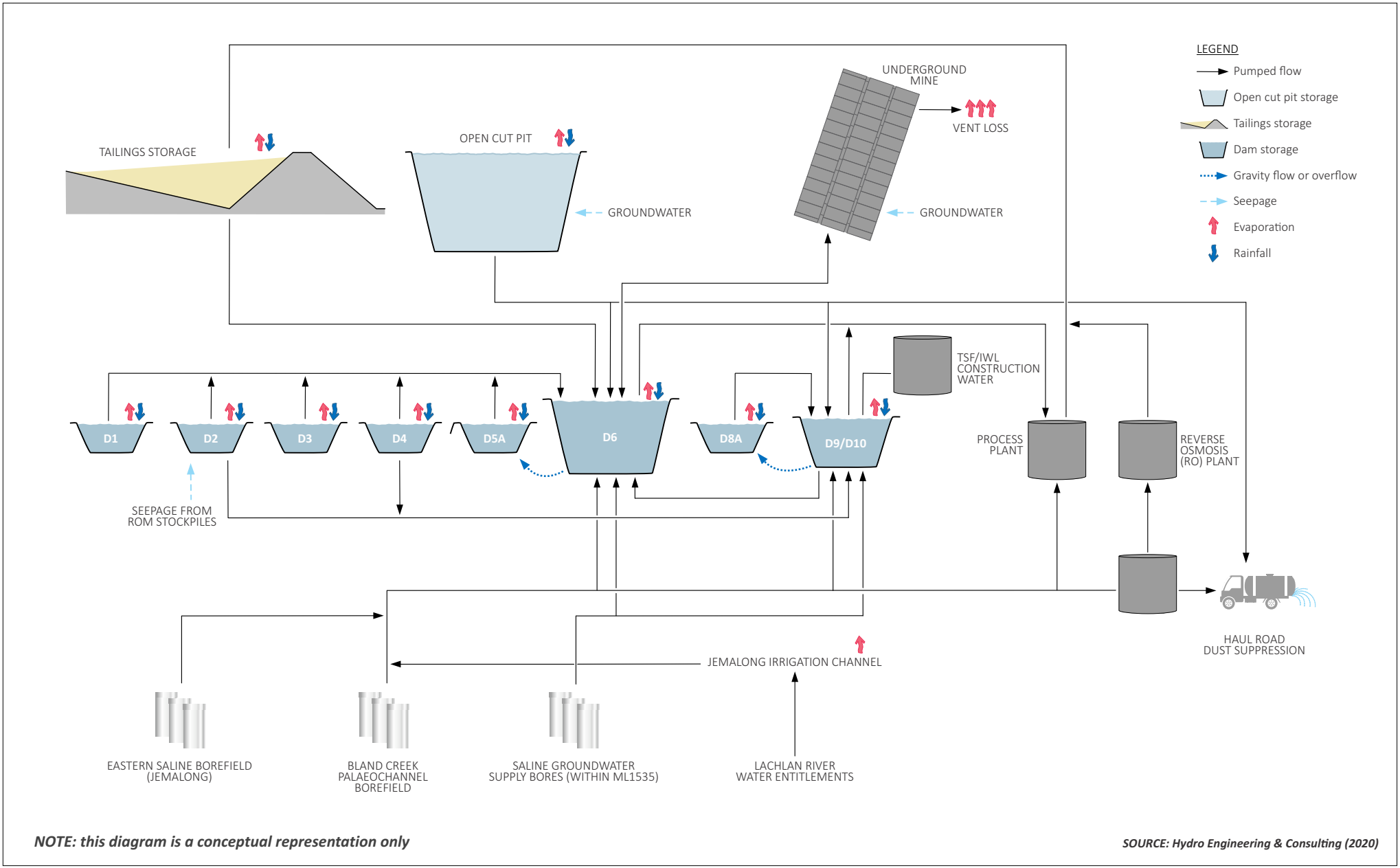
Water used for ore processing is sourced from the following internal and external sources:

- Internal water sources (within the ICDS):
  - water returned from the TSFs, which is stored in contained water storage D6 (process water supply storage);
  - water from the open pit sump which is stored in contained water storages D2, D6 and D9 (process water supply storages); and
  - runoff water from the waste rock emplacements, open pit area and other areas within the ICDS which is collected in contained water storages and transferred to the process water supply storages for re-use in the process plant.

[3] EC (mS/cm) converted to TDS (mg/L) by multiplying by conversion factor of 0.67.

- External water sources (ie outside the ICDS):
    - water from the saline groundwater supply bores within ML 1535;
    - water from the ESB, located approximately 10 km east of Lake Cowal's eastern shoreline;
    - water from the BCPB, which is pumped from four production bores located approximately 20 km to the east-northeast of the CGO in accordance with approved extraction limits; and
    - licensed water accessed from the Lachlan River, which is supplied via a pipeline from the Jemalong Irrigation Channel.

Some water from the external water supply sources is treated by a reverse osmosis (RO) plant prior to use in the process plant or to satisfy other operational requirements. Brine from the RO plant is disposed of in the TSFs.



NOTE: this diagram is a conceptual representation only

SOURCE: Hydro Engineering & Consulting (2020)

Schematic of CGO water management system

Evolution Mining

Mod 16 Modification Assessment Report

Figure 2.1

EMM creating opportunities

2.11 Groundwater supply

Regionally, groundwater resources are present in the Bland Creek Palaeochannel, and include the following two geological formations:

- Cowra Formation: comprising isolated sand and gravel lenses in predominantly silt and clay alluvial deposits, with groundwater of generally higher salinity; and
- Lachlan Formation: comprising quartz gravel with groundwater of generally low salinity.

The CGO open-cut pit intersects the Cowra Formation, but does not intersect the Lachlan Formation.

For the CGO, Evolution sources groundwater from local saline groundwater supply bores on ML 1535, the ESB and the BCPB. Further detail of each groundwater supply, including licensing, is provided in the following sub-sections.

2.11.1 Local supply bores

There are two saline groundwater supply bores extracting water from the Cowra Formation, which are located 1 km south-east of the open-cut pit within Lake Cowal and are within ML 1535. When Lake Cowal is inundated, the saline groundwater supply bores are decommissioned and capped. These bores are licensed by water access licence (WAL) 36615 under the Water Sharing Plan for the *Lachlan Unregulated and Alluvial Water Sources 2012* and have an extraction limit of 0.7 mega litres (ML) per day, or 366 ML per annum.

2.11.2 Eastern Saline Borefield

The ESB consists of two bores extracting water from the Cowra Formation. The ESB is approved under DA 2011/64 and licensed under WAL 36569 under the *Lachlan Unregulated and Alluvial Water Sources 2012* and has a transfer rate of up to 750 ML per annum per bore.

The bores are located north-east of Lake Cowal, near Kurboo Road and adjacent to the Newell Highway. It is connected to the water supply pipeline, which extends across Lake Cowal to the CGO.

2.11.3 Bland Creek Palaeochannel Borefield

Evolution operates four bores within the Bland Creek Palaeochannel extracting water from the Lachlan Formation, with an approved extraction limit of 15 ML per day (3,650 ML per annum). The bores are located 20 km north-east of Lake Cowal, along Kurboo Road, Websters Road and Cadalgulee Lane and adjacent to the Newell Highway. The bores are connected to the water supply pipeline, which extends across Lake Cowal to the CGO.

Extraction from the Bland Creek Palaeochannel is managed under strict trigger levels associated with lake water level which were developed in consultation with Department of Planning, Industry and Environment – Water Group and users of the Blank Creek Palaeochannel. Extraction is licensed under WAL 31864 under the *Lachlan Unregulated and Alluvial Water Sources 2012.*

The trigger levels are as follows:

- BCPB area: Bore GW036553 - trigger levels of 137.5 m AHD and 134 m AHD;
- Billabong area: Bore GW036597 - trigger level 145.8 m AHD; and
- Maslin area: Bore GW036611 - trigger level 143.7 m AHD.

The trigger levels are detailed in a Groundwater Contingency Strategy which forms part of the approved Water Management Plan for the CGO site. Under the Groundwater Contingency Strategy, pumping from the Bland Creek Palaeochannel ceases if the Bore GW036553 trigger levels are reached.

2.12 Lachlan River

Evolution can also draw water from the Lachlan River if other sources are not available or to supplement water use on site if necessary. This take is licensed under High Security WAL 14981 (80 Units) High Security WALs 14981 and 13749 (zero allocation) and general security WAL 13748 (zero allocation). Access to this water is controlled through purchasing temporary water allocation from the Lachlan River trading market. Water from the Lachlan River is delivered via a pipeline which connects to the Jemalong Irrigation Channel.

2.13 Water management system

There is a well-established and sophisticated surface water management system at CGO, which generally operates to:

- prevent inflows from Lake Cowal to the open-cut pit;
- contain potentially polluted water within the site;
- divert clean surface run-off around the site using the UCDS; and
- capture water for re-use during on site for dust suppression and ore processing using the ICDS.

CGO also operates an integrated erosion, sediment and salinity control system, in accordance with the approved Erosion and Sediment Control Management Plan (ESCMP), and an open pit sump and dewatering borefield to manage surface water run-off.

2.13.1 Lake isolation system

As noted in Section 2.3, a lake isolation system separates Lake Cowal from the open-cut pit. The lake isolation system is comprised of a series of isolation embankments designed to prevent the inflow of water from Lake Cowal into the open-cut pit.

The lake isolation system consists of the LPB, the temporary isolation bund and the perimeter waste rock emplacement. These structures were established early in the development of the CGO site and have been successful in preventing inundation of the open-cut pit by lake waters.

The open-cut pit is designed to ensure the long-term stability of the lake isolation system. Stability of the LPB is monitored through the Monitoring Programme for Detection of any Movement of LPB, Water Storage and Tailings Structure and Pit-Void Walls, which details the applicable monitoring program and management measures which are implemented if any of the structures are compromised. The stability of the lake isolation is also regularly monitored through ongoing geotechnical studies of the open-cut pit.

2.13.2 Diversion systems

There are two catchment diversion systems operating at the site.

The UCDS is a low bund which directs external clean surface water run-off which flows towards the western perimeter of the site and into drainage lines located along the northern and southern perimeters of the site.

The ICDS comprises a series of low bunds which collect internal surface water run-off. It is located along the western perimeter of the of the site and also extends along the northern and southern perimeters of both the northern and southern waste rock emplacement sites. These low bunds direct water to a series of water storages, which are shown in Table 2.2.

Water sources within the ICDS include water returned from the TSFs, water from the open-pit sump and run-off from the waste rock emplacements open-cut pit area and other areas within the site.

2.14 Site water storages

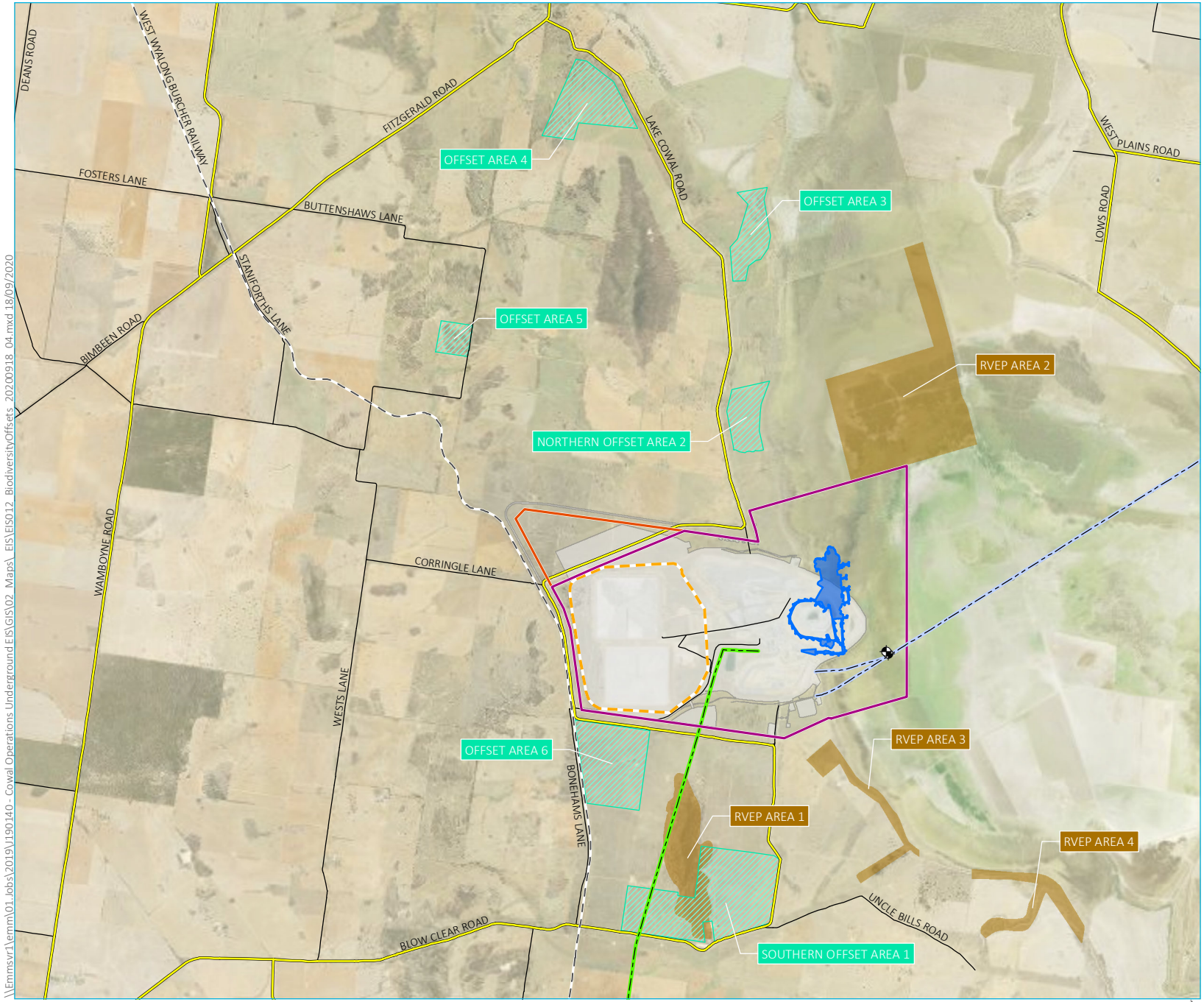
An overview of the water storages at CGO is provided in Table 2.2.

Table 2.2 Overview of water storages

Name	Purpose	Approximate storage capacity (ML)
D1	Collects surface water run-off from the northern perimeter of the northern waste rock emplacement site, which is pumped to D6.	58
D2	Collects surface water run-off and seepage from the ROM pad and stockpile areas of the northern waste rock emplacement site, the northern TSF and parts of the ICDS, which is pumped to D6 or D9.	198
D3	Collects surface water run-off from the perimeter of the open cut pit and the northern, southern and perimeter waste rock emplacement sites, which is pumped to D6.	38
D4	Collects surface water run-off from the southern perimeter of the southern waste rock emplacement site, which is pumped to D6.	62
D5A	Collects excess water from the processing, which is pumped to D6.	79
D6	Collects water from the other contained water storages for use in the processing facility.	19
D8B	Collects surface water run-off from the southern waste rock emplacement site, the southern TSF and parts of the ICDS, which is pumped to D9.	30
D9	Collects and stores water from the other contained water storages for use in the processing facility, which is pumped to D6, and the TSFs lift construction.	731
D10	Evolution has approval to construct a new contained water storage D10 immediately south of the southern waste rock emplacement. If it is constructed, it will collect and store water from the other contained water storages for use in the processing facility (which is pumped to D9).	1500

2.15 Biodiversity offset sites

Evolution is required to offset the loss of native vegetation cleared under the development consent. It has six biodiversity offset areas which are located within 5 km of the mine, covering a total area of 944 ha. (refer Figure 2.2).



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Source: EMM (2020); Evolution (2020); DFSI (2017)

Existing biodiversity offset area

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 2.2

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2.16 Site access and transport routes

The site is accessed via a number of preferred and alternate routes from West Wyalong, Forbes and Condobolin (refer Table 2.3). The alternate routes are only used when local conditions require the closure of the preferred routes (eg due to flooding). The main site access is off Lake Cowal Road, which is located along the southern and western perimeter of the site (refer Figure 1.3).

Approved heavy vehicle access to the site is via the designated route between the site and West Wyalong with light vehicle access also available via Condobolin and Forbes. Hazardous goods are transported to site by truck from Port Botany or from their point of production in accordance with the approved CGO Transport of Hazardous Materials Study.

Private vehicle travel to and from the CGO is undertaken in accordance with Evolution's *Private Vehicle Travel to and from Site Policy* and related policies. Under this policy, company-provided transport to and from the CGO is to be used where possible, and private vehicles are not permitted to travel to and from the CGO unless an Essential Driver Authority or temporary exemption is provided by Evolution. Contractors, including those engaged in construction activities, are expected to provide transport for their employees.

The Private Vehicle Travel Policy is linked to the management of fatigue related risks, as part of the Cowal Gold Operations Safety Management System, and considers the total time a worker spends travelling and working.

Table 2.3 Preferred and alternate traffic routes

All mine-related traffic to/from West Wyalong (fully sealed)	• Ungarie Road; • Wamboyne Road; • Blow Clear Road; • Bonehams Lane; and • the internal mine access road within ML 1535.
All mine-related traffic to/from Condobolin uses the preferred approved mine access route when it is trafficable. The route is partially unsealed (refer Figure 1.3)	• The Gipps Way; • Burcher Road; • Bena Street; • Lake Cowal Road (east-west) (unsealed); • Fitzgerald Road (unsealed); • Lake Cowal Road (north-south) (unsealed); and • the internal mine access road within ML 1535.
Alternate route to/from Condobolin when the preferred route is impassable due to flood conditions	• Wamboyne Road (also known as Livingstone Road, unsealed near former railway level crossing); • Blow Clear Road; • Bonehams Lane; and • the internal mine access road within ML 1535.
Preferred Mine Access mine access routes to/from Forbes	• Newell Highway; • West Plains Road; • Bogies Island Road (partly unsealed); • Lake Cowal Road (east-west) (unsealed); • Fitzgerald Road (unsealed); • Lake Cowal Road (north-south) (unsealed); and • the internal mine access road within ML 1535.

Table 2.3 Preferred and alternate traffic routes

Alternate route to/from Forbes when the water level is high in Lake Cowal/Nerang Cowal (refer Figure 1.1)	• Newell Highway; • Lachlan Valley Way; • Driftway Road; • Warroo Road; • Corinella Road (partly unsealed); • Marsden Road (unsealed); • Lake Cowal Road (east-west) (unsealed); • Fitzgerald Road (unsealed); • Lake Cowal Road (north-south) (unsealed); and • the internal mine access road within ML 1535.
Alternate route when neither the preferred mine access route or the alternative/temporary high-water route from Forbes are trafficable due to flood conditions (refer Figure 1.3)	• Newell Highway via West Wyalong and then the approved mine access route from West Wyalong (an entirely sealed route); or • Newell Highway to Bodells Lane (unsealed), then Lonergans Lane (unsealed), Blow Clear Road, Bonehams Lane and the internal mine access route within ML 1535.

2.17 Electricity supply

The existing 132 kilovolt (kV) electricity transmission line (ETL) provides electricity to the site. It extends from Temora, approximately 90 km south of the site and between West Wyalong and Wagga Wagga.

2.18 Waste management

Evolution aims to reduce, recycle and reuse resources as much as possible at their operations. Multiple waste streams are generated from CGO. These are outlined below in Sections 2.18.1 to 2.18.6.

2.18.1 General liquid waste

Sewage and greywater treatment management

Sewage and greywater are treated at an on-site sewage treatment facility and trucked off-site to a licenced facility within Bland LGA and in accordance with the conditions of the Environmental Protection Licence (EPL) 11912 for the site.

2.18.2 General solid waste (non-putrescible)

Recyclables

Recyclable materials, such as cardboard, paper, plastic, glass and aluminium cans, are generated from office buildings and workforce areas. These recyclable materials are disposed of in designated areas and collected regularly by external waste disposal contractors.

2.18.3 General solid waste (putrescible)

Trash screen oversize waste from the milling circuit is disposed of within the waste rock emplacement sites.

2.18.4 Dangerous goods and hazardous liquid wastes

The on-site storage and management of hazardous and dangerous goods and liquid wastes is undertaken in accordance with the CGO's approved Hazardous Waste and Chemical Management Plan (HWCMP). The HWCMP has been prepared in accordance with relevant legislation, Australian Standards and codes.

2.18.5 Bioremediation waste

Organic waste is treated on-site via bioremediation, which involves the use of micro-organisms to break down organic waste. Site-generated hydrocarbon-impacted material (general solid (putrescible) waste) is treated in the on-site designated Bioremediation Facility and is disposed of within the waste rock emplacements.

2.18.6 Waste tyres

Waste tyres are disposed of within designated areas of the waste rock emplacements.

2.19 Workforce

CGO has an existing approximate workforce of 500 persons during peak periods (which includes contractors).

2.20 Hours of operation

The approved hours of operation for the CGO are shown in Table 2.4:

Table 2.4 Hours of operation

Activity	Hours
Construction of TSF lifts or rock buttress	7:00 am to 6:00 pm, 7 days a week
Supplementary IWL activities	
Construction of Lake Cowal water supply pipeline (excluding construction at the western side of Lake Cowal	7:00 am to 6:00 pm, Monday to Friday 8:00 am to 1:00 pm, Saturday
Lake Cowal Road Realignment construction	No activities on Sundays or Public Holidays
All other activities	24 hours a day, 7 days a week



Chapter 3 Proposed modification

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3 Proposed modification

3.1 Introduction

While much of the necessary infrastructure required to support the proposed underground mining operations already exists and is approved to be developed (for example, ore processing plant, IWL and waste rock emplacements), a range of new and augmented supporting surface infrastructure is required.

Mod 16 therefore requests approval for these changes and for an extension to the approved term of operations for the CGO surface facilities. This extension will facilitate underground mining, allowing more gold to be produced and continuation of the associated economic benefits until completion of the Underground Development Project.

3.2 Key components

The key components of the proposed modification include:

- extending the life of the surface operations to the end of 2040, to include treatment of ore sourced from the proposed underground mine (GRE46 Mineral Deposit);
- producing an estimated 1.8 Moz of gold;
- modifications to the processing facility to allow receipt and processing of underground ore, including a tailings deslimer, tailings pipeline, ore receival hopper and conveyor;
- transport of approximately 27 Mt of ore from the underground ROM ore stockpile and to the primary crusher or temporary ore stockpiles;
- transport and emplacement of approximately 5.74 Mt of waste rock from the underground mine into the existing waste rock emplacement areas;
- continued emplacement of tailings in the IWL and increasing the final rehabilitated height of the IWL by one vertical metre, from 245 mAHD to 246 mAHD; and
- construction and operation of other ancillary supporting infrastructure at the current mine infrastructure area to facilitate continued operations at CGO, including a control room, truck maintenance and washdown facilities, administrative facilities, bathhouse, access tracks and telecommunications equipment.

The proposed modification components are summarised in Table 3.1 in comparison with the existing approved CGO open-cut project components.

Table 3.1 Proposed modification – key components overview

Development Component	Approved CGO	Proposed Modification
Tenement	Mining activities are approved to be undertaken in ML 1535 and ML 1791.	No change.
Life of mine	The mine is approved to operate to the end of 2032.	Extension to the end of 2040, to align with the operations of the proposed underground mine development and its ore processing requirements.
Gold production	Production of approximately 6.1 Moz of gold over the life of the CGO.	Production of a further 1.8 Moz of gold (approximate), totaling 7.9 Moz over the life of the CGO.
Mining extent	Development of the open-cut pit is staged as it is progressively deepened and widened. The total open-cut pit area is approximately 131 ha and its final depth will be approximately -331 mAHD.	No change.
Ore production	Approximately 167 Mt of ore will be produced over the life of the CGO from the open-cut pit.	No change to the amount of ore from the open-cut pit.
On-site ore transportation	Ore is transported from the open-cut pit by truck to a temporary stockpile prior to rehandling to the primary crusher.	No change. Underground ore will also be trucked from the underground run-of-mine stockpile in the vicinity of the box-cut to the temporary ore stockpile.
Ore processing	Ore processing is undertaken at the ore processing facility at a rate up to 9.8 Mtpa. A secondary ore crushing circuit within existing process plant is approved to be constructed.	No change to ore processing rate. The existing processing facility will be modified to include: • a tailings desliming; • an ore receival bin and mill feed conveyor; and • an upgraded elution circuit.
Cyanide consumption	Use of a primary ore conventional carbon-in-leach circuit, which includes recovery of gold from flotation tailings.	No change to circuit. Increase in annual cyanide consumption associated with the higher grade ore.
Cyanide concentration levels	The use of cyanide is undertaken in accordance with the approved Cyanide Management Plan (CMP). Cyanide concentrations in the aqueous component of the tailings slurry stream at the process plant not to exceed the following: • 20 mg/L CN_{WAD} (90^{th} percentile over six months); and • 30 mg/L CN_{WAD} (maximum permissible limit at any time).	No change.
Mineralised material processing	CGO is approved to process approximately 39.3 Mt of mineralised material.	No change.

Table 3.1 Proposed modification – key components overview

Development Component	Approved CGO	Proposed Modification
Water supply sources	Water on site is captured and used for ore processing and dust suppression. Water is preferentially sourced from internal sources, and supplemented with water from external sources as follows: <u>Internal sources</u> • recycled water from the TSF/IWL; • open-cut pit sump and pit dewatering borefield; • rainfall runoff from mine waste rock emplacements, and other areas within the site which is collected as part of the ICDS and contained in nine on-site water storages; and • approved D10 dam (yet to be constructed). <u>External sources</u> • saline groundwater from four production bores located south-east of ML 1535; • ESB located approximately 10 km east of Lake Cowal's eastern shoreline; • BCPB which comprises four production bores within the Bland Creek Palaeochannel, located approximately 20 km northeast of the CGO; and • water accessed from the Lachlan River under licence, which is supplied via a pipeline from the Jemalong Irrigation Channel.	No change.
BCPB extraction limits	The maximum extraction of water from the Bland Creek Palaeochannel must not exceed: • 15 ML per day; or • 3,650 ML per annum. Extraction is managed to maintain groundwater levels above the established Department of Industry (DoI) (Water) trigger levels.	No change.

Table 3.1 Proposed modification – key components overview

Development Component	Approved CGO	Proposed Modification
Site water management infrastructure	The existing CGO water management infrastructure is comprised of the following key components: • UCDS; • the ICDS (including the contained water storages); • lake isolation system (comprising the temporary isolation bund, IPB and perimeter waste rock emplacement); • integrated erosion, sediment and salinity control system; and • open pit sump and dewatering borefield. Water storage D5 is approved to be modified to accommodate the extension of the open-cut pit (known as D5A). A new contained water storage/sediment dam for the soil stockpile catchment area located in the north of ML 1535. Relocation of pit dewatering bores as the open pit extends beyond the currently installed bores around its perimeter. Relocation of a portion of the UCDS and ICDS around the IWL (within ML 1535 and MLA 561) and relocation of approved contained water storage D10 (within ML 1535).	No change to UCDS and ICDS. Construction of a pipeline from the tailings deslimer to the paste fill plant to send tailings to the paste fill plant and a return water pipeline from the paste fill plant to the processing facility. Augmentation of dam D5A to allow the ore receival hopper and ore feed mill conveyor to be developed. This augmentation will not change the overall catchment area of the dam. Augmentation of other on-site water storages from time to time depending on water supply and on-site requirements.
Waste rock management	Mined waste rock is emplaced in the northern, southern and perimeter waste rock emplacements over the life of the CGO, and it is used to form the perimeter of the IWL.	No change.
	Approximately 299 Mt of waste rock would be produced over the life of the approved CGO.	Approximately 5.74 Mt of additional waste rock would be managed from the underground mine over the life of the underground mine.
	Northern waste rock emplacement to be constructed to a design height of approximately 308 m AHD.	No change to the height of the northern waste rock emplacement.
	Southern waste rock emplacement to be constructed to a design height of approximately 283 m AHD.	No change to the height of the southern waste rock emplacement
	Perimeter waste rock emplacement to be constructed to a design height of approximately 233 m AHD.	No change to the height of the perimeter waste rock emplacement.
Mineralised material stockpiling	Temporary stockpiling of mineralised material on the northern waste rock emplacement to a maximum design height of approximately 320 m AHD. This material will be processed and the stockpile will be progressively removed.	No change to temporary stockpiling of mineralised material.

Table 3.1 Proposed modification – key components overview

Development Component	Approved CGO	Proposed Modification
Soil management	Application of soil resources management strategies/objectives in accordance with the existing ESCMP.	No change.
Soil stockpiles	Development of soil stockpiles within ML 1535 and MLA 561.	No change.
Tailings storage	Tailings are deposited in two TSFs (Northern and Southern). NTSF and STSF are approved to be constructed to approximately 240 m AHD and 248 m AHD, respectively. These TSFs are also approved to be combined with the northern waste rock emplacement to form the IWL, which will provide a life of mine tailings strategy. The IWL is approved to be developed to a final height of 245 m AHD.	A height increase of one vertical metre, from 245 m AHD to 246 m AHD is required to the final rehabilitated height of the IWL, as a result of emplacing the residual tailings from the processing of the underground ore.
Mining fleet	The existing mobile equipment fleet used for open pit ore extraction, waste rock handling, TSF lifts and rockfill buttress construction includes: excavators; haul trucks; dozers; loaders; water trucks; articulated dump trucks; compactors; rollers; scrapers; graders; and drill rigs.	No change.
Biodiversity Offset Strategy	The Biodiversity Offset Strategy is shown conceptually in Appendix 4 of Development Consent (DA 14/98), and generally involves securing six offset sites.	No change.
Power Supply	Electricity to the site is supplied via a 132 kV electricity transmission line from Temora, approximately 90 km south of the CGO.	No change.
Site access road	Site access road following existing roads from West Wyalong to the CGO. Light vehicle access from Condobolin and Forbes.	No change.
Ancillary surface infrastructure	A range of ancillary surface infrastructure is operated to support open-cut mining operations, including that related to administration, water management, maintenance, pipelines, magazines and other functions.	Development of additional surface infrastructure and augmentation of existing infrastructure, all within the existing approved disturbance areas, including (but not limited to): administration facilities, offices and car parking, warehouses and stores, vehicle washdown facilities, heavy vehicle and light vehicle maintenance workshop and maintenance bays, control room, fuel farm, core yards and drill sheds, hard stands and go lines, ablutions and changerooms, communications infrastructure, access roads, water storages and other minor ancillary infrastructure.
Exploration	Exploration activities undertaken within ML 1535 in accordance with existing tenement.	Continuation of exploration activities within ML 1535.

Table 3.1 Proposed modification – key components overview

Development Component	Approved CGO	Proposed Modification
Hours of operation	Mining operations and ore processing are approved to be undertaken 24 hours a day, seven days a week. Construction activities, including activities at the IWL are approved to be undertaken only during standard construction hours.	No change.
Employment	During peak periods, the CGO employs up to 500 people.	No change to the open-cut pit workforce. A peak construction workforce of up to approximately 160 full time equivalent (FTE) employees and contractors is currently anticipated for the development of the underground mine and changes to the surface infrastructure. The operational workforce for the underground mine is estimated to be up to approximately 230 FTE additional employees.

3.3 Mine life extension

The approved life of the current open-cut project is until the end of December 2032. The underground mining operations are anticipated to be undertaken up to mid-2039. Therefore, there will be the need to operate the processing facility, waste rock emplacements and IWL until 2040.

3.4 Ore handling

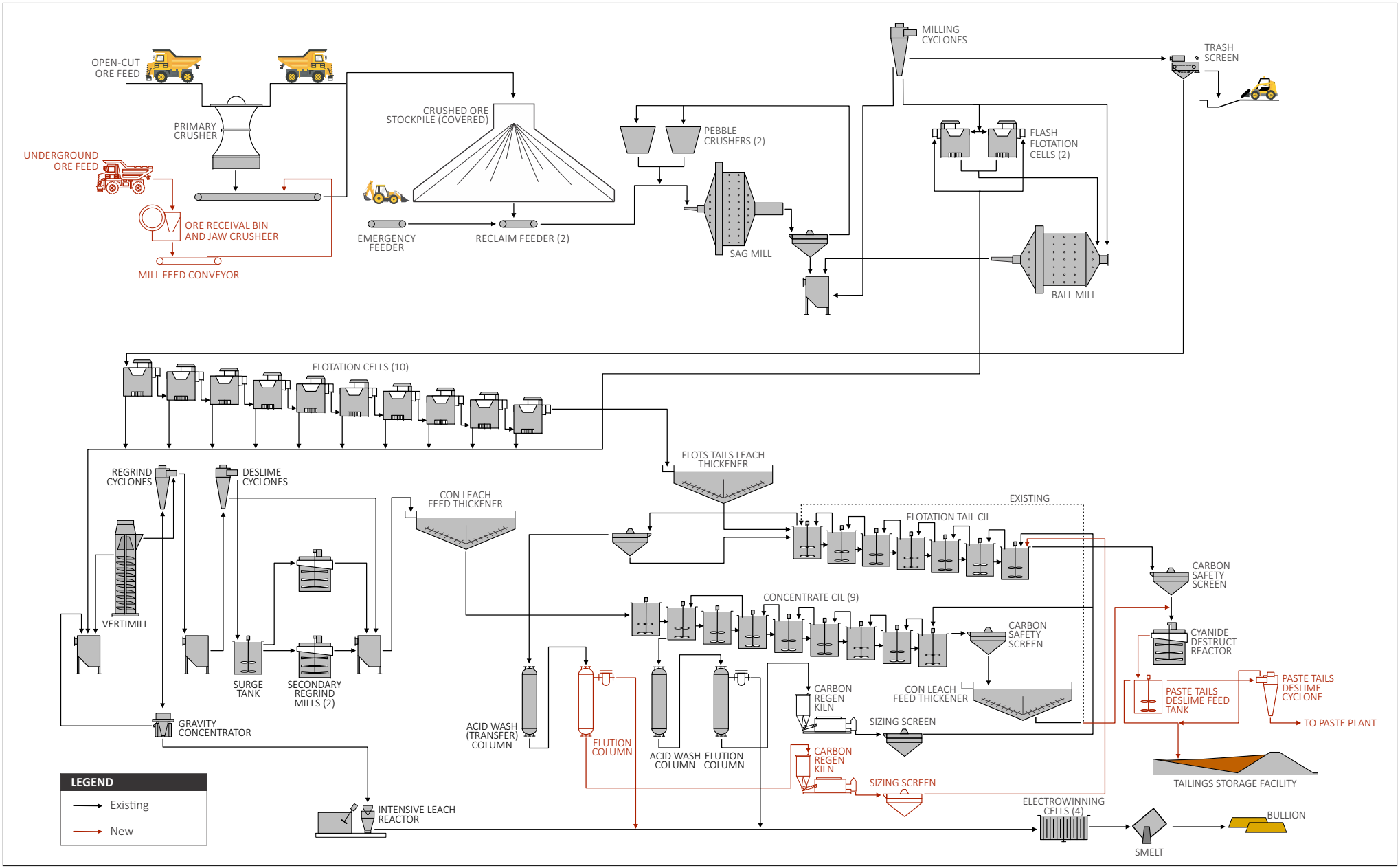
Load haul dump units will be used to remove rock from development and production areas underground with loading into 50 tonne diesel trucks for transport to temporary ore stockpiles at the surface. Sulfide ore (which comprises most of the ore that will be produced underground) and oxide ore will be separated and stockpiled.

Sulfide ore will be delivered by truck and dumped into a receival bin and ore mill feed conveyor that will be developed under the modification (refer Figure 3.1).

3.5 Ore processing

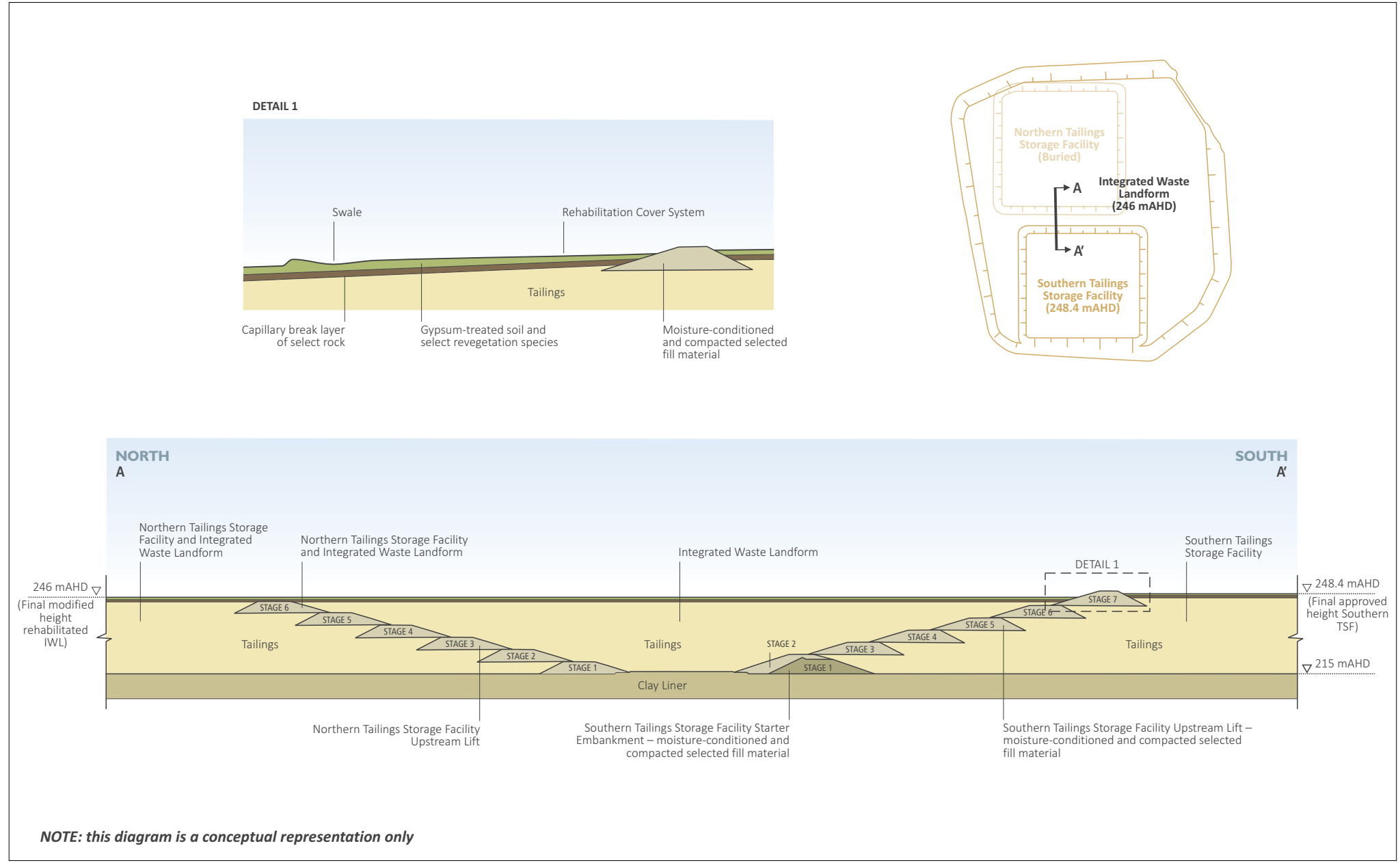
Modifications to the existing ore processing facility will allow continued processing of ore from the open-cut pit (E42 Mineral Deposit) as well as accommodating underground ore (GRE46 Mineral Deposit). The proposed modifications to the primary ore processing circuit are shown schematically in Figure 3.1 and include the following:

- Primary crushing circuit: addition of an ore receival hopper and a mill feed conveyor.
- Cyanide destruction and tailings circuit: addition of a paste tailings deslime feed tank and deslime cyclone.
- Gold recovery circuit: upgrades to the elution circuit, including the addition of an elution column, carbon regeneration kiln and sizing screen
- Site water management infrastructure: a pipeline from the paste tailings deslime cyclone to the paste plant, and a return water pipeline from the paste plant back to the processing circuit.



Primary ore process flowsheet modifications

Evolution Mining
Mod 16 Modification Assessment Report
Figure 3.1



NOTE: this diagram is a conceptual representation only

Conceptual cross-section of central IWL at closure

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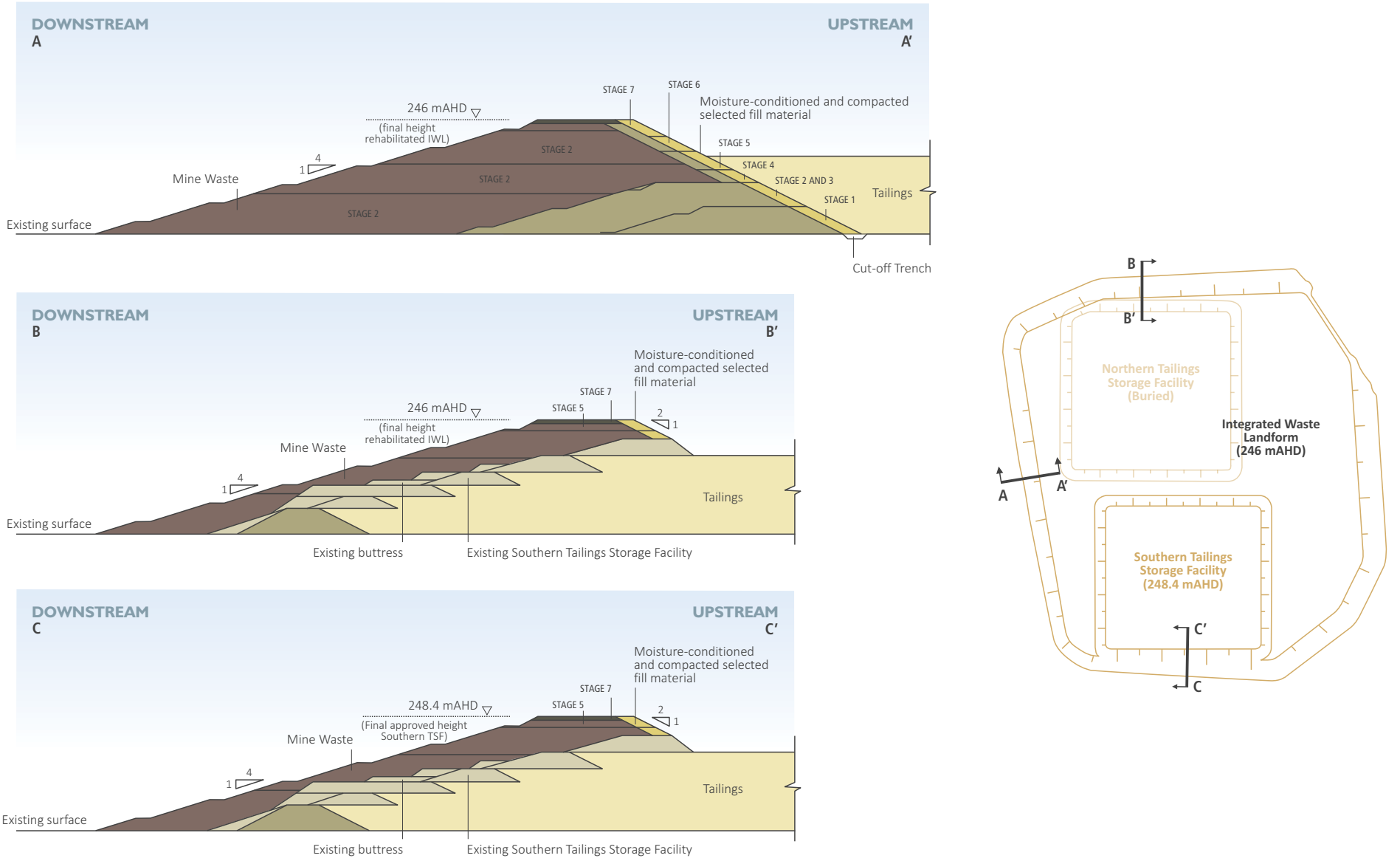
Mod 16 Modification Assessment Report

Figure 3.2



NOTE: this diagram is a conceptual representation only

Conceptual embankment cross-section of IWL at closure

Evolution Mining
Mod 16 Modification Assessment Report
Figure 3.3

3.5.1 Waste rock management

Despite the planned addition of waste rock from the underground, no change to the general arrangements for the emplacement of waste rock is proposed as part of the modification and the use of the northern, southern and perimeter waste rock emplacements will continue as currently approved. The Underground Development Project will contribute approximately 5.74 Mt of additional waste rock to the waste rock emplacements.

3.5.2 Waste rock geochemistry

An assessment of the acid-generating potential and metal-leaching behaviour of mine waste rock extracted during the development of the underground mine has been undertaken (GEM 2020). As no change to the open-cut pit is proposed, there will be no change to the geochemical characteristics from the approved CGO waste rock geochemistry (GEM 2020).

The results of the GEM (2020) assessment confirm that the proposed underground development waste rock is geochemically similar to the waste rock from the current open-cut pit operations, indicating that the management strategies currently employed for the waste rock emplacements would not need to be modified to accommodate the development waste rock.

On this basis, existing mine waste rock management strategies will continue to be used. Segregation of suitable mine waste rock for use in the cover system of the waste rock emplacements will also continue (ie for rehabilitation use).

The volume of waste rock produced will decrease over the life of the mine as the volume of waste rock produced from underground decline and development drives reduces.

3.6 Integrated Waste Landform

The design objectives of the current IWL are to:

- provide life of mine tailings storage for the CGO;
- provide optimum removal of water from the facility and return to the plant for re-use for ore processing;
- optimise tailings storage capacity by maximising tailings density; and
- optimise the earthworks and timing of staging to coincide with open-cut pit mining activities and availability of suitable mine waste material for construction of the IWL.

The modification will not affect these design objectives or increase the overall footprint of the IWL at closure. However, the anticipated increase in tailings production due to processing additional ore from the Underground Development Project will require the final height of the IWL at closure to increase by one vertical metre, from 245 m AHD to 246 m AHD. The modified final profile of the IWL at closure is shown in the cross-sections in Figure 3.2 and Figure 3.3. There is no change proposed to other approved IWL design parameters, including the final approved height of the Southern TSF (248.4 m AHD), embankment lift staging or to the rehabilitation cover system.

3.7 Gold production

The modification will result in an additional 1.8 Moz of gold being produced at the mine. This will take the planned total gold production over the life of the mine to 7.9 Moz.

3.8 Ancillary surface infrastructure

To support the Underground Development Project, minor modifications to the existing mine infrastructure area will be required. The changes relate to ancillary surface infrastructure to support the underground mining operations. Any changes will be undertaken within the existing disturbance footprint of the mine infrastructure area and its surrounds and where possible, existing structures will be retained.

The changes mainly relate to administrative and general operating functions of the site. There will be a new control room installed from which mining operations will be controlled. There will be the need to operate a heavy vehicle and light vehicle maintenance workshop, maintenance bays and washdown facilities. The changes also include the development of warehouses and stores, a fuel farm, core yards and drill sheds hardstands and go lines, ablutions and change rooms, crib room, communications infrastructure and internal access roads.



Chapter 4 Legislation and policy

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4 Legislation and policy

4.1 Introduction

This chapter describes the relevant Commonwealth and State legislation and regulatory framework under which the proposed modification will be assessed and determined.

4.2 Commonwealth legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of Agriculture, Water and the Environment (DAWE). It provides a legal framework to protect nationally and internationally important flora, fauna, ecological communities and heritage places defined as 'matters of national environmental significance' (MNES).

A proponent must refer a proposed action to the Commonwealth Minister under section 68 of the EPBC Act if the proposed action may be a "controlled action". A proposed action may be a "controlled action" if it will, or is likely to, have a significant impact on a MNES.

A preliminary review of the environmental risks of the modification relevant to MNES was completed as part of the scoping phase of the proposal. This included a search of the Protected Matters Search Tool on 18 June 2019. The results of this search are summarised in Table 4.1.

Table 4.1 MNES under the EPBC Act

MNES	Matters relevant to the proposed modification
World heritage properties	None
National heritage places	None
Wetlands of international importance	None within search tool buffer radius (10 km). The search tool identified four wetlands of international importance over 500 km away.
Great Barrier Reef Marine Park	Not applicable
Commonwealth marine areas	Not applicable
Commonwealth listed threatened ecological communities (TECs)	Three Commonwealth listed TECs may/are likely to occur in the vicinity of the proposal: • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia; • Weeping Myall Woodlands; and • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.
Commonwealth listed threatened species	Twenty-one listed threatened species, including four critically endangered bird species.
Commonwealth listed migratory species	Thirteen listed migratory species, including the critically endangered Curlew Sandpiper and Eastern Curlew.
Other matters	
Commonwealth land	None
Commonwealth heritage places	None

Table 4.1 MNES under the EPBC Act

MNES	Matters relevant to the proposed modification
Nuclear actions (including uranium mines)	Not applicable
A water resource, in relation to coal seam gas development and large coal mining development	Not applicable
Nationally important wetlands	The Lake Cowal/Wilbertroy Wetlands are listed as being of National significance in the Australian Wetlands Database.

As it was assessed that the proposed modification is not likely to have a significant impact on any MNES, the proposed modification has not been referred to the Commonwealth Minister under section 68 of the EPBC Act. In this regard, it is relevant that no additional surface disturbance will occur outside of the existing disturbance boundary of CGO.

It is noted that the Underground Development Project, which the modified project would support, was referred to the Commonwealth Minister under section 68 of the EPBC Act and was determined to not be a controlled action under the EPBC Act.

4.3 NSW State legislation

4.3.1 - Environmental Planning and Assessment Act 1979

i Section 4.55(2) modification

Applications to modify a development consent are determined under section 4.55 of the EP&A Act. There are a number of matters that the consent authority must satisfy before a development consent can be modified under section 4.55.

Evolution Mining is seeking to modify DA 14/98 pursuant to section 4.55(2) of the EP&A Act to allow for the modification of existing surface facilities at CGO. Compliance of the proposed modification with the requirements of section 4.55(2) is summarised in Table 4.2.

Table 4.2 Compliance with Section 4.55(2) requirements

Section 4.55(2) requirements	Matters relevant to the proposed modification
4.55(2) Other modifications A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if—	
it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	As a result of item 3BA(6) in Schedule 1 to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*, the applicable requirement is that the development as proposed to be modified would be substantially the same development as the development authorised by the last modification under the former section 75W of the EP&A Act. That is, the development as proposed to be modified must be substantially the same development as that authorised by Mod 14 on 4 October 2018. The consent authority can be satisfied as to this matter because the proposed modification would not change the primary purpose of the original development, being an open cut mine with associated surface infrastructure, including ore processing and waste management activities. The modified project would continue to use existing processing and waste management infrastructure, which would be augmented with a paste fill plant to further manage waste (tailings) by turning it into paste to fill underground stopes. The modification will include the construction of a box cut within the existing open-cut mine, however this will be located within the existing approved disturbance area in close proximity to the open cut pit. The modification will also include alterations to the existing processing facility in order to process the additional ore from the underground development, however the processing rate of ore and the location of the processing facility will remain as approved. Waste rock and tailings at the site will continue to be stored at the existing waste rock emplacement areas and IWL. The IWL will be raised by one metre, however the location and lateral extent of the IWL will remain as approved.
it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and	Evolution Mining has consulted with DPIE and other relevant State Government agencies during the preparation of this modification report. Further evidence of consultation undertaken with Government agencies is provided in Chapter 5. All state government agencies will be afforded the opportunity to comment on the modification application and any proposed amendments to the conditions of consent (if required) during the assessment process.

Table 4.2 Compliance with Section 4.55(2) requirements

Section 4.55(2) requirements	Matters relevant to the proposed modification
it has notified the application in accordance with— the regulations, if the regulations so require, or a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and	Clause 118 of the EP&A Regulation sets out the notification requirements for certain section 4.55(2) modification applications. The consent authority or its delegate will attend to notifying the modification application in accordance with the EP&A Regulation and placing the modification application on public exhibition. The relevant consent authority for the modification is the Minister for Planning and Public spaces, and therefore (c)(ii) does not apply to this modification application.
it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.	Any submissions made concerning the proposed modification will be forwarded to Evolution to consider and respond to in a Submissions Report.

ii Matters for consideration

In determining an application for the modification of a consent under section 4.55(2), the consent authority must take into consideration such of the matters referred to in section 4.15(1) as are of relevance to the development the subject of the application. The consent authority must also take into consideration the reasons given by the consent authority for the grant of the consent that is sought to be modified.

The relevant matters referred to in section 4.15(1) of the EP&A Act, include:

3. the provisions of
   a) any environmental planning instrument, and
   b) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and
   c) any development control plan, and
   iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and
   iv. the regulations (to the extent that they prescribe matters for the purposes of this paragraph),
   v. (Repealed)

   that apply to the land to which the development application relates,
b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,
c) the suitability of the site for the development,
d) any submissions made in accordance with this Act or the regulations,
e) the public interest.

Relevant matters in section 4.55(1)(a) are addressed in the following sections of this chapter. The matters in section 4.55(1)(b) to (e) are addressed in Chapters 5, 6 and 7.

4.3.2 Environmental Planning and Assessment Regulation 2000

The key requirements of the EP&A Regulation are detailed and addressed in Table 4.3.

Table 4.3 EP&A Regulation requirements

Requirement	Consideration
Clause 115	
(1) An application for modification of a development consent under section 4.55(1), (1A) or (2) or 4.56(1) of the Act must contain the following information—	
the name and address of the applicant,	Refer section 1.8
a description of the development to be carried out under the consent (as previously modified),	Refer Chapter 2
the address, and formal particulars of title, of the land on which the development is to be carried out,	Refer section 1.1
a description of the proposed modification to the development consent,	Refer Chapter 3
a statement that indicates either— that the modification is merely intended to correct a minor error, misdescription or miscalculation, or that the modification is intended to have some other effect, as specified in the statement,	Refer Chapter 3
a description of the expected impacts of the modification,	Refer Chapter 6
an undertaking to the effect that the development (as to be modified) will remain substantially the same as the development that was originally approved,	Refer section 7.1
g1) in the case of an application that is accompanied by a biodiversity development assessment report, the reasonable steps taken to obtain the like-for-like biodiversity credits required to be retired under the report to offset the residual impacts on biodiversity values if different biodiversity credits are proposed to be used as offsets in accordance with the variation rules under the *Biodiversity Conservation Act 2016*,	Under clause 30A(2)(c) of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, a biodiversity development assessment report is not required to be submitted with this modification application if the authority or person determining the application for modification (or determining the environmental assessment requirements for the application) is satisfied that the modification will not increase the impact on biodiversity values. The modification will not increase the impact to biodiversity values, as it will be contained within the existing approved disturbance boundary of CGO (refer section 6.6). Therefore, a BDAR due diligence and consistency assessment has been included in this modification application (refer section 6.6).
if the applicant is not the owner of the land, a statement signed by the owner of the land to the effect that the owner consents to the making of the application (except where the application for the consent the subject of the modification was made, or could have been made, without the consent of the owner),	Where required, Evolution will obtain the consent of the owner of relevant land for this application.
a statement as to whether the application is being made to the Court (under section 4.55) or to the consent authority (under section 4.56),	Not applicable, as the proposed modification application is not being made to the NSW Land and Environment Court.

Table 4.3 EP&A Regulation requirements

Requirement	Consideration
(1A) An application for modification of development consent must—	
(a) be in the form that is approved by the Planning Secretary and made available on the NSW planning portal, and (b) be accompanied by the information and documents specified in the approved form and information or documents required by the Act or this Regulation, and (c) be lodged on the NSW planning portal.	This application will be made via the NSW Planning Portal and is in the form approved by the Planning Secretary. The application is accompanied by the information and documents specified by the Secretary in the letter dated 27 August 2019 outlining the assessment approach, and in accordance with the modification report guideline (DPIE 2019) and the requirement of cl 115(1)(f).
(2) The notification requirements of clause 49 apply in respect of an application if the consent of the owner of the land would not be required were the application an application for development consent rather than an application for the modification of such consent.	Evolution will attend to the notification requirements of clause 49 for this application.
Clause 118	
(1) This clause applies to an application under section 4.55(2) or 4.56(1) of the Act to modify a development consent if the original development application for the consent was an application to carry out any of the following— (a) designated development, (b) State significant development, (c) nominated integrated development, threatened species development or Class 1 aquaculture development where the application was made to a consent authority other than a council.	As the original development application for the consent was an application to carry out designated development, the consent authority is required to attend to the notification requirements set out in clause 118(2) and (3) of the EP&A Regulation.

4.3.3 *Protection of the Environment Operations Act 1997*

The *Protection of the Environment Operations Act 1997* (POEO Act) is the principal NSW environmental protection legislation and is administered by the Environment Protection Authority (EPA).

CGO is a 'premises-based scheduled activity' under Schedule 1 the POEO Act and Evolution is therefore required to hold an EPL. EPLs are issued by the EPA under section 55 of the POEO Act.

Evolution holds EPL 11912, which authorises the following scheduled activities at CGO under the POEO Act:

- concrete works;
- crushing, grinding or separating;
- extractive industries;
- mineral processing; and
- mining for minerals.

The modification may require a variation to EPL 11912 to authorise the processing of additional ore mined from the underground development and construction of the pastefill plant and box cut. Evolution will review its EPL in consultation with the EPA to assess whether any variation will be required.

4.3.4 Other relevant NSW State legislation and planning instruments

A summary of other relevant NSW State legislation is provided in Table 4.4.

Table 4.4 Other relevant NSW State legislation

NSW legislation	Comment
Work Health and Safety (Mines and Petroleum Sites) Act 2013	The *Work Health and Safety (Mines and Petroleum Sites) Act 2013* aims to assist in securing and promoting the health, safety and welfare of people at work at mining operations. Evolution holds all necessary approvals under the Act and the operations at CGO will continue to be regulated under the provisions of the Act.
Water Act 1912 and *Water Management Act 2000*	The *Water Act 1912* was historically the main legislation for the management of water resources in NSW. This Act has largely been replaced by the *Water Management Act 2000* (WM Act). This legislation is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. Water sharing plans prepared in accordance with this legislation include rules for protecting the environment and administering water licensing and trading. As described in section 2.9, water is sourced primarily from internal on-site sources and supplemented from external sources as required. External water sources, including the saline groundwater supply bores, Eastern Saline Borefield, Blank Creek Palaeochannel Borefield and the Lachlan River are accessed in accordance with relevant Water Access Licences (WALs) and WM Act approvals held by Evolution. The modification will not require any changes to existing water supply sources and the WALs associated with these sources. It is anticipated that - additional water will be required during the operation of the modified project, and that this additional requirement will be met under existing water entitlements.
Mining Act 1992	The *Mining Act 1992* regulates mining in NSW and provides for the granting of mining authorities. It also places controls on exploration and mining, disposal of mining waste, land rehabilitation and environmental management activities. It is an offence under section 5 of the *Mining Act 1992* to mine for minerals except in accordance with a valid authorisation. Section 6 of the *Mining Act 1992* provides that an authorisation is also required to carry out designated ancillary mining activities. Construction and operation of the proposed modification will occur within the approved mining lease ML 1535, which is governed under Part 5 of the *Mining Act 1992*. No change to Evolution's existing mining tenements is required as part of the modification. The Mining Operations Plan (MOP), which is required to be prepared for all MLs by Mining, Exploration and Geoscience within Regional NSW, will be amended to consider operational changes associated with the modification.
Heritage Act 1977	The *Heritage Act 1977* aims to protect and conserve the natural and cultural history of NSW, including scheduled heritage items, sites and relics. No impacts to historical heritage would result from the modification. This is discussed further in section 6.10.

Table 4.4 Other relevant NSW State legislation

NSW legislation	Comment
Biodiversity Conservation Act 2016	The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development (ESD). It establishes a regulatory framework for assessing and offsetting biodiversity impacts for proposed development. The modification will not require the removal of vegetation, as no disturbance outside of the existing disturbance boundary for CGO will occur. Providing that the authority or person determining the modification application (or determining the environmental assessment requirements for the application) is satisfied that the modification will not increase the impact on biodiversity values, a biodiversity development assessment report will not be required to be submitted for the proposed modification. Instead, a BDAR due diligence is included with the modification report.
National Parks and Wildlife Act 1974 (NPWS Act)	The NPWS Act provides for nature conservation in NSW, including the conservation of places, objects and features of significance to Aboriginal people and protection of native flora and fauna. A person must not harm or desecrate an Aboriginal object or place without an Aboriginal heritage impact permit (AHIP) under section 90 of the NPWS Act. CGO operates under the following consents and permits under the NPW Act: • Permit 1468, authorising certain archaeological works in the ML 1535 area, water pipeline and borefield area; • Consent 1467, authorising the destruction of Aboriginal objects in the ML 1535 area, water pipeline area and borefield area; • Permit 1681, authorising certain archaeological works in the road upgrade area and the travelling stock route (TSR); • Consent 1680, authorising the destruction of Aboriginal objects in the road upgrade and the TSR; and • AHIP C0004750, for ML 1791 and the TSR. Existing consents and permits would continue to apply to CGO. Construction and operation of the proposed modification will operate under existing consents and permits (as listed above). An Aboriginal heritage due diligence assessment has been completed for the modification. It is summarised in section 6.9.
Fisheries Management Act 1994	The *Fisheries Management Act 1994* aims to conserve, develop and share the fishery resources of NSW and the benefit of present and future generations. It lists threatened aquatic species and ecological communities and contains measures to conserve these. No impacts to threatened species or key fisheries habitat is likely as part of the proposed modification. No permits are therefore likely to be required under the *Fisheries Management Act 1994.*
Pipelines Act 1967	The *Pipelines Act 1967* sets licensing requirements for the construction and operation of pipelines. The modification will not give rise to a need for a licence under this Act.
Rural Fires Act 1997	The *Rural Fires Act 1997* aims to prevent, mitigate and supress bushfires and other fires in local government areas of NSW. In this regard, bushfire risk will continue to be managed by the site's Environmental Management System.
Roads Act 1993	Activities listed in section 138 of the *Roads Act 1993* cannot be carried out in, on, or over a public road unless the appropriate roads authority has given consent. Approval under section 138 of the *Roads Act 1993* is not required as part of the modification, as no activities on the local or State road network are proposed A traffic impact assessment has been completed for the modification to assess the impacts of additional light and heavy vehicles associated with the modification on the road network. This is summarised in section 6.11 and provided in full in Appendix K.

4.4 Applicable environmental planning instruments

4.4.1 State environmental planning policies

i State Environmental Planning Policy No 33 – Hazardous and Offensive Development

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) concerns the potential of development to cause hazards or to be offensive, including as a result of the location of the development and the way in which it is to be carried out.

CGO is considered a "potentially hazardous industry" under *Applying SEPP 33* (DoP 2011), as chemicals and combustibles are currently transported, stored and handled on site. A preliminary hazard analysis (PHA) was completed for the original EIS for CGO in line with *Applying SEPP 33* (DoP 2011) and relevant Hazardous Industry Planning Advisory Papers (HIPAPs).

A review of the existing PHA has been completed in consideration of the proposed modification, including all identified risks on site and risk reduction mitigation measures noted in the PHA. This is provided in section 6.14.

ii State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) aims to provide for the proper management and development of mineral, petroleum and extractive mineral resources for the social and economic welfare of NSW. The Mining SEPP establishes planning controls, defines the permissibility of mining projects and the additional matters which must be considered by a consent authority when evaluating development applications for mining.

Clause 7(1) of the Mining SEPP provides that certain development for the purpose of mining may only be carried out with development consent, including:

a) underground mining carried out on any land,

b) mining carried out –

i. on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or

ii. on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999,

c) mining in any part of a waterway, an estuary in the coastal zone or coastal waters of the State that is not in an environmental conservation zone,

d) facilities for the processing or transportation of minerals or mineral bearing ores on land on which mining may be carried out (with or without development consent), but only if they were mined from that land or adjoining land,

e) mining on land that is reserved as a state conservation area under the National Parks and Wildlife Act 1974,

f) extracting a bulk sample as part of resource appraisal of more than 20,000 tonnes of coal or of any mineral ore.

In relation to any inconsistency between the Mining SEPP and an environmental planning instrument, sub-clause 5(3) provides that the Mining SEPP prevails to the extent of the inconsistency.

Part 3 of the Mining SEPP prescribes certain matters that the consent authority must consider with respect to a development application seeking consent for mining development, including matters relating to: compatibility with other land uses; the voluntary land acquisition and mitigation policy; natural resource management and environmental management; resource recovery; transport and rehabilitation. Further, clause 12AB identifies non-discretionary development standards for mining development.

Insofar as these matters are relevant to this modification application, the consent authority can be satisfied of these matters based on the assessment contained in this modification report.

iii State Environmental Planning Policy No 55- Remediation of Land

State Environmental Planning Policy No 55 – Remediation of Land (SEPP 55) provides a state-wide approach to the remediation of contaminated land for the purpose of minimising the risk to human health and the environment.

Clause 7 of SEPP 55 states:

> (1) A consent authority must not consent to the carrying out of any development on land unless—
>
> (a) it has considered whether the land is contaminated, and
>
> (b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and
>
> (c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.
>
> (2) Before determining an application for consent to carry out development that would involve a change of use on any of the land specified in subclause (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines.
>
> (3) The applicant for development consent must carry out the investigation required by subclause (2) and must provide a report on it to the consent authority. The consent authority may require the applicant to carry out, and provide a report on, a detailed investigation (as referred to in the contaminated land planning guidelines) if it considers that the findings of the preliminary investigation warrant such an investigation.
>
> (4) The land concerned is—
>
> (a) land that is within an investigation area,
>
> (b) land on which development for a purpose referred to in Table 1 to the contaminated land planning guidelines is being, or is known to have been, carried out,
>
> …

The proposed development for this modification application would be undertaken on land which is not contaminated land and on land within the existing CGO site on which there is no evidence of contamination.

The modification does not involve a change of use on any of the land specified in subclause (4).

iv State Environmental Planning Policy Infrastructure 2007

Clause 101(2) of the Infrastructure SEPP states:

> The consent authority must not grant consent to development on land that has a frontage to a classified road unless it is satisfied that—
>
> d) (a) where practicable and safe, vehicular access to the land is provided by a road other than the classified road, and
>
> e) (b) the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the development as a result of:
>
> i) (i) the design of the vehicular access to the land, or
>
> ii) (ii) the emission of smoke or dust from the development, or
>
> iii) (iii) the nature, volume or frequency of vehicles using the classified road to gain access to the land, and
>
> f) (c) the development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.

The modification would not result in a significant impact to the classified road network. The existing mine, and in particular the mine access road, has been designed in consultation with Roads and Maritime Services (RMS) so as to not adversely affect the safety, efficiency and ongoing operation of the Newell Highway.

v State Environmental Planning Policy (Koala Habitat Protection) 2019

State Environmental Planning Policy (Koala Habitat Protection) 2019 (Koala Habitat SEPP) encourages the conservation and management of Koala (*Phascolarctos cinereus*) habitat, to ensure permanent free-living Koala populations are maintained over their present range.

Clause 5(1) of the Koala Habitat SEPP states:

> (1) This Policy applies to each local government area listed in Schedule 1.

The Bland Shire local government area is not listed in Schedule 1 and, as such, this SEPP does not apply to this local government area. However, the Koala Habitat SEPP does apply to the Forbes local government area.

With respect to the objectives of the Koala Habitat SEPP and the matters contained in the Koala Habitat SEPP (to the extent that they are relevant to this modification application), the consent authority can be satisfied of these matters as the proposed modification is not predicted to have any impacts on koalas or any koala habitat.

4.4.2 Bland Local Environmental Plan 2011

The relevant local environmental plans are the *Bland Local Environmental Plan 2011* (Bland LEP) and the *Forbes* Local Environmental Plan 2011 (Forbes LEP). The CGO site is zoned RU1 Primary Production under the Bland LEP and RU1 Primary Production under the Forbes LEP. The objectives and how the proposed modification is consistent with the objectives is provided in Table 4.5.

Table 4.5 Bland LEP RU1 Primary Production zone objectives

Objective	Consistency review
To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	The modification would be undertaken on land already approved for mining activity and being used for mining purposes. It does not affect the capability of the land under which it would be developed for primary industry production and the natural resource base would not be affected.
To encourage diversity in primary industry enterprises and systems appropriate for the area.	The modification would not affect the diversity in primary enterprises and systems, as the activities would occur on land already established and used for mining activities.
To minimise the fragmentation and alienation of resource lands.	The modification would occur on an established mine site. It would not fragment or alienate resource lands.
To minimise conflict between land uses within this zone and land uses within adjoining zones.	The modification would occur on an established mine site. There will be no new land disturbed for operations and therefore no land-use conflicts between land-uses in this zone would result.
To ensure that development on land within this zone does not unreasonably increase the demand for public services or public facilities.	The modification would occur on an established mine site. It does not rely on public services or public facilities at the site. The proposed modification would not significantly increase the current workforce at the site and would therefore not unreasonably increase the demand for public services or public facilities.

Table 4.5 Forbes LEP RU1 Primary Production zone objectives

Objective	Consistency review
To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	The modification would be undertaken on land already approved for mining activity and being used for mining purposes. It does not affect the capability of the land under which it would be developed for primary industry production and the natural resource base would not be affected.
To encourage diversity in primary industry enterprises and systems appropriate for the area.	The modification would not affect the diversity in primary enterprises and systems, as the activities would occur on land already established and used for mining activities.
To minimise the fragmentation and alienation of resource lands.	The modification would occur on an established mine site. It would not fragment or alienate resource lands.
To minimise conflict between land uses within this zone and land uses within adjoining zones.	The modification would occur on an established mine site. There will be no new land disturbed for operations and therefore no land-use conflicts between land-uses in this zone would result.

Table 4.5 Bland LEP RU1 Primary Production zone objectives

Objective	Consistency review
To provide opportunities for intensive and extensive agriculture in appropriate locations consistent with the environmental capability of the land.	The modification would continue the use of land to supply water to the mine and does not affect the provision of opportunities for intensive and extensive agriculture.

As such, the development proposed in this modification application is considered to be generally consistent with the relevant objectives of the Bland LEP and Forbes LEP.

4.5 Strategic policies

4.5.1 Strategic Regional Land Use Policy

The NSW Government released the Strategic Regional Land Use Policy (SRLUP) in 2012 to "provide greater protection for valuable agricultural land and better balance competing land uses" by "identifying and protecting strategic agricultural land, protecting valuable water resources and providing greater certainty for companies wanting to invest in mining and coal seam gas projects in regional NSW". The SRLUP provides a strategic framework and a range of initiatives to balance agriculture and resource development.

The SRLUP applies to mining proposals that are SSD under the Mining SEPP and require a new or extended mining lease under the NSW Mining Act. In such cases, applicants are required under the Mining SEPP to obtain a gateway certificate or a site verification certificate before lodging a development application.

In this regard, Mod 16 is not predicted to result in any significant adverse impacts on valuable agricultural land, valuable water resources or other land uses in the vicinity of the project.

4.5.2 NSW Aquifer Interference Policy

The AIP was released by the NSW government in September 2012 to address water licensing and the potential impacts of aquifer interference activities within NSW. The AIP defines the regime for protecting and managing the impacts of aquifer interference activities on NSW's water resources and assist proponents to prepare necessary information for activities that may affect aquifers.

The AIP aims to:

- clarify water licence and impact assessment requirements for aquifer interference activities;
- ensure equitable water sharing among different types of water users;
- ensure that water taken by aquifer interference activities is properly licensed and accounted for in the water budget and water sharing arrangements; and
- enhance existing regulation, resulting in a comprehensive framework to protect the rights of all water users and the environment.

The AIP states that a proposed development must address minimal impact consideration for impacts on water table, water pressure and water quality. It requires planning for measures if the actual impacts are greater than predicted, including making sure that there is sufficient monitoring in place.

The AIP focuses on high risk activities such as mining, coal seam gas, sand and gravel extraction, construction dewatering, aquifer injection activities, and other activities that have the potential to contaminate groundwater or decrease aquifer storage and yields. Impacts on connected alluvial aquifers and surface water systems, as well as impacts to other water dependent assets, such as water supply bores and groundwater dependent ecosystems are also considered.

Relevantly, the AIP requires that the proponent of a mining development that may result in aquifer interference carry out an assessment of the proposed development against the minimal impact considerations in Table 1 of the AIP, which addresses water table, water pressure and water quality impacts. If the predicted impacts are less than the applicable Level 1 minimal impact considerations set out in Table 1 of the AIP, then these impacts will be considered as acceptable.

An assessment of Mod 16 against the minimal impact considerations in Table 1 of the AIP is set out in in Appendix B of the Groundwater Assessment (Coffey 2020), refer to Appendix G and Appendix H of this EIS.

With respect to licensing under the WM Act, Evolution will hold the required water access licences and WM approvals to account for the "take" of the modified development.

With respect to the baseline groundwater data requirements under the AIP, as described in Appendix A of the Groundwater Assessment (Coffey 2020), baseline data has been collected for the modified development with groundwater levels and groundwater quality monitored via a dedicated groundwater monitoring network since 2004.

4.5.3 Riverina Murray Regional Plan 2036

The Riverina Murray Regional Plan 2036 (the RMR Plan) was released by DPIE in 2017 to guide the land use planning priorities and decision making in the Riverina Murray Region for the next 20 years. It covers the LGAs of Albury, Berrigan, Bland, Carrathool, Coolamon, Cootamundra-Gundagai, Edward River, Federation, Greater Hume, Griffith, Hay, Junee, Leeton, Lockhart, Murray River, Murrumbidgee, Narrandera, Snowy Valleys, Temora and Wagga Wagga.

The RMR Plan provides a strategic framework to grow the region's cities and local centres, supports the protection of high-value environmental assets and makes developing a strong, diverse and competitive economy central to build prosperity and resilience in the region. The goals of the RMR Plan are:

- a growing and diverse economy;
- a healthy environment with pristine waterways;
- efficient transport and infrastructure networks; and
- strong, connected and healthy communities.

The RMR Plan identifies the LGA economic opportunities for West Wyalong to be agribusiness, mining and tourism.

Mining is noted as a priority growth sector, as the region contains valuable mining resources. Direction 12 of the goal 'a growing and diverse economy' is to 'sustainably manage mineral resources'. It is identified that the mineral resources sector provides economic and employment benefits to the local communities and the broader region.

The MRM Plan notes that care must be taken to manage the impacts of mining to produce long-term sustainable economic, social and environmental outcomes, and so there is potential for other land uses amongst mining. The development as modified will have limited impacts towards multiple environmental factors, such as air quality, noise, biodiversity (including the forestry industry), ground water and surface water.

It will not impact the local or regional road network (including freight corridors), tourism or community services (including health, business, manufacturing or industrial services). It will not impact local or regional Aboriginal and historic heritage values or amplify housing demand.

The development as modified can be considered consistent with the abovementioned directions and goals of the MRM Plan.



Chapter 5 Stakeholder engagement

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5 Stakeholder engagement

5.1 Introduction

This chapter provides an overview of the outcomes of community and stakeholder engagement actions undertaken for the Underground Development Project and Mod 16 by Elton Consulting (Elton 2020a). The engagement program included a number of communications methods to ensure community members directly or indirectly affected and other stakeholders, are kept informed about the proposals.

Evolution has been actively engaging with and supporting the surrounding community since the commencement of operations at CGO in 2005. A range of stakeholders were consulted in relation to the Underground Development Project, including members of the local community, neighbouring landowners, Bland Shire Council, Forbes Shire Council, Lachlan Shire Council and CGO's existing Community Environmental Management Consultative Committee (CEMCC).

The CEMCC is well established and has been operating since 2014. It provides a vehicle for Evolution to regularly report on its operations to the community and to discuss issues of importance to that community. Over the years the CEMCC has provided continual and increased opportunity for community participation and the establishment of productive working relationships between Evolution and the participating community members.

Targeted consultation was completed during the Scoping Phase of the Underground Development Project, which included consultation on the changes relevant to Mod 16, and meetings with stakeholders and the CEMCC. The engagement process has been guided by Evolution's core values of accountability, excellence, respect and safety.

5.2 Consultation requirement

The EP&A Act objects include:

> (j) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

Consultation has been undertaken in accordance with the relevant requirements of the SEARs received for the Underground Development Project on 26 August 2020, in which DPIE emphasised the importance of effective and genuine community consultation in preparing the EIS for the Underground Development Project. It also asked that the process ensure that the community has a good understanding of the Underground Development Project and its potential impacts and is actively engaged on issues of concern. It also asked for the EIS to describe the consultation that was carried out, identify the issues raised during this consultation and to explain how Evolution proposes to address these issues during the execution of the Underground Development Project.

CGO's existing CEMCC was consulted on the proposed modification during the Scoping Phase and during the preparation of the modification report, in accordance with a Community and Stakeholder Engagement Plan.

5.3 Stakeholder engagement approach

5.3.1 Stakeholder engagement tools

Stakeholder engagement used several different communications methods to consult, record and respond to those stakeholders and is outlined in Table 5.1. The variety of methods used was, in part, in consideration of COVID-19 restrictions and collectively, were used to ensure stakeholders were fully informed of the proposals and could use at least one of several options to provide feedback during the preparation of the EIS and modification report.

Table 5.1 Overview of engagement tools

Engagement activity	Description
Emails	Emails were sent to 36 individual community members and neighbouring landholders. The email included an overview of the Underground Development Project's consultation process, a copy of the Community Newsletter and direction on where to direct enquires about the Underground Development Project.
Website	A website was created (https://evolutionmining.com.au/cgo-env-statement/) which included a project description, information on upcoming engagement, a link to an online feedback survey and contact details of the community engagement team.
Newspaper advertisements	Newspaper advertisements were published in the Forbes Advocate (4 September 2020), West Wyalong Advocate (4 September 2020) and Condobolin Argus (9 September 2020) to provide project information, contact details of the project's community engagement team and request feedback proposals
Community newsletter	One community newsletter was prepared and distributed across the Bland, Lachlan and Forbes LGAs as well as in email to community members and local landholders. This included: • 3,000 copies of the newsletter distributed across the Bland Shire LGA; • 2,000 copies of the newsletter distributed across the Lachlan Shire LGA; and • 2,500 copies of the newsletter distributed across the Forbes Shire LGA. The community newsletter provided project information and contact details of the project's community engagement team.
Displays	A display suite was exhibited at local libraries within the Bland, Lachlan and Forbes LGAs. These displays showed information on the Underground Development Project and Mod 16, how to register for the online community information sessions and provided hard copies of the survey.
Project email address and telephone	A dedicated project email address and phone number was created and shared through engagement activities. The phone number and email address was monitored by the project's community engagement team.
Survey	A survey was developed for community members to provide their feedback of the Underground Development Project. The survey was published via the website and hard copies were located at the local library displays.
Social media	Social media posts were shared across local council and community Facebook pages to notify community members of the Underground Development Project's online community information sessions and surveys.
Stakeholder meetings	Separate meetings were held with: • the Bland Shire, Lachlan and Forbes councils; • the CEMCC; and • six individual neighbouring landowners.
Online community information sessions	Three online community sessions conducted by an independent facilitator were held in September. The aim of these sessions was to provide project information, such as an outline of the proposal, technical studies completed as part of the EIS and modification report and efforts that have been made to minimise potential environmental impacts. In total, there were 10 participants across the three meetings.

5.4 Stakeholder engagement results

The results of the engagement actions that were undertaken are summarised below. The results should be considered along with the results of the Social Impact Assessment (SIA) that has also been prepared for the Underground Development Project by Elton (2020b) and summarised in section 6.16. The SIA provides further detail and context on the Underground Development Project's social impact to local and regional stakeholders.

5.4.1 Online community information sessions

Three community information sessions were held in September 2020. The sessions were held online due to NSW Government restrictions on social gatherings arising from the COVID-19 pandemic. A total of 10 people attended the community information sessions. Key themes of interest that were identified during the sessions are summarised in Table 5.2.

Table 5.2 Summary of online community information sessions

Key theme	Items discussed
Community benefits	• Regional benefits, including employment opportunities and contribution to local businesses.
Accommodation options	• Location of the proposed accommodation village option. • Opportunity for local accommodation businesses in the area to be utilised during the early stages of the Underground Development Project.
Water usage	• surface water and groundwater impacts. • Proposed mitigation measures to ameliorate impacts on neighbouring landowners.
Toxicity impacts to soil	• Cyanide usage at the mine and emplacement in the tailings facilities.
Safety	• Safety of underground mining as it is a new mining method for CGO.
Visual impacts	• Visual impact of the mine at neighbouring properties.
Size and operation of the mine	• Potential future expansion of the underground development.
Consultation with Aboriginal community members	• Evolution's existing agreements with registered Aboriginal parties.

5.4.2 Survey

An online survey was made available on a dedicated Evolution Project website. The survey included questions on the following:

- awareness of the Underground Development Project, Mod 16 and the associated accommodation village;
- general perception of the Underground Development Project;
- elements of the Underground Development Project (including the Mod 16 elements);
- if further information was required; and
- values of the local area.

In total, 19 respondents completed the survey. Of this number, 63% of respondents identified that they were aware of the Underground Development Project. The survey results also show:

- perception of the Underground Development Project is positive to very positive for those who are aware of the Underground Development Project;

- issues of most interest included:
  - potential local employment benefits;
  - the Underground Development Project's impact on usage of public infrastructure, services and facilities;
  - the Underground Development Project's impact on water security;
  - population change as a result of the Underground Development Project;
  - public safety and the environment; and
  - community investment.

Overall, the survey results show that the participants value their way of life, how safe the region is and the sense of community in the region's towns.

5.4.3 Stakeholder meetings

i Council meetings

Evolution met with Bland Shire Council, Forbes Shire Council and Lachlan Shire Council to discuss the Underground Development Project and to update the councils on the progress of the EIS studies. The Underground Development Project and Mod 16 were perceived as a positive for the region by the councils. Items discussed at each of the council meetings are summarised in Table 5.3.

Table 5.3 Summary of council meetings

Council	Date of meeting	Issues raised
Bland Shire Council	26 May 2020	• Design of the underground development, including the size of stopes. • Safety of the underground development. • Commencement date of the underground development. • The accommodation village. • Opportunity for local businesses to be utilised.
Forbes Shire Council	28 May 2020	• Operation and timeframe of the underground development. • Future water management and delivery plans. • Composition of the proposed additional workforce. • Potential partnership initiatives to benefit the local community. • Opportunity for local accommodation businesses to be utilised.
Lachlan Shire Council	2 June 2020	• Water capture and recycling. • Upskilling of existing workforce. • The workers accommodation village. • Composition and safety of the proposed additional workforce.

ii Neighbouring landowner meetings

One-on-one meetings and semi-structured phone interviews were held with six landowners near to the CGO site.

The reaction to the Underground Development Project in these meetings was generally positive, largely based on the landowners' recognition of the economic benefits of the mine for the regional economy.

Observations were made by the interviewees in relation to noise and the visual impact of the existing mine. For most neighbours, these impacts are acceptable when weighed against the positive economic impacts. Comments were made in relation to local business operators and agricultural operators when trying to attract and retain local employees noting that they cannot compete with mine wages. Suggestions were also made in relation to upskilling younger members of the community, to attract them to continue to reside in the area and that Evolution could look to help upskill local people.

Comments were also made about housing the workforce and that the construction of the Underground Development Project would coincide with other construction projects in the region and should therefore motivate the construction of an accommodation village by CGO.

Traffic issues in relation to the current mining operations were raised by neighbours. They commented that Evolution's worker shuttle bus service has a positive effect on minimising traffic impacts in the region. General suggestions were also made for Evolution to consider improving the surface of local roads.

In general, the landowners acknowledged that interactions with the Evolution team have improved over time with win-win arrangements with nearby landowners.

iii Community Environmental Management Consultative Committee

A workshop was held with the CEMCC held during the Scoping Phase of the Underground Development Project which was positively received and consultation in relation to the Underground Development Project has continued with CEMCC during the EIS preparation since that time. A briefing was held with the CEMCC on 4 June 2020 to discuss the significant advances in project planning and the changes that were made to the Underground Development Project since the Scoping Phase workshop.

During the June meeting, the CEMCC members were interested in how Evolution planned to manage water at the site during the operation of the Underground Development Project and, in particular, whether it would still rely on water from off-site sources at the current rates of extraction. The CEMCC members were also interested in the potential economic and social benefits to the region from the creation of additional jobs at the mine.

5.4.4 Other consultation

The other consultation methods listed in Table 6.1 resulted in the following engagements:

- 134 visits to the dedicated CGO website for the Underground Development Project;
- 29 likes and 11 shares of social media posts; and
- One telephone enquiry, and no email enquiries.

5.5 Ongoing stakeholder engagement

Evolution will continue to work closely with the local community, councils and neighbouring landowners to ensure these stakeholders are kept informed of the Underground Development Project's progression, with a particular focus on the areas of interest identified in the various consultation meetings, such as water usage and management, the accommodation village and composition of the additional workforce. Engagement using the same suite of communication methods will be continued as the Underground Development Project is developed.

5.6 Summary and conclusion

Evolution has undertaken a comprehensive consultation program in accordance with the assessment requirements. The results of the consultation show that, in general, many members of the local community support the Underground Development Project and Mod 16 due to the potential social and economic benefits that would accrue from the continued operation of the mine and the jobs it would create through the construction and operational stages.

One-on-one briefings were provided to neighbouring landowners, who generally voiced concerns in relation to impacts from the current mine operations, including noise and visual impacts and traffic matters.

In response to the NSW Government's restriction on large-scale community gatherings arising from COVID-19 restrictions, online community forums were undertaken as a result of COVID-19 restrictions. The participants of the forums asked a range of questions about the potential environmental impacts of the Underground Development Project and how it would be managed.

The online survey on the Evolution website resulted in a mostly positive response to the Underground Development Project due to the potential economic investment in the region.

Evolution has committed to continuing its consultation activities with the community throughout the development of the Underground Development Project and Mod 16.



Chapter 6 Assessment of impacts

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6 Assessment of impacts

6.1 Introduction

The potential environmental impacts of the proposed modification are identified in the *Cowal Gold Operations: Underground Development Modification 16 to DA 14/98 Scoping Report* (EMM 2019). The assessment approach for each environmental aspect was determined based on the potential environmental impacts and DPIE's guidance provided on 27 September 2019 regarding the assessment of Mod 16.

The environmental aspects for which a technical report was prepared are summarised in Table 6.1. The findings of each technical report are summarised in this chapter. The potential impacts of the proposed modification on biodiversity, geochemistry, Aboriginal and historic heritage, hazards, public safety and health, and waste management are assessed in this chapter alone.

Considering that the underground development project will not operate in isolation and requires surface changes to be made, the technical assessments reproduced in the Appendices to this Modification Report were undertaken as a holistic assessment of the impacts associated with both applications.

Table 6.1 Environmental assessment

Environmental aspect	Technical assessment	Proposed modification report section
Air quality	Appendix E	Section 6.2
Greenhouse gas	Appendix E	Section 6.3
Noise and vibration	Appendix F	Section 6.4
Groundwater	Appendix G Appendix H	Section 6.5
Surface water	Appendix I	Section 6.6
Biodiversity	-	Section 6.7
Geochemistry	Appendix J	Section 6.8
Aboriginal heritage	-	Section 6.9
Historic heritage	-	Section 6.10
Traffic and transport	Appendix K	Section 6.11
Rehabilitation	Appendix L	Section 6.12
Visual amenity	Appendix M	Section 6.13
Hazards, public safety and health	-	Section 6.14
Waste management	-	Section 6.15
Social	Appendix N	Section 6.16
Economic	Appendix O	Section 6.17

6.2 Air quality

6.2.1 Introduction

An air quality impact assessment (AQIA) has been prepared by EMM and is included as Appendix E.

The AQIA documents the existing air quality and meteorological environment, applicable impact assessment criteria, air pollutant emission calculations, dispersion modelling of calculated emissions and provides an assessment of predicted impacts relative to criteria.

Due to the complexity of separating out impacts of Mod 16 from the Underground Development Project, and considering that the Underground Development Project will not operate in isolation and requires surface changes to be made, the assessment of air quality impacts presented here is a cumulative assessment of the impacts associated with both applications.

6.2.2 Assessment requirements

The air quality assessment requirements for Mod 16 and where they are addressed in this assessment report are listed in Table 6.2.

Table 6.2 Air quality related assessment requirements

Requirement	Location in this document
The goals of the project in relation to air quality should be to ensure sensitive receptors are protected from adverse impacts from odour and dust.	The existing air quality management plan and monitoring programme will be reviewed and updated, as required, for the Underground Development Project (refer section 6.2.9)
Details would need to be provided on the proposed measures to manage odour and dust from all sources. Measures to prevent or control the emission of odour from the composting activities must be detailed based on the outcome of an air quality impact assessment undertaken in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2016). All potentially impacted residential or sensitive premises likely to be impacted by the development must be identified and included in the assessment.	Refer section 6.2.9 for proposed measures to manage dust. Refer to section 6.2.5v for odour.
The Assessment Report should identify any other existing impacts on air quality within the area and if necessary provide an assessment and commentary on the predicted cumulative impacts that may arise.	Cumulative impacts are assessed in section 6.2.8ii
Emissions from any plant must meet the design criteria detailed in the Protection of the Environment Operations (Clean Air) Regulation 2010. Details need to be provided on the proposed air pollution control techniques from any air emission points, including proposed measures to manage and monitor efficiency and performance.	Refer section 6.2.5iii

Additionally, the AQIA has been prepared in general accordance with the guidelines specified by the NSW Environment Protection Authority (EPA) in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016).

6.2.3 Existing environment

Meteorological conditions have been described and characterised in Appendix E using data from the CGO on-site meteorological station. Existing air quality was characterised using data from the on-site monitoring network, supported with data from rural monitoring sites operated by DPIE.

To assess potential cumulative impacts from the Underground Development Project, Appendix E has also characterised the existing ambient air quality environment primarily on data from the air quality monitoring program for CGO, which includes a network of 12 dust deposition gauges (DDGs) and one High Volume Air Sampler (HVAS) (measuring total suspended particles (TSP)).

The meteorological conditions and existing ambient air quality environment have been used to input into the model to determine potential impacts. Further details regarding the meteorological characteristics and existing ambient air quality environment are in Appendix E.

6.2.4 Assessment locations

The area surrounding the CGO site includes rural residential properties, with the closest located approximately 2.3 km south-west of the CGO. In order to assess potential air quality impacts across the surrounding area, the closest residences around the Underground Development Project have been selected as discrete model prediction locations. Details are provided in Table 6.3 and their locations are shown in Figure 6.1.

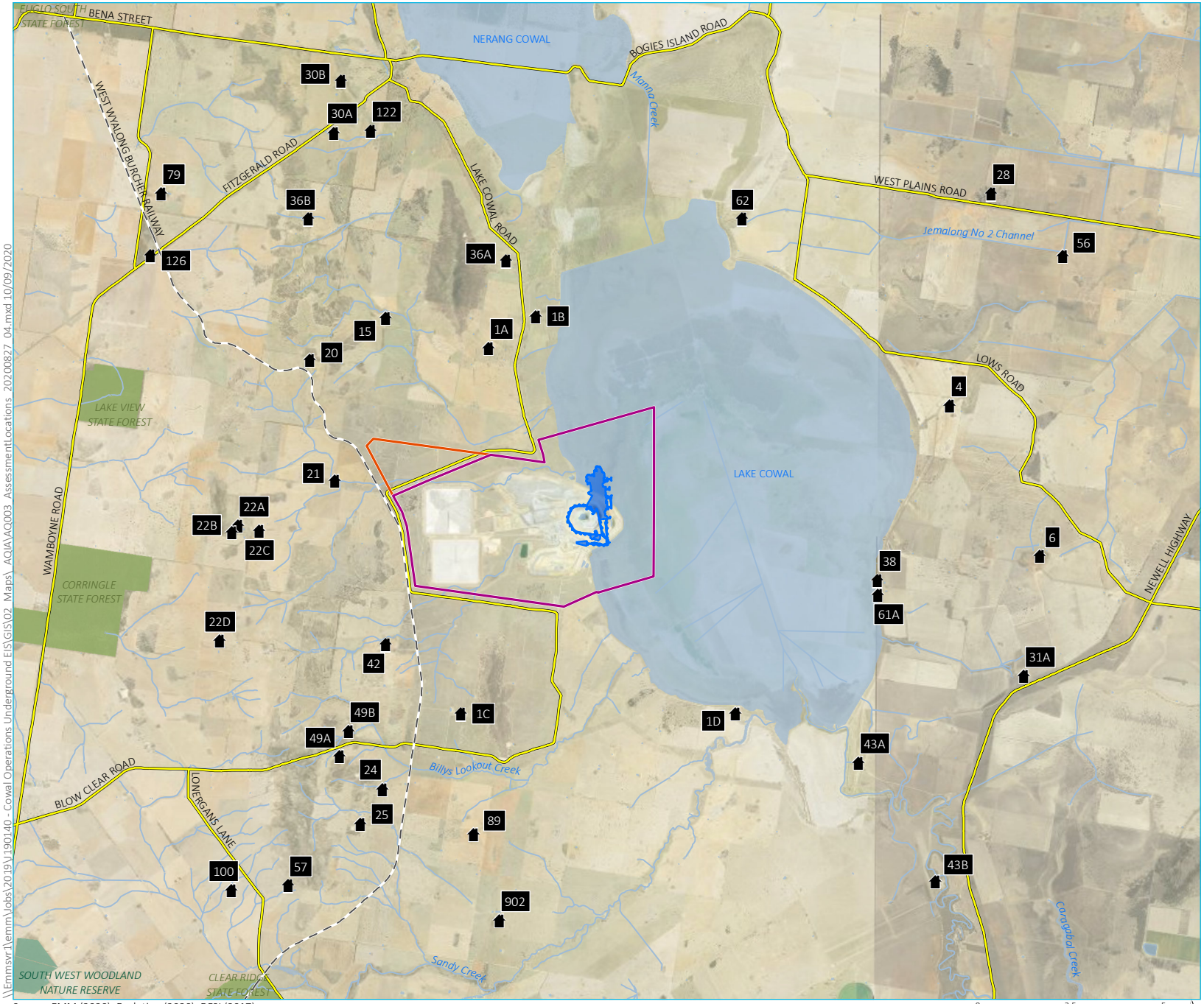
The selected residences are referred to as assessment locations. Assessment locations 1a to 1d are classified as mine-owned residences, while the remaining are classified as private residences.

Table 6.3 Air quality assessment locations

Figure ID	Assessment location type	Easting (MGA Zone 55 GDA94)	Northing (MGA Zone 55 GDA94)
1a	Residential (mine-owned)	535153	6282548
1b	Residential (mine-owned)	536424	6283400
1c	Residential (mine-owned)	534407	6272697
1d	Residential (mine-owned)	541794	6272704
4	Residential	547567	6281001
6	Residential	549989	6276946
15	Residential	532378	6283364
20	Residential	530337	6282231
21	Residential	531013	6278985
22a	Residential	528402	6277761
22b	Residential	528249	6277583
22c	Residential	528976	6277626
22d	Residential	527918	6274662
24	Residential	532297	6270665
25	Residential	531695	6269734
28	Residential	548681	6286710

Table 6.3 Air quality assessment locations

Figure ID	Assessment location type	Easting (MGA Zone 55 GDA94)	Northing (MGA Zone 55 GDA94)
30a	Residential	530989	6288345
30b	Residential	531171	6289740
31a	Residential	549554	6273711
36a	Residential	535625	6284898
36b	Residential	530297	6286030
38	Residential	545613	6276295
42	Residential	532383	6274566
43a	Residential	545105	6271379
43b	Residential	547179	6268189
49a	Residential	531145	6271554
49b	Residential	531386	6272221
56	Residential	550605	6285032
57	Residential	529760	6268071
61a	Residential	545627	6275893
62	Residential	541979	6286026
79	Residential	526342	6286717
89	Residential	534740	6269452
902	Residential	535441	6267131
100	Residential	528226	6267940
122	Residential	531978	6288396
126	Residential	526050	6285038



\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02 Maps\ AQIA\AQ003 AssessmentLocations 20200827 04.mxd 10/09/2020

Source: EMM (2020); Evolution (2020); DFSI (2017)

Air quality assessment locations

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.1

EMM
creating opportunities

6.2.5 Assessment criteria

i Impact assessment criteria for particulate matter

Consistent with AQIA for the most recent previous CGO modifications, this assessment will focus on emissions and impacts from particulate matter, which includes TSP, particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}), and particulate matter less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$).

The impact assessment criteria are designed to maintain ambient air quality that allows for the adequate protection of human health and well-being and is outlined in Table 6.4.

Table 6.4 Impact assessment criteria for particulate matter

PM metric	Averaging period	Impact assessment criterion
TSP	Annual	90 µg/m^3
PM_{10}	24 hour	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hour	25 µg/m^3
	Annual	8 µg/m^3
Dust deposition	Annual	2 g/m^2/month (project increment only)
		4 g/m^2/month (cumulative)

Notes: µg/m^3: micrograms per cubic meter; g/m^2/month: grams per square metre per month

ii Voluntary land acquisition and mitigation policy

In September 2018, the then NSW Department of Planning and Environment (now DPIE) released the Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments.

Under the VLAMP, if a development cannot comply with the relevant impact assessment criteria, or if the mitigation or acquisition criteria may be exceeded, the applicant should consider a negotiated agreement with the affected landowner or acquire the land. In doing so, the land is then no longer subject to the impact assessment, mitigation or acquisition criteria, although provisions do apply to the "use of the acquired land", primarily related to informing and protecting existing or prospective tenants. The VLAMP describes the voluntary mitigation and land acquisition policy to address dust and noise impacts, and outlines mitigation and acquisition criteria for particulate matter. The VLAMP criteria is detailed further in Appendix E and has been considered in this AQIA in relation to dust at private residential assessment locations. There are no private residences where the VLAMP criteria are triggered.

iii POEO (Clean Air) Regulation

The statutory framework for managing air emissions in NSW is provided in the POEO Act and the primary regulation for air quality made under the POEO Act is the Protection of the Environment Operations (Clean Air) Regulation 2010[4] (POEO Regulation). As a scheduled activity under the POEO Regulation, the Underground Development Project will operate under an EPL and will comply with the associated requirements, including emission limits, monitoring and pollution reduction programmes (PRPs).

[4] http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+428+2010+cd+0+N

iv Hydrogen cyanide

Cyanide (CN) is used as a reagent in the processing plant and can lead to small amounts of fugitive emissions of hydrogen cyanide (HCN) through volatilisation from storage tanks and the IWL. CGO operate under an existing approved Cyanide Management Plan, which includes cyanide monitoring and incident response measures. The Underground development Project will result in a relatively small increase in cyanide usage and therefore no change is anticipated to the management measures currently in place.

No further assessment of HCN is therefore presented in this report.

v Odour

There are no significant sources of odour identified for the Underground Development Project. The processing plant may use small quantities of potassium amyl xanthate (PAX), which has a pungent odour, however off-site odour impacts from its use do not currently occur (a review of the complaint register indicates that no odour complaints have been received from surrounding residences). There would be no significant increase in usage of PAX from the Underground Development Project and therefore no further assessment of odour is presented in this modification report.

6.2.6 Emissions inventory

An emissions inventory has been developed for a single representative mining year, selected to assess the air quality impact of worst-case operational conditions. The emissions inventory includes existing (approved) open-cut operations, as well as operations as part of the Underground Development Project and Mod 16.

The proposed mining schedule for the Underground Development Project is shown in Figure 6.2, along with the approved material movement for the open-cut pit. The total material movement for the underground development peaks in financial year 2024 (FY24); however, when the Underground Development Project is combined with the open-cut production schedule, the year with the maximum combined total movement of ore and waste at the site is FY22. This year is therefore selected as the modelled emissions scenario.

The Modification 14 emissions scenario has been updated to reflect the 2022 open-cut production schedule and incorporate the 2022 underground development production schedule, to develop an emission scenario that corresponds to the maximum combined total movement of ore and waste at the site. Emissions of TSP, PM_{10}, $PM_{2.5}$ were estimated and modelled. This conservative approach demonstrates that the overall impact of the Underground Development Project compared to the open-cut mining will be minimal. Figure 6.2 shows that even when the open-cut component has closed (by FY26) and the Underground Development Project is running at full capacity, it still only amounts to ~10% of the material movements of the open-cute component. Considering most of the particulates in the plume dispersion originates from truck movements and blasting, the actual impact for the local residents will be a significant improvement in air quality.

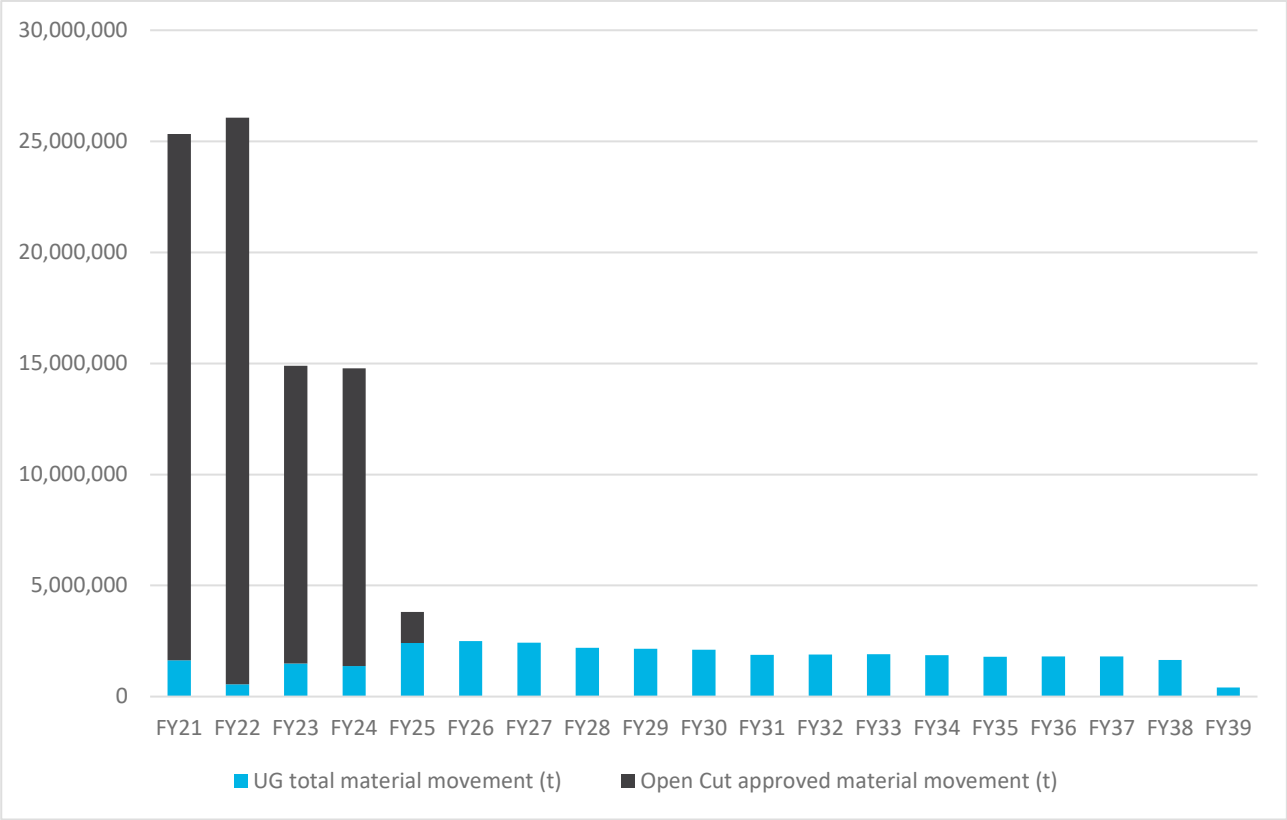


Figure 6.2 Proposed mining schedule for the underground development and open-cut and total material movement

In addition to the emission estimates for existing (approved) operations, the following activities are considered in the dust emission estimates for the Underground Development Project and Mod 16.

Underground development

- development of a box-cut entry to the underground workings;
- additional blasting required to develop the underground stopes;
- mining (extraction) of material from underground workings;
- trucking of ore and waste to the surface; and
- development of a paste fill plant, and the delivery of paste fill via a borehole and the backfilling underground stopes with the paste.

Emissions for these underground mining activities are modelled as a release from the Exhaust Adit point.

Surface changes modification

- hauling waste and ore to the waste rock dump and processing plant;
- unloading waste and ore at the waste rock dump and processing plant;
- rehandling ore to the crusher and processing of ore (crushing/screening); and
- loading the coarse ore stockpile.

Minor changes to the IWL footprint/height associated with Mod 16 are considered negligible from an air quality perspective, however activities at the IWL are included as an emission source for existing operations. Material movement during development of the box cut is included in FY21 mining schedule, and is less than material movement during the modelled scenario (FY22). Accordingly, an additional modelling scenario for the development of the box cut was not considered necessary. Activities associated with producing the cemented paste to backfill the mined underground stopes are not considered as significant dust sources.

The Underground Development Project's contribution to annual dust emissions by source type is provided in Figure 6.3 and further detail is provided in Appendix E. Emissions are presented separately for existing (approved operations) and the underground development (including surface changes and underground sources). The most significant source of particulate matter emissions from the operation of the Underground Development Project is associated with hauling of materials and wind erosion. This is typical for facilities involving open-cut mining operations.

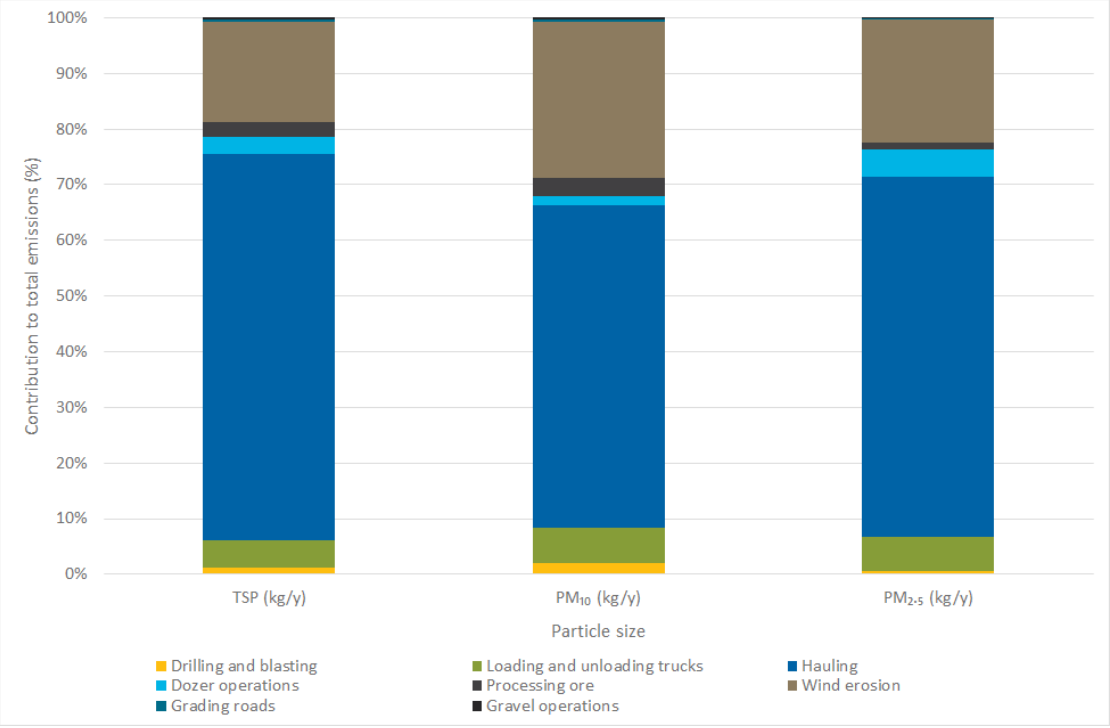


Figure 6.3 Contribution to annual emissions by emissions source type and particle size

A comparison of the estimated emissions from the approved open-cut operations (Modification 14), the surface changes due to Mod 16 and the Underground Development Project is shown in Figure 6.4 and further detail is provided in Appendix E. The emissions data show that the Mod 16 surface changes make up approximately 1% of the already approved open-cut operations while the Underground Development Project makes up approximately 3 per cent to 4 per cent of the already approved open-cut operations.

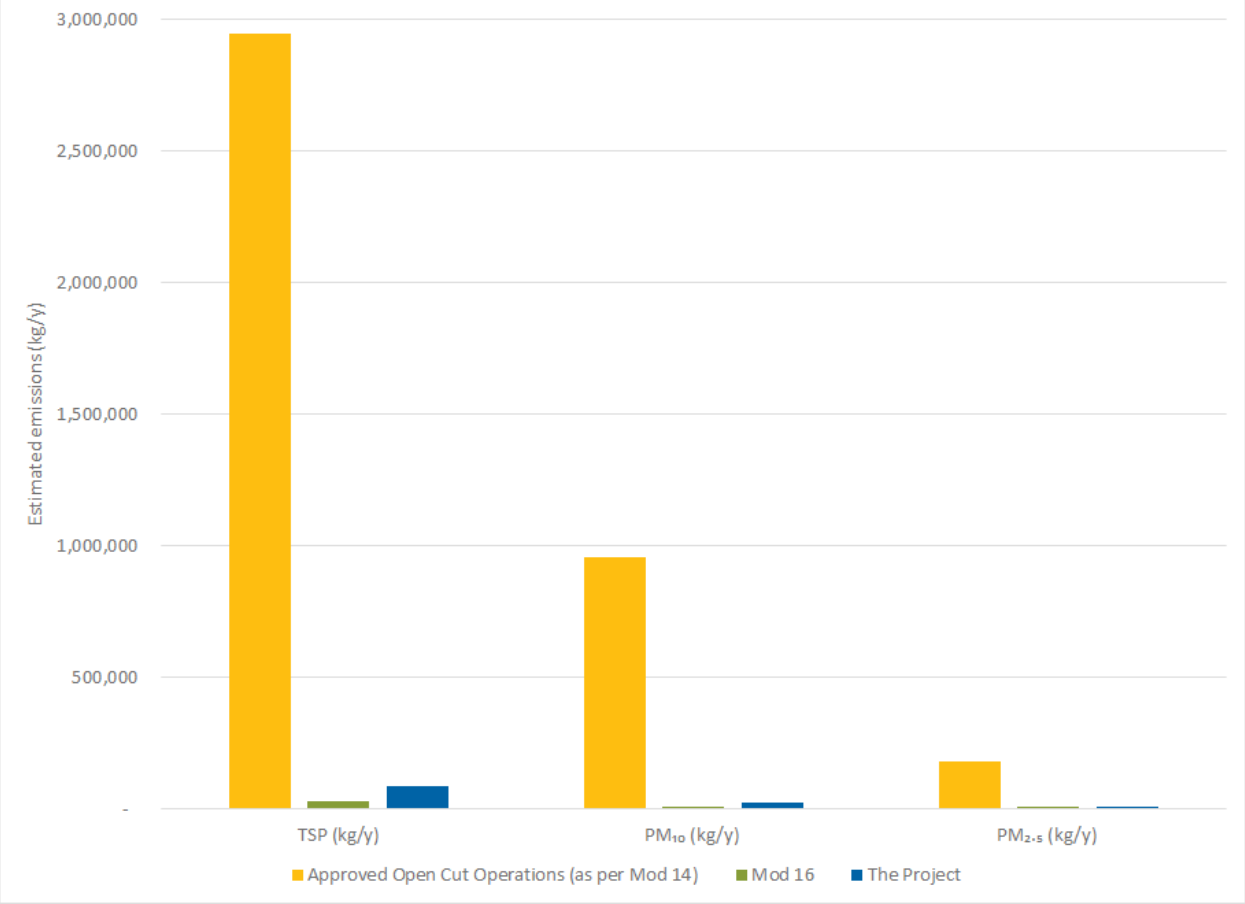


Figure 6.4 Comparison of estimated TSP, PM_{10} and $PM_{2.5}$ emissions for the approved open-cut, Mod 16 surface changes and the underground workings SSD

6.2.7 Dispersion modelling method

The atmospheric dispersion modelling completed for this assessment used the AERMOD dispersion model (version v18081). AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain.

6.2.8 Modelling results

i Project-only modelling results

A summary of the modelling results for each particulate size fraction include:

- the highest predicted project-only increment in annual average PM_{10} at a private receptor is <0.1 µg/m³ and the highest predicted increment in 24-hour average PM_{10} at a private receptor is 0.5 µg/m³.

Comparing this to the modelling results for the total combined site operations, the highest predicted increment in annual average PM_{10} at a private receptor is 2.0 µg/m³ and the highest predicted increment in 24-hour average PM_{10} at a private receptor is 15.0 µg/m³;

- the highest predicted increment in annual average $PM_{2.5}$ at a private receptor is <0.1 µg/m³ and the highest predicted increment in 24-hour average $PM_{2.5}$ at a private receptor is 0.1 µg/m³. Comparing this to the modelling results for the total combined site operations, the highest the highest predicted increment in annual average $PM_{2.5}$ at a private receptor is 0.4 µg/m³ and the highest predicted increment in 24-hour average $PM_{2.5}$ at a private receptor is 3.0 µg/m;

- the highest predicted increment in annual average TSP at a private receptor is 0.1 µg/m³. Comparing this to the modelling results for the total combined site operations, the highest predicted increment in annual average TSP at a private receptor is 2.0 µg/m³; and

- the highest predicted increment in annual average dust deposition at a private receptor is <0.1 g/m²/month. Comparing this to the modelling results for the total combined site operations, the highest predicted increment in annual average dust deposition at a private receptor is 0.1 g/m²/month.

There are no private residences where the short-term VLAMP criteria are triggered.

In summary, the results of the modelling show that the predicted concentrations and deposition rates for incremental particulate matter (TSP, PM_{10}, $PM_{2.5}$ and dust deposition) are below the applicable impact assessment criteria at all assessment locations. For all pollutants and averaging periods, the project alone (underground development and associated surface changes), represents a minor change from the existing open-cut operations.

ii Cumulative results

This conservative approach used in modelling demonstrates that the overall impact of the Underground Development Project compared to the open-cut mining will be minimal, as 98% of the material movements used in the emission estimate of FY22 will be associated with earthmoving from the open-cut (refer Figure 6.2).

Furthermore, it is noted that the dominant sources of particulate matter emission from the CGO are those associated with surface truck movements and blasting. Therefore, annual emissions and associated impacts to local residents will experience a progressive reduction as mining transitions from the open-cut to the Underground Development Project.

When recorded ambient background concentrations are added to the predicted concentration levels and averaged out over a year, the cumulative concentrations for all pollutants were predicted to be below the applicable impact assessment criteria at all surrounding private receptor locations.

The 24-hour average PM_{10} criterion (50 µg/m³) is predicted to be exceeded at a number of private receptors, up to two additional days per year above background. However, these predicted two additional exceedance days coincide with elevated background concentrations of 49.7 µg/m³ and 49.2 µg/m³ that were associated with regional-scale dust storm events.

To further investigate the likelihood of additional cumulative exceedance for 24-hour average PM_{10} concentrations, a frequency analysis was conducted using an extended five-year background dataset for the receptors with the highest mine-only predictions. This analysis showed that the probability of additional days above 50 µg/m³ was very low, with less than one additional criterion exceedance day predicted for each receptor. On the basis of the analysis conducted, it is considered that the likelihood that the project would result in exceedance of the 24-hour average PM_{10} criterion is very low.

The maximum predicted cumulative 24-hour $PM_{2.5}$ concentrations were below the impact assessment criterion at all assessment locations. Finally, there are no private residences where the VLAMP criteria are triggered.

iii Construction phase impacts

Material movement during development of the box cut is included in FY21 mining schedule and is less than material movement during the modelled scenario (FY22). Therefore, an additional modelling scenario for the development of the box cut was not considered necessary. The air quality impacts associated with additional construction activities would be relatively minor when compared to the modelled scenario of open-cut mining operations and the Underground Development Project .

Consequently, construction phase emissions are not inventoried or modelled. In comparison to mining operations, construction activities are short in duration and relatively easy to manage through commonly applied dust control measures. Procedures for controlling dust impacts during construction would be consistent with measures outlined in the AQMP.

The air quality impacts of the construction of the accommodation camp for the Underground Development Project will be considered in a separate development application/environmental impact assessment and have not been considered in this assessment.

6.2.9 Management and mitigation measures

The CGO Air Quality Management Plan AQMP has been developed for approved operations at the site. The dust management measures applied to the emission estimates for Mod 16 are consistent with the AQMP and are outlined in Table 6.3 of Appendix E.

Other control measures adopted at the CGO, while not explicitly applied as reduction factors in the emission calculations, are provided in Table 6.5 below.

Table 6.5 Air quality management measures listed in the CGO AQMP

Source	Management measure
Haul road	• Routes to be clearly marked. • Obsolete roads will be ripped and re-vegetated.
Minor roads	• Minor road development will be limited, and the locations will be defined and within approved surface disturbance areas. • Obsolete roads will be ripped and re-vegetated.
Materials handling	• Prevention of truck overloading to reduce spillage during ore loading/unloading and hauling. • Freefall height during ore/waste stockpiling will be limited.
Soil stripping	• Soil stripping will be limited to areas required for mining operations.
Drilling	• Dust aprons will be lowered during drilling for collection of fine dust.
Blasting	• Fine material collected during drilling will not be used for last stemming. • Adequate stemming will be used at all times. • Blasting will only occur following an assessment of weather conditions by the Environmental Manager to ensure that wind speed and direction will not result in excess dust emissions from the site towards adjacent residences (see the blasting Management Plan for further details).
Equipment maintenance	• Emissions from mobile equipment exhausts will be minimised by the implementation of a maintenance programme to service equipment in accordance with the equipment manufacturer specifications.

Table 6.5 Air quality management measures listed in the CGO AQMP

Source	Management measure
General areas disturbed by mining	• Only the minimum area necessary for mining will be disturbed. • Exposed areas will be reshaped, topsoiled and revegetation as soon as practicable.
Waste emplacement areas	• Exposed active work areas on waste emplacement surfaces will be watered to supress dust where practicable. • Rehabilitation (ie reshaping, topsoil placement and revegetation) will be conducted progressively, as soon as practicable.
Tailings Storage Facility	• During non-operational periods, dust suppression measures will be undertaken to minimise dust emissions from dry exposed areas.
Soil stockpiles	• Long-term stockpiles will be revegetated with a cover crop.
Material handling and ore stockpiles	• Prevention of truck overloading to reduce spillage during ore loading/unloading and hauling. • The coarse ore stockpile will be protected by a hood to prevent wind erosion. • The surface of all stockpiles will be sufficiently treated to minimise dust emissions. Treatment may include application of a dust suppressant, regular dust suppression watering or establishment of vegetation on longer term stockpiles (eg the low-grade ore stockpile).
General exposed areas	• Increased watering of exposed surfaces via water trucks or other methods as required.
Ancillary activities	• Temporary cessation of ancillary or non-essential on-site dust generating activities (eg soil stripping).
Gold room doré melt furnace	• Use of a baghouse and associated collection hood/ducting to remove dust particles.

i Monitoring

The air quality monitoring network for the CGO consists of a meteorological monitoring station, 12 dust deposition gauges and a TSP HVAS. Recent additions to the air quality monitoring program include two new sites with continuous monitoring for PM_{10} and $PM_{2.5}$.

Air quality impacts will continue to be monitored throughout the life of the Underground Development Project. With the addition of these continuous monitoring sites, the existing monitoring network is considered suitable for ongoing operations associated with the Underground Development Project.

There have never been any odour complaints from the site, therefore odour monitoring is not considered necessary.

The air quality impacts of the CGO site will continue to managed under the approved Air Quality Management Plan. The plan includes a rigorous monitoring program and a range of mitigation measures to ensure air quality impacts are minimised throughout the life of the mine.

6.2.10 Summary and conclusion

The results of the modelling show that the predicted concentrations and deposition rates for incremental particulate matter (TSP, PM_{10}, $PM_{2.5}$ and dust deposition) are below the applicable impact assessment criteria at all assessment locations. For all pollutants and averaging periods, the Underground Development Project and Mod 16, represents a minor change from the existing open-cut operations.

When background concentrations are added, the cumulative annual average concentrations for all pollutants were predicted to be below the relevant impact assessment criteria.

However, the predicted cumulative 24-hour average PM_{10} is greater than the impact assessment criterion (50 µg/m³) at a number of private receptors, with two additional days above 50 µg/m Predicted. Further analysis shows that these predicted two additional exceedance days coincide with elevated background concentrations of 49.7 µg/m³ and 49.2 µg/m³ that were associated with regional-scale dust storm events.

Additional cumulative analysis was presented with an extended background dataset, for the receptors with the highest predictions. This analysis shows that the probability of additional days above 50 µg/m³ was very low, with less than one additional criterion exceedance day predicted for each receptor. On the basis of the analysis conducted, it is considered that the likelihood that the project would result in exceedance of the 24-hour average PM_{10} criterion is very low. There are no private residences where the VLAMP criteria are triggered.

The air quality impacts of the CGO site will continue to managed under the approved Air Quality Management Plan for the life of the modified project.

6.3 Greenhouse gas

6.3.1 Introduction

This chapter provides a summary of the greenhouse gas (GHG) impact assessment completed by EMM (2020) for Mod 16 and the underground development, which is provided in full as Appendix E.

This chapter collectively assesses the GHG emissions from both construction and operation of Mod 16 and the Underground Development Project. This is due to the need to cumulatively assess the GHG impacts from both components at the same time and recognises the unnecessary complexity and potential confusion in undertaking separate assessments for each approval process. As a result, this section is identical to the respective section in the EIS.

The GHG assessment is based upon the National Greenhouse Accounts Factors (NGAF) workbook (DoEE 2019) and the *National Greenhouse Energy Reporting Act 2007* (the NGER Act).It estimates Scope 1, 2 and 3 emissions to result from the Underground Development Project in accordance with 'Method 1' of the National Greenhouse and Energy Reporting Measurement (Technical Guidelines) (DoE 2014).

6.3.2 Assessment Requirements

There were no specific requirements received for Mod 16 relating to GHG from agencies. Notwithstanding, this chapter has summarised the GHG assessment undertaken for the Underground Development Project, as the GHG assessment covers the changes to surface infrastructure relevant to Mod 16.

6.3.3 Research method

GHG emissions are estimated using the methodologies outlined in the NGAF workbook and are further detailed in the following sections.

In brief, GHG emission sources are first defined for the scope of work. Annual energy consumption is then detailed for the proposed works and GHG emissions are calculated using the annual consumption data and Scope 1, 2 and 3 emission factors.

6.3.4 Emission sources

GHG emission sources are defined as 'direct' and 'indirect' emissions:

- direct emissions (also referred to as Scope 1 emissions) occur within the boundary of an organisation and as a result of that organisation's activities; and

- indirect emissions are generated as a consequence of an organisation's activities but are physically produced by the activities of another organisation (DoEE 2019).

Indirect emissions are further defined as Scope 2 and Scope 3 emissions. Scope 2 emissions occur from the generation of the electricity purchased and consumed by an organisation. Scope 3 emissions occur from all other upstream and downstream activities, for example the downstream extraction and production of raw materials or the upstream use of products and services.

The GHG emission sources included in this assessment are listed in Table 6.6. These sources represent the most significant sources associated with Mod 16 and Underground Development Project.

Table 6.6 Scope 1, 2 and 3 emissions sources

Scope 1	Scope 2	Scope 3
Direct emissions from fuel combustion (diesel) by onsite plant and equipment	Indirect emissions associated with the consumption of purchased electricity from the state power grid	Indirect upstream emissions from the extraction, production and transport of diesel used for onsite plant and equipment and employee travel
Direct emissions associated with use of explosives (mainly Ammonium Nitrate-Fuel Oil or ANFO)		Indirect upstream emissions from electricity lost in delivery in the transmission and distribution network

6.3.5 Estimated annual energy consumption for the proposed modification and underground development

Estimates of annual energy consumption are detailed in Table 6.7. The estimated energy consumption includes estimated electricity, diesel consumption and explosive usage and were provided by Evolution. The additional electricity consumption for the Underground Development Project has been estimated by scaling CGO's 2019 electricity consumption (as reported under NGERs) pro-rata based on the additional ore processed for the Underground Development Project.

It is noted that Year 2020 of the Underground Development Project represents construction activities and the first year of production is 2021.

Table 6.7 Estimated annual energy consumption (diesel, electricity and explosive consumption) for the proposed modification and underground development

Year	Estimated diesel consumption (kL)	Estimated electricity consumption (kWh)	Estimated additional explosive usage (t)
2020 construction	11,070		86
2021	5.9	91,822	179
2022	161.6	2,494,785	244
2023	1,425	21,992,603	982
2024	1,520	23,458,011	1,323
2025	3,807	58,767,516	1,767
2026	4,092	63,161,349	1,854
2027	4,078	62,949,713	1,733

Table 6.7 Estimated annual energy consumption (diesel, electricity and explosive consumption) for the proposed modification and underground development

Year	Estimated diesel consumption (kL)	Estimated electricity consumption (kWh)	Estimated additional explosive usage (t)
2028	4,091	63,146,635	1,614
2029	4,096	63,226,072	1,507
2030	4,078	62,950,292	1,520
2031	4,090	63,129,755	1,537
2032	4,095	63,208,007	1,544
2033	4,081	62,985,083	1,385
2034	4,092	63,163,891	1,328
2035	4,078	62,938,080	1,049
2036	4,100	63,289,550	693
2037	4,092	63,158,413	355
2038	3,760	58,035,696	6
2039	924.3	14,266,770	

6.3.6 Results

Scope 1, 2 and 3 emission factors for diesel, ULP, LPG, explosives and electricity use in NSW were applied to the data provided in Table 6.7 as per methodology outlined in the NGAF workbook (DoEE 2019). Scope 1 emission factors were applied to diesel and explosives consumption and Scope 2 emission factors were applied to electricity consumption as per the NGAF workbook.

A comparison of the estimated annual GHG emissions to be generated from the Underground Development Project to the NGERS data reported by CGO in FY2019 is provided in Table 6.8.

The Underground Development Project will increase Scope 1 and Scope 2 emissions by approximately 19 per cent on an annual basis above the NGER data for FY2019 due to on site energy consumption, specifically diesel combustion and consumption of purchased electricity. The Underground Development Project will include conventional drill, blast and haul techniques, which are mostly dependent on the use of diesel-powered equipment.

Table 6.8 Estimated annual GHG emissions for the proposed modification and underground development

Project year	Scope 1 ($t CO_2$-e/year)		Scope 2 ($t CO_2$-e/year)	Scope 3 ($t CO_2$-e/year)	
	Diesel	Explosives	Electricity	Diesel	Electricity
2020 (construction)	29,997	14.3		1,538	
2021	231	30.0	74.4	12	8.3
2022	6,287	40.7	2,021	322	225
2023	10,045	164.0	17,814	515	1,979
2024	11,159	220.9	19,001	572	2,111
2025	13,064	295.0	47,602	670	5,289
2026	14,016	309.7	51,161	719	5,685
2027	14,016	289.4	50,989	719	5,665
2028	14,209	269.5	51,149	729	5,683
2029	15,031	251.7	51,213	771	5,690
2030	15,031	253.9	50,990	771	5,666
2031	14,692	256.6	51,135	753	5,682
2032	14,467	257.8	51,198	742	5,689
2033	14,692	231.3	51,018	753	5,669
2034	14,467	221.8	51,163	742	5,685
2035	13,707	175.3	50,980	703	5,664
2036	13,707	115.7	51,265	703	5,696
2037	13,707	59.2	51,158	703	5,684
2038	13,707	1.0	47,009	703	5,223
2039	12,948		11,556	664	1,284
Annual average	**13,459**	**192**	**37,925**	**690**	**4,436**
FY2019 NGERs data	**70,741**		**202,168**	**NA**	
Annual average increase over 2019 data	**19%**		**19%**	**NA**	

6.3.7 Predicted impacts

The GHG impact assessment of the modification and underground development is based upon the predicted GHG emissions from diesel, electricity and explosive consumption during the construction and operational (from 2021 to 2039) phases.

It is estimated that the modification and underground development will increase annual Scope 1 and 2 emissions. The predicted annual average of Scope 1 emissions from diesel and explosive consumption will be 13,459 and 192 t CO_2-e/year respectively. Considering the equivalent GHG emissions from CGO in 2019 came to 70,741 t CO_2-e/year from diesel and explosive consumption, this is approximately an 19% increase over CGO's NGERS data from 2019.

The predicted annual average of Scope 2 emissions from electricity consumption will be 37,925 t CO_2-e/year. Considering the equivalent GHG emissions from CGO in 2019 came to 202,168 t CO_2-e/year from electricity consumption, this is approximately an 19% increase over CGO's NGERS data from 2019.

Annual Scope 1 and 2 emissions will account for 0.04% of total annual GHG emissions for NSW and 0.01% of total annual GHG emissions for Australia (refer Table 6.9). This is based upon the National Greenhouse Gas Inventory for 2017, for which GHG emissions totalled 128,780.2 kt CO_2-e for NSW and 530,840.9 kt CO_2-e for Australia in 2017. This is also representative of the Underground Development Project's contribution to global greenhouse gas emissions. The Underground Development Project will result in a very small contribution to projected climate change.

Table 6.9 Comparison of annual site emissions with NSW and Australia

Source	Total emissions (kt CO_2-e)
CGO site	51.6
NSW	128,780.2
Australia	530,840.9

This impact assessment does not further consider Scope 3 emissions, as it is not a mandatory reporting requirement and this type of assessment typically accounts for only major sources of Scope 3 emissions.

6.3.8 Mitigation measures

The Underground Development Project will increase GHG emissions by 19% in comparison to existing emissions. The existing AQMP for CGO includes mitigation measures focused on decreasing GHG emissions where possible. These are deemed appropriate to continue being applied to the site also through construction and operation of the Underground Development Project and include:

- regular maintenance of plant and equipment to minimise fuel consumption;
- efficient mine planning (eg minimising rehandling and haulage of materials) to minimise fuel consumption; and
- consideration of energy efficiency in the plant equipment selection phase.

The following mitigation will also be applied at the site during the proposed activities:

- opportunities to improve energy efficiency will be investigated on an ongoing basis throughout the life of the Underground Development Project; and
- energy consumption and Scope 1 and 2 emissions will be continually measured and reported as per the NGER Act, as the predicted Scope 1 and 2 emissions from the modification area greater than that reporting threshold noted in the NGER Act of 25,000 tpa CO_2-e.

6.3.9 Summary and conclusion

This GHG assessment has been completed to assess the impact of the Underground Development Project on climate change in accordance with the NGAF workbook (DoEE 2019), National Greenhouse and Energy Reporting Measurement (Technical Guidelines) (DoE 2014) and the NGER Act. It considers Scope 1 and 2 emissions from such activities as fuel, electricity and explosives consumption.

The research method included a review of Scope 1 and 2 emissions from CGO in 2019, as reported under NGER Act. This was compared to the predicted annual average Scope 1 and 2 emissions of Mod 16 and the Underground Development Project. It was found that Scope 1 and 2 emissions will increase by approximately 19% respectively over 2019 annual average emissions levels at the site. The predicted Scope 1 and 2 emissions will account for 0.04% of total annual GHG emissions for NSW and 0.01% of total annual GHG emissions for Australia. The Underground Development Project will therefore result in a minimal increase in national greenhouse gas emissions and overall projected climate change.

The existing GHG focused mitigation measures are considered appropriate to be continually applied to the site through construction and operation of the Underground Development Project. In addition, opportunities to improve energy efficiency will be investigated on an ongoing basis throughout the life of the Underground Development Project and Evolution will continue to measure and report energy consumption and Scope 1 and 2 emissions as required by the NGER Act.

6.4 Noise and vibration

6.4.1 Introduction

A noise and vibration impact assessment (NVIA) has been prepared by EMM and is included as Appendix F. The NVIA documents the existing acoustic and meteorological environment, outlines the noise assessment criteria and study method, and assesses the potential noise impacts from the proposed construction works and mining operations on the surrounding community.

Due to the relative complexity of separating out the inputs to the noise modelling which are related to the Underground Development Project and those which are related to Mod 16 to the existing development consent, this assessment provides a cumulative assessment of all noise and vibration impacts for the two applications.

6.4.2 Assessment Requirements

There were no SEARs issued for the proposed modification. However, DPIE asked for consideration of agency comments on Mod 16. Comments on noise for Mod 16 were received from the EPA. These are listed in Table 6.10.

Table 6.10 Noise related assessment requirements

Requirement	Location in EIS
EPA:	
Potential impacts of noise	
The goals of the project should include design, construction, operation, and maintenance of the facility in accordance with relevant EPA policy, guideline and criteria, and in order to minimise potential impacts from noise.	Sections 6.3.3 and 6.3.5

Table 6.10 Noise related assessment requirements

Requirement	Location in EIS
The EPA expects that potential noise sources are assessed in accordance with the *Noise Policy for Industry* (EPA 2017) and, where required, mitigation measures are proposed (eg appropriate equipment chosen to minimise noise levels). All residential or noise sensitive premises likely to be impacted by the development must be identified and included in the assessment.	Sections 6.3.5 and 6.3.7
The proposed development may result in an increase in traffic movements associated with the receival of materials. The number of traffic movements associated with the proposal should be quantified and the potential noise impacts associated with these traffic movements need to be assessed in accordance with the *NSW Road Noise Policy* (DECCW 2011).	Section 6.3.6(v)
Monitoring:	
The EIS must outline the proposed monitoring regime to be implemented in relation to the following potential impacts, where relevant:	
• Construction and operational noise.	Sections 6.3.3(II) and 6.3.

The NVIA has been prepared in accordance with the development consent, noise policies and guidelines as follows:

- development consent (14/98);
- EPL 11912;
- Industrial Noise Policy (EPA 2000);
- *Noise Policy for Industry* (NPfI) (EPA 2017);
- *Interim Construction Noise Guideline* (ICNG) (DECC 2009);
- *NSW Road Noise Policy* (RNP) (EPA 2011); and
- CGO's approved Noise Management Plan (NMP) (Evolution 2018).

6.4.3 Existing environment

i Ambient noise environment

The existing ambient acoustic environment was characterised by the ambient noise monitoring by Renzo Tonin & Associates (Renzo Tonin) for Modification 13 to the existing development consent at CGO. The background noise levels in the surrounding community are at, or below, the NPfI minimum rating background level (RBL) of 35 decibels (dB) for the day period and 30 dB for the evening and night periods. These minimum RBLs have been adopted for all assessment locations in the NVIA. Assessment locations are shown in Figure 6.5 and Table 6.12.

ii Existing CGO noise emissions

Ore mining, ore processing and ore and waste rock transportation, maintenance of plant and equipment, and other ancillary processes are all noise producing activities from CGO.

CGO has been operating since 2005 and has been through several operational modifications. Through this time, an extensive suite of management and mitigation measures have been implemented on-site.

Noise limits that Evolution must meet during its current operations are provided in Condition 6.4 of Schedule 2 of the development consent (DA 14/98) and Condition L4 of the EPL (11912). Operational noise limits provided in the development consent (DA 14/98) are outlined in Table 6.11. However, these noise limits do not apply if Evolution has an agreement with the owner(s) of the relevant residence or land to generate higher noise levels, and the DPIE has been notified in writing of this agreement. This is the case for assessment location 15 (Laurel Park, refer Figure 6.5) where Evolution has a noise agreement in place with the landowner of this privately-owned property. In addition, assessment locations 21 (Westella) and 22 (Westlea) qualify for acquisition upon request in accordance with the development consent and therefore noise limits do not apply at these privately-owned residential properties.

Review of CGO's quarterly noise monitoring data and complaints history indicate a history of compliance with prescribed noise limits by CGO and responsiveness in the event of a complaint.

Table 6.11 Development consent (DA 14/98) noise limits

Assessment location ID	Property name	Operational noise limits, $L_{Aeq,15min}$, dB		
		Day[1]	Evening[2]	Night[3]
21	Westella[4]	Acquisition upon request in accordance with development consent Condition 6.4(a)		
42	Westlea[4]			
22c	Lakeview III[5]	38	38	38
36a	The Glen	37	37	37
22a	Lakeview	36	36	36
49b	Foxman Downs II	36	36	36
All other locations	All other privately-owned land	35	35	35

Notes: 1. Day period: Monday to Saturday: 7 am to 6 pm, on Sundays and public holidays: 8 am to 6 pm.
2. Evening period: Monday to Saturday: 6 pm to 10 pm, on Sundays and public holidays: 6 pm to 10 pm.
3. Night period: Monday to Saturday: 10 pm to 7 am, on Sundays and public holidays: 10 pm to 8 am.
4. Land subject to acquisition upon request in accordance with development consent Condition 6.4(a).
5. Land subject to mitigation upon request in accordance with development consent Condition 6.4(b).

6.4.4 Assessment locations

The area surrounding CGO includes rural properties, with the closest residence located approximately 2.3 km south-west of the CGO. In order to assess potential noise impacts across the surrounding area, the closest residences have been selected for assessment. Details are provided in Table 6.12and their locations are shown in Figure 6.5.

The selected residences have been used as noise assessment locations. Assessment locations 1a to 1d are classified as mine-owned residences, while the remaining are classified as private residences.

Table 6.12 Noise assessment locations

Assessment location ID	Receiver type	Property name	Easting (MGA Zone 55 GDA94)	Northing (MGA Zone 55 GDA94)
1a	Residential	Coniston (mine-owned)	535153	6282548
1b	Residential	Lakeside (mine-owned)	536424	6283400
1c	Residential	Hillgrove (mine-owned)	534407	6272697
1d	Residential	Lake Cowal (mine-owned	541794	6272704
4	Residential	Goodwood	547567	6281001
6	Residential	Boongarry	549989	6276946
15[1]	Residential	Laurel Park	532378	6283364
20	Residential	Bramboyne	530337	6282231
21[2]	Residential	Westella	531013	6278985
22a	Residential	Lakeview	528402	6277761
22b	Residential	Lakeview II	528249	6277583
22c[3]	Residential	Lakeview III	528976	6277626
22d	Residential	Thistleview	527918	6274662
24	Residential	Mangelsdorf	532297	6270665
25	Residential	Mangelsdorf II	531695	6269734
28	Residential	Bristowes	548681	6286710
30a	Residential	Wamboyne	530989	6288345
30b	Residential	Grinter	531171	6289740
31a	Residential	Koobah	549554	6273711
36a	Residential	The Glen	535625	6284898
36b	Residential	Wamboyne II	530297	6286030
38	Residential	Gumbelah	545613	6276295
42[2]	Residential	Westlea	532383	6274566
43a	Residential	Lake Cowal II	545105	6271379
43b	Residential	Billabong	547179	6268189
49a	Residential	Foxman Downs	531145	6271554
49b	Residential	Foxman Downs II	531386	6272221
56	Residential	Mattiske II	550605	6285032
57	Residential	Harmer	529760	6268071
61a	Residential	Bungabulla	545627	6275893
62	Residential	Cowal North	541979	6286026
79	Residential	Ridley	526342	6286717
89	Residential	Morton	534740	6269452
90	Residential	Caloola	535441	6267131

Table 6.12 Noise assessment locations

Assessment location ID	Receiver type	Property name	Easting (MGA Zone 55 GDA94)	Northing (MGA Zone 55 GDA94)
100	Residential	Blampied	528226	6267940
122	Residential	Fitzgerald	531978	6288396
126	Residential	Noble	526050	6285038

Notes: 1. Evolution Mining has a noise agreement in place with the landowner of this privately-owned property.
2. Subject to acquisition upon request in accordance with the development consent.
3. Subject to mitigation upon request in accordance with the development consent.

Other assessment locations (non-residential) also included in this assessment are provided in Table 6.13. The locations of these non-residential assessment locations are also shown on Figure 6.5.

Table 6.13 Non-residential assessment locations

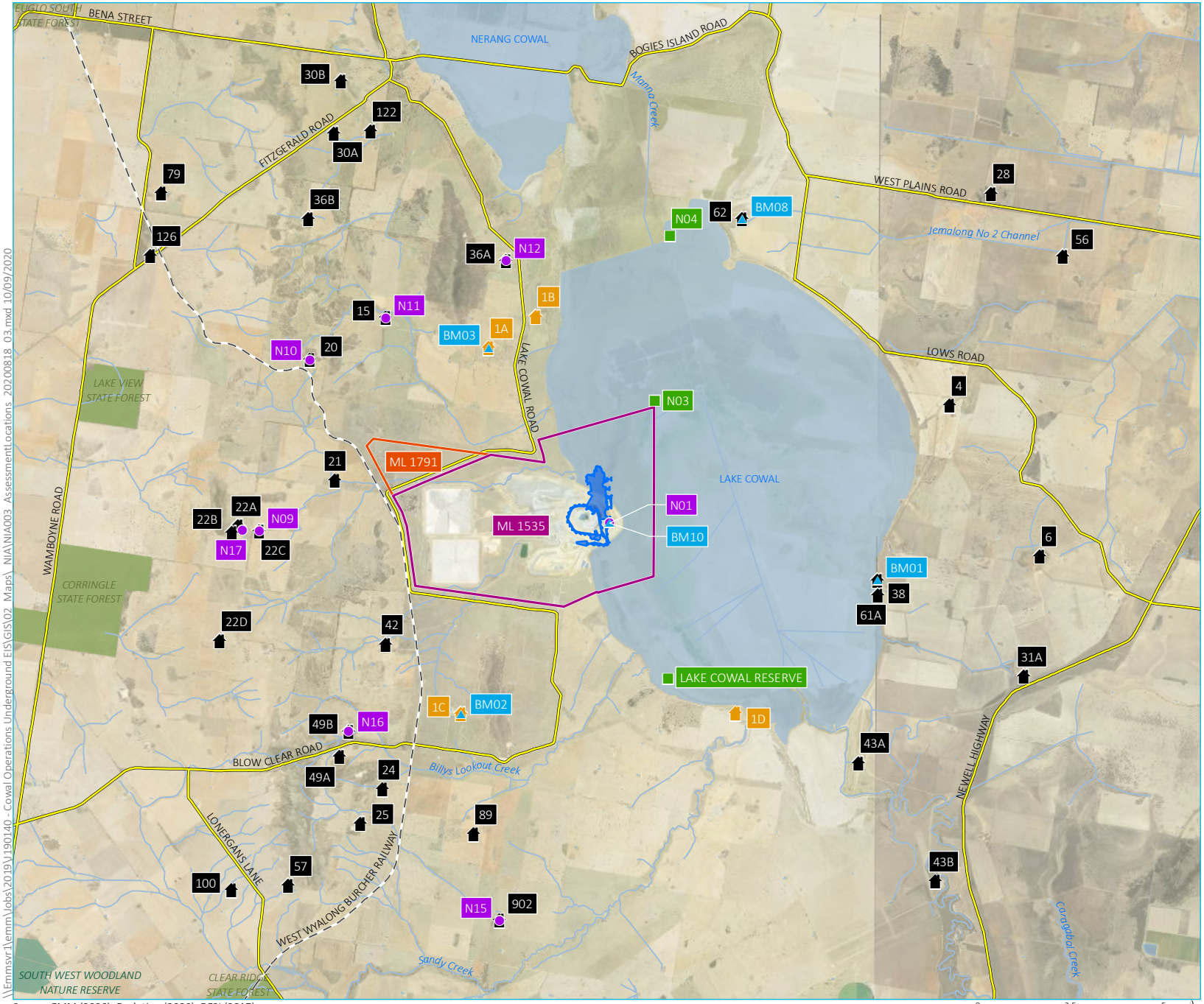
Assessment location	Description	Easting	Northing
N04 - Bird Breeding Area	Bird Breeding Area North	540025	6285561
N03 - Bird Breeding Area	Bird Breeding Area South	539620	6281131
Lake Cowal Reserve	Relocated Crown Reserve	539978	6273640

6.4.5 Assessment criteria

i Operational noise

The NPfI provides guidance in the EPA's preferred methods for the assessment of noise from existing industrial sites. Since a noise and blasting assessment was undertaken for Modification 14 of COG, the *NSW Industrial Noise Policy* (INP) (EPA 2000) has been superseded by the NPfI (EPA 2017). The NVIA has adopted the NPfI approach and hence, assessment requirements for operational noise (eg criteria) and modelling methods (eg modelled meteorological conditions) have been updated where applicable.

The NPfI derived intrusive noise levels are 40 dB and 35 dB $L_{Aeq,15min}$, for the daytime and evening/night respectively at all residential assessment locations. The intrusiveness noise levels require that $L_{Aeq,15min}$, noise levels from the site during the relevant operational periods (ie day, evening and night) do not exceed the RBL by more than 5 dB. It is noted that intrusiveness noise levels are only applicable at residential assessment locations.



Source: EMM (2020); Evolution (2020); DFSI (2017)

\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02 Maps\ NIA\NIA003 AssessmentLocations 20200818 03.mxd 10/09/2020

Noise and vibration monitoring and assessment locations

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.5

EMM
creating opportunities

For non-residential locations (ie rural areas and passive recreation areas such as Lake Cowal Reserve), amenity noise levels were assessed based on noise criteria specific to land use and associated activities. The criteria relate only to industrial type noise and do not include road or rail traffic. Underground Development Project amenity noise levels are:

- 50 dB, 45 dB and 40 dB for day, evening and night respectively for rural areas; and
- 50 dB for Lake Cowal Reserve, whenever it is in use.

As per the NPfI, the project noise trigger levels (PNTLs) are the more stringent of either the intrusive or amenity noise levels. Section 6.1 of the NPfI states that:

> The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

Project PNTLs are:

- 40 dB and 35 dB for day, evening/night respectively for all residential locations; and
- 53 dB for Lake Cowal Reserve.

The PNTLs are largely unchanged from the existing development consent (DA 14/98) limit. However, there are six assessment locations referenced in the development consent (DA 14/98) where existing noise limits are higher than the above PNTLs. Existing limits at these assessment locations were based on operational noise levels predicted in the Mod 14 noise and blasting assessment (Renzo Tonin 2018), inclusive of feasible and reasonable noise mitigation.

The existing noise limits (DA 14/98) were adopted for the NVIA.

ii Sleep disturbance

The site will continue to operate during the night-time period and therefore, in accordance with the NPfI, the potential for sleep disturbance has been assessed. The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where the development night-time noise levels at a residential location exceed:

- 40 dB $L_{Aeq,15min}$ or the prevailing RBL plus 5 dB (whichever is greater); and/or
- 52 dB L_{Amax} or the prevailing RBL plus 15 dB (whichever is greater).

The adopted night RBL is 30 dB, and maximum noise level event screening criteria are 40 dB and 52 dB$L_{Aeq,15min}$. These values exclude mine-owned properties and privately-owned properties where the application has a noise agreement in place with the land owner.

iii Construction noise

The SEARs reference the ICNG for the assessment of noise from Mod 16 construction activities, where demonstrated to be relevant. However, noise associated with construction activities for extractive industries are not covered by the ICNG, as they are assessed as operational noise, as noise emissions from plant and equipment items associated with construction are similar to those used for operation. Furthermore, operational noise trigger levels are generally more stringent for the day period than those provided in the ICNG. Therefore, the operational PNTLs presented in Section 6.4.5i have been adopted as the relevant construction noise criteria.

iv Voluntary land acquisition and mitigation policy

Under the NSW Government Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments (2018), if a development cannot comply with the relevant impact assessment criteria or, if the mitigation or acquisition criteria are likely to be exceeded, Evolution should consider a negotiated agreement with the affected landowner or acquisition of the land. In doing so, the land is then no longer subject to the impact assessment, mitigation or acquisition criteria, with the exception of the provisions that apply under the "Use of acquired land", which relates to informing and protecting existing or prospective tenants.

Voluntary mitigation or voluntary acquisition rights apply when a development contributes to exceedances of the criteria set out in Table 1 of the VLAMP.

While the NVIA demonstrates that the noise emissions are predicted to be relatively the same as existing CGO operational noise emissions at all assessment locations, it is noted that voluntary mitigation and acquisition rights have been applied by the consent authority (ie DPIE) for three existing residential properties following the Modification 14 noise and blasting assessment (Renzo Tonin 2018).

Voluntary mitigation rights have been included in the development consent for one privately-owned residence, namely assessment location 22c (Lakeview III). The development consent states that CGO shall implement additional noise mitigation measures at the residence upon receiving a written request from the landowner(s).

Voluntary acquisition rights have been included in the development consent for two privately-owned residences, including assessment locations 21 (Westella) and 42 (Westlea). The development consent states that CGO shall acquire the land(s) upon receiving a written request from the relevant land owner(s).

v Road traffic noise

The principal guidance to assess the impact of the road traffic noise on assessment locations is the RNP (EPA 2011). The road traffic noise assessment criteria for residential land uses (ie assessment locations), as outlined in the RNP for road categories are:

- 60 dB $L_{Aeq,15hr}$ (external) for daytime hours (7 am to 10 pm) on freeway/arterial/sub-arterial roads; and
- 55 dB $L_{Aeq,9hr}$ (external) for night-time hours (10 pm to 7 am) on freeway/arterial/sub-arterial roads.

The RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to an increase of up to 2 dB. In addition to meeting the assessment criteria outlined above, any significant increase in total traffic noise at assessment locations must also be considered.

6.4.6 Predicted impacts

i Operational noise

Operational noise associated with Mod 16 will principally be from existing or new surface infrastructure (ie ore processing facility, IWL lift, additional surface infrastructure, etc) as described in Chapter 3.

To assess the potential operational noise impacts from Mod 16 and additional surface operations were modelled for 2031 during noise-enhancing meteorological conditions. This is the year when the proposed underground mine will be at maximum production and hence, is considered the worst-case operational scenario for noise emissions (as relevant to Mod 16 surface infrastructure changes). The predicted 2031 noise levels were then combined with the Modification 14 2024 noise predictions for the day, evening and night periods, and represent future operational noise levels.

Future operational noise levels are shown in Table 6.14.

Table 6.14 Predicted operational noise levels

Assessment location	Mod 14 2024 $L_{Aeq,15min}$ noise predictions[1], dB			Predicted future $L_{Aeq,15min}$ noise levels[2], dB			Existing limits (DA 14/98)/PNTLs, $L_{Aeq,15min}$, dB			Exceedance of the existing limits (DA 14/98)/PNTLs, dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
4	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
6	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
15[3]	<35	<35	<35	<35	<35	35	N/A	N/A	N/A	N/A	N/A	N/A
20	<35	<35	35	<35	35	35	35	35	35	Nil	Nil	Nil
21[4]	<35	44	44	<35	44	44	N/A	N/A	N/A	N/A	N/A	N/A
22a	<36	<36	36	<36	<36	36	36	36	36	Nil	Nil	Nil
22b	<35	35	35	<35	35	35	35	35	35	Nil	Nil	Nil
22c[5]	<38	38	38	<38	38	38	38	38	38	Nil	Nil	Nil
22d	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
24	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
25	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
28	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
30a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
30b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
31a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
36a	<37	<37	<37	<37	<37	<37	37	37	37	Nil	Nil	Nil

Table 6.14 Predicted operational noise levels

Assessment location	Mod 14 2024 $L_{Aeq,15min}$ noise predictions[1], dB			Predicted future $L_{Aeq,15min}$ noise levels[2], dB			Existing limits (DA 14/98)/PNTLs, $L_{Aeq,15min}$, dB			Exceedance of the existing limits (DA 14/98)/PNTLs, dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
36b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
38	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
42[4]	<35	46	46	<35	46	46	N/A	N/A	N/A	N/A	N/A	N/A
43a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
43b	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
49a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
49b	<36	<36	36	<36	<36	36	36	36	36	Nil	Nil	Nil
56	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
57	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
61a	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
62	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
79	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
89	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
90	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
100	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
122	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil

Table 6.14 Predicted operational noise levels

Assessment location	Mod 14 2024 $L_{Aeq,15min}$ noise predictions[1], dB			Predicted future $L_{Aeq,15min}$ noise levels[2], dB			Existing limits (DA 14/98)/PNTLs, $L_{Aeq,15min}$, dB			Exceedance of the existing limits (DA 14/98)/PNTLs, dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
126	<35	<35	<35	<35	<35	<35	35	35	35	Nil	Nil	Nil
LCR	<35	<53	<53	<53	<53	<53	N/A	N/A	N/A	N/A	N/A	N/A
NO3	<35	42	42	<40	45	45	N/A	N/A	N/A	N/A	N/A	N/A
N04	<35	<35	<35	<40	<35	<35	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
1. Referenced from the Mod 14 noise and blasting assessment prepared by Renzo Tonin (2018).
2. Combined Mod 14 2024 noise predictions and predicted 2031 noise levels.
3. Evolution Mining has a noise agreement in place with the land owner of this privately-owned property.
4. Subject to acquisition upon request in accordance with the development consent.
5. Subject to mitigation upon request in accordance with the development consent.
6. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: remaining periods.
7. NA= not applicable

The modelling results show that future operational noise levels for the day, evening and night periods during noise-enhancing meteorological conditions are essentially unchanged from existing approved operations and predicted to satisfy the existing noise limits (DA 14/98) at all assessment locations.

The noise assessment has demonstrated that noise emissions (approved and proposed) are predicted to be essentially the same as existing CGO noise emissions at all assessment locations and generate no additional noise impacts. Feasible and reasonable mitigation measures have previously been considered as part of the Modification 14 noise assessment (Renzo Tonin 2018) and therefore have not been considered further as part of NVIA.

At the waterbird breeding areas (assessment locations N03 and N04, the modelling results show that CGO noise levels during Mod 16 are predicted to be up to 45 dB $L_{Aeq,15min}$ during evening and night periods. Noise and bird behaviour monitoring is currently undertaken at CGO to monitor change in behaviour of birds in the area. The bird behaviour monitoring has not found any noticeable change in the behaviour of birds due to CGO noise emissions. The bird behaviour monitoring is expected to continue in accordance with the CGO Flora and Fauna Management Plan. No significant noise impact is anticipated as a result of Mod 16.

It is important to note that predicted future operational noise levels represent worst-case scenarios for each assessment period and operations. Notwithstanding, noise management measures currently in place at CGO such as quarterly attended noise monitoring will continue to be implemented.

ii Sleep disturbance

Maximum noise levels from future night-time operations of Mod 16, with the potential to cause sleep disturbance at nearby residences, have been assessed in accordance with the NPfI. Predicted future operational $L_{Aeq,15min}$ noise levels for the night period were taken from Table 6.14 and assessed against the relevant sleep disturbance screening criteria.

Further, maximum L_{Amax} noise events from future night-time operations considered for this assessment included an excavator bucket hitting the ground or a truck loading ore into the primary crusher at the processing area. A sound power level of 125 dB L_{Amax} was adopted to cover any of these possible events in the prediction of sleep disturbance impacts at residential assessment locations during night-time noise-enhancing meteorological conditions.

Table 5.3 of the NIVA shows that maximum L_{Aeq} noise levels are predicted to satisfy the screening criteria for sleep disturbance at all residential assessment locations during night-time noise-enhancing meteorological conditions. Therefore, Mod 16 is unlikely to cause CGO maximum L_{Aeq} noise levels to increase above the L_{Aeq} screening criterion at any of the assessment locations where Modification 14 2024 noise predictions previously satisfied the L_{Aeq} screening criterion for sleep disturbance.

As already noted, the land owner(s) of the privately-owned properties associated with assessment locations 21 and 42 have acquisition rights upon request in accordance with the development consent (DA 14/98).

Noise modelling results show that maximum L_{Amax} noise levels are predicted to satisfy the screening criteria for sleep disturbance at all residential assessment locations during night-time noise-enhancing meteorological conditions.

iii Construction noise

Proposed construction works as part of Mod 16 will occur concurrently with mining operations at CGO. The assessment of noise emissions related to construction has been modelled as a worst-case construction scenario. The modelling has assumed construction works will occur 24-hours and seven days per week.

Predicted noise levels for construction activities are provided in Table 5.1 of the NVIA (refer Appendix F).

At the waterbird breeding areas (assessment locations NO3 and NO4), the modelling results show that CGO noise levels during construction are predicted to be up to 44 dB $L_{Aeq,15min}$, during evening and night periods. Noise and bird behaviour monitoring is currently undertaken at CGO to monitor change in behaviour of birds in the area. The bird behaviour monitoring is expected to continue in accordance with the CGO Flora and Fauna Management Plan. No significant noise impact is anticipated during construction.

iv Voluntary land acquisition and mitigation policy assessment

The VLAMP states that voluntary mitigation and voluntary land acquisition rights should not be applied where a modification to an existing development with legacy noise issues would have beneficial or negligible noise impacts. This noise assessment has demonstrated that noise emissions from the project (approved and proposed) are predicted to be relatively the same as existing CGO noise emissions at all assessment locations and generate no additional noise impacts. Feasible and reasonable mitigation measures have previously been considered as part of the Mod 14 noise assessment (Renzo Tonin 2018) and therefore have not been considered further as part of this assessment.

v Road traffic

Additional daily mine traffic movements will primarily be related to the additional workforce travel. Two proposals will generate light vehicle movements from individual employee cars and utes, as well as heavy vehicle movements from buses and coaches which will be transporting the major proportion of the additional workforce (75 per cent) to and from the site each day.

The peak construction workforce for the two proposals will occur during month 9 of construction, with a total of 123 persons. The proposed construction hours for Mod 16 will generally be from 6 am to 6 pm seven days per week, resulting in two hourly peak periods of construction related traffic movements, travelling to site between 5 am and 6 am and travelling from site between 6 pm and 7 pm.

The future workforce for the Underground Development Project will comprise a total of 83 persons for each 12-hour shift. The shift work hours for CGO will be from 6 am to 6 pm and from 6 pm to 6 am, seven days per week, resulting in peak periods of workforce traffic movements between 5 am to 7 am and 5 pm to 7 pm.

The following roads were assessed for operational and construction road traffic noise emissions, including: Ungarie, Wamboyne, Bow Clear, Mine Access, Lake Cowal, West Plains, and Burcher Roads, Bonehams Lane, The Gipps Way and Newell Highway.

a Operational

The results show that the existing (2019) road traffic noise levels calculated for the day and night periods at the nearest residential facade along Ungarie Road, Wamboyne Road and the Newell Highway currently exceed the relevant baseline criteria. Future road traffic noise levels, including Mod 16 related traffic, at the nearest residential facade along these roads are predicted to negligibly increase from existing noise levels - 0.6 dB during the day and 0.7 during the night period. Hence, road traffic noise levels are predicted to satisfy the RNP 2 dB allowance increase criterion.

Road traffic noise levels on all other roads assessed are predicted to satisfy the day and night criteria.

b Construction

The results show that the existing (2019) road traffic noise levels calculated for the day and night periods at the nearest residential facades along Ungarie Road, Wamboyne Road and Newell Highway currently exceed the relevant criteria. Future road traffic noise levels, including Mod 16 construction related traffic, at the nearest residential facade along these roads are predicted to negligibly increase from existing noise levels - 1.1 dB during the day period and 1.3 dB during the night period. Hence, construction road traffic levels are predicted to satisfy the RNP 2 dB allowance increase criterion.

Road traffic noise levels at all other locations are predicted to be below both the day and night absolute criteria.

6.4.7 Management measures

Noise and vibration impacts will continue to be managed in accordance with the NMP (Evolution 2018). Evolution will continue to implement the management measures outlined below.

- Quarterly attended noise monitoring will continue to be conducted at the following monitoring locations:
  - N01 – New Lake Foreshore (reference site);
  - N09 – "Lakeview III" residence;
  - N10 – "Bramboyne" residence;
  - N11 – "Laurel Park" residence;
  - N12 – "The Glen" residence;
  - N15 – "Caloola II" residence;
  - N16 – "Foxham Downs II" residence; and
  - N17 – "Lakeview" and "Lakeview II" residences.
- Waterbird behaviour and breeding activity will continue to be monitored during bird breeding periods by a suitably qualified person during operational activities in accordance with the CGO's Flora and Fauna Management plan.
- Best management practice will continue to be implemented where necessary to reduce CGO noise emissions, and will include the following measures:
  - restricting movement of trucks on ridgelines and exposed haul routes where their noise can propagate over a wide area, especially at night. This means restricting nigh-time movement of material to areas shielded by barriers or mounds and reserving large-scale material movement for daytime. The lake protection bund and perimeter waste rock emplacement provides some noise shielding, thereby reducing the potential for noise levels to propagate from the open-cut pit across Lake Cowal;
  - scheduling the use of any noisy equipment during daytime;
  - siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area, or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise;

- where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently where possible;
- keeping equipment well maintained;
- employing 'quiet' practices when operating equipment (eg positioning idling trucks in appropriate areas);
- reducing the speed limit on the portions of the mine access road where residents may be affected by mine generated traffic in consultation with relevant authorities;
- toolbox talks on the effects of noise and the use of quiet work practices; and
- specify maximum noise/sound levels in tender documents and contracts and when purchasing equipment.

- Continued Independent Environmental Audits and Annual Reviews will continue to be conducted in accordance with development consent (14/98).
- A complaints register will continue to be maintained in accordance with EPL Condition M5.1, with a dedicated Community Complaints Line (via 02 6975 3454 or via community.cowal@evolutionmining.com.au) that is available 24 hours, seven days a week for community members who have enquiries or with to lodge complaints.

6.4.8 Summary

The key findings of the NVIA are as follows:

- Future operational noise levels were assessed against the existing development consent limits (DA 14/98) for the day, evening and night periods for noise-enhancing meteorological conditions. The modelling results showed that future operational noise levels are predicted to satisfy the existing development consent (14/98) limits at all locations.
- Noise levels during construction were assessed against the existing development consent limits (DA 14/98) for the day, evening and night periods for noise-enhancing meteorological conditions. The modelling results showed that CGO noise levels during the construction are predicted to satisfy the existing development consent limits at all locations.
- The sleep disturbance assessment demonstrated that night-time maximum $L_{Aeq,15min}$ and L_{Amax} noise levels are predicted to satisfy the relevant screening criteria at all residential assessment locations.
- Mod 16 will result in additional road traffic movements during future operations, however, the overall increase in average road traffic noise at nearest residential facades is predicted to satisfy relevant RNP criteria during both the day and night periods.

6.5 Groundwater

A hydrogeological assessment conducted by Coffey Services Australia Pty Ltd (Coffey) has been prepared and included as Appendix H. Additionally, a study of potential impacts on groundwater levels and quality from future groundwater extraction from the BCPB and ESB for the proposed modification has also been prepared and included as part of Appendix G.

The assessment employed predictive numerical modelling based on a major revision of an earlier numerical groundwater flow model, taking into account the proposed underground mining. This chapter provides a summary of the findings in Appendix H and is outlined below.

6.5.1 Assessment requirements

The assessment requirements for the proposed modification's potential impact on groundwater and where they are addressed in this document is listed in Table 6.15.

Table 6.15 Groundwater related assessment requirements

Requirement	Location in this document
The goals of the project should include the following: • No pollution of waters (including surface and groundwater), except to the extent authorised by EPA (ie in accordance with an Environment Protection Licence); The AR should document the measures that will achieve the above goals.	Section 6.4iii
• The AR should provide details of any water management systems for the site to ensure surface and ground waters are protected from contaminants.	Section 6.5.4

The groundwater assessment has also been prepared with consideration of the following legislation, policies, guidelines and plans:

- *National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia* (Australian and New Zealand Environment and Conservation Council, 1995).
- *Protection of the Environment Operations Act 1997.*
- *NSW State Groundwater Policy Framework Document* (NSW Department of Land and Water Conservation [DLWC], 1997).
- *NSW State Groundwater Quality Protection Policy* (DLWC, 1998).
- *NSW Groundwater Dependent Ecosystem Policy* (DLWC, 2002).
- *NSW Aquifer Interference Policy* (NSW Department of Primary Industries Office of Water, 2012).
- Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources – Background document for amended plan 2016 (NSW Department of Primary Industries Water, 2016).

- *Australian Groundwater Modelling Guidelines* (Barnett et al, 2012).

- *Guidelines for the Assessment and Management of Groundwater Contamination* (Department of Environment and Conservation NSW, 2007).

6.5.2 Existing environment

i Overview

The region is characterised by a generally flat landscape with some low undulating hills and occasional rocky outcrops. Regionally, the terrain drains from the north east (Lachlan Floodplain) and south east (upper Bland Creek Palaeochannel) into the ephemeral Lake Cowal which is a regional low point. Floodwaters that overtop Lake Cowal flow northwest towards Nerang Cowal and eventually into the Lachlan River. Ground elevations at the CGO site range from around 225 m AHD on the western lease boundary to about 200 m AHD at the eastern lease boundary within Lake Cowal.

The climate of the region is characterised by low rainfall and high evaporation. In average conditions, a rainfall deficit exists throughout the year and amounts to approximately 1,500 mm across the full year.

The regional geological setting is dominated by the Gilmore Fault Zone (also called the Gilmore Suture), a structurally and lithologically complex feature that trends north-south through ML1535, approximately 500 m west of the CGO open pit. The fault separates a Late Ordovician volcaniclastic sequence (referred to as the Lake Cowal Volcanic Complex) from the Siluro-Devonian sedimentary basement to the west. Siluro-Devonian sedimentary rocks also occur east of the Lake Cowal Volcanic Complex on the eastern side of Lake Cowal, where the basement has been deeply incised and hosts palaeochannel deposits of the Bland Creek unit.

The region is covered by varying thicknesses of Tertiary and Quaternary regolith deposits. The Bland Creek Palaeochannel Plain was formed by the infilling of the Lachlan and Bland Creek Palaeochannels, located to the north and east of Lake Cowal, respectively, with sediments of the Lachlan and Cowra Formations. The depth of sediments specifically across the mine site and surrounds ranges from approximately 14 m to 55 m.

Regionally, groundwater resources include the following two geological formations:

- Cowra Formation: comprising isolated sand and gravel lenses in predominantly silt and clay alluvial deposits, with groundwater of generally higher salinity.

- Lachlan Formation: comprising quartz gravel with groundwater of generally low salinity.

Locally, at the CGO site, four hydrogeological units have been identified:

- **The Transported unit:** comprising alluvium (thick clay sequences and more permeable zones of gravel within a sandy clay matrix) of the Quaternary-aged Cowra Formation. The Cowra Formation is laterally equivalent to the Transported unit (Barrick Australia Limited 2010).

- **The Saprolite unit:** underlies the Transported unit and is of relatively low hydraulic conductivity. The unit comprises extremely weathered rock, often weathered to clay. Draft Only

- **The Saprock unit:** underlies the Saprolite unit and occurs in the weathered fractured surface of the Lake Cowal Volcanics. The unit comprises highly to moderately weathered rock with some zones of clay.

- **The Primary Rock unit:** consisting of slightly weathered to fresh rock underlying the Saprock unit. This unit is generally considered to be less fractured and less permeable than the Saprock.

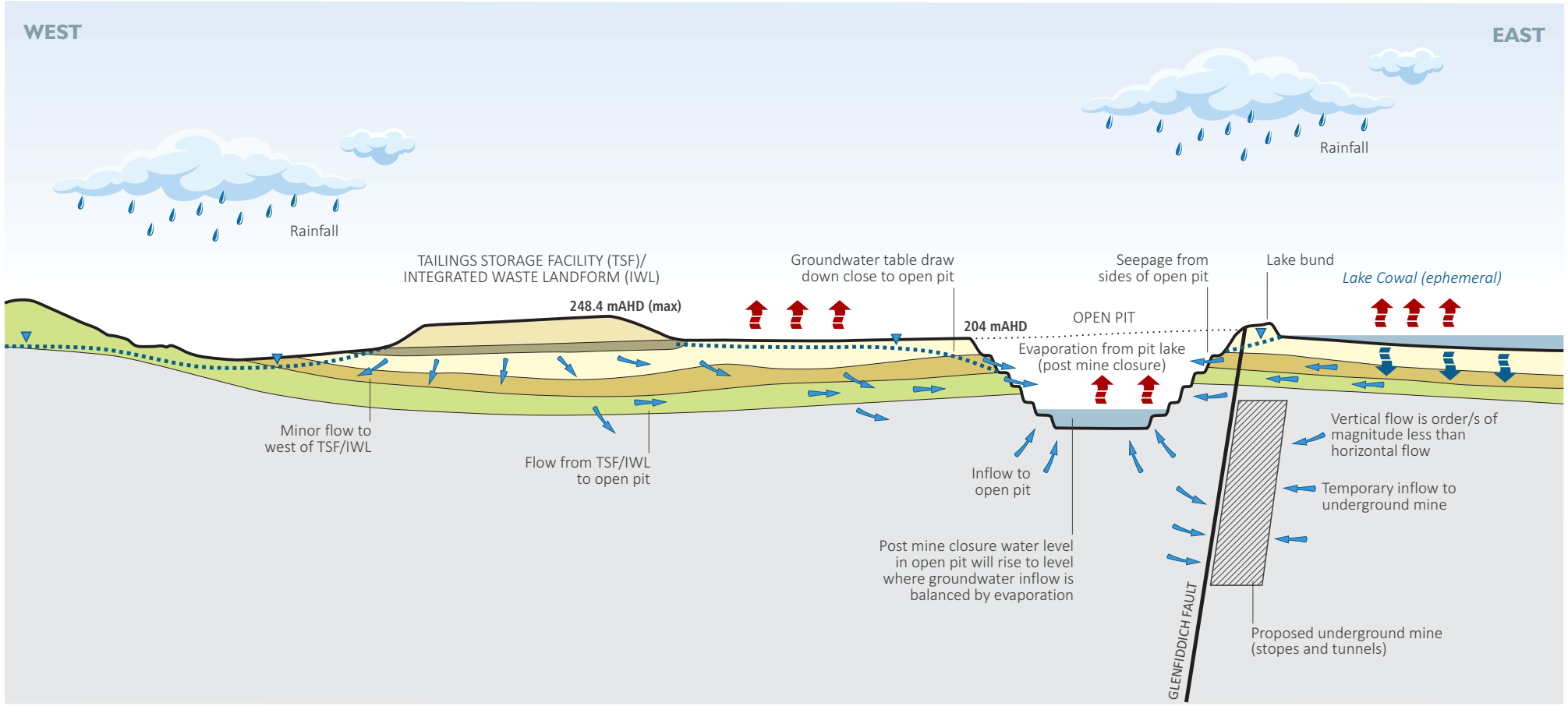
Surface drainage of the site is intermittent and recharge to the groundwater system occurs by the following processes:

- rainfall infiltration;
- leakage from Bland Creek when flowing;
- intermittent flooding;
- deep drainage from irrigation practices (mostly in the northern areas); and
- groundwater inflow through a constriction in the bedrock surface at Corinella (referred to as the Corinella Constriction).

Discharge from the groundwater system occurs by the following processes:

- Extraction from water supply bores for stock/domestic, irrigation, and industrial uses.
- Intermittent evaporation from surface ponds (local groundwater flow systems only).
- Groundwater outflow from the Corinella Constriction.

A visual representation of the different hydrological processes occurring at the site and region is provided in Figure 6.6.



SOURCE: Coffey (2020)

Conceptual Hydrogeological Model

Evolution Mining

Mod 16 Modification Assessment Report

Figure 6.6

ii Faults and structure

Evolution's geological model for the mine includes several faults, namely the Central, Cowal, Glenfiddich, Wilga and Wyrra faults, and a number of smaller faults. The five major faults all strike approximately north-south, with the Wilga deviating the most from this direction, striking north-north east. In addition, the structural contacts between geological units around the mine site strike generally north-south with some localised north-west or north-east deviations.

The faults around the mine site are all non-active and thus unlikely to provide higher conductive pathways for water. The zones surrounding the faults, however, may consist of more fractured rock and may have a higher conductivity. Observation of the exposed Glenfiddich Fault in May 2019 close to the entrance of the Exploration Decline from the open pit showed minor groundwater inflow to the tunnel occurring on one side of the fault with little inflow elsewhere along a 150m section of tunnel near its intersection with the fault. The centre of the fault was clay filled. Relevant fault structures are detailed in Appendix H.

iii Groundwater levels and flow regimes

There are 37 piezometers currently monitoring groundwater levels within ML1535. A further 12 piezometers were installed as part of field investigations in February 2020 at four boreholes to the north of the open-cut pit near the underground mine.

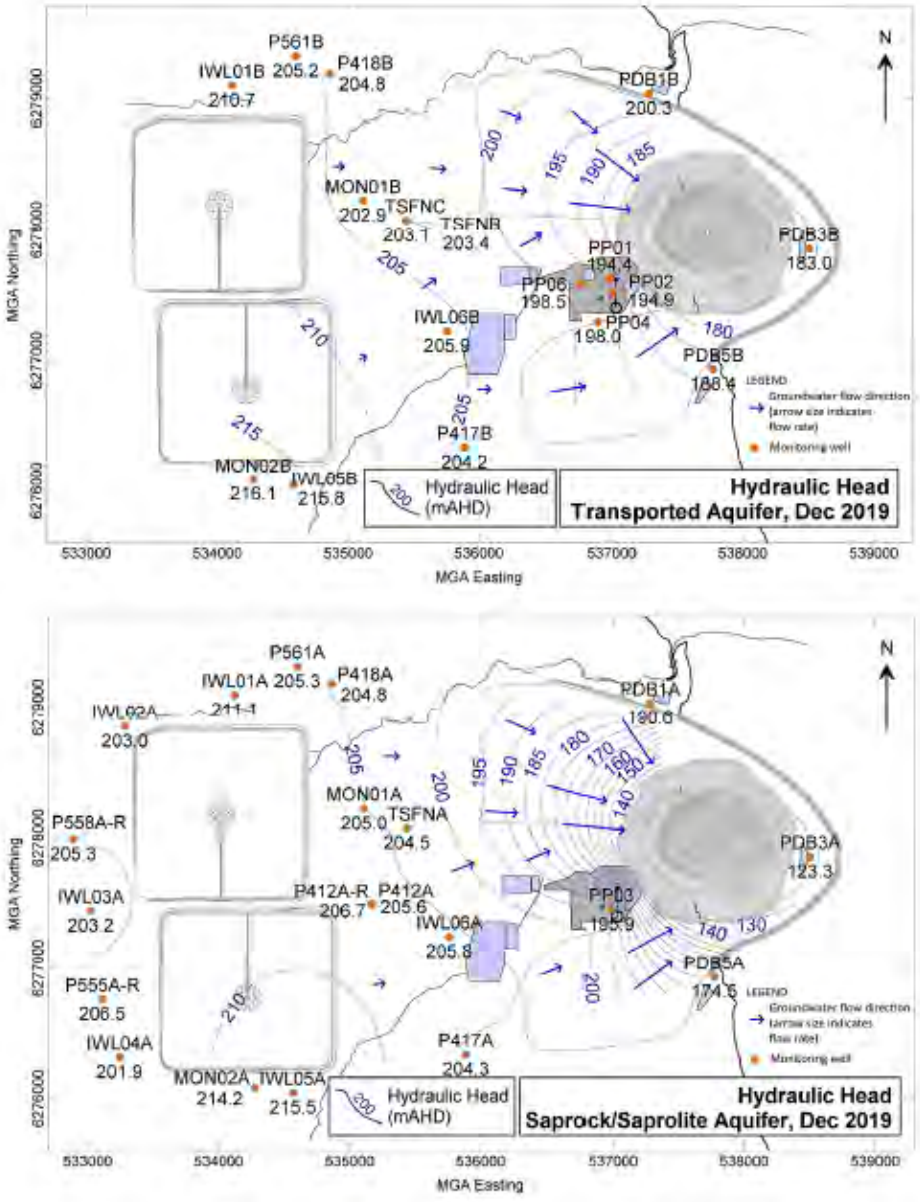
The coordinates and screen elevations for these piezometers are provided in Table 6.1 and Table 6.2 of Appendix H and their locations are shown in Figure 6.8.

a Groundwater levels and flow regimes within ML 1535

Over the life of the CGO operations, Lake Cowal has remained dry for significant periods. The lake was dry from the commencement of operations in 2005 until June 2010, when significant rainfall caused the lake to fill. By late 2014 the lake had dried out, due to evaporation. The lake again began to fill from significant rainfall events in June to September 2016; the peak water level recorded being 207.49 m AHD in October 2016. At the peak, water overflowed to Nerang Cowal. The lake water level dropped rapidly to its full level, controlled by overflow to Nerang Cowal, with the gradual decline in water level continuing to February 2019 when the lake was again dry. It continues to be dry at the time of writing (August 2020).

The underlying aquifers surrounding and intercepting the open pit have been depressurised by discharges into the open pit and active pit dewatering. Despite Lake Cowal becoming inundated, records show that groundwater flows into the open pit have remained at or below historical levels. This is likely because the lacustrine sediments that form the lakebed have a very low vertical permeability and act as an aquitard between the lake water and underlying aquifers (Coffey 1997). The calibration of the groundwater model, discussed in Appendix H, support this understanding. The observed groundwater flows in December 2019 for the Transported and Saprolite units are shown in Figure 6.7.

The open-cut pit groundwater inflow observations from recent field investigations confirm the finding of Coffey (1997) that the long-term leakage from the lake (when containing water) to underlying aquifers is very small and not quantifiable.



Source: Figure 6-9 of the Cowal Underground Development EIS Mine Site Hydrogeological Assessment (August 2020)

Figure 6.7 Observed hydraulic head in December 2019 for the Transported and Saprolite units

b Groundwater levels at the Tailings Storage Facility

Groundwater levels in the Transported, Saprolite and Saprock units in the vicinity of the TSFs have shown a progressive rise since the CGO began operating. Generally, the magnitude of the groundwater rise correlates with the proximity of the monitoring bore to the TSFs.

Groundwater levels at MON02A and MON02B (screened in the Saprock and Saprolite units, respectively) have displayed a significant rise since late 2006. Groundwater level variation around the TSFs was investigated by Coffey (2009a). Rises were assessed to be related to the percolation and the movement of seepage from the TSFs.

Appendix H notes that modelling carried out for the Cowal Gold Project EIS (North Limited, 1998) predicted a groundwater level rise around the tailings impoundments to near the ground surface under some assumptions, in relation to hydraulic properties of the soil profile and tailings dam materials. The results at MON02A and MON02B are consistent with this possibility. Well-established measures can be used to control groundwater levels approaching the surface should this prove necessary and are discussed further in section 6.5.4.

iv Groundwater quality in ML 1535

Electrical conductivity (EC) and pH levels in groundwater within ML1535 have generally remained stable for the groundwater data reviewed since mining operations began in 2004. ANZECC 2000 trigger values for pH range between 6.5 and 8 and are based on values for NSW upland rivers. Some pH results are below the ANZECC 2000 trigger value of pH 6.5. However, pH levels have generally remained stable, are slightly acidic to neutral, and are similar to baseline levels. EC results have generally remained stable and are similar to, or higher than, the baseline levels.

Monitored pH levels close to the TSFs have generally ranged between 6.5 and 7, with the exception of MON01B (to the east of the northern TSF), with a lower pH generally ranging between 4.5 and 7, TSFNC with a pH of around 6, and PP03 and CB01 with a pH of around 8.

While open pit dewatering is causing a localised reduction in groundwater levels, pH and EC appear to be unaffected by this drawdown.

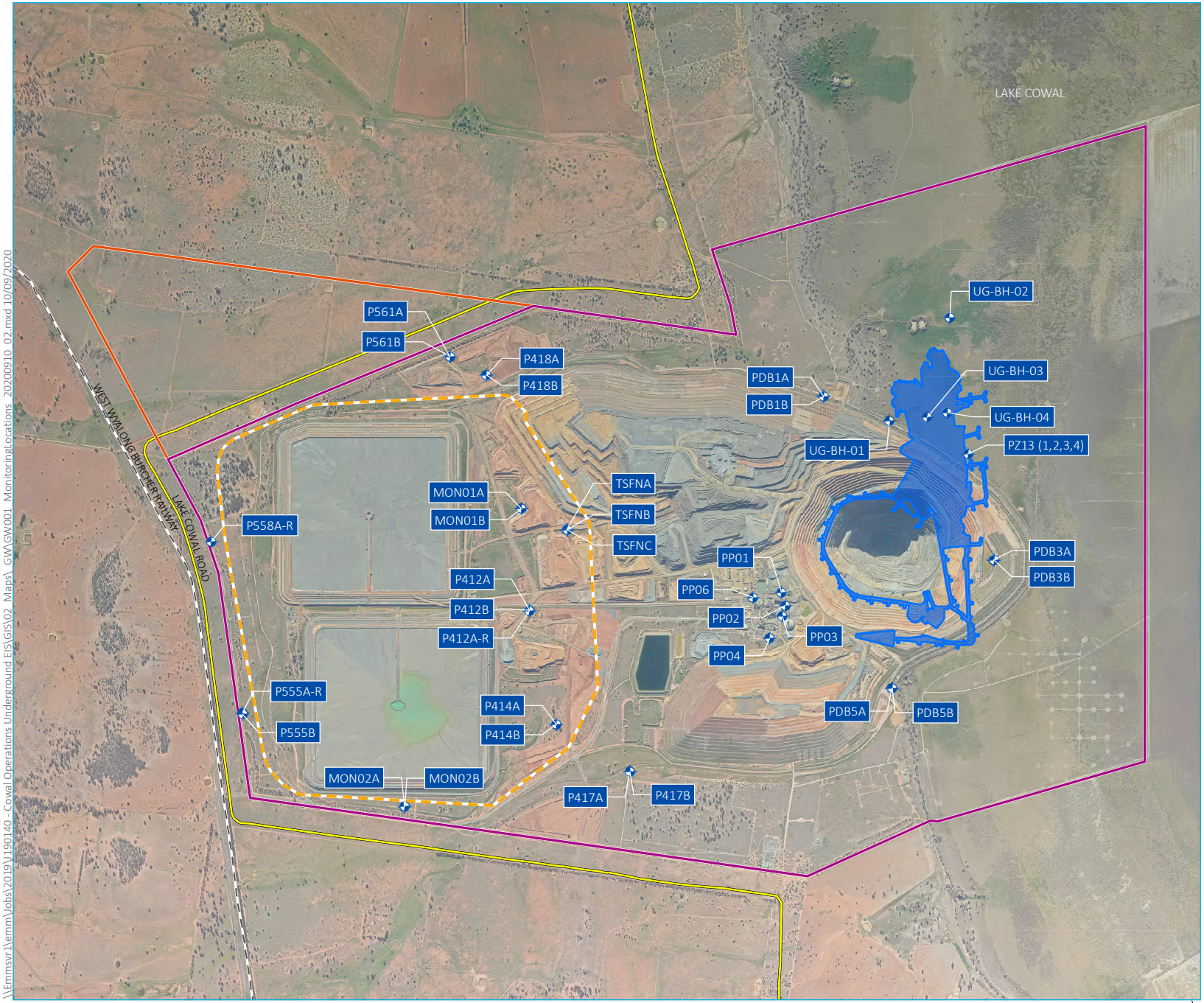
Trends in major ions have generally remained stable. Sodium results have generally remained higher compared to the baseline levels and sodium concentrations in the TSF area, pit area and Bland Creek Palaeochannel have increased at some bores. In general, a broad trend of increasing sodium concentrations is seen between 2004 and 2010, beyond which sodium concentrations begin falling. This trend is stronger for the mine site than for the BCPB, suggesting the cause may be related to severe drought conditions between 2004 and 2010. Groundwater with higher TDS, in high evaporation climates, is more prone to impact by drought conditions.

Variations in metal concentrations are assessed to reflect the natural heterogeneity in ground conditions, rather than direct impacts from mining. Regional groundwater is located in a metalliferous geological terrain in which iron and manganese naturally dominate the metal concentrations. Local fluctuations in manganese and iron concentrations were evident in the pit area and this may be related to ground disturbance and proximity to the pit (Coffey 2018).

a Groundwater contamination in ML 1535

Generally, cyanide has not been observed at significant concentrations in groundwater over the site. Where monitoring has shown total cyanide to be present, its concentration at individual monitoring locations has not been consistent over time, and its observed presence has not always been supported by weak acid dissociable (WAD) analysis.

The groundwater monitoring results suggest that, as of January 2020, there is no consistent trend to suggest that significant concentrations of cyanide have leached from the TSFs into the surrounding groundwater.



KEY

- Monitoring well location
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Indicative integrated waste landform perimeter
- Rail line
- Main road

Source: EMM (2020); Evolution (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 55

N

\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02 Maps\ GW\GW001 MonitoringLocations 20200910 02.mxd 10/09/2020

Monitoring well locations

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.8

EMM
creating opportunities

v Process water supply and water balance

On an annualised basis, CGO uses approximately 7,430 ML/year of process water (for a median rainfall sequence, which is detailed in Appendix I), primarily sourced from on-site with make-up from external sources. A detailed summary of the water balance is provided in Section 6.6.5.

In order of preference, process water sources are:

1. Reclaim from the IWL decant pond.
2. Pumping from the open pit and underground mine sumps.
3. Water from contained water storages.
4. Groundwater from the ESB via the mine borefield pipeline.
5. Groundwater from the saline groundwater bores located with ML 1535 when lake conditions allow.
6. Groundwater from the BCPB via the mine borefield pipeline (consistent with existing licensed limits outlined below).
7. Water accessed from the Lachlan River via the Jemalong Irrigation Channel using regulated flow licences purchased by Evolution on the open market.

Items 4-6 are groundwater sources and detailed further below. Further details regarding the remaining items are in the surface water chapter (refer section 6.6).

a Open-cut pit dewatering

A ring of vertical dewatering bores was installed around the open-cut pit to control groundwater levels. The vertical bore dewatering system was commissioned progressively, commencing in January 2005 and was fully operational by mid-2005. Records of dewatering volumes for the vertical bores for the period February 2005 to December 2009 indicate relatively consistent results after August 2005.

By 2012, all of the initial sets of bores had been decommissioned due to the lateral expansion of theopen-cut pit. Seven new dewatering bores were installed during 2011 and began pumping groundwater in November 2011. These were gradually decommissioned with mine groundwater inflow being captured by horizontal drains or emerging from the face. In August 2017 only two vertical dewatering bores remained in use, and by the end of 2017 no vertical dewatering bores were in use.

The progressive installation of horizontal bores (drains) in the open pit began in 2006. Some of these horizontal bores continue to operate and have proven successful in controlling groundwater pressure behind the open-cut pit face.

Groundwater seepage into the open pit, groundwater flows from in-pit horizontal drains and rainfall runoff in the open-cut pit are directed to sumps before being pumped to water storage dams.

CGO records the volumes pumped out of in-pit sumps and the volumes abstracted by the vertical dewatering bores on a monthly basis. The volume pumped out of in-pit sumps in any month is the sum of the volumes from the rainfall runoff, pit face seepage and horizontal drains. Rainfall runoff may come from areas outside the open-cut pit footprint.

Based on modelling and interpretation of pit dewatering volumes, groundwater inflow to the open pit is estimated to have gradually increased since 2008 and by January 2020 there is an estimated 1,000 m^3 of groundwater inflow to the open-cut pit per day. It is relevant to note that there was no increase in groundwater inflow to the open-cut pit observed during or following the 2010, 2012 and 2016 flooding of Lake Cowal.

b Storage dams

Water level records for storage dams D1, D2, D3, D4, D5A, D6, D8B and D9 were reviewed and all dams (with the exception of D9) were considered but are not regarded as likely to have any significant impact on regional or local groundwater levels due to their location within the groundwater drawdown cone for the open-cut pit.

Available groundwater monitoring data suggest that water seepage from D9 does not affect groundwater levels.

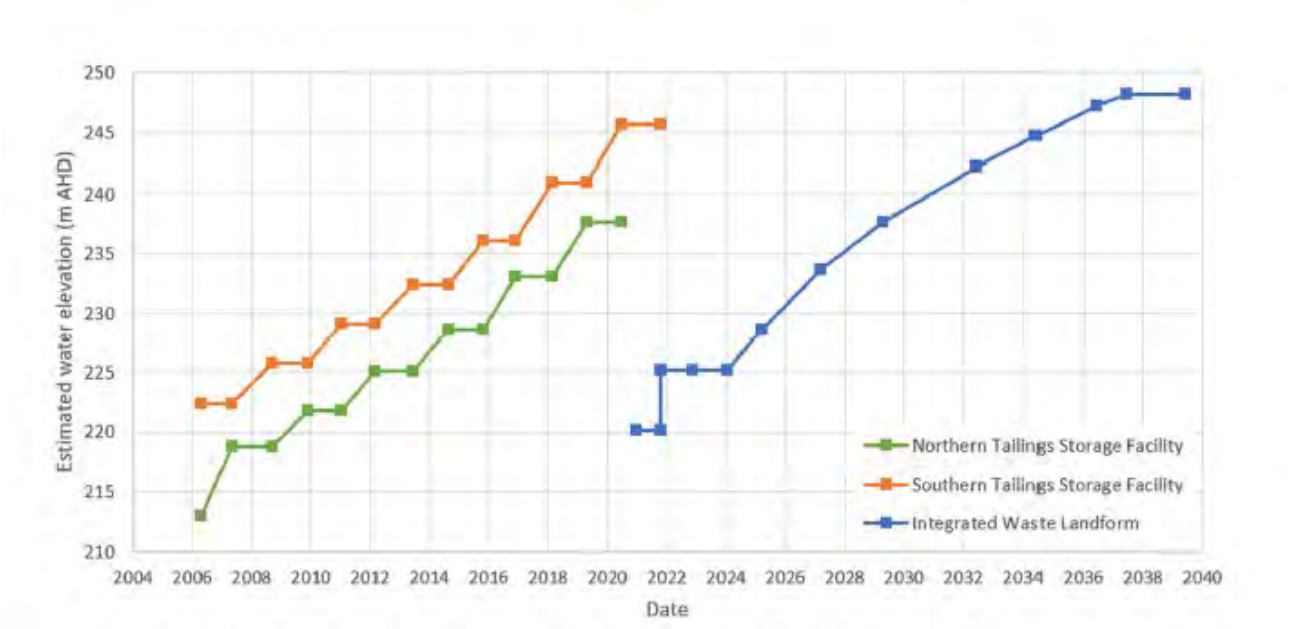
c Tailings storage facilities and Integrated Waste Landform

The IWL (encompassing the existing TSFs) is planned to be operational from 1 January 2021.

Due to tailings solids deposition, the surface of deposited tailings rises over time within each TSF. The lowest elevation of the surface of deposited tailings within each dam was estimated based on the nominated crest levels, known dam geometries, and assuming a tailings beach slope of 0.5%.

Table 7-1 in Appendix H presents the estimated lowest deposited tailings surface elevation within each dam associated with each raise of the tailings embankment. Historical percentage water coverage data for the tailings dams was provided for May 2006 to September 2010, and for March 2012 to November 2012. Based on the geometry of the TSFs, the maximum water depth within both the northern and southern TSFs, averaged over these periods, is estimated to be 0.2 m.

The estimated average water elevations are shown in Figure 6.9.



Source: Figure 7-3 of the Cowal Underground Development EIS Mine Site Hydrogeological Assessment (August 2020)

Figure 6.9 TSF and IWL water levels

The hydraulic conductivity of the TSF foundation material is lower than that of the deposited tailings and the surface water lying within the storage facility ponds is expected to maintain full hydraulic connection with the top of the TSF foundation material through the deposited tailings. The hydraulic head of the overlying saturated tailings mass and the (very weak) hydraulic connection through the TSF's clay liner acts as a driver of groundwater mounding below the TSF. The management of this connection is discussed further in section 6.5.4.

d Eastern saline borefield

The ESB is located approximately 10 km east of the Lake Cowal eastern shoreline. Pump tests (Groundwater Consulting Services Pty Ltd 2010) indicated that two bores could supply approximately 1.5 ML/day of saline water.

Average extraction since commissioning of the borefield has been approximately 0.45 ML/day. The borefield is currently approved for the life of the mine to supply a maximum of 750 ML/year.

e Bland Creek Palaeochannel Borefield

The BCPB is one of three groundwater areas within the Lachlan Formation. Groundwater from this palaeochannel is used for mine process water by CGO and extraction from the BCPB is expected to continue for the life of the mine with withdrawals limited to the following daily and annual licensed volumetric limits:

- maximum daily rate: 15 ML/day; and
- maximum annual extraction: 3,650 ML.

The NSW government monitors groundwater levels in the Lachlan Formation in each of the following areas within the BCPB (at the request of the Bland Palaeochannel Groundwater Users Group) using the following observation bores (with respective trigger levels):

- BCPB Area: Bore GW036553 (Investigation Trigger Level 137.5 metres Australian Height Datum (m AHD) and Mitigation Trigger Level 134 m AHD);
- Billabong Area: Bore GW036597 (Trigger Level 143.7 m AHD); and
- Maslin Area: Bore GW036611 (Trigger Level 145.8 m AHD).

Irrigators at the Billabong and Maslin farms also extract significant groundwater volumes from this source. If the trigger levels are breached, this triggers actions to protect the groundwater resource from overuse. Over the period 1 July 2004 to 31 December 2019, the average total pumping rates at the largest groundwater extraction bores (4.1 Megalitres per day [ML/day] at the borefield supplying CGO, 2.8 ML/day at the Billabong bores, and 2.7 ML/day at the Maslin bore) resulted in groundwater levels above the trigger levels for these monitoring bores. Pumping rates for the Billabong and Maslin bores, as used in verification analysis, involve significant assumptions (detailed in Appendix H). The lowest observed groundwater levels over the period 1 July 2004 to 31 December 2019 were as follows:

- BCPB Area bore GW036553: 7.5 m above trigger (141.5 m AHD on 15 January 2010);
- Billabong Area bore GW036597: 1.5 m above trigger (145.2 m AHD on 21-23 November 2019); and
- Maslin Area bore GW036611: 1.6 m above trigger (147.4 m AHD on 16 December 2019).

f Saline groundwater supply bores

Currently, two saline groundwater supply bores are located within ML 1535 to the south-east of the open pit. Continued operation of the existing saline groundwater supply bores is proposed for the mine life.

Pumping tests (Coffey 2009) indicate that the groundwater bores could supply up to 1 ML/day of saline water for use in the process plant. During periods when Lake Cowal is inundated, the bores would be shut-down and capped and, as such, the bores would only operate during low rainfall periods. At various times during the mine life, sourcing water from the saline groundwater supply bores would reduce demand on the other external water supply sources.

6.5.3 Impact assessment

i Field investigations

To support assessment of groundwater level and hydraulic conductivity parameters adopted for the Underground Development Project, a field investigation program was carried out between 28 January and 29 February 2020.

Four vertical boreholes (UG-BH-01, UG-BH-02, UG-BH-03 and UG-BH-04) were drilled from the surface of Lake Cowal. Lake Cowal was dry during the fieldwork (June 2020). Two boreholes were drilled to 70 m and two boreholes were drilled to 100 m depth. Borehole water pressure (packer) testing was carried out on selected boreholes. Further details and a summary of the packer test results is provided in Appendix H.

As part of the fieldwork, groundwater seepage into the GRE46 exploration decline was mapped by a Coffey field engineer. The total rate of groundwater inflow into the decline was assessed to be 2.8 L/s on 27 February 2020 based on site records. An assessment of the hydraulic conductivity required to produce this flow rate was carried out. This was done by assuming an equivalent length tunnel in uniform rock with the same approximate groundwater heads and tunnel elevation profile. The resulting hydraulic conductivity was assessed to be 4.8 x 10^{-4} m/day.

ii Numerical model development

A three-dimensional numerical groundwater flow model was developed using the proprietary software Feflow, Version 7.2. The model was used to calibrate hydraulic conductivity, specific storage and rainfall infiltration rates for the conceptual hydrogeological model, based on observed groundwater heads, open pit excavation progress and interpreted pit inflows for the period 1 January 2005 to 1 January 2020.

The numerical groundwater flow model was calibrated using an automated process. This resulted in adopted aquifer properties that provided a good fit to observed open pit inflows and to groundwater monitoring data from 22 locations over a fourteen year period from 2005 to 2020 and four locations above the proposed underground development where monitoring commenced in February 2020.

The calibrated model was then used to predict the impacts from the Underground Development Project on local groundwater levels and flow directions and to predict the rates of groundwater inflow into the underground mine.

Further details regarding the numerical model development is provided in Appendix H.

iii Predicted impacts

Predicted impacts associated with the proposed modification predominantly relate to potential impacts on the BCPB (from the continued water abstraction to provide process water to the ore processing plant) and predicted impacts on the groundwater from the tailings storage facility. This section provides further discussion on these predicted impacts.

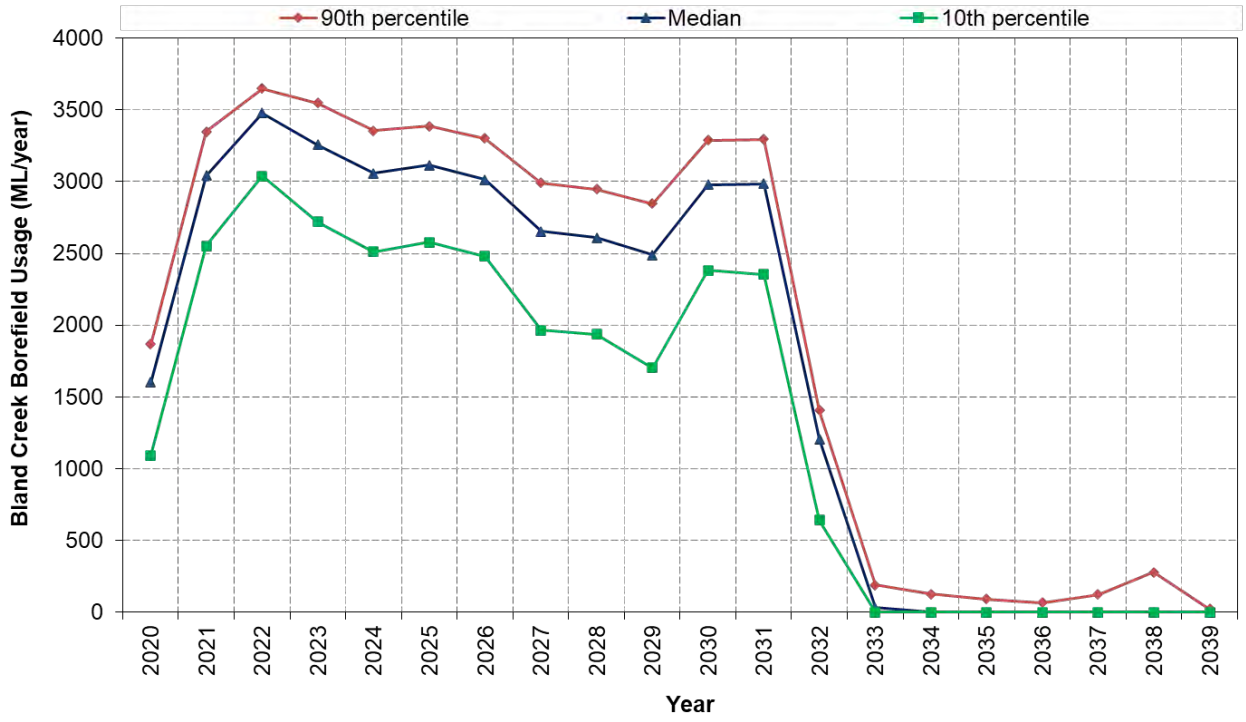
a Predicted impacts on the Bland Creek Palaeochannel Borefield

A groundwater assessment was undertaken to assess potential impacts due to groundwater extraction from the BCPB and ESB in relation to Mod 16 and the Underground Development Project.

The water balance model results of average system inflows and outflows for the Underground Development Project (outlined further in section 6.6) show that the demand from external sources (ie the eastern saline borefield, the BCPB and licensed extraction from Lachlan River water entitlements) for a median rainfall sequence averages 3,104 ML/year.

This compares with 4,247 ML/year predicted as part of the Modification 14 Surface Water assessment (HEC 2016), indicating that reliance on external sources is likely to decrease on average as a result of the proposed modification.

Figure 6.10 shows predicted annual water demands for the BCPB. It shows that the median annual demand from the BCPB is predicted at a maximum rate of 3,480 ML/year during the period of open-cut mining and associated ore processing, with zero requirement predicted following the cessation of treatment of the residual open pit ore stockpiles.



Source: Figure 19 of the Cowal Gold Operation Underground Mine Project Hydrological Assessment (HEC 2020)

Figure 6.10 Predicted Annual Bland Creek Palaeochannel Borefield Usage

Recovery of the ESB and BCPB is predicted at around 166 m AHD in ten years (about 30 m below 1998 water levels), and will continue to gradually recover over time subject to the amount of ongoing abstraction from private bores after CGO closes and the prevailing climate. It is possible that it will take significant periods of time for water levels to recover to levels seen in the late 1990s (prior to the drought and onset of extensive pumping) due to the low rate of recharge and continuing pumping for irrigation.

b Groundwater levels around the Tailings Storage Facility

Groundwater levels in piezometers in the vicinity of the TSFs have shown increases in levels in recent years. Of these, the largest rises were recorded at MON02A and MON02B (screened in the Saprock and Saprolite units, respectively) which have displayed a gradual rise since late 2006. Groundwater level variation around the TSFs was investigated by Coffey (2009a) and further investigations were carried out in 2016 by Northern Resource Consultants, where the rises were assessed to be related to the percolation and the movement of seepage from the TSFs.

If the current trends were extrapolated linearly the water level at MON02A and MON02B would reach the ground surface at 222.4 mAHD at the end of 2026. Evolution has developed mitigation measures as a contingency. These are outlined in section 6.5.4.

Following mine closure, the elevated groundwater levels are expected to dissipate over time as the water levels within the TSFs gradually reduce.

c Predicted impact on groundwater quality

The quality of groundwater collected by the dewatering system is expected to be similar to existing groundwater quality and would be used as a water supply for the processing plant. The expected concentration/value range for a number of analytes is provided in Table 6.16. Pit dewatering will only have a small and localised (ie within ML 1535) impact on groundwater quality.

Table 6.16 Expected dewatering groundwater quality

Analyte	Concentration (mg/L) or value
pH	5.8 to 7.1
Dissolved sodium	8,000 to 13,000
Sulphate	2,500 to 7,000
Alkalinity (bicarbonate)	80 to 500

An assessment of contaminant migration, based on a conservative assessment of the movement of contaminants originating from the IWL over a period of up to 200 years after mine closure is detailed in Appendix H. Contaminants identified as having the potential to be released from the IWL include cyanide, arsenic, zinc and other heavy metals (Coffey 2018a). It should be noted that of these, cyanide is the only substance introduced by the mining operation the metals and arsenic derive from the mine ore.

Potential impacts to groundwater quality due to seepage from the IWL suggest that after 100 years groundwater quality may change due to seepage from the IWL stored water, and may will extend a distance of up to approximately 1.7 km from the IWL walls. The Australian Groundwater Explorer database confirms there are no registered water supply bores within 1.7 km of the IWL[5]. Additionally, cyanide is introduced to mine tailings during ore processing at a maximum concentration of 20 mg/L and is the only significant chemical in the tailings that is not derived from the host rock. Consideration of cyanide decay times indicates that cyanide concentrations are predicted to fall well below detectable limits prior to seeping outside the CGO mine area.

[5] http://www.bom.gov.au/water/groundwater/explorer/map.shtml

6.5.4 Mitigation and management measures

The existing CGO Surface Water, Groundwater, Meteorological and Biological Monitoring Programme (SWGMBMP) guides the ongoing management of the quality and quantity of surface and groundwater within and around the site. The objectives of the SWGMBMP are to:

- fulfil the relevant development consent conditions;
- provide a description of baseline water, meteorological and biological monitoring and therefore, information against which operational monitoring results can be compared;
- 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;
- outline a process by which administering authorities and stakeholders can regularly assess and confirm the effectiveness of the management strategies; and
- provide details of the surface water, groundwater, meteorological and biological monitoring programmes during the construction and operation phases of the CGO.

Additionally, as the water level rises at MONO2A and MONO2B are interpreted to be associated with seepage from the TSFs, the following management and mitigation measures have been developed:

- continuation of monitoring of piezometers in the vicinity of the TSFs;
- installation of new monitoring piezometers to replace those which will be destroyed (including (MONO2A and MONO2B) by the construction of the IWL, allowing at least six months of overlap so that correlations between the new monitoring piezometers and the ones they will replace can be developed;
- review of groundwater levels on an annual basis; and
- should existing trends continue, develop a groundwater control plan and design control measures to address water level rise which could include:
    - augmentation of the existing monitoring network;
    - pumping groundwater from bores introduced in the vicinity of MON02 back to the TSFs; and/or
    - installation of trench drains and sumps to collect groundwater and suppress further rise in groundwater levels.

Additionally, the following monitoring activities are recommended:

- continued groundwater monitoring to validate the predictive modelling, particularly in the vicinity of the open pit, TSFs, stopes and access tunnels and ML1535 saline groundwater supply borefield; and
- establishment of new monitoring bores to replace those that would be displaced by the IWL, including MON02A, MON02B, P414A, P414B, P412A, P412A-R, TSFNA, TSFNB, TSFNC, MON01A, MON01B, P558A-R and P555A-R.

a Lachlan Formation Water Source – contingency strategy

The groundwater level in the Lachlan Formation in the BCPB area is monitored continuously in a groundwater monitoring bore on Burcher Road (GW036553). Contingency measures have been developed for implementation when water levels reach an elevation of either 137.5 m AHD (Investigation Trigger Level) or 134 m AHD (Mitigation Trigger Level). These trigger levels were developed in consultation with Department of Planning Industry and Environment – Water Group (DPIE Water - then known as the Department of Industry Water) and other water users within the Bland Creek Palaeochannel, including stock and domestic users and irrigators. For each trigger level, there are the following contingency measures:

- Where the groundwater level in GW036553 is below 137.5 mAHD, one or more of the following contingency measures will be implemented in consultation with DPIE Water:
    - Investigate the groundwater level in the Trigalana bore (GW702286) 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.
- Where the groundwater level in GW036553 is below 134 m AHD, one or both of the following contingency measures will be implemented in consultation with DPIE Water:
    - Alter the pumping regime to maintain the water level in the impacted stock and domestic bores.
    - Maintain a water supply to the owner/s of impacted stock and domestic bores.

b Cowra Formation Water Source – contingency strategy

Modelling results indicate a maximum predicted drawdown of about 32 m at bore GW029574, the only known water bore installed to a depth within the Lower Cowra Formation and within 15km of the BCPB. It is located 10km south of BCPB. The bore is 88 m deep and may be able to continue operation if the screen length is sufficiently long and optimally located. If not, contingency measures may be required for this bore.

6.5.5 Summary and conclusion

A hydrogeological assessment was undertaken by Coffey to assess potential impacts on the groundwater system under the proposed modification (refer Appendix H). The assessment employed predictive numerical modelling based on a major revision of an earlier numerical groundwater flow model, taking into account the proposed underground mining to the north of the existing open-cut pit.

Recovery of the ESB and BCPB is predicted around 166 m AHD in 10 years (about 30 m below 1998 water levels), and will continue to gradually recover over time subject to the amount of ongoing abstraction from private bores after CGO closes and the prevailing climate. It is possible that it will take significant periods of time for water levels to recover to levels seen in the late 1990s (prior to the drought and onset of extensive pumping) due to the low rate of recharge and continuing pumping for irrigation.

An assessment of contaminant migration, based on a conservative assessment of contaminant transport parameters, was undertaken. The assessment predicted that after 100 years the potential for groundwater quality changes due to seepage from the IWL stored water will extend a distance of up to approximately 1.7 km from the IWL walls (there are no registered water supply bores within this distance). Consideration of cyanide decay times indicates that cyanide concentrations are predicted to fall well below detectable limits prior to seeping outside the CGO mine area.

6.6 Surface water

6.6.1 Introduction

A detailed surface water assessment was conducted by HEC which assessed the Underground Development Project combined with Mod 16. The HEC report is reproduced in full as Appendix I. The assessment also drew on the groundwater assessment and modelling for the Underground Development Project and for the BCPB contained in Coffey reports (Coffey 2020a and 2020b - refer Appendix G and Appendix H).

The main surface water-related activities associated with Mod 16 include:

- water management requirements for the processing of ore from the open-cut pit and the underground, taking into consideration the extended period of operations; and
- surface water impacts from the deposition of additional tailings in the IWL.

6.6.2 Assessment requirements

There were no formal assessment requirements issued by DPIE for Mod 16. However, agencies made comments in relation to assessment issues. Comments were received from EPA on surface water issues. Its comments are reproduced in Table 6.17.

Table 6.17 Surface water related assessment requirements

Requirement	Location in this document
EPA	
The goals of the project should include the following:	
• no pollution of waters (including surface and groundwater) except to the extent authorised by the EPA (ie accordance with the EPL)	Appendix I
• polluted water (including effluent, process waters, wash down waters, polluted stormwater or sewage) is captured on the site and collected, treated and beneficially reused, where it is safe and practicable to do so	Section 6.6.4 Section 6.6.5
The assessment should document the measures that will achieve the above goals.	Section 6.6.9
Details of the site drainage and any natural or artificial waters within or adjacent to the development must be identified and where applicable measures proposed to mitigate potential impacts of the development of these waters.	Section 6.6.4 Section 6.6.5 Section 6.6.9
The assessment should provide details of any water management systems for the site to ensure surface and groundwaters are protected from contaminants.	Section 6.6.9

The surface water assessment has been prepared with consideration of the following legislation, policies, guidelines and plans:

- *Water Management Act 2000;*
- *Water Management Amendment Act 2014;*
- *Water Sharing Plan for the Lachlan Regulated River Water Source 2016;*
- *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012;*
- NSW State Rivers and Estuary Policy (NOW);
- NSW Government Water Quality and River Flow Objectives (EPA);
- National Water Quality Management Strategy including:
    - Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000a)
    - Australian Guidelines the Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ 2000a);
    - Guidelines for Sewerage Systems – Effluent Management (ANZECC/ ARMCANZ 1997);
    - Use of Reclaimed Water (ANZECC/ARMCANZ 2000c);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018);
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004b);
- Managing Urban Stormwater: Soils and Construction (Landcom 2004); and
- Managing Urban Stormwater Guidelines (EPA 1997; EPA 1998).

6.6.3 Existing environment

i Catchment hydrology

CGO is located on the western side of Lake Cowal and overlaps part of the western shoreline of Lake Cowal (refer Figure 6.11). This ephemeral, freshwater lake is in the lower reaches of the Bland Creek catchment and is part of the Wilbertroy Cowal Wetlands on the Jemalong Plain.

The Lachlan River is the major regional surface drainage and part of the Murray-Darling Basin. Lake Cowal periodically also receives inflows from the Lachlan River during periods of high flow. Lake Cowal also overflows to Nerang Cowal, a smaller lake to the north and overflow from both lakes ultimately returns to the Lachlan River further downstream via Bogandillion Creek. Flows in the Lachlan River near Lake Cowal are regulated by releases from Wyangala Dam.

ii Rainfall and evaporation

Rainfall data was sourced from Bureau of Meteorology (BoM) stations at Wyalong, Ungarie and Burcher Post Offices (PO) as well as rainfall recorded at CGO since 2002. The data shows that long-term regional rainfall averages 455 millimetres (mm) per annum.

Average annual rainfall recorded at the CGO from 2002 to May 2020 averaged 415 mm, which compares with an annual average of 432 mm recorded at Wyalong PO and 463 mm at Burcher PO for the same period.

The nearest BoM pan evaporation station is located at the Condobolin Agricultural Research Station, approximately 65 km north of CGO. Annual pan evaporation averages 1,972 mm at this station.

iii Water quality

Baseline water quality has been assessed based on results of an intensive sampling program conducted between 1991 and 1995 at 34 monitoring locations along four transects across Lake Cowal. This data has been supplemented by further monitoring undertaken when the lake re-filled (November 2010 to July 2014 and August 2016 to July 2018), as well as sampling of lake inflow from Sandy Creek and Bland Creek at various times between 2010 and 2017 when sufficient flow permitted.

The results of the monitoring program, when compared to relevant default guideline values in ANZECC/ARMCANZ (2000a) and ANZG (2018), show:

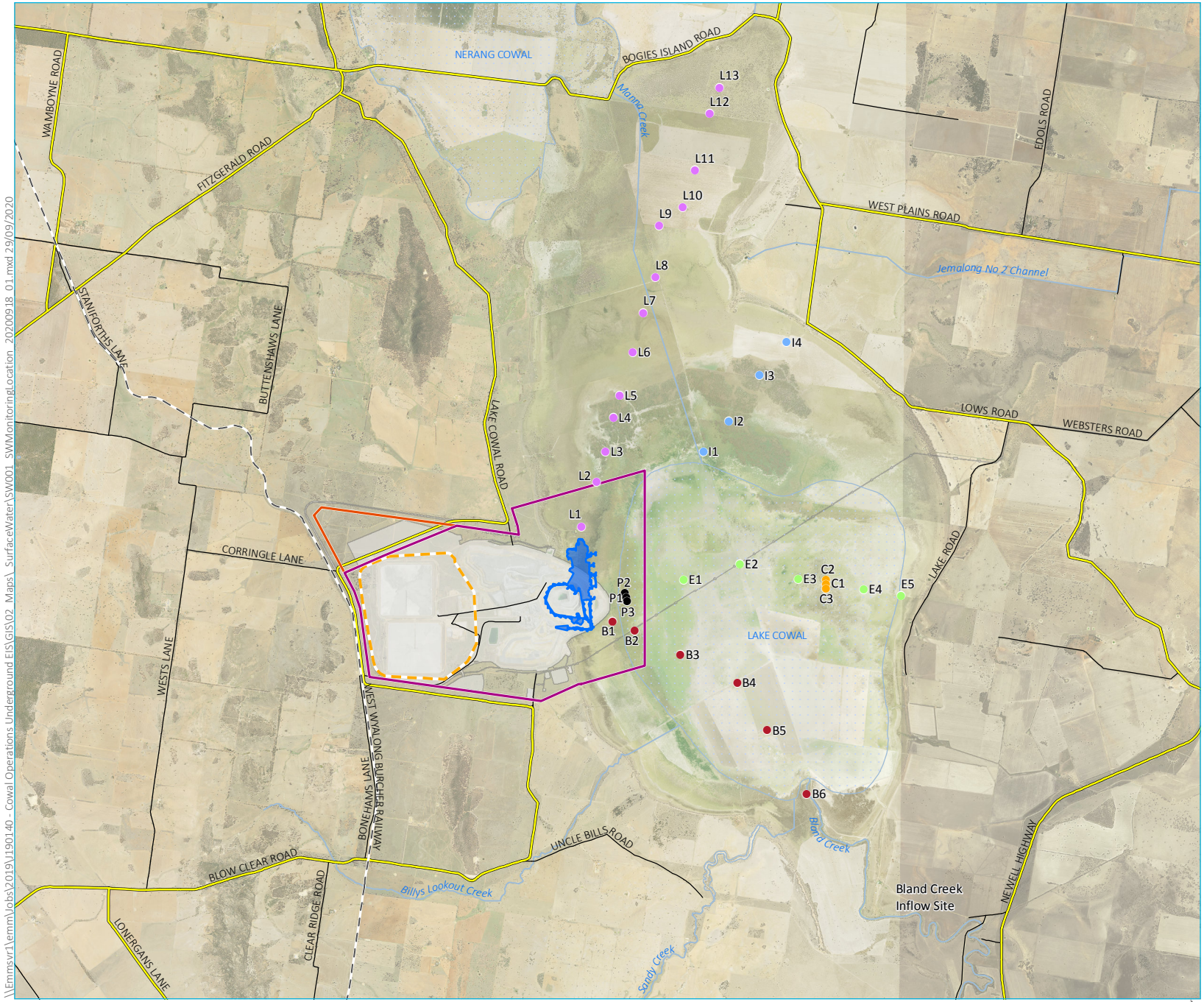
- a high pH range relative to the ANZECC/ARMCANZ (2000a) default guideline values and baseline ranges, however, similar to elevated levels at other sites near to the CGO;
- average copper, lead and zinc concentrations were high relative to both the ANZG (2018) default guideline values and baseline concentrations, however they were lower than inflow site concentrations and have been similarly elevated at sites over 6 km away on the opposite side of Lake Cowal;
- average turbidity significantly higher than the ANZECC/ARMCANZ (2000a) default guideline value and higher than baseline levels, however turbidity levels have been relatively uniform at sites close to the CGO; and
- total phosphorous concentrations significantly higher than the ANZECC/ARMCANZ (2000a) default guideline value for freshwater lakes, however concentrations have been similar at sites both close to the CGO and on the other side of Lake Cowal, and lower than inflow site records. It is also noted that the average total phosphorous concentration is much lower than the baseline average.

As an ephemeral lake, and given that it and its surrounds are subject to agricultural activities when dry, Lake Cowal will be subject to filling with run-off and floodwater which generally will elevate turbidity and result in a higher amount of total suspended solids and soluble metals.

The surface water assessment concluded that there is no obvious causal link between the mining operations and water quality in Lake Cowal, as surface water runoff within the CGO area is fully contained in the ICDS and groundwater (including any seepage from on-site storage) flows towards the open-cut pit.

The only plausible links between mining activity at the CGO and lake water quality is that overflow from storage dams D1 and/or D4 (which are outside the ICDS as shown in Figure 6.11), or mine site dust fall-out onto the lake or runoff/wash-off from the outside batters of the perimeter waste emplacement when the lake protection bund is inundated. Both D1 and D4 storage dams are fitted with pump back systems and have never overflowed. Based on assessment of monitoring data, the surface water assessment concluded that there is no evidence that the existing CGO has resulted in changes to water quality in Lake Cowal.

Existing surface water monitoring locations are shown in Figure 6.11.



KEY

- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- DA14/98 approved surface disturbance
- Indicative integrated waste landform perimeter
- Rail line
- Main road
- Minor road
- Named watercourse
- Named waterbody

Surface water monitoring locations

- Bland Creek transect
- Control transect
- East shore transect
- Irrigation channel transect
- Lachlan floodway transect
- Project transect

Source: EMM (2020); Evolution (2020); DFSI (2017)

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Existing surface water monitoring locations

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Figure 6.11

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6.6.4 Existing on-site water management system

The following sections describe the on-site surface water management systems, including the drainage diversion systems, surface water circulation, water supply and water balance. CGO's on-site water management system is shown in Figure 6.12.

The surface water assessment outlines the following key principles, employed by CGO in their water management strategy, for both the existing site and the construction and operational phases of Mod 16:

- minimisation of disturbance areas;
- containment of potentially contaminated water;
- recycling of captured water; and
- progressive stabilisation and revegetation of disturbed areas.

i Catchment diversion systems

CGO's mining infrastructure is within a constructed catchment, referred to as the Internal Catchment Drainage System (ICDS - refer Figure 6.12). The ICDS captures all site runoff and seepage to prevent offsite impacts and to direct it the process water circuit. It comprises six internal drainage catchments, each served by storage dams or runoff collection, and two water supply storages.

Details of the ICDS are shown in Table 6.18.

The ICDS works in combination with the UCDS and the on-site lake protection bund to ensure potentially contaminated water originating within CGO remains separated from Lake Cowal. The lake protection bund comprises a temporary isolation bund and a permanent isolation bund (refer Figure 6.12). The lake protection bund is made up of a large engineered embarkment that provides a permanent barrier between the lake and the open-cut pit. Runoff from areas undisturbed by mining is directed via the UCDS around the CGO to Lake Cowal.

A summary of existing approved internal catchment and dams is shown in Table 2.2.

Table 6.18 Summary of existing/approved internal catchments and storages

Storage	Catchment/function	Catchment area (hectares)	Storage capacity (ML)
D1	Runoff from northern perimeter of the northern waste rock emplacement	92	57.8
D2	Runoff/seepage from run-of mine (ROM) pad, low grade ore stockpile and from the northern waste rock emplacement area	332	198.2
D3	Runoff from perimeter catchment surrounding the open-cut pit and the perimeter waste rock emplacement areas	88	38.1
D4	Runoff from the southern perimeter of the southern waste rock emplacement	64	62.3
D5A	Process plant area runoff collection	32	78.6
D6	Process water storage, and main source of process plant water	10	19.3
D8B	Runoff from southern waste rock emplacement and area between southern tailing storage facilities (TSF) and D9	216	30.4

Table 6.18 Summary of existing/approved internal catchments and storages

Storage	Catchment/function	Catchment area (hectares)	Storage capacity (ML)
D9	Process water storage and storage of raw water	Incident area	730.7
D10*	Process water storage and storage for raw water	Incident area	1,500

*Approved storage D10 is yet to be constructed

ii Surface water capture and circulation

The open-cut pit accumulates groundwater seepage from the surrounding rock mass and incident rainfall. It is also the point to which any overflow reports to from any of the on-site dams (except D1 and D4 which are emptied by pumping) or in the highly unlikely event of an overflow from the TSFs. Inflows in the open-cut pit are pumped to dam D6. Groundwater is further discussed in section 6.5 of this report.

Mine waste rock disposal occurs in three waste rock emplacements: the northern, southern and perimeter waste rock emplacements. Runoff from these areas is managed as follows:

- from the northern waste rock emplacement, runoff reports to the storage dam D1 which is pumped to storage dam D6;
- from the southern waste rock emplacement, runoff reports to dam D4 which is pumped to storage dam D6 or D9; and
- from the perimeter waste rock, runoff reports to the storage which forms between the perimeter waste rock emplacement and the temporary isolation bund. Water that accumulates in this storage is pumped to D6.

Tailings material is currently piped as a slurry from the process plant for disposal in the two TSFs. Rainfall and decant water from the settled tailings accumulates in an internal pond within each TSF, which is subsequently pumped to storage D6 for re-use in the process plant.

iii Water supply

a Water sources

The process water circuit at CGO continually recycles water decanted from the TSF and that captured as runoff from areas within the ICDS for re-use in ore processing. Water is also sourced on-site from groundwater seepage into the open-cut pit and groundwater sourced from the saline groundwater supply bores within ML 1535 when Lake Cowal is dry. Other, external water supply is provided to the site via the mine borefield pipeline from three sources. In order of importance, water supply sources are:

- reclaim from the processing plant and IWL;
- pumping from the open-cut pit;
- water from contained storage dams (transferred to either storage dam D6 or D9);
- groundwater from the ESB via the mine borefield pipeline;
- groundwater from the BCPB refield via the mine borefield pipeline;

- groundwater from the saline groundwater bores located within ML 1535 when lake conditions allow; and
- water from the Lachlan River via the Jemalong Irrigation Channel using regulated flow licences purchased by Evolution on the open market under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.

Information about water usage and volumes is provided in sections 4.2.2 to 4.2.5 of Appendix I. Groundwater sources are further discussed in section 6.5 of this modification report.

The surface water assessment examined at the annual volume of water extracted from the Lachlan River for use at the CGO in comparison with the total volume of water usage from general security and high security water allocation assignments for the Lachlan River regulated water source. The data shows that CGO extracted 3,179 ML of water from the Lachlan River between 1 July 2019 and 30 April 2020. This amounts to approximately 3.5% of total water usage from the Lachlan River regulated water source for that year. The maximum annual CGO water usage from the Lachlan River occurred in 2009/2010 and amounted to 16.8% of the total usage.

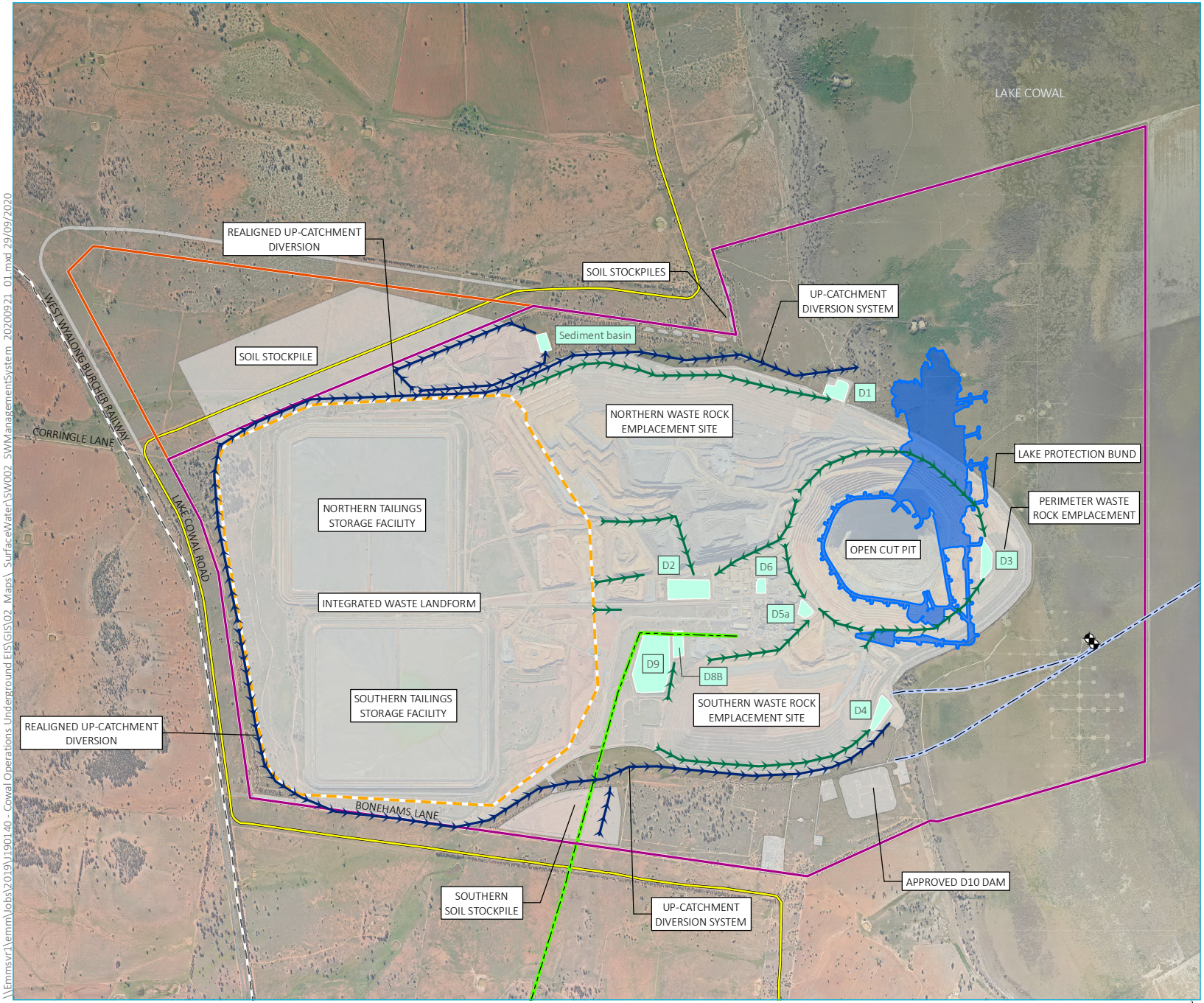
b Harvestable right

None of the storage dams at CGO are used to harvest runoff from land and all storages are used to contain contaminated drainage, mine water or effluent. For this reason, the on-site storage dams are not considered as a component of the harvestable right calculations in the surface water assessment.

iv Water use

The main water consumer at CGO is the process plant. Water is also consumed in construction and haul road dust suppression. Since mid-2007, the CGO processing rate has averaged 7.4 Mtpa and total water demand has averaged 17 ML/day, of which up to approximately 7.6 ML/day (around 45%) on average was supplied by on-site recycled water and incident rainfall.

Past monitoring data shows that haul road dust suppression averages 0.62 ML/day. In 2019, the average process plant demand was 22 ML/day. In the past, during the initial oxide ore processing phase, the total water demand averaged 33.7 ML/day. A higher water demand is required for oxide ore, due to its clayey and fine nature.



KEY

- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- DA14/98 approved surface disturbance
- Indicative integrated waste landform perimeter
- Electricity transmission line
- Water supply pipeline
- Saline groundwater supply bore
- Rail line
- Main road

Surface water management system

- Internal catchment drainage system
- Up catchment diversion system
- Existing dam

Source: EMM (2020); Evolution (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 55

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Surface water management system

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.12

EMM
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6.6.5 Proposed water management system

i Overview

Mod 16 will result in fairly minor changes to surface water management at site and none of which will result in any effects offsite. The changes are:

- augmentation of dam D5A to allow the ore receival hopper to be constructed. The existing catchment area of the dam will not change;
- augmentation of other storage dams as required throughout the life of the modified mine, within the existing catchment/disturbance area of each storage dam; and
- extending the period that runoff will be captured from waste rock emplacements and ore stockpiles (including the batters of the IWL) and directed to storage dams.

However, the above changes will not significantly affect the operation of the current water management system, as they will not change the way the ICDS operates or change the order of priority of water use at the mine.

ii Water supply

Water supply will continue to be primarily sourced on-site, with additional water sourced offsite to make up the balance. The order of importance of water supply sources will remain as described in section 6.5.4 above. To mitigate against potential supply disruption from offsite sources, the D9 storage dam will be maintained as full as possible and topped-up by both on-site and off-site sources.

If additional water storage is required on site, Evolution will construct the approved process water storage D10 which has a design capacity of 1,500 ML. Storage dam D10 will complement storage D9, with water shared between the storages and used to provide supply to the process plant.

6.6.6 Post-closure water management system

In accordance with Condition 2.4(b) of DA 14/98, progressive rehabilitation of final landforms or disturbed areas will occur as soon as reasonably practicable following disturbance. Mine closure concepts and management measures will continue to be developed in accordance with the Mining Operations Plan, the Strategic Framework for Mine Closure (Department of Industry, Tourism and Resources 2000) and the Leading Practice Sustainable Development Program for the Mining Industry- Mine Closure (Department of Industry, Innovation and Science 2016).

The stopes of the underground mine will fill with water over time and groundwater will report to the open-cut pit void where it will reach a peak equilibrium water level of 148.6 m AHD - more than 60 m below the spill level (ie the final void will be contained). Equilibrium levels will be reached slowly over a period of more than 1,600 years. Given the water level and groundwater flux relationship provided groundwater outflow was not simulated to occur and the final void will remain a groundwater sink.

6.6.7 Assessment approach

The assessment simulated the dynamic behaviour of the water balance from April 2020 to August 2039 under a range of different climatic conditions. Given the integration of site operations, surface water modelling was combined for the whole Underground Development Project.

The water balance model structure is largely the same as the layout provided in Figure 6.12, and includes the proposed storage dam D10 modelled as an expansion of D9 from January 2022 onwards and the extraction of ore from the underground mine commencing in April 2022. The water balance model was used to simulate the likely performance of the water management system over the simulated 131 climatic sequences. The model was run using the following parameters:

- borefield pipeline capacity of 22 ML/day at 100% availability;
- oxide tailings bleed reduction of 2%;
- Bland Creek Palaeochannel Borefield daily extraction rate limited to 10 ML/day; and
- no limit on extraction from Lachlan River entitlements. If borefield supplies cannot be fully utilised to meet demand, supplementary water is sourced from the Lachlan River and is limited only by the capacity of the borefield pipeline (22 ML/day).

The water balance model developed for the CGO simulates all the inflows, outflows, transfers and changes in storage of water on-site at regular time intervals (ie six-hourly basis).

The surface water assessment also takes into consideration the possible effects of climate change on the water balance. It considers models developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the BoM (CSIRO and BoM 2015a), and projected changes in, and probability distributions for, a range of climate variables including temperature, mean and extreme rainfall and potential evapotranspiration and the potential interaction between the on-site surface water management system and Lake Cowal.

6.6.8 Predicted impacts

i Operational phase

a Water demand

Most of the water consumed at the CGO site is in ore processing. The surface water assessment estimated process water demand on planned ore processing tonnages, estimated paste fill volume and assumed tailings and paste solids content (refer Table 15 of Appendix I). Based on the predicted ore processing tonnages provided (refer Table 9 of Appendix E), the average water demand is estimated to be:

- 22 ML/day across the 2020 – 2031 period when both primary and oxide ore are being processed;
- 18 ML/day across the 2032 – 2034 period when oxide ore processing will have ceased; and
- 2.9 ML/day across the 2035 to 2038 period.

The assessment shows water demand peaks at 25 ML/day in 2024 when the combined amount of ore being processed from the underground and the open-cut mines is also at its peak.

Water will also continue to be required for general uses on site, including haul road dust suppression (average of 0.61 ML/day), losses to tailings storage (average of 0.25 ML/day) and IWL embankment construction works (average of 0.015 ML/day) .

b Predicted water balance

HEC ran water balance model simulations, each representing possible mine life sequences with each sequence approximately 19 years long. This simulations correlate to the daily BoM rainfall data recorded between 1889 and 2019 (ie 131 years), with CGO rainfall data for the period 2002-2020. Using this method, 131 19-year sequences of daily rainfall and evaporation were formulated for use in the model simulations.

The water balance model results (refer Table 17 of Appendix I) show the total inflows and outflows for the 10th percentile (low rainfall), median and 90th percentile (high rainfall) average annual rainfall. Overall, the assessment shows no supply shortfalls predicted for any of the 131 simulations. Water balance model results are shown in Table 6.19.

Table 6.19 Water Balance Model Results (Averaged over Remaining Mine Life ML/year)

	10th percentile Rainfall Sequence (Dry)	Median Rainfall Sequence	90th percentile Rainfall Sequence (Wet)
Inflows (ML/year)			
Catchment Runoff	1,114	1,380	1,443
Tailings Bleed	2,579	2,579	2,579
Open Pit and Underground Mine Groundwater Seepage	685	685	685
Saline Groundwater Supply Bores (within ML 1535)	52	43	49
Bland Creek Palaeochannel Bores	1,777	1,628	1,597
Eastern Saline Bores	438	430	421
Lachlan River Licensed Extraction*	754	686	676
Total Inflow	**7,399**	**7,430**	**7,449**
Outflows (ML/year)			
Evaporation	960	1,011	1,037
Haul Road Dust Suppression	223	222	221
Construction Water	93	93	93
Process Plant Supply	5,880	5,880	5,880
Overflow	0	0	0
Underground Mine Vent Loss	134	134	134
Total Outflow	**7,290**	**7,340**	**7,364**

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

Table 6.19 shows that under median rainfall sequence conditions, predicted total inflows average 7,430 ML/year (of which 53 per cent will be sourced on-site), and total outflows average 7,340 ML/year. It also shows that an average of 4.5 ML/day (1,628 ML/year) will be needed from the BCPB. This is slightly above the long-term average of 4 ML/day used in Coffey's hydrological assessment of sustainable pumping from this borefield (Coffey 2020b). However, if the pumping volumes were restricted from the borefield below an average of 4.5 ML/day, Evolution will make up the supply with water from the Lachlan River under existing tradeable allocations.

The demand from external sources under the median rainfall scenario averages 2,744 ML/year. When compared to the assessment undertaken for Modification 14 (HEC 2018), which predicted that 4,247 ML/year would be required to be sourced externally, the reliance on external sources will decrease by an average of 39 per cent over the life of the Underground Development Project.

CGO's maximum demand from the BCPB is predicted to be 2,901 ML/year (ie 7.9 ML/day) while both open-cut and underground mining is in progress, with zero demand from the borefield predicted when only the underground mine is in operation as there will be sufficient supply from on-site sources during this period. This maximum rate is well within Evolution's current licence limit of 3,650 ML/year.

- The demand from external sources decreases substantially during the period where only underground ore is processed, as the underground ore does not require as much water to process as oxide ore. For example, the median annual demand from the Eastern Saline Borefield is predicted to decline from a maximum rate of approximately 500 ML/year (open-cut and underground mining), to a rate of 330 ML/year during the period of underground mining only.

- The maximum predicted annual demand from the Lachlan River is approximately 2,850 ML, and will occur during the early years of the operation of the IWL, commencing in 2021, due to the reduced reclaim from the IWL during these years. However, the annual demand from the Lachlan River is predicted to substantially decline from 2034 as the planned ore processing rate declines.

- Coffey's hydrological assessment of the BCPB Borefield (Coffey 2020b), assumed an average abstraction rate of 4 ML/day from the BCPB for the life of the Underground Development Project. This rate will maintain groundwater levels above relevant water trigger levels set for Evolution's bores assuming that withdrawals from other users remains constant. When taking this into consideration, if the pumping rate was restricted to this daily limit, the modelling shows that predicted annual average demand from the Lachlan River will increase to a maximum of 2,812 ML/year and 3,160 ML/ year based on the 90th percentile rainfall scenario.

It should be noted that the above water balance results include the use of approved storage dam D10 which is yet to be constructed. D10 has an influence over the water sourced from external sources as it will rely on being topped up from these sources to provide a constant operating level. It therefore presents a worst case in terms of the water that will be required to be sourced externally.

Without storage dam D10, the predicted total inflows average 7,232 ML/year while total outflows average 7,209 ML/year, while demand from external sources (the ESB, the BCPB and licensed extraction from Lachlan River water entitlement) averages 2,592 ML/year. The reduction in total inflow relates to the reduction in external water supply requirements that will be necessary to maintain an operating storage volume in D10. The reduction in total outflow is largely due to the reduction in evaporation from water storage D10.

c Climate change effects

The surface water assessment concluded that the effect of climate change in the longer term is likely to lead to reductions in rainfall runoff on site. However, the impact of climate change on water management is unlikely to be significant over the remaining life of mine, as they are small compared to the natural climatic variability.

d Interaction with Lake Cowal

The water balance model predicts that no overflow from either of the contained storage dams (D1 and D4) could reach Lake Cowal. However, this outcome is reliant upon pumped dewatering of these storage dams between rainfall events.

The on-site containment (ie the UCDS and lake protection bund) and use of water that will otherwise have drained from the area into the lake, will also reduce inflows to Lake Cowal. Furthermore, the surface water assessment undertaken for Modification 14 (HEC 2018) identified that the risk of inflows to Lake Cowal will be slightly reduced due to the development of the IWL and the realignment of the UCDS.

The maximum water volume predicted in the open-cut pit, to the end of open-cut mining and for all 131 model simulations was 1,359 ML. However, the probability of such a large water volume is low.

The model predictions indicate that the final void will reach a peak equilibrium level of 148.6 m AHD, which is more than 60 m below the spill level (ie the final void will be contained). Equilibrium levels will be reached slowly over a period of more than 1600 years, and the final void will remain a groundwater sink.

The void water quality will reflect the influence of the high salinity in the groundwater. Given that the only outflow from the final void will be evaporation, salinity is predicted to increase trending to hyper-salinity in the very long term. Water quality in the final void at any given point in time will vary with depth as a result of mixing and stratification processes that will occur as a result of temperature and salinity differentials.

Given that proposed surface infrastructure changes from Mod 16 are to be contained within the current approved disturbance area, no additional impacts on inflows to Lake Cowal are expected to occur as result of the proposed modification.

e Water quality

The assessment concluded that there has been no apparent link between the mining operations and any variance in water quality in Lake Cowal (when it exists). It concluded that there will be a low risk of more than a negligible hydrological impact on Lake Cowal due to the proposed modification.

There is an established water quality monitoring program in operation at CGO. Due to the potential enrichment of silver, arsenic, cadmium, copper, lead, selenium and zinc in the ROM ore and low-grade ore, GEM (2020) recommended that these metals and total alkalinity are monitored. The current site water quality monitoring program already monitors these metals and alkalinity under the approved CGO Water Management Plan (Evolution, 2018). The monitoring programme will be revised to include analysis for silver as recommended in GEM (2020).

Also, a small amount of the ROM and low-grade ore may be potentially acid forming (PAF), and appropriate management measures should be taken on site, with stockpiled ROM ore only be exposed at the to surface for short periods of time. Lower grade ore can be stockpiled and exposed to surface oxidation and leaching processes over longer periods, however, the potential risk to water quality needs to be appropriately managed. In this regard, CGO will undertake a geochemical assessment of the ROM ore to develop a better understanding of the quantity and distribution of the PAF and PAF-LC material within the underground ore.

Depending on the outcomes of the assessment, further measures may be introduced to further limit impacts (refer Section 6.6.9).

ii Post-closure phase

Potential post-closure surface water impacts include:

- possible mobilised salinity, sediment or soluble metals in Lake Cowal due to erosion or structural failure of final mine landforms; and
- the potential for reduced inflow to Lake Cowal as a result of the increased catchment area of the final void.

However, it is anticipated that the majority of the CGO site post-closure will continue to drain to the final void and will therefore have no impact on the water quality of Lake Cowal.

Evolution is conducting batter rehabilitation trials, using a number of different combinations of rock mulch, soil and vegetation. Results of these trials will inform the final design of the waste rock emplacement rehabilitation and will also allow prediction of sediment generation rates likely to be generated from the final landform to Lake Cowal.

Because the proposed surface changes associated with Mod 16 are to be contained within the current approved disturbance area, no additional impact on inflows to Lake Cowal is expected to occur.

6.6.9 Mitigation measures

The following management and mitigation measures are planned:

i Operational monitoring and management

- continuation of surface water monitoring in accordance with condition 4.5(b) of DA 14/98;
- silver will be added to the water quality analytes;
- an assessment of the appropriate management of PAF material will be carried out;
- maintenance of an environmental data management system to facilitate management of all environmental data at site. This will include the quality and quantity of surface and groundwater within and around the mine site; and
- periodic review of the site water balance model and numerical groundwater model in order to maintain the models as reliable tools for assessing the effectiveness of the site water management system.

ii Post-mining monitoring and management

- continue water quality monitoring for two years following cessation of operations, with monitoring data reviewed at annual intervals (as part of the annual review process) over this period;
- continued monitoring of water quality during and following mine closure (including in the final void); and
- review the geotechnical stability of the final void from the cessation of mining until lease relinquishment.

iii Potential contingency measures

- additional monitoring (eg increase in monitoring frequency or additional sampling locations) where necessary to confirm impacts and inform the proposed contingency measures; and
- refinements to the water management system design where necessary, such as additional containment dams, increases to storage or pumping capacity, installation of new structures.

6.6.10 Summary

No changes are planned to the sources of water for CGO or its water supply system. The key outcomes of the surface water assessment are:

- The maximum water demand to accommodate processing of primary and oxide ore from the proposed underground mine and open-cut pit operations is estimated at 25 ML/d and will occur in 2024. This compares with an average process plant demand of 22 ML/d in 2019 for the current CGO.
- Modelling of the site water balance indicates that at the 90th percentile outcome and based on the predicted median rainfall scenario, the requirement for water from external sources will average 2,744 ML/year and up to a maximum of 2,850 ML/year may be needed from the Lachlan River.

- If supply from the BCPB was reduced to an average of 4 ML/d over the life of the Underground Development Project, equivalent to the predicted sustainable borefield yield, a maximum demand of 3,160 ML/year will be required from the Lachlan River based on the 90th percentile model results.

- Based on DPIE-Water trading records, there has been sufficient allocation of water on the market from this source in previous years to meet this predicted demand requirement.

- Runoff from the ore stockpile areas and additional waste rock associated with the underground mine operations will continue to be captured and contained by CGO's surface water control system within the approved disturbance area. Because the proposed underground development waste rock is geochemically similar to the waste rock from the current open-cut pit operations, no change is required to the management strategies currently employed for the waste rock emplacements.

- Augmentation of on-site water storages will be undertaken within the existing catchment area/disturbance area of each storage. With regard to the two water storages (D1 and D4) that have the potential to overflow to Lake Cowal, none of the 131 model simulations predicted any overflow.

- Modelling of the final void water balance indicates that the final void will reach a peak equilibrium water level of 148.6 m AHD - more than 60 m below the spill level (ie the final void will be contained).

- As proposed, changes to the surface water regime arising from the Underground Development Project are to be contained within the current approved disturbance area and no impact on inflows to Lake Cowal or the water quality of Lake Cowal are expected.

6.7 Biodiversity

6.7.1 Assessment scope

There were no formal SEARs issued for the proposed modification. Notwithstanding, the Department's Biodiversity and Conservation Division (BCD) provided comments on the scope of an assessment to be included in the modification report (refer Table 6.1). Discussions with the Department on the nature and scale of the proposal in relation to the existing site operations have resulted in this due diligence assessment to confirm that Mod 16 will not increase the approved impact on biodiversity values.

Table 6.20 Biodiversity related assessment comments

Comment	Location in the document
Biodiversity – including: Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* using the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016* (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and the BAM, unless the Department determines that the proposed development is not likely to have any significant impact on biodiversity values.	Section 0 outlines that a Biodiversity due diligence has been prepared to allow the Department to confirm and determine that the proposal is not likely to have any significant impact on biodiversity values.

6.7.2 Biodiversity due diligence

All the proposed changes under Mod 16 will be undertaken on land already disturbed by mining activities and cleared of vegetation, as shown in Figure 6.13. There is no vegetation clearing required proposed for the modification. Therefore, Mod 16 will not increase the impact on biodiversity values at the site in accordance with section 7.17 of the BC Act. Table 6.21 assesses the proposal against the key values.

Table 6.21 Mod 16 biodiversity due diligence - consideration

Biodiversity value and meaning	Consideration
Vegetation abundance Occurrence and abundance of vegetation at a particular site.	To identify native vegetation plant community types (PCTs) present within the potential indirect impact area (Lake Cowal), regional vegetation mapping for the State Vegetation Map - Central West Lachlan: Central West/Lachlan Region Version 1.4. VIS_ID 4468 was utilised to determine the plant community types. Lake Cowal is a large ephemeral wetland system. In terms of abundance of vegetation, the lake floor is used mainly for grazing or other agricultural purposes, which has varying levels of abundance of various species, which are mostly drought tolerant, exotic grasses (refer Photograph 6.1). The abundance of vegetation species is controlled to an extent by periodic filling, drying and revegetation of the lake. Whilst the majority (83%) of Lake Cowal is identified as being non-native vegetation, a total of six PCTs are identified from the Central West Lachlan vegetation map (refer Figure 6.13). The proposed modification deals with the augmentation of existing site infrastructure and development of new infrastructure on existing disturbed areas, as shown in Figure 6.13. There would be no additional vegetation clearing required for the Underground Development Project, no direct impacts and no changes in drainage patterns that may indirectly affect extant vegetation. The approved operations have existing biodiversity offsetting obligations that would continue to be satisfied in accordance with relevant legislation and policies.
Vegetation integrity Degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state.	
Habitat suitability Degree to which the habitat needs of threatened species are present at a particular site.	

Table 6.21 Mod 16 biodiversity due diligence - consideration

Biodiversity value and meaning	Consideration
Threatened species abundance Occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site	When it is holding water, Lake Cowal provides habitat to a range of threatened aquatic species, with those species recorded (AMBS 2018) that may utilise the Lake Cowal wetlands when present summarised below: • Olive Perchlet (western population) (*Ambassis agassizii);* • Southern Purple Spotted Gudgeon (*Mogurnda adspersa);* • Flathead Galaxias (*Galaxias rostratus);* • Murray Cod (*Maccullochella peelii);* • Macquarie Perch (*Macquaria australasica);* • Southern Pygmy Perch (*Nannoperca australis);* • Eel-tailed Catfish (Murray-Darling Basin population) (*Tandanus tandanus);* • Silver Perch (*Bidyanus bidyanus);* and • Hanley's River Snail (*Notopala hanleyi).* One PCT, 250 - Derived tussock grassland of the central western plains and lower slopes of NSW, is identified in the Biodiversity Assessment Method (BAM)as being potentially associated with an Endangered Ecological Community (EEC), White Box Yellow Box Blakely's Red Gum Woodland, and a total of 3.86 ha of this PCT is mapped as potentially occurring within Lake Cowal. PCT's 24, 45, 53 and, 249 are identified in the vegetation information system (VIS) as potentially being associated with Artesian Springs Ecological Community in the Great Artesian Basin EEC but are not associated with this EEC in the Biodiversity Assessment Method Calculator (BAMC). However, this EEC has not been identified in recent vegetation mapping undertaken by AMBS (2018a). AMBS (2018a) identified two EECs as being present within the project area, though not within Lake Cowal itself: • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions, and • Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions. However, the site will remain separated from Lake Cowal by the lake protection bund and by ensuring that surface water on-site cannot escape to the lake. As the proposed modification deals with augmentation of existing site infrastructure and developing new infrastructure on existing disturbed areas (refer Figure 6.13), it will have no impact on the lake or the abundance of aquatic species which occur in the lake when it holds water. The approved operations have existing biodiversity offsetting obligations that would continue to be satisfied in accordance with relevant legislation and policies.
Habitat connectivity Degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range **Threatened species movement** Degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle	Lake Cowal is identified on the *Directory of Important Wetlands in Australia* (Environment Australia 2001). Under the BAM, a 50 m riparian buffer distance is applied for the purposes of assessment of this landscape feature, and a portion of the Underground Development Project area sits within this buffer. In addition, the potential indirect impact area includes Lake Cowal. Lake Cowal is part of a matrix of wetlands in the bioregion, and as such it is considered that a connectivity feature is present and related to the lake. The proposed modification deals with augmentation to existing site infrastructure and development of new infrastructure within the area of existing disturbance, as shown in Figure 6.13. No additional clearance of native vegetation is required for the Underground Development Project.

Table 6.21 Mod 16 biodiversity due diligence - consideration

Biodiversity value and meaning	Consideration
Flight path integrity Degree to which the flight paths of protected animals over a particular site are free from interference	The approved operations have existing biodiversity offsetting obligations that would continue to be satisfied in accordance with relevant legislation and policies

Photograph 6.1 The bed of Lake Cowal immediately north of the CGO site – June 2019

6.7.3 Potential direct and indirect impacts from Mod 16

i Direct impacts

Mod 16 does not have any new direct impacts on the land surface, other than as associated infrastructure to be built on previously disturbed areas within the impact footprint previously approved for the operational mine.

There are no material changes to the surface water management systems currently operational at CGO. These systems ensure water captured at the mine and recycled through the processing plant stays within the site, and water outside the site is directed away from the site. Therefore Mod 16 will not cause or influence any change in the quality, quantity, availability or flow of surface water in, or from, Lake Cowal. There is a very high degree of certainty given to this conclusion as the systems are currently operating as designed and the mine has never needed to discharge any water off-site.

ii Potential indirect impacts

If the IWL is not closely managed, groundwater quality may be affected by seepage with associated indirect impacts. This is particularly important as CGO's processing plant uses cyanide to extract gold from the ore. However, the use of cyanide in gold production is a normal and well understood process in the industry.

There will continue to be a small amount of cyanide in tailings emplaced in the IWL as there is currently. The current conditions of consent strictly limits cyanide concentrations in tailings to 20 mg CN_{WAD}/L (90^{th} percentile over six months) and 30 mg CN_{WAD}/L (maximum). The tailings at the processing plant are checked twice daily to ensure they remain within this limit.

The IWL is already approved and construction has commenced. The current tailings storage facilities are clay lined to ensures that they have very low permeability. The IWL will be similarly constructed with a clay floor to ensure the continued protection of groundwater throughout the life of the mine. The groundwater modelling assessment (Coffey 2020a) predicted that after 100 years the potential for groundwater quality changes due to migration from the IWL stored water will extend a distance of up to approximately 1.7 km from the IWL walls. However, the modelling does not take account of decomposition of the cyanide concentration with time (detailed further in section 6.4) When taking into account the decomposition time of the cyanide and the low levels that would be in the tailings being emplaced, the groundwater assessment concluded that cyanide concentrations are anticipated to fall well below detection levels after 12 years and measurable concentrations of cyanide are not anticipated to migrate beyond 1 km from the perimeter of the IWL.

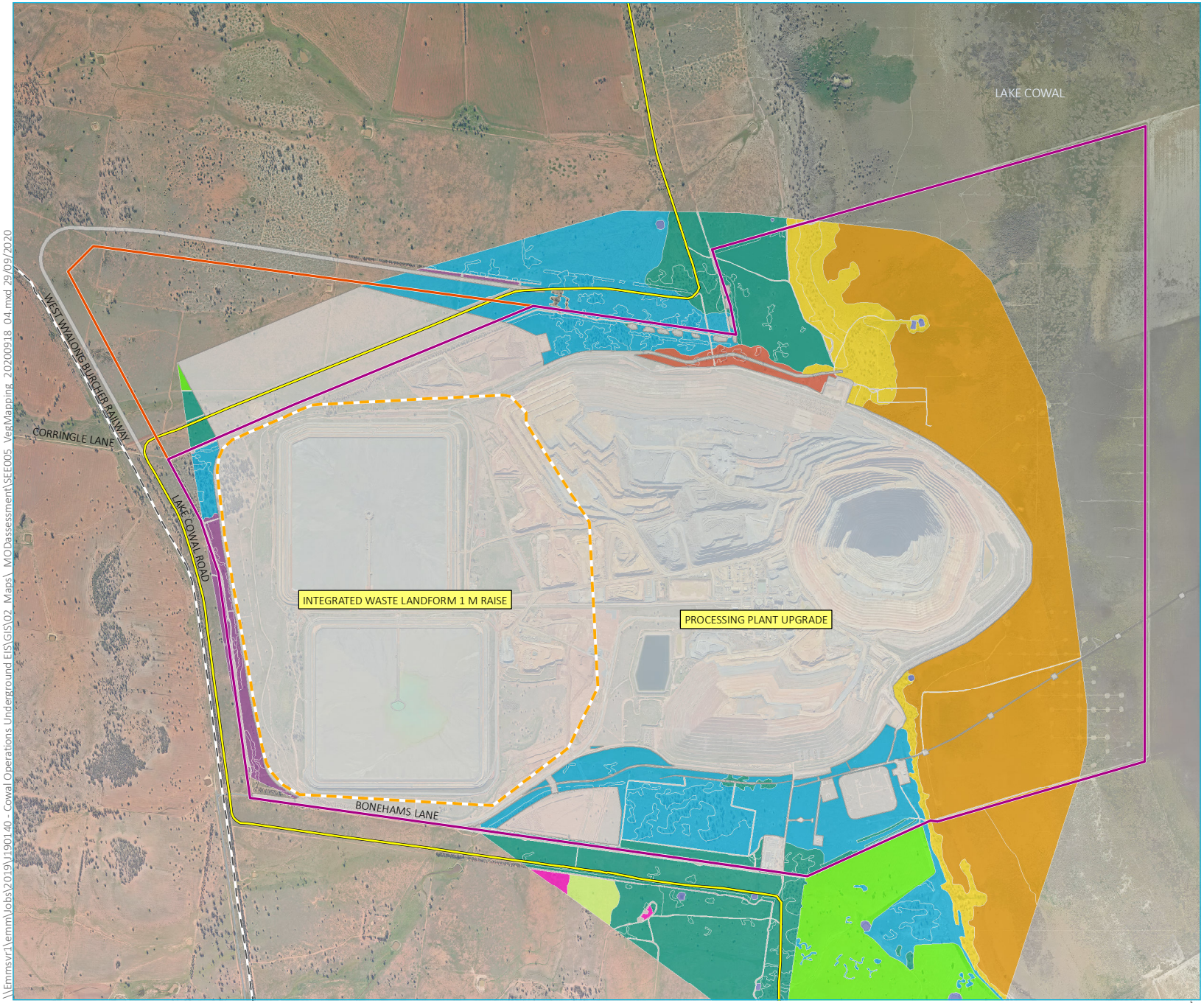
Therefore, cyanide concentrations are predicted to fall well below detectable limits prior to migrating outside of the CGO mining lease. There is a high degree of certainty that seepage issues will not impact Lake Cowal or its biodiversity. CGO will continue its regular groundwater and cyanide monitoring regime to ensure this continues for the duration of the modified life of mine.

6.7.4 Conclusion

In conclusion, Mod 16 will be undertaken wholly on land already disturbed for mining activities and there will be no vegetation clearance required. Therefore, there will be no new direct impacts to biodiversity values.

The current surface water systems, including the lake protection bund will continue to ensure that Lake Cowal remains separate from the mine and water on-site does not interact with the lake or the biota that in the lake from time to time.

The proposed additional tailings being emplaced at the IWL will be of a very similar composition to the tailings currently emplaced. The strict controls in place to monitor cyanide levels will continue throughout the life of the mine. Seepage from the IWL is not expected to result in any significant impacts to biodiversity values, given the length of time it would take for seepage to reach groundwater and the natural decay of cyanide. Therefore, there will be no indirect impacts to biodiversity values. For the above reasons, Mod 16 is not expected to increase previously approved impacts on biodiversity values.



KEY

- Mining lease (ML1535)
- Mining lease (ML1791)
- DA14/98 approved surface disturbance
- Indicative integrated waste landform perimeter
- Rail line
- Main road
- XXX Mod 16 surface elements

Vegetation mapping

- PCT26 - Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
- PCT53 - Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains
- PCT55 - Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.
- PCT82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion
- PCT185 - Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland mainly in the NSW South Western Slopes Bioregion
- PCT244 - Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).
- PCT249 - River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW
- Cropped
- Exotic grassland
- Dam
- Cleared

\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02 Maps\ MODassessment\SEE005 VegMapping 20200918 04.mxd 29/09/2020

Source: EMM (2020); Evolution (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 55

N

Vegetation mapping for Modification 16

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.13

EMM
creating opportunities

6.8 Geochemistry

6.8.1 Introduction

This chapter provides a summary of the environmental geochemistry assessment completed by GEM for the Underground Development Project.

This environmental geochemistry assessment based on the environmental geochemistry assessment considers the geochemical characteristics of the waste rock, mine rock, ore, low grade ore and tailings to be produced from the underground development, and identifies any impacts which may arise from the processing, stockpiling and storage of this material as proposed under Mod 16 and listed above. It has been included in the impact assessment of this modification report, as the processing and disposal of these materials will occur on the surface under the existing development consent.

6.8.2 Assessment Requirements

The additional agency requirements and sections where they are addressed are listed in Table 6.22.

Table 6.22 Geochemistry related assessment requirements

Requirement	Location in this document
DPIE	
The proponent is to supply a summary of the geological components of the mineral resource, including: a) A description of the physical characteristics of the mineral resource, including the dimensions (with representative plans and cross sections including each ore body/lens if appropriate). b) Details of the ore and waste rock, including mineralogy and deleterious elements. This information is key to understanding the environmental effects of the proposal.	The environmental geochemistry assessment has been provided in full in Appendix J. It is summarised in this chapter of the modification report.

6.8.3 Research method

GEM (2020) a desktop study was completed, which included a review of available information consisting of data collected from previous geochemical investigations, to further understand the existing geochemical environment of CGO. This included:

- geochemical investigations for the initial EIS by North Limited in 1995, 1996, 1997 and 1998;
- subsequent geochemical investigations completed by Barrick Australia Limited in 2004; and
- geochemical investigations completed by GEM for CGO in 2008, 2011, 2013 and 2016.

A geochemical sampling program was completed which included rock sampling and testing of the proposed waste rock, mine rock, ore and low-grade ore to be produced from the underground development. From this, the geochemical characteristics were identified based on the results of laboratory tests. This has informed the impact assessment of the processing, stockpiling and storage of this material.

i Desktop study

A review of past geochemical investigations completed for the E42, E46 and Gateway/Regal deposits was completed to identify any information which may inform this environmental geochemistry assessment. This information has informed the description of the existing geochemical environment of CGO.

ii Geochemical assessment program

A geochemical assessment program was carried out by GEM (2020). This included the completion of five drill holes across the footprint of the underground development.

Thirty-four samples were taken from the drill holes to represent the waste rock and mine rock to be produced/exposed from the underground development. Thirty-nine samples were taken from the drill holes to represent the ore and low-grade ore to be excavated from the underground development. Sample intervals of each drill hole were chosen to represent major lithologies that will be excavated or exposed as part of underground development.

Samples were tested for the following geochemical parameters:

- pH and EC determination (all samples);
- total sulfur (S) assay (all samples);
- sulfide S analysis (selected samples);
- acid neutralising capacity (ANC) determination (all samples);
- single addition net acid generation (NAG) test (all samples);
- extended boil NAG test (selected samples);
- acid buffering characteristic curve (ABCC) determination (selected samples);
- exchangeable cation analysis (selected samples); and
- multi-element scans on solids and water extracts (selected samples).

A full description of how each test is completed is provided in sections 3.1.1 to 3.1.3 of the GEM (2020) report (refer Appendix J).

The results of the geochemical assessment program are summarised below.

a Results

Waste rock and mine rock

Waste rock and mine rock samples were mostly taken from below the oxidised zone and therefore were considered fresh rock. Thirty-two samples were taken to represent waste rock and 18 samples to represent mine rock. Two samples were taken from saprock and therefore were oxidised. The full test results for these samples are provided in Attachment B and C of the environmental geochemistry assessment (refer Appendix J).

A summary of the pH, EC and acid forming characteristics of the waste rock and mine rock samples is provided in Appendix J and explained further below.

Table 6.23 Summary of geochemical results for proposed waste rock and mine rock

Material Type		$pH_{1:2}$	$EC_{1:2}$	Total S	Maximum potential acidity (MPA)	Acid neutralising capacity (ANC)	Difference between the MPA and ANC (known as the NAPP)	Net acid generation test output (known as the NAGpH)
		°	(dS/m)	(%S)		(kg H_2SO_4/t)		°
Waste rock (saprock) 2 samples	Minimum	7.2	1.285	0.02	1	1	-4	5.6
	Maximum	7.4	1.884	0.03	1	4	0	8.7
	Average	7.3	1.585	0.03	1	3	-2	7.2
Waste rock 32 samples	Minimum	7.5	0.110	0.01	0	30	-180	8.3
	Maximum	9.3	0.478	1.06	32	187	-30	10.0
	Average	7.9	0.184	0.38	12	87	-75	8.8
Mine rock 18 samples	Minimum	7.7	0.138	0.02	1	60	-179	7.6
	Maximum	8.7	0.632	2.45	75	194	10	9.2
	Average	8.1	0.211	0.96	29	117	-88	8.3

Salinity, sodicity and pH

A summary of the results for salinity, sodicity and pH tests are listed below:

- pH of all waste rock and mine rock samples are slightly to moderately alkaline.
- All waste rock samples and most of the mine rock samples are considered to be non saline due to a relatively high reactive sulfide content. Waste rock and mine rock may become saline when oxidised.
- One mine rock sample (containing mudstone) is considered is slightly saline.
- Saprock (or oxidised material) samples (part of the waste rock samples) are slightly to moderately saline.
- Most waste rock and mine rock samples are non to slightly sodic, however some moderately to highly sodic material is likely to be encountered.
- Two waste rock samples (containing diorite and dyke) are highly sodic.
- Saprock samples are highly sodic.

Acid forming characteristics

A summary of acid forming characteristics of the waste rock and mine rock samples are listed below:

- All samples are NAF.
- Saprock samples are NAF and 'barren' in terms of acid generation and neutralisation due to low reactive sulfide content and ANC.
- Waste rock and mine rock samples are relatively reactive in terms of acid generation and neutralisation.

Metal enrichment and solubility

A summary of the metal enrichment and solubility of the waste rock and mine rock samples are listed below:

- All waste rock and mine samples are enriched in arsenic and antimony.
- There are equal proportions of salt in waste rock and mine rock samples.
- The anion suite amongst saprock samples are dominated by chloride.
- Waste rock and mine rock samples have low elemental solubility, apart from the presence of arsenic which is soluble.

The levels of dissolved arsenic in these samples do not exceed the short- or long-term exposure limits for irrigation as noted in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).

Ore and low-grade ore

The full test results for these samples are provided in Attachment B and C of the environmental geochemistry assessment (refer Appendix J). A summary of the pH, EC and acid forming characteristics of the waste rock and mine rock samples is provided in Table 6.24 and explained further below.

Table 6.24 Summary of geochemical results for proposed ore and low grade ore

Material Type		$pH_{1:2}$	$EC_{1:2}$	Total S	Maximum potential acidity (MPA)	Acid neutralising capacity (ANC)	Difference between the MPA and ANC (known as the NAPP)	Net acid generation test output (known as the NAGpH)
		°	(dS/m)	(%S)		(kg H_2SO_4/t)		°
Low grade ore 9 samples	Minimum	7.7	0.141	0.04	1	43	-93	8.0
	Maximum	8.8	0.222	3.01	92	105	31	9.0
	Average	8.1	0.170	0.96	30	85	-55	8.3
Ore 12 samples	Minimum	7.6	0.115	0.32	10	40	-185	3.1
	Maximum	8.5	0.400	3.92	120	212	40	9.3
	Average	8.0	0.185	1.67	51	89	-38	8.3

Salinity and pH

All samples (both ore and low-grade ore) are slightly alkaline and non-saline. However, due to the presence of reactive sulfides, salinity may increase if these materials are left exposed when stockpiled.

Acid forming characteristics

A summary of acid forming characteristics of the ore and low-grade ore samples are listed below:

- All tested samples have wide ranging sulfur content.
- All tested samples readily available ANC to neutralise the sulfide generating acidity.
- 10 ore samples are NAF apart from two samples which are considered potentially acid forming (PAF) to a degree.
- Sulfide is present in three low grade ore samples and eight ore samples.

Metal enrichment and solubility

Multi-elemental scans were performed on three low grade ore samples and five ore samples. A summary of the metal enrichment and solubility of the ore and low-grade ore samples are listed below:

- Samples were enriched in silver, arsenic, cadmium, copper, lead, selenium and zinc.
- Ore and low-grade ore have low elemental solubility, apart from the presence of arsenic which is soluble.

The levels of dissolved arsenic in these samples do not exceed the short- or long-term exposure limits for irrigation as noted in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).

6.8.4 Existing environment

Previous geochemical investigations completed for CGO form an understanding of the existing geochemical environment. This includes a description of salinity, sodicity, acid forming characteristics, metal enrichment and solubility of waste rock, ore, low grade ore and tailings currently being processed and stored as part of CGO. As noted in section 6.8.3, the existing geochemical environment of CGO is considered representative of the underground development's geochemical environment.

Previous and widespread investigations were completed across the site in 1995, 1996, 1997, 1998 and 2004 prior to the commencement of open-cut pit mining operations as part of CGO. Since then, targeted investigations have been completed in 2008, 2011, 2013 and 2016. A summary of these investigations has been provided in Table 1 of the environmental geochemistry assessment (refer Appendix J).

i Salinity and sodicity

Waste rock and tailings from the existing open-cut, were initially found to have low salinity, however this was expected to increase with weathering due to the presence of reactive sulfides. Waste rock and tailings consisting of oxide material, including such shallow geology as saprock, saprolite and alluvium) were found to be moderately to highly saline and highly sodic.

More recent investigations found the waste rock, ore, low grade ore and tailings to have low salinity and to be non-sodic. Oxide material were found to be moderately to highly saline and have high sodicity.

ii Acid forming characteristics

Waste rock and tailings from the existing open-cut were initially found to be NAF and contain reactive sulfides neutralised by a high ANC. Oxide material was found also be NAF and contain a relatively low reactive sulfide content.

More recent investigations found waste rock, ore, low grade ore and tailings to be NAF due to a high ANC. Oxide material were also found to be NAF still due to a relatively low reactive sulfide content.

iii Metal enrichment and solubility

Past elemental analysis has been completed on waste rock, ore, low grade, tailings and oxide material from the existing open-cut pit from 1995 to 2006. Generally, past geochemical investigations found high concentrations of arsenic, silver, cadmium, lead, selenium, antimony, molybdenum and zinc in selected samples from the existing open-cut pit.

Geochemical investigations completed in 1995 and 1997 also included sequential batch water extractions and testing of the waste rock and column leach tests of tailings at CGO. It was found that the leaching of environmentally important elements from waste rock stored at CGO was unlikely to occur if pH values were maintained. It was found that soluble copper and zinc would initially leach from tailings stored at CGO, however concluded this to be the result of the processing produce and unlikely to impact the surrounding water quality.

6.8.5 Predicted impacts

As noted above in section 6.8.4iii, waste rock, mine rock, ore and low grade ore samples were found to have low solubility levels. Arsenic levels are within short- and long-term exposure limits for irrigation noted in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000). Further assessment of impacts are provided in sections 6.8.5i and 6.8.5iii.

i Waste rock

As noted in section 6.8.4i, waste rock samples may become saline when oxidised (exposed during stockpiling) and saprock samples are slightly to moderately saline. This may result in the release of sulfate salts, such as gypsum, if the material is exposed to weathering processes when stockpiled at one of the waste emplacement areas. During stockpiling, sodic conditions may also develop which could lead to increased sediment dispersion and surface erosion.

GEM (2020) found that the geochemistry of the waste rock tested as part of the underground development is consistent with previous investigations completed for CGO, specifically waste rock currently being mined from the open-cut pit and stockpiled at the existing waste rock emplacement areas. Existing management measures are therefore adequate to be applied to waste rock mined from the underground development.

ii Mine rock

Mine rock samples were chosen to represent the exposed rock of the proposed underground mine. The mine rock samples were found to be geochemically similar to the waste rock of the underground development.

As noted in section 6.8.4i, mine rock may become saline when oxidised (exposed during mining). However, considering the regional groundwater has a TDS range of around 40,000 to 45,000 mg/L, the contribution of sulfate salts which may leach from exposed mine rock of the underground development into groundwater is expected to be negligible.

iii Ore and low-grade ore

It was found that the geochemistry of the ore and low-grade ore is similar to previous geochemical investigations completed for CGO. However as noted in section 6.8.3, two samples of ore and low grade ore to be processed from the underground development were found to be PAF.

The development of acid drainage from any ore or low-grade ore if temporarily stockpiled prior to processing is not expected to occur. This is because there is a low quantity of PAF material in the proposed ore and low-grade ore, and this material will not be subjected to long exposure times of stockpiling.

Stockpiled low-grade ore would be exposed to surface oxidisation and leaching conditions, if exposed over a long period of time. This may result in low pH conditions, increase salinity and metal solubility and release. This presents a risk to any released water or water drainage of the stockpiled low-grade ore if not managed appropriately.

6.8.6 Mitigation measures

Mitigation measures as outlined in the environmental geochemistry assessment for the management of proposed waste rock, mine rock, ore and low-grade ore from the underground development are summarised below.

These mitigation measures are based upon the results of previous geochemistry investigations completed for CGO and the geochemical assessment program completed for this environmental geochemistry assessment.

Mitigation measures for the treatment of tailings and a water quality monitoring program is also noted in the environmental geochemistry assessment and summarised below. Mitigation measures for the tailings and TSF (now considered the IWL as noted in section 6.8.6) have been inferred from the geochemical analysis of the ore and low grade ore to be excavated from the underground development.

i Waste rock

GEM (2020) note the following mitigation measures for the treatment of waste rock to be produced from the underground development:

- due to the low acid and metalliferous drainage (AMD) risk no special management requirements would be required for AMD control within the existing waste rock emplacement area; and
- due to the predicted enrichment of arsenic and antimony in the proposed waste rock, it is recommended that management of proposed waste rock at the existing waste rock emplacement area be included in the applicable water quality monitoring program.

ii Mine rock

GEM (2020) note the following mitigation measures for the treatment of mine rock to be exposed as part of the underground development:

- due to the low AMD risk no special management requirements would be required for AMD control within the underground development; and
- due to the predicted enrichment of arsenic and antimony in the mine rock, it is recommended that the exposed mine rock within the underground development be included in the applicable water quality monitoring program.

iii Ore and low-grade ore

GEM (2020) note the following mitigation measures for the treatment of ore and low-grade ore from the underground development:

- due the predicted NAF nature and low AMD risk for the low-grade ore, no special management would be required for AMD control if ore or low-grade ore is temporarily stockpiled prior to processing. However as noted in section 6.8.3, if the low grade ore is left exposed for extended periods, an increase in salinity may occur and this would need to be taken into account for water management of the stockpile area;

- as noted in section 6.8.3, stockpiled ore may increase in salinity and metal solubility and release due to PAF material. Because of this, it is recommended that a geochemical assessment of the proposed ore be untaken over an extended period of time to develop a better understanding of the quantity and distribution of the PAF and PAF-LC material within the ore produced from the underground development; and

- due the potential enrichment of silver, arsenic, cadmium, copper, lead, selenium and zinc in the ore and low grade ore it is recommended that the stockpiling and processing of ore and low grade ore is included in the applicable water quality monitoring program.

iv Tailings

As noted above, mitigation measures have been provided for tailings, which will result from the processing of ore and low-grade ore from the underground development. Tailings will be stored at the IWL and used to make paste at the proposed pastefill plant. These mitigation measures have been inferred from the geochemical analysis of the ore and low-grade ore to be mined from the underground development.

As noted in section 6.8.3, there is a small amount of PAF material in the two of the ore and low-grade ore samples. This means that the tailings, when stored in the TSF, may also be PAF.

GEM (2020) note the following mitigation measures for tailings to be generated from the processing of ore and low-grade ore from the underground development:

- due to the possibility of the tailings from the underground development being PAF, it is recommended that a program be undertaken to geochemically characterise any pilot plant and processing tailings. The characterisation program for the process tailings would most likely involve the routine collection of the discharge tailings over a period of time;

- previous geochemical investigations have identified the risk of the tailings from the open-cut pit being saline and developing saline conditions within the TSF. It is recommended that the TSF as part of the underground development include a cover in order to avoid development of a salt-pan; and

- due to similar geochemical characteristics of the ore between the past investigations and the geochemical assessment program, it is predicted that the tailings would be enriched in silver, arsenic, cadmium, lead, antimony, selenium and zinc. It is recommended that the management of the TSF be included in the applicable water quality monitoring program.

v Water quality monitoring program

It is noted by GEM (2020) that the water quality monitoring program is suitable to be applied to the underground development, and should be maintained for the waste rock emplacement areas, ore and low grade ore stockpiles and the TSF.

The existing water quality monitoring program tests for such parameters as pH, EC, turbidity, dissolved oxygen, temperature, biological oxygen demand, faecal indicators, total hardness, total suspended solids and such metals as calcium, magnesium, potassium, sodium, chlorine, sulfate, silver, arsenic, cadmium, molybdenum, lead, antimony, selenium and zinc.

GEM (2020) recommends that total alkalinity is also tested as part of the existing water quality monitoring program.

6.8.7 Summary and conclusion

Seventy-three samples were taken across five drill holes to represent the waste rock, mine rock, ore and low-grade ore to be exposed or mined from the proposed underground development. Geochemical analysis of these samples was completed as part of the geochemical assessment program.

These results, in conjunction with the results of previous geochemical investigations completed for CGO, were used to inform the assessment of impacts and provide subsequent mitigation measures for the processing, stockpiling and storage of this material at CGO. Geochemical analysis of the ore and low-grade ore of the proposed underground development was used to infer potential impacts and subsequent management measures of tailings associated with the underground development.

GEM (2020) found that the waste rock and mine rock to be mined or exposed as part of the underground development is of similar geochemical composition to the waste rock currently being mined from the open-cut pit of CGO. Both the waste rock and mine rock will have a low AMD risk. Therefore, no specific additional mitigation measures are required for the stockpiling of the waste rock at the existing waste emplacement areas. Although mine rock may become saline when exposed during mining, leaching of sulfate salts into the surrounding groundwater system is expected to be negligible and therefore no special mitigation measures are required.

If stockpiled for long periods of time prior to processing, the ore and low-grade ore may increase in salinity and metal solubility release due to small amounts of PAF material. Because of this, any ore or low grade or to be stockpiled for extended periods of time will be regularly tested for PAF material to prevent leaching of metals into surface water run-off. As the ore and low-grade ore may be PAF, this may result in the development of a salt pan in the TSF, now part of the IWL, once processed. The TSF will be covered as a preventative measure.

The existing water quality monitoring program for CGO will continue to be applied to the existing waste rock emplacements, ore and low grade ore stockpiles and the TSFs, and is appropriate to be applied to the processing, stockpiling and storage of material mined from the underground development at CGO.

6.9 Aboriginal heritage

6.9.1 Introduction

This chapter provides a summary of the Aboriginal heritage due diligence assessment completed by EMM (2020).The assessment was prepared in consideration of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010) and additional agency assessment requirements (refer Table 6.25).

It also describes the Aboriginal cultural heritage values relevant to Mod 16, consultation undertaken to date with relevant Registered Aboriginal Parties (RAPs) and assesses the impact of the Mod 16 on Aboriginal cultural heritage values based on the findings of a desktop study and a predictive model.

As part of the CGO, Mod 16 will operate under AHIP Consent 1467/Permit 1468. CGO also operates under the Indigenous Archaeology and Cultural Heritage Management Plan (IACHMP) (Barrick 2003). That assessment (for permits and consent to harm Aboriginal objects) has been used to develop a management framework for the CGO.

It should be noted that all proposed ground-disturbing works will take place within the footprint of areas previously assessed for Aboriginal heritage values and approved for disturbance. The site at CGO is highly disturbed by bulk earthworks necessary to establish the surface facilities and excavation of the open-cut. While acknowledging the lateral extent and severity of this disturbance, an Aboriginal heritage due diligence assessment was carried out to demonstrate that Mod 16 will not result in any new impacts outside of the existing disturbance footprint of CGO and is consistent with the additional agency assessment requirements.

A site inspection was carried out on 6 June 2019, by EMM archaeologists Ryan Desic and Taylar Reid, Aaron Bowden (EMM Associate Environmental Planner), Rob Morris (EMM Divisional Leader, Planning/Acoustics/Air Quality) and Evolution's Superintendent Danielle Wallace. The inspection included the (dry) lakebed of Lake Cowal above the proposed underground mine area and the existing facilities at CGO. The inspection is described in the Aboriginal heritage due diligence assessment.

A site inspection of the disturbance footprint associated with Mod 16 was not carried out due to the existing, pervasive ground disturbance within ML 1535.

6.9.2 Assessment Requirements

Additional agency assessment requirements for Mod 16 were received on 27 September 2019 from the BCD. The agency requirements and sections of this chapter where they are addressed are listed in Table 6.25.

Table 6.25 Aboriginal heritage-related assessment requirements

Requirement	Location in report
The modification does not involve an expansion of the total footprint of the mine so direct impacts on Aboriginal cultural heritage are unlikely. Given this, the Department considers that for this modification the assessment requirements for Aboriginal Cultural Heritage (ACH) as part of the EIS may comprise a due diligence approach in accordance with the 'Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales'.	As noted in section 6.9.1, the Aboriginal heritage due diligence assessment has been prepared in consideration of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010).
The Department supports the approach for Aboriginal community consultation for the proposed modification outlined in Section 6.6 of the Scoping Report (EMM, 2019). This approach comprises the proponent providing the Registered Aboriginal Parties (RAPs) for the existing development with the project information relating the proposed modification, detail of any identified potential impacts to ACH values from the new works and effective consultation with RAPs regarding avoidance or mitigation strategies in relation to ACH.	As noted in section 6.9.1, the Aboriginal heritage due diligence assessment was provided to RAPs for review on 25 August 2020.
Aboriginal Cultural Heritage (ACH) may be assessed using a due diligence approach in accordance with the 'Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales' (DECCW 2010). The purpose of the due diligence will be to: a. Identify whether or not Aboriginal objects are, or are likely to be present in the area of the proposed modification works b. Determine whether or not the activity is likely to harm Aboriginal objects (if present) c. Determine whether further assessment, management and approval is required.	A desktop study and predictive model was completed to identify any Aboriginal objects within the site(refer section 6.9.1and section 0). An impact assessment was completed to determine whether the modification is likely to harm Aboriginal objects (if present) (refer section 6.9.4).
If ACH values are identified during the due diligence assessment for the modification, the Department must be notified in the first instance to determine further assessment requirements. It is likely this would necessitate the preparation of an Aboriginal Cultural Heritage Assessment Report in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 2010), and be guided by the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011)	As noted in Section 6.9.4, there will be no additional harm to Aboriginal objects outside the existing boundary of AHIP Consent 1467/Permit 1468, as ground disturbing works associated with Mod 16 are wholly located within previously assessed and approved disturbance areas within CGO. Therefore, preparation of an Aboriginal cultural heritage assessment report in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (OEH 2010) is not required.
Consultation with Aboriginal people must be undertaken as outlined in Section 6.6 of the Scoping Report (EMM, 2019). This includes: a. Providing the Registered Aboriginal Parties (RAPs) for the existing Cowal Gold Mine with the project information relating to the proposed modification b. Providing detail of any identified potential impacts to ACH c. Providing RAPs with sufficient opportunity to provide advice regarding avoidance or mitigation strategies in relation to ACH.	As noted in section 6.9.1, the Aboriginal heritage due diligence assessment was provided to RAPs for review on 25 August 2020.

6.9.3 Research method

The research method used during the Aboriginal heritage due diligence assessment for Mod 16 is summarised below. The research comprised a desktop study and consultation with relevant RAPs.

i Desktop study

The desktop study consisted of:

- a search of the Aboriginal Heritage Information Management System (AHIMS);
- a search of the National Native Title Tribunal (NNTT) Register of Native Title Applications, Registration Decisions and Determinations and Register of Indigenous Land Use Agreements (ILUAs); and
- review of previous key archaeological and heritage study reports and permits completed within and surrounding CGO.

The following Aboriginal heritage investigations previously completed within the area surrounding CGO were reviewed as part of the desktop study:

- Paton (1989) Preliminary Archaeological Inspection of Lake Cowal Mining Exploration Lease;
- Cane (1995) Camp sites at Lake Cowal: an archaeological survey in central New South Wales;
- The Cowal Gold Project EIS (North Limited, 1998);
- Pardoe (2009a) Archaeological Investigations at Lake Cowal;
- Pardoe (2009b) Archaeological Excavations at Lake Cowal;
- Pardoe (2013) Cowal Gold Mine Extension Modification Aboriginal Cultural Heritage Assessment;
- Pardoe (2015) Summary of Stone Tools from Barrick Gold Mine;
- Niche (2018 Cowal) CGO processing rate modification (Modification 14) Aboriginal Cultural Heritage Assessment; and
- Multiple due diligence style investigations and salvage activities (2005 to present).

The desktop study was used to establish the context of Mod 16 within the known Aboriginal cultural heritage of the study area and to develop a predictive model in relation to the potential impact on Aboriginal cultural heritage objects and values. The predictive model assists in assessing the potential for Aboriginal objects and places to occur within the footprint of CGO.

ii Consultation with registered Aboriginal parties

As required by BCD, consultation has been undertaken with the following RAP whom have previously registered an interest in CGO:

- Alona Apps;
- Beverly Johnson;
- Braydon and Mikayla Davis;
- Calara Culture and Heritage Aboriginal Corporation;
- Cindy Fuller;
- Condobolin Local Aboriginal Land Council;
- Didge Ngunawal Clan;
- Enid Clarke;
- Ernie Johnson; and
- Isabelle Collins.

Given the absence of impact on Aboriginal cultural values, discussion of impacts or management measures with the RAPs was not required. Nevertheless, Evolution provided a draft version of the Aboriginal Due Diligence Assessment Report to the RAPs on 25 August 2020 for review.

6.9.4 Results

i Desktop study

Aboriginal Heritage Information Management System

A search of the AHIMS database was carried out. In total, 104 Aboriginal objects were identified within an 84 km^2 area centred on CGO (refer Table 6.26 and Figure 6.14). The results provided by the AHIMS database are regarded as a predictive modelling tool to assist in assessing the potential for Aboriginal objects and places to occur within certain landforms and features within the overall landscape.

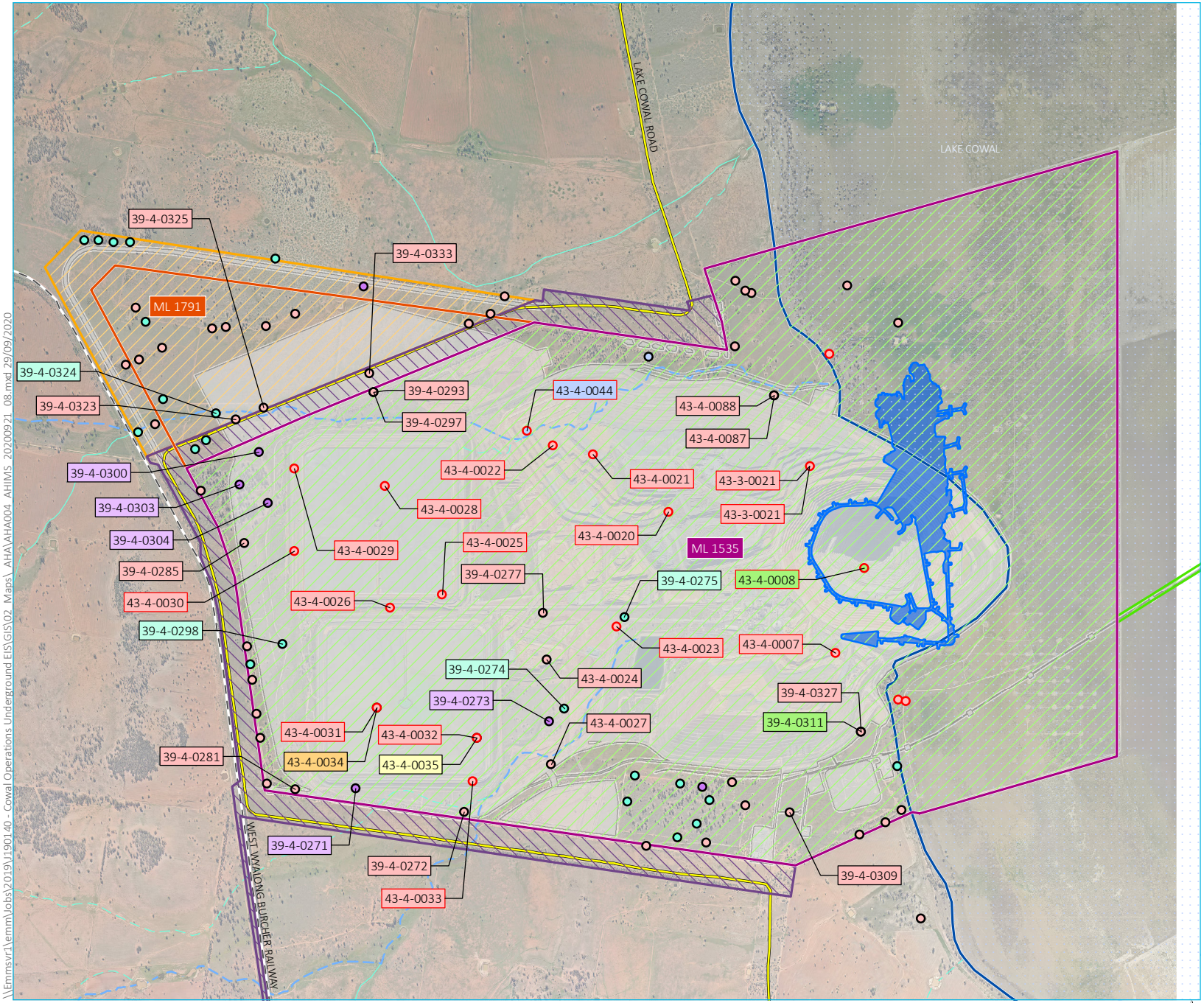
Table 6.26 AHIMS search results

Site types	Number of sites	%
Isolated finds	2	2
Artefact scatters (number unspecified)	68	65
Hearths	29	28
Stone Quarry	1	1
Modified Tree	4	4
Total	**104**	**100**

Stone artefact sites, including isolated finds and artefact scatters, dominate the local archaeological assemblage (67 per cent), followed by hearth sites (29%) featuring heat retainers and ground ovens. Modified trees have been documented in limited numbers, and one stone quarry is listed. Additionally, a total of 19 Aboriginal sites, including 18 artefact sites and one modified tree, are listed as destroyed in AHIMS in accordance with an approved AHIPs.

National Native Title Tribunal

A search of the NNTT Register of Native Title Applications, Registration Decisions and Determinations was carried out. There are no determined native title or land claims over the study area. Additionally, a search of the NNTT Register of ILUAs was also completed, which no ILUAs exist over the study area.



KEY

- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- DA14/98 approved surface disturbance
- Rail line
- Main road
- Waterbody
- Extent of Lake Cowal

Strahler stream order

- 1st order
- 2nd order
- 3rd order

AHIP boundaries

- Existing consent 1467/Permit 1468*
- Existing consent 1680/Permit 1681*
- AHIP C0004570

AHIMS site feature

- Isolated find
- Isolated find (destroyed)
- Artefact and hearth
- Artefact and modified tree
- Artefact and stone quarry
- Hearth
- Modified tree
- Modified tree (destroyed)
- Not specified
- Not specified (destroyed)

NOTE
*THE CONSENT BOUNDARIES SHOWN ARE CONSEPTUAL REPRESENTATIONS OF THE AREAS DESCRIBED IN CONSENT 1467 AND CONSENT 1680.
THE FULL EXTENT OF CONSENT 1467 AND CONSENT 1680 IS NOT SHOWN ON THIS FIGURE.

Source: EMM (2020); Evolution (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 55

N

Archaeological context

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.14

EMM
creating opportunities

6.9.5 Existing environment

An understanding of the existing environment is useful when predicting the spatial distribution, preservation and likelihood of archaeological material. This is because landform features were an important factor in the lifestyle of Aboriginal people. Natural resources provided food, tools and material resources, which are linked to the topography, hydrology, geology and soils types of the region.

i Ethno-historical context

Lake Cowal is the traditional country of the Wiradjuri peoples, which is the largest language group in NSW. It extends from the Great Dividing Range in the east, to Hay in the west, Nyngan in the north and Albury in the south. The Wiradjuri peoples are amongst the oldest cultures that lived in Australia, likely thriving on country as early as 45,000 years ago (Pardoe 2013).

Social and cultural exchange occurred amongst different groups, which included large gatherings for ceremonies, initiation and trade. This would have been paramount for the cultural and social stability of the Wiradjuri people (Kabaila 2005).

Wiradjuri country was highly sought after by European colonialists who were drawn to the area in search of fertile soils for agriculture and farming, which lead to open conflict for several years during the early 1800s (Niche 2018). The Wiradjuri were in conflict with settlers until about 1840 (Cane 1994).

Ethnohistorical information indicates that despite this period of upheaval, the Wiradjuri still maintained strong kinship ties with their neighbours, reinforced through trade, economy, movements and participating in ceremonies (Kabaila 2005). The Wiradjuri maintain strong cultural connections to, and knowledge of, their land.

ii Landform

The study area is within the Lower Slopes subregion of the NSW South Western Slopes (NSS) Bioregion, which is characterised by ephemeral lakes, swamps, channels and lunettes. Historically, agricultural and pastoral activities such as cropping and livestock grazing have occurred in and surrounding Lake Cowal. This has impacted the upper soil profile and likely affected any cultural material present.

iii Hydrology

The study area is located within the Lachlan River Catchment within the Murray-Darling Basin.

The main hydrological feature within the study area is Lake Cowal, which is a shallow and ephemeral lake. It is periodically used for agricultural and pastoral activities, which has resulted in damage to soil and likely any cultural material present. Lake Cowal is fed by floodwaters and groundwater from Bland Creek and overflow from the Lachlan River. Several streams feed into Lake Cowal on the western and southern perimeter. Historically, substantial amounts of lithic artefactual material has been identified along these channels.

The margin of Lake Cowal contains gilgaj depressions, which originated from the Wiradjuri word “Gilgaay” meaning ‘waterhole’. Lake Cowal would have been a focal point for hunting for large groups of Aboriginal peoples as well as a water source. Gilgaj depressions would have provided a source of water during dryer times.

iv Geology and soils

The geology of the study area consists of the Cowra and Lachlan formations, which includes mainly alluvium clays, sands and gravels from the Quaternary period. The study area is in the Lake Cowal soil landscape. These soils are very poorly drained due to a permanently high-water table with high salinity, and are susceptible to erosion. Soil types are dominated by very deep grey clays (>150 cm) with occasional very deep self-mulching black earths (>150 cm) on lake margins and less inundated areas.

6.9.6 Predictive model

A predictive model of the potential for archaeological sites in and around Lake Cowal was formulated as part of the Aboriginal heritage due diligence assessment. The predictive model was based on previous archaeological and heritage investigations and permits for Lake Cowal and the results of the AHIMS search. The predictive model was then verified by the site inspection.

The predictive model is largely based upon the research design and study plan completed by Pardoe (2002) to accompany two investigative AHIPs for impacts to Aboriginal objects associated with CGO. The research design divided the project area into different zones of management based on their landforms, soils, potential erosion impact, recorded Aboriginal sites and archaeological potential. The archaeological potential of each zone of management is Table 6.27.

The site is located in the back plain management zone, which Pardoe (2002) predicted to contain widespread archaeological artefacts. These artefacts are the result of Aboriginal occupation associated with the ephemeral water sources of the gilgaj depressions. Despite this, the site of CGO is highly disturbed due to existing operations. No previously identified or new Aboriginal artefacts are predicted to occur within the site.

Table 6.27 Summary of archaeological management zones (after Pardoe, 2002)

Management zones	Aboriginal heritage values
Lakebed zone	This landform is considered to be of low archaeological potential and only one stone artefact has been registered on this landform to date AHIMS 43-4-0089. Pardoe predicted that it would have largely been unsuitable for prolonged occupation due to regular inundation and that if Aboriginal objects were identified within this zone, they would likely have been transported via lake water movement.
Beach zone	One scarred tree was identified within this landform. Pardoe predicted that alluvial fans within this management zone would be of higher archaeological sensitivity for subsurface deposits.
Slope zone	This landform is considered to be of low archaeological potential and no Aboriginal sites have previously been registered on this landform. Pardoe predicted that Aboriginal objects within this landform would likely have been transported by erosion and bioturbation from sites upslope of this zone.
Lake edge ridge zone	This landform is considered to have high archaeological potential for surface and subsurface archaeological deposits. This area is likely to represent the foci of Aboriginal occupation and activity associated with Lake Cowal with potential to feature an array of site types including stone artefact sites, hearths, grinding stones, heat retainers and Aboriginal modified trees (carved or scarred).
Back plain zone	This landform has widespread archaeological material in varying densities, from background scatter to concentrated scatters. Concentrations of artefacts are likely to relate to Aboriginal occupation associated with the ephemeral water sources of the gilgai depressions. This zone is characterised by a 'continuous background scatter of artefacts', and there is a distinct difference between the sites recorded on the margins of the lake, which consist primarily of backed-blade artefacts.

6.9.7 Predicted impacts

As noted in section 6.9.1, ground disturbing works associated with Mod 16 are wholly located within previously assessed and approved disturbance areas within CGO. Additionally, it is within the boundary of AHIP Consent 1467/Permit 1468 and managed by the approved IACHMP (Barrick 2003).

This area has previously been the subject of an archaeological survey and surface artefact collection prior to soil stripping, followed by further inspection after soil stripping and additional artefact collection by an archaeologist and Aboriginal community representatives (refer sections 5.3 and 5.4 of the IACHMP, Barrick 2003). Since those surveys, the site has been highly disturbed by bulk earthworks for the surface facilities and excavation of the open-cut. Little of the undisturbed land surface remains.

Overall, the surface disturbance associated with Mod 16 will not cause further harm to Aboriginal objects outside the existing boundary of AHIP Consent 1467/Permit 1468.

6.9.8 Mitigation measures

Mitigation measures such as those within AHIP Consent 1467/Permit 1468 and IACHMP remain in place however, as no additional impacts to Aboriginal cultural heritage values or objects are anticipated from Mod 16, no additional and specific management measures are proposed.

An unexpected finds protocol for Aboriginal heritage objects will be in place during construction and operation of the Underground Development Project. In the event new Aboriginal heritage objects are discovered during construction or operation of the Underground Development Project, it will be managed in accordance with the conditions of AHIP Consent 1467/Permit 1468 and IACHMP and the following unexpected finds protocol:

> *If Aboriginal objects are found at any stage of the life of the project all works in the immediate vicinity must cease immediately and the find will be reported to the work supervisor who will immediately advise the environmental manager or other nominated senior staff member of its discovery.*

AHIPS Consent 1467/Permit 1468 does not permit any impacts to human skeletal remains. The following unexpected finds protocol will apply to Aboriginal burials or human skeletal remains:

> *In the event that Aboriginal burials or skeletal material is uncovered during construction all work in the immediate vicinity will cease and the find will be reported to the work supervisor who will advise the site supervisor or other nominated senior staff member. The site supervisor or other nominated senior staff member will promptly notify the police and the State coroner (as required for all human remains discoveries).*

6.9.9 Summary and conclusion

In accordance with the additional agency assessment requirements received and the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010), an Aboriginal heritage due diligence assessment has been completed to assess the impact of Mod 16 on Aboriginal cultural heritage objects and value.

The research method included a desktop study, which consisted of a search of the AHIMS and NNTT and review of previous key archaeological and heritage investigations and permits completed within and surrounding CGO, and consultation with relevant RAPs. A site inspection of the disturbance footprint associated with Mod 16 was not deemed necessary, as it will exist wholly within approved disturbed areas within the ML 1535. Existing disturbance associated with CGO has been managed previously under AHIP Consent 1467/Permit 1468 and the approved IACHMP (Barrick 2003).

No objects of Aboriginal heritage value exist or are predicted to exist within the boundary of CGO. No native title or land claims or ILUAs are over the study area. The site of CGO is highly disturbed and has been the subject of previous archaeological survey and surface artefact collection prior and after initial soil stripping by an archaeologist and Aboriginal community representatives.

Considering this, no additional and specific management measures are proposed apart from those in place under the AHIP Consent 1467/Permit 1468 and IACHMP. An unexpected finds protocol for Aboriginal heritage objects, as noted in AHIP Consent 1467/Permit 1468 and IACHMP, and for human skeletal remains will be in place during construction and operation of Mod 16.

6.10 Historical heritage

6.10.1 Introduction

This section provides a summary of the desktop study completed by EMM as part of the historical heritage assessment for Mod 16. It describes the historical heritage context of the project area, identifies relevant items listed on all relevant statutory and non-statutory heritage databases and inventories and assesses the impact of Mod 16 on historical heritage items, cultural value and archaeological resources.

Historical heritage is considered the study of the past using documentary sources and in Australia dates from 1788. Aboriginal heritage is the study of the Aboriginal past which excludes colonial settlement.

It should be noted that all ground-disturbing works that are part of Mod 16 will take place within the footprint of areas previously assessed for historical heritage values and approved for disturbance. The site at CGO is highly disturbed by bulk earthworks necessary to establish the surface facilities and excavation of the open-cut. While acknowledging the lateral extent and severity of this disturbance, an historical heritage assessment was carried out to demonstrate that Mod 16 will not result in any new impacts outside of the existing disturbance footprint of CGO.

6.10.2 Assessment Requirements

Additional agency assessment requirements for Mod 16 were received on 27 September 2019 from DPIE. This was part of the SEARs issued by DPIE for the underground development component of the project.

No additional agency assessment requirements for historical heritage were received. However, an historical heritage assessment has still been completed, as documented in this section, to demonstrate that Mod 16 will not impact historical heritage items, cultural value and archaeological resources outside of the existing disturbance footprint of CGO.

6.10.3 Research method

A search of all relevant statutory and non-statutory heritage databases and inventories was conducted for the historical heritage assessment for Lake Cowal in the Bland local government area (LGA) of NSW. These are listed below.

- National Heritage List (NHL). This register is made under the EPBC Act.
- Commonwealth Heritage List (CHL). This register is made under the EPBC Act.
- State Heritage Register (SHR). This register is authorised under Part 3A of the NSW *Heritage Act 1977* (Heritage Act). Items on the SHR undergo a rigorous assessment process and must reach a high significance threshold to be included. Inclusion on the SHR is directed by the Minister of the agency that administers the Heritage Act.

- Heritage and Conservation Register (s170 register). This register is made under Section 170 of the Heritage Act and is also referred to as the s170 register. It is a register of heritage items that are owned or managed by state government authorities. Items on the s170 register may also be listed on other registers. Any demolition, change to fabric and change of ownership require notification to the Heritage Council of NSW.

- Bland Local Environmental Plan 2011 (Bland LEP). The EP&A Act sets the provisions for the making of LEPs. Most LEPs are prepared using a standard template, in which Schedule 5 addresses environmental heritage. Where an item is included in the Schedule 5 of an LEP, development applications must include an assessment of impacts to the item. Where a project is being assessed as a State-Significant Development application, approval by the relevant council is not required but the items require assessment and management if they are affected by a proposal.

- State Heritage Inventory (SHI). The SHI is not a single statutory register, but a central collection of state-listed statutory heritage items maintained by the Heritage Division of the Office of Environment and Heritage (OEH). The search of the SHI was cross-checked with Schedule 5 of the BLEP and s170 register.

- Register of the National Estate (RNE). The RNE is an archived list of heritage items that were protected under the now repealed *Australian Heritage Commission Act 1975*, which was replaced by the EPBC Act. While many items were transferred from the RNE to the NHL or CHL, those that were not remain on the RNE as an indication of their heritage value.

- National Trust of Australia, NSW (NT). The NT is made up of autonomous state chapters. Each chapter is a community-based and non-government organisation, with a mandate to conserve and promote Australia's natural and cultural heritage. Classification by the NT is a strong acknowledgment of heritage significance and while statutory constraints are not applicable, classification offers protection through visibility and community action.

6.10.4 Results

A summary of the findings of the search of the databases and inventories is provided in Table 6.28.

One heritage item is listed in the project area boundary (Lot 7 DP 753083) in Schedule 5 of the Bland LEP: *Cowal West Group comprising homestead, quarters, sheds and stables* (heritage item I11) and Lake Cowal itself is listed on the RNE (non-statutory archive).

Table 6.28 Register search results

Register	Results
NHL	No items listed
CHL	No items listed
SHR	No items listed
s170 register	No items listed
Bland LEP	1 item listed – *Cowal West Group comprising homestead, quarters, sheds and stables* (heritage item I11)
SHI	No items listed
RNE	1 item – Lake Cowal
NT	No items listed

6.10.5 Existing environment

CGO is highly disturbed due to historical and continual mining and agricultural and pastoral activities. The land has been subjected to bulk earthworks and excavation for the purposes of establishing an open-cut pit and associated surface facilities and is therefore in an unnatural state. Additionally, the land surrounding Lake Cowal has been used for agricultural and pastoral purposes, causing the upper soil to become heavily compacted and disturbed.

A search of the registers identified relevant listings in Schedule 5 of the BLEP and the RNE.

One heritage item is listed in the CGO site boundary (Lot 7 DP 753083) in Schedule 5 of the Bland LEP: *Cowal West Group comprising homestead, quarters, sheds and stables* (heritage item I11, refer to Plate 6.1). However, despite this listing, the heritage elements to which this listing relates have been removed as part of historical mine development associated with CGO. The approved demolition of the Cowal West Homestead Complex occurred during 2011 to 2012. The relocation and reconstruction of the Shearing Shed at the Lake Cowal Conservation Centre was completed in April 2013.

Plate 6.1 Location of heritage item I11 as shown in the Bland LEP. This item no longer exists.

Lake Cowal itself is listed on the RNE, which was registered in 1992 as a natural heritage place of significance (Place ID 16581). Its listing on the RNE did not include cultural heritage values.

No other items exist in or near the boundary of CGO, which are listed on the remaining relevant statutory and non-statutory heritage databases and inventories.

6.10.6 Predicted impacts

No known items of heritage significance were found during the register searches or are predicted to occur within the existing boundary of CGO due to its highly disturbed condition. One heritage item is listed within the CGO site boundary (Lot 7 DP 753083) in Schedule 5 of the Bland LEP: *Cowal West Group comprising homestead, quarters, sheds and stables* (heritage item I11). However, these heritage elements were approved for relocation and no longer exist. Therefore, the listing is no longer relevant to Mod 16.

Lake Cowal itself is listed on the RNE, which did not include cultural heritage values. As Mod 16 is wholly located within the existing site boundary of CGO, it will not affect Lake Cowal or any cultural heritage values it may hold. Considering the site of CGO is highly disturbed due to bulk earthworks and that ground disturbance associated with Mod 16 will be wholly within the boundary of CGO which is previously assessed for historical heritage items and approved for disturbance, there will be no impact to historical heritage items, cultural value and archaeological resources outside of this boundary.

6.10.7 Mitigation measures

Considering no existing items of heritage significance were found during register searches or are predicted to occur within the existing boundary of CGO no specific mitigation measures are required to be implemented during construction or operation of the project.

An unexpected finds protocol will be added to the existing Heritage Management Plan (HMP) for CGO to be applied to existing operations, Mod 16 and the underground development. The unexpected finds protocol will provide guidance to the construction and operational workforce should works uncover historic heritage items that may indicate relics. The unexpected finds protocol is provided below:

In the event of discovery of new historical sites within CGO, the following protocols apply:

- if the find meets the materiality threshold, work will immediately but temporarily cease and a minimum of 5 m around the site will be secured to protect the find with temporary fencing/ flagging. The materiality threshold includes:
    - bonded bricks, timber or stones appearing in formation indicating a wall, foundations or floor;
    - a well or cistern, which are usually constructed of brick, sandstone and in this region may be granite;
    - soil with artefact concentrations such as bottles and broken glass, broken crockery, metal, pins and leather, as this type of feature may be a rubbish pit and indicate other as yet undiscovered features; and
    - a collection of bricks that show evidence of early manufacture such as narrower than modern bricks, inconsistent colour and material and striations across the length;
- the find will be immediately reported to the relevant supervisor, environmental manager or other nominated staff member;
- an archaeologist will be contacted to assess the find, where relevant, and determine if it is clearly a relic or has moderate to high potential to be a relic (this may require additional research) – if possible, identification would be competed over email using photographs and if necessary, the archaeologist will attend the site;
- if the find is determined to be a relic, a 146 notification (of the NSW *Heritage Act 1977*) is to be forwarded to the Heritage Council who will be consulted on the appropriate management measure;
- if the find is assessed and is not a relic, work inside the area that was made a no-go area can re-commence; and
- any new sites will be added to the HMP.

6.10.8 Summary and conclusion

An historical heritage assessment has been completed for the project to address the impacts of Mod 16 on historical heritage items, cultural value and archaeological resources.

One heritage item is listed in the Underground Development Project area boundary (Lot 7 DP 753083) in Schedule 5 of the Bland LEP: *Cowal West Group comprising homestead, quarters, sheds and stables* (heritage item I11) however, it no longer exists.

Lake Cowal is also listed on the RNE, for which the listing does not include cultural heritage values. Mod 16 will not impact this listing or any cultural heritage values held by Lake Cowal, as associated surface disturbance is wholly within the site boundary of CGO.

No historical heritage items were discovered during the site inspection nor are they predicted to occur within the site boundary of CGO due to highly disturbed nature of the land.

6.11 Traffic and transport

6.11.1 Introduction

For clarity and simplicity, this section summarises the traffic impact assessment (TIA) completed by EMM that has considered the anticipated changes in traffic associated with all aspects of the Underground Development Project and Mod 16. It includes traffic associated with the construction of the proposed new facilities and the commuting of personnel to and from site in the longer term.

The assessment was prepared in consideration of the *Guide to Traffic Generating Developments* (RTA 2002) in addition to the relevant guidelines by Austroads. It describes the existing local and regional traffic network surrounding CGO and assesses the impacts of the Underground Development Project on that network. The TIA focuses on existing transport routes between CGO and the townships of West Wyalong, Condobolin and Forbes, including the impact that the Underground Development Project will have during both the construction and operational phases. These routes are listed below:

- CGO - West Wyalong: Mine Access Road, Bonehams Lane, Blow Clear Road, Wamboyne Road, Ungarie Road and Newell Highway.
- CGO - Condobolin: Mine Access Road, Lake Cowal Road, Fitzgerald Road, Lake Cowal Road, Bena Street, Burcher Road and The Gipps Way.
- CGO - Forbes: Mine Access Road, Lake Cowal Road, Fitzgerald Road, Lake Cowal Road, Bogies Island Road, West Plains Road and Newell Highway.

The following key intersections along the existing transport routes between CGO were assessed as part of the TIA:

- West Wyalong Condobolin Road/Ungarie Road/Wamboyne Road;
- Wamboyne Road/Girral Road/Blow Clear Road; and
- Mine Access Road/Bonehams Lane/Lake Cowal Road.

The Underground Development Project will result in an increase in movements of both light and heavy vehicles as the workforce increases during both the construction and operational phases of the Underground Development Project. This includes light vehicle (car) movements and heavy vehicle movements including the existing shuttle bus service between CGO and local town and additional heavy vehicle movements delivering construction mate

6.11.2 Assessment Requirements

Agency assessment requirements for Mod 16 were received on 27 September 2019 from DPIE. These were attached to the SEARs issued by DPIE for the underground development component of the Underground Development Project. No traffic related additional agency assessment requirements were received for Mod 16. Regardless, the summary of the TIA has been included in this modification report to show the potential traffic impacts of the proposed modification, as there will be new infrastructure built on site that will generate some traffic during the construction period and during operations.

6.11.3 Summary of Traffic Impact Assessment

A more detailed summary of the TIA is provided in Chapter 16 of the EIS for the Underground Development Project. This is because most of the increase to traffic impacts will mostly result from elements associated with the Underground Development Project (eg underground mine, paste fill plant and box-cut) and the TIA has cumulatively considered impacts from both the underground development and Mod 16. A brief summary of the TIA has been provided below in Table 6.29, including the existing environment, research method, predicted impacts and mitigation measures described in the TIA.

Table 6.29 Summary of the Traffic Impact Assessment

Aspect	Summary
Existing environment	To establish an understanding of the existing environment, EMM (2020) completed a review of baseline traffic data and intersection traffic surveys for roads and key intersections within the transport route. From this data, intersection modelling and an Austroads turning lane warrant assessment was completed. Baseline traffic data was obtained from TfNSW, Bland Shire Council, Forbes Shire Council and Lachlan Shire Council for the existing transport routes. The average daily traffic volumes in 2019 for roads within the transport route are listed below (it should be noted that these numbers were estimated based upon baseline traffic data for roads within the Lachlan Shire Council and Forbes Shire Council): • Blow Clear Road – 254 vehicles; • Bonehams Lane – 254 vehicles; • Lake Cowal Road – 55 vehicles; • Ungarie Road – 1,221 vehicles; • Wamboyne Road – 303 vehicles; • The Gipps Way – 478 vehicles; • Burcher Road – 43 vehicles; and • West Plains Road – 42 vehicles. Existing intersection performance was modelled using the SIDRA-8 Model for key intersections based upon results of the intersection traffic survey provided in section 2.2 of the TIA. All key intersections are performing at a Level of Service (LOS) standard of A and low degree of saturation (DOS), average delay per second (DEL) and back of queue length (BQL). This means that there is minimal delay with good operation. An Austroads turning lane warrant assessment was completed for the key intersections and based upon baseline traffic data and the intersection traffic survey. It was found that existing traffic volumes at each intersection only require the minimum right-hand lane turning requirement known as a basic right (BAR) turn treatment.

Table 6.29 Summary of the Traffic Impact Assessment

Aspect	Summary
Research methods	The research method for the TIA included a site inspection, desktop research, intersection traffic surveys, intersection modelling and an Austroads turning lane warrant assessment. The site inspection was completed on 6 June 2020 and included an inspection of CGO, the existing transport routes and key intersections along the existing transport routes. Desktop research included a review of the local and regional road networks, crash records, public transport routes, known future improvement projects and baseline traffic volumes. Intersection traffic surveys and modelling was completed for key intersections. Intersection modelling was completed using the SIDRA-8 Model as per *Austroads Guide to Road Design Part 4: Intersections and Crossings: General (Austroads 2017).* It was completed for the following time periods: • 5 – 6 am and 6 – 7 pm for the construction traffic; and • 5 – 6 am, 6 – 7 am, 5 – 6 pm and 6 – 7 pm for operational traffic. The performance of key intersections was determined through the following parameters: • LOS; • DOS; • average DEL; and • 90th percentile BQL. Lastly, an Austroads turning lane warrant assessment was completed at the key intersections as per *Part 4 Intersection Design Standards* (Austroads 2017). This was to determine whether an additional right-hand turn lane was required to accommodate light and heavy vehicles associated with the Underground Development Project.
Predicted impacts	Mine Access Road will experience the largest increase of project-related traffic, including an additional 210 vehicles during the construction phase and 110 vehicles during the operation phase. This road is currently primarily used by traffic associated with CGO, and therefore this increase is not likely to impact other road users or nearby private residences. Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane will also experience an increase in Underground Development Project related traffic, including an additional 168 vehicles during the construction phase and 76 during the operation phase. Lake Cowal Road, West Plains Road, Burcher Road and The Gipps Way will experience minimal Underground Development Project-related traffic levels, ranging from an additional 3 to 10 vehicles during both the construction and operation phase. The intersection modelling found that the Underground Development Project will not significantly change the performance of each key intersection. The LOS will remain at a standard of A for both Underground Development Project phases. The DOS, DEL and BQL will remain as is or experience a negligible increase. The Austroads turning lane warrant assessment found that an additional right-hand turning lane is not required to accommodate Underground Development Project-related traffic. It was found that the existing transport routes do not have significant accident histories, as only two collisions have occurred in the vicinity of CGO in the last five years. Mine Access Road will experience the highest increase of Underground Development Project-related traffic however, is not often used by other road users. Other roads in the transport route have been constructed to industry standards and frequently used by heavy and light vehicles. The Underground Development Project will therefore not impact the safety of roads within the transport routes. The Underground Development Project will not affect public transport routes, as the additional workforce will utilise the existing shuttle bus service between CGO, West Wyalong, Forbes and Condobolin.

Table 6.29 Summary of the Traffic Impact Assessment

Aspect	Summary
Mitigation measures	No specific or additional mitigation measures are proposed by Evolution beyond the existing monitoring of road quality and maintenance in accordance with the existing Transport Management Plan (TMP), which includes the following mitigation measures: • Evolution will monitor the road quality of Wamboyne Road, Blow Clear Road, Bonehams Lane and Lake Cowal Road along the existing transport routes; • responsibility for road maintenance of Wamboyne Road and Blow Clear Road will be shared between Evolution and the Bland Shire Council to ensure these roads are maintained to a safe trafficable standard; • Evolution will complete appropriate maintenance works on Bonehams Lane and Lake Cowal Road as the primary user to ensure a safe trafficable standard; and • Evolution will revise existing monitoring programs in the TMP to take into account the increase in traffic using the route between CGO and West Wyalong to contribute to the continued safety of all road users.

6.12 Rehabilitation

6.12.1 Introduction

This section provides a summary of the rehabilitation strategy for the proposed modification. A detailed assessment of the rehabilitation and closure of the entire CGO site is presented in Appendix L and in the EIS for the SSD Underground Development Project.

The overarching objective of the rehabilitation strategy for the site is to create safe, stable and non-polluting landforms that are consistent with agreed post mining land uses.

The rehabilitation concepts presented in Appendix L will be reviewed over time to allow for the consideration of several factors, including the outcomes of future rehabilitation trials and research. Final rehabilitation and project closure requirements will ultimately be formulated in consultation with key government agencies and other relevant stakeholders.

6.12.2 Assessment requirements

The mine closure and rehabilitation strategy has been prepared in accordance with requirements of the (DPIE), as set out in its letter of 27 September 2019. The letter asked for consideration of comments from EPA in relation to pollution of land and mitigation of erosion impacts and from Resources Regulator in relation to rehabilitation and closure. These are detailed in Table 6.30 and Table 6.31 respectively.

Appendix L also details the original DA 14/98 rehabilitation and closure conditions and where they are addressed in the strategy.

Table 6.30 EPA assessment requirements for the proposed modification

Requirement	Location in this document
Potential impacts on land	
The goals of the project should include the following:	
• No pollution of land, except to the extent authorised by EPA (ie in accordance with an Environment Protection Licence); and	Section 6.12.3
• The potential impact of land erosion from the development is mitigated.	
The EIS should document the measures that achieve the above goals.	Section 4 and Section 3.3.2 of Appendix L.

Table 6.31 Resources Regulator assessment requirements for the proposed modification

Requirement	Location in document
Post-mining land use	
Identification and assessment of post-mining land use options;	Section 6.12.9 Chapter 4 of Appendix L
Identification and justification of the preferred post-mining land use outcome(s), including a discussion of how the final land use(s) are aligned with relevant local and regional strategic land use objectives;	Section 6.12.8 Chapter 4 of Appendix L.
Identification of how the rehabilitation of the project will relate to the rehabilitation strategies of neighbouring mines within the region, with a particular emphasis on the coordination of rehabilitation activities along common boundary areas;	Not applicable as there are no neighbouring mines.
Rehabilitation objectives and domains	
Inclusion of a set of project rehabilitation objectives and completion criteria that clearly define the outcomes required to achieve the post-mining land use for each domain. Completion criteria should be specific, measurable, achievable, realistic and time-bound. If necessary, objective criteria may be presented as ranges;	Sections 6.12.3 and 6.12.9 Section 4.1 and Chapter 6 of Appendix L.
Rehabilitation method	
Details regarding the rehabilitation methods for disturbed areas and expected time frames for each stage of the rehabilitation process.	Chapter 4 and Chapter 5 of Appendix L.
Mine layout and scheduling, including maximising opportunities for progressive final rehabilitation. The final rehabilitation schedule should be mapped against key production milestone (i.e. ROM tonnes) of the mine layout sequence before being translated to indicative timeframes through the mine life. The mine plan should maximise opportunities for progressive rehabilitation;	Chapter 4 and Chapter 5 of Appendix L.
Conceptual final landform design	
Inclusion of a drawing at an appropriate scale identifying key attributes of the final landform, including final landform contours and the location of the proposed final land use(s)	Figure 6.15 Figure 4.1 of Appendix L.
Monitoring and research	
Outlining the monitoring programs that will be implemented to assess how rehabilitation is trending towards the nominated land use objectives and completion criteria	Section 6.12.8 Sections 5.5.1 and section 6 of Appendix L.
Details of the process for triggering intervention and adaptive management measures to address potential adverse results as well as continuously improve rehabilitation practices;	Section 5.5.1 of Appendix L.

Table 6.31 Resources Regulator assessment requirements for the proposed modification

Requirement	Location in document
Outlining any proposed rehabilitation research programs and trials, including their objectives. This should include details of how the outcomes of research are considered as part of the ongoing review and improvement of rehabilitation practices;	Section 6.12.8 Section 6.2.2 of Appendix L.
Post-closure maintenance	
Description of how post-rehabilitation areas will be actively managed and maintained in accordance with the intended land use(s) in order to demonstrate progress toward meeting the rehabilitation objectives and completion criteria in a timely manner;	Section 6.12.10 Section 5.5 of Appendix L.
Barriers or limitations to effective rehabilitation	
Identification and description of those aspects of the site or operations that may present barriers or limitations to effective rehabilitation, including:	Summary provided in Table 6.33.
evaluation of the likely effectiveness of the proposed rehabilitation techniques against the rehabilitation objectives and completion criteria	Section 4.1.3 of Appendix L.
an assessment and life of mine management strategy of the potential for geochemical constraints to rehabilitation (e.g. acid rock drainage, spontaneous combustion etc.), particularly associated with the management of overburden/interburden and reject material;	Section 3.1.2 of Appendix L. Note given that this is not a coal mining proposal, spontaneous combustion is not a risk for this project.
the process that will be implemented throughout the mine life to identify and appropriately manage geochemical risks that may affect the ability to achieve sustainable rehabilitation outcomes;	Sections 3.1.2 of Appendix L.
a life of mines tailings management strategy, which details measures to be implemented to avoid the exposure of tailings materials that may cause environmental risk, as well as promote geotechnical stability of the rehabilitated landform; and	Sections 2.2.4, 3.1.3 and 4.3.3 of Appendix L.
existing and surrounding landforms (showing contours and slopes) and how similar characteristics can be incorporated into the post-mining final landform design. This should include an evaluation of how key geomorphological characteristics evident in stable landforms with the natural landscape can be adapted to the materials and other constraints associated with the site.	Section 4.3 of Appendix L.
Where a void is proposed to remain as part of the final landform include:	
A constraints and opportunities analysis of final void options, including backfilling, to justify that the proposed design is the most feasible and environmentally sustainable option to minimise the sterilisation of land post-mining;	Section 5.3.1 of Appendix L.
A preliminary geotechnical assessment to identify the likely long term stability risks associated with the proposed remaining high wall(s) and low wall(s) along with associated measures that will be required to minimise potential risks to public safety; and	Sections 3.2.1, 4.2.3 and 4.3.6 of Appendix L.
outcomes of the surface and groundwater assessments in relation to the likely final water level in the void. This should include an assessment of the potential for fill and spill along with measures required to be implemented to minimise associated impacts to the environment and downstream water users.	Sections 2.2.1 and 4.4.1 of Appendix L.
Where the mine includes underground workings:	
Determine (with reference to the groundwater assessment) the likelihood and associated impacts of groundwater accumulating and subsequently discharging (eg acid or neutral mine drainage) from underground workings post cessation of mining; and	Sections 2.2.1 and 4.4.1 of Appendix L.
Consideration of the likely controls required to either prevent or mitigate against these risks as part of the closure plan for the site.	Sections 2.2.1 and 4.4.1 of Appendix L.

Table 6.31 Resources Regulator assessment requirements for the proposed modification

Requirement	Location in document
Consideration of the controls likely to be required to either prevent or mitigate against rehabilitation risks as part of the closure plan for the site;	Section 3 of Appendix L.
Where an ecological land use is proposed, demonstrate how the revegetation strategy (eg seed mix, habitat features, corridor width etc) has been developed in consideration of the target vegetation community(s);	Section 6.12.7 Section 4, 5.2, 5.5 and 6 of Appendix L.
Where the intended use is agriculture, demonstrate that the landscape, vegetation and soil will be returned to a condition capable of supporting this; and	Section 6.12.7and Section 6.12.10 Section 4, 5.2, 5.5 and 6 of Appendix L.
Consider any relevant government policies	Section 7.1i. Section 1.4 of Appendix L.

i Relevant policies, guidelines and plans

The mine closure and rehabilitation strategy has been prepared in accordance with relevant State and Commonwealth guidelines, policies and plans, including:

- *The guideline for mineral exploration drilling; drilling and integrity of petroleum exploration and production wells* (the drilling guideline);
- The *ESG3 – Mining Operations Plan (MOP) Guidelines, September* 2013 (the MOP guidelines) (NSW Department of Trade and Investment – Division of Resources and Energy 2013);
- The *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia, 2000) (SFMC);
- *The Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (NSW Department of Industry, Tourism and Resources, 2006) (MR Handbook);
- *The Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry* (NSW Department of Industry, Tourism and Resources, 2006) (MCC Handbook);
- *NSW Wetlands Policy* (DECCW 2010);
- The DPI's *Policy and Guidelines for Fish Habitat Conservation Management* (Update 2013);
- *Jemalong Land and Water Management Plan* (Jemalong Land and Water Management Plan Steering Plan Committee [JLWMPSPC] 2000);
- The *Lake Cowal Land and Water Management Plan* (Australian Water Technologies Pty Ltd 1999); and
- The *Lachlan Catchment Action Plan* (Lachlan Catchment Management Authority 2006).

6.12.3 Rehabilitation principles and objectives

The Evolution rehabilitation philosophy is to operate as a non-intrusive land-user and to create stable rehabilitated landforms that increase the areas of endemic vegetation in the mine area and the status of land-lake habitats (Evolution 2018a).

The above philosophy has led to the rehabilitation principles and objectives described below.

i Rehabilitation Principles

Evolution's rehabilitation program includes the following general principles (Evolution 2018a):

- The rehabilitation of landforms is to be progressive (where possible) and conducted in accordance with approved, verified plans.
- Final landforms are to be stable in the long-term and include native and/or endemic vegetation characteristic of remnant vegetation within the surrounding landscape.
- Native and/or endemic groundcover, understorey, tree seeds and seedlings are to be used in the rehabilitation program.
- Rehabilitation concepts are to be flexible to allow for adjustments, based on investigations, to improve the rehabilitation program.
- The annual rehabilitation program and budget is to be prepared by a site team incorporating senior management representatives.

ii Rehabilitation objectives

Evolution's rehabilitation objectives for the rehabilitation program include (Evolution 2018a):

- 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 (where practicable) of soils on final landforms to enable the progressive establishment of vegetation.
- The expansion of vegetation suitable as 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* (DECCW, 2010).
- The selection of revegetation species in accordance with accepted principles of long-term sustainability (eg genotypic variation, vegetation succession, water/drought tolerances).
- Grazing of land within ML 1535 to be excluded during operations and during rehabilitation of the site. At lease relinquishment, rehabilitated final landforms are excluded from grazing, with some areas suitable for grazing surrounding the rehabilitated final landforms.

6.12.4 Existing environment

i Land use

The land within ML 1535 is former cleared and semi-cleared farmland that was used for grazing of native and improved pastures by livestock. Prior to the development of the CGO, the original native tree cover within ML 1535 had largely been removed except for scattered individual trees or small stands and the tree cover on the former Cowal West Hill which had been retained due to its shallow soils and poorer grazing potential.

The landscape surrounding the CGO (including Evolution-owned lands outside ML 1535) is predominantly used for agriculture (eg broad-acre cropping) and grazing over relatively large landholdings.

Current (and historical) uses of Lake Cowal include commercial and recreational fishing when inundated, and agricultural production including grazing by livestock when dry.

ii Soil erosion

An assessment of soil erosion hazard was undertaken for the CGO site and ranges from very low to very high. The key erosion risks for the proposed modification are:

- highly erodible dispersible subsoils and topsoils;
- low annual average rainfall to establish and sustain vegetation cover; and
- long and steep slopes.

6.12.5 Rehabilitation domains

i Overview

CGO has six existing primary closure domains, with each domain having similar bio-physical characteristics. These domains have been assigned in accordance with the requirements of the MOP guidelines. It will not be necessary to assign any new domains as all underground infrastructure will be located within existing domains.

A summary description of the domains is provided below with additional detail provided in Appendix L.

ii Primary and secondary domains

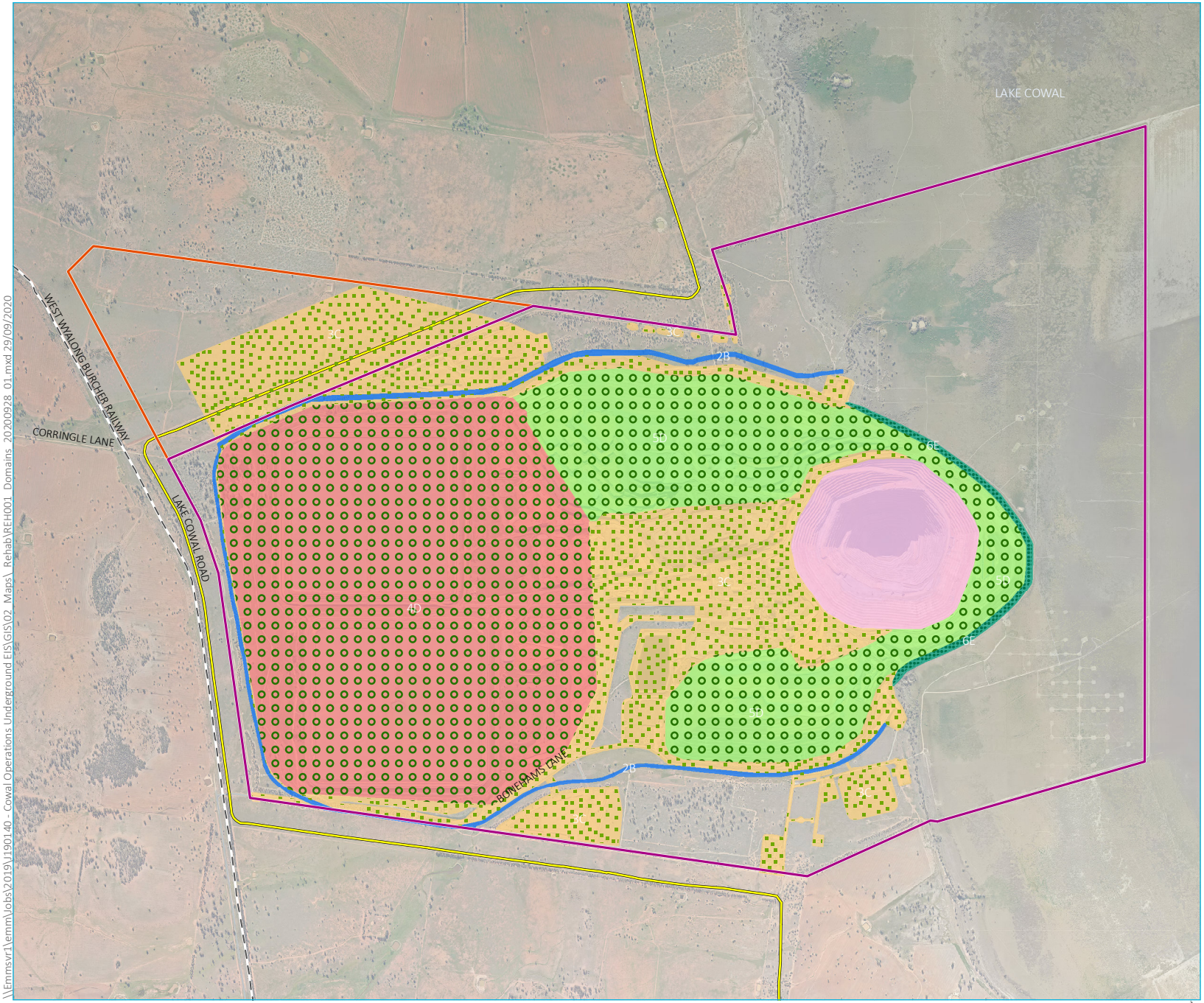
Primary domains are based on land management units within the proposed modification area, usually with a unique operational and functional purpose during operation and therefore, have similar physical and geochemical characteristics that require management. The primary domains form the basis of conceptual closure and rehabilitation planning for this strategy.

The secondary domains are defined as land management units characterised by a similar post-mining land use objective (ie following mining). The primary and secondary domains are defined together with codes allocated for each domain.

These primary and secondary domains are summarised in Table 6.32 below and are shown in Figure 6.15.

Table 6.32 Evolution rehabilitation domains

Primary Domains	
Code	**Domain**
1	Void
2	Permanent water management infrastructure
3	Infrastructure area
4	Integrated waste landform
5	Waste rock emplacements
6	Woodland corridor
7	New lake foreshore
Secondary Domains	
Code	**Post-mine land use**
A	Final void
B	Permanent water management infrastructure
C	Grassland/ scattered Eucalypt woodland
D	Eucalypt woodland
E	Riverine woodland/ freshwater communities



\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02 Maps\ Rehab\REH001 Domains 20200928 01.mxd 29/09/2020

Source: EMM (2020); Evolution (2020); DFSI (2017)

Primary and secondary rehabilitation domains

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.15

EMM
creating opportunities

6.12.6 Summary of potential impacts and rehabilitation for Mod 16

A summary of potential impacts and the rehabilitation in the domains relevant for the proposed modification (focussed on the IWL) is provided in Table 6.33. Further details of the other domains are included in Appendix L.

Table 6.33 Summary of rehabilitation domains

Domain	Description
4D – Integrated waste landform	The Northern Tailings Storage Facility (NTSF) and Southern Tailings Storage Facility (STSF) will continue to be constructed as a succession of new embankments raised in advance of the storage requirements. New embankments will be added as an upstream 'raise' at a rate of approximately 5 m per year. Each lift would comprise an earth/rock fill embankment, with a clay basal zone, supported by the dry tailings beach. Construction of each lift will continue to involve placement of an interim rock buttress cover on the outer slope of the embankment to enhance stability. Rehabilitation materials (eg rock mulch and topsoil) on the existing TSF embankments will continue to be stripped prior to placement of the interim rock buttress. The stripped rehabilitation materials will be either transferred to a new rehabilitation area or stockpiled proximal to the IWL for use during ongoing or final rehabilitation activities. The tailings will be covered and revegetated as described in the MOP rehabilitation objectives which are: • to establish permanently stable landforms; • during operations, stabilise batters so that they provide minimal habitat value for bird life (ie rock mulch or pasture cover); • post-operations, to establish vegetation communities (including Eucalypt and Riverine Woodland species and understorey species such as Rush sp. and pasture species) which are suited to the hydrological features and substrate materials of the top surface of the landform; • post-operations, to establish vegetation communities (including native and/or endemic Eucalypt Woodland, shrubland and grassland species) similar to those remnants in the surrounding landscape which are suited to the substrate materials and slope of the embankments; and • to exclude grazing and agricultural production.

6.12.7 Rehabilitation methods

i Soil management

a Soil stockpile management

The general protocol for management of stockpiled soil includes soil handling measures that optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth. The protocol includes:

- locating soil stockpiles outside the Lake Cowal floodplain;
- leaving the surface of the completed soil stockpiles in a roughened condition to help promote water infiltration and minimise erosion prior to vegetation establishment;
- deep ripping soil stockpiles with gypsum (or other relevant ameliorants) and seeding to maintain soil organic matter levels, soil structure and microbial activity;
- installing signposts for all soil stockpiles with the date of construction and type of soil; and
- recording details of all soil stockpiles on a site database which includes the location and volume of each stockpile and the stockpile maintenance records (e.g. ameliorative treatment, weed control, seeding).

Long-term topsoil stockpiles will continue to be constructed up to 3 m in height with slopes at a maximum acceptable angle to resist erosion. Subsoil stockpiles would vary in height as determined by storage volumes and available space within the footprint of approved disturbance areas.

A detailed soil stockpile inventory is maintained to track soil resource accounting.

b Soil amelioration and management

Soil amelioration and management measures include:

- Undertake a site-wide characterisation of the soils to determine what soils and topsoils require specific management measures;
- spreading gypsum on the *in situ* soil surface prior to soil stripping;
- deep-ripping and applying gypsum (or other relevant treatment) to stockpiled soil; and
- applying gypsum to soil during re-application on rehabilitation areas.

A summary of the proposed soil amelioration methods is provided below. These are listed in order of preference:

1. Application to soil prior to stripping - gypsum has low solubility and requires mixing in the soil to be effective, so application to the soil surface prior to stripping is desirable as it ensures that the gypsum and soil is well mixed during the stripping process. Gypsum will be applied to the surface of the Northern Waste Rock Emplacement expansion area, IWL footprint area and other approved infrastructure disturbance areas prior to stripping.
2. Treatment of soil stockpiles - if required by soil testing, soil stockpiles will be ripped to incorporate gypsum (or lime, or a gypsum-lime blend). The ameliorated soil is then excavated for rehabilitation purposes and the process repeated until all soil within the stockpile has been treated.
3. Treatment of soil on rehabilitation areas - consistent with current rehabilitation procedures at the CGO, gypsum will continue to be applied to soil used for rehabilitation at rates based on soil testing results.

Soil re-application activities would include:

- deep-ripping the soil surface to minimise compaction;
- applying coarse grade gypsum at approximately 10 t/ha to rehabilitation areas to provide a prolonged source of calcium ions to minimise dispersion of soils to assist with the revegetation establishment; and
- applying native pasture hay where possible to protect the surface soil and provide slow-release nutrients to encourage native plant growth.

ii Vegetation

Revegetation of the final landforms will include endemic vegetation communities, selected specifically for their suitability to the created elevation, substrate conditions and the overriding objective of re-establishing a greater extent of endemic vegetation within ML 1535.

The revegetation approaches for disturbed areas will continue to be informed by the results of the rehabilitation investigations, trials, and rehabilitation monitoring results. Based on these results, the CGO rehabilitation program (including revegetation species lists for each rehabilitation domain) will be refined in consultation with relevant regulatory agencies.

As a component of the Vegetation Clearance Protocol, during the preliminary habitat assessment phase, trees may be examined for their provision of seed to be used in the rehabilitation program.

Where available, seed would be collected at the time of vegetation clearance activities and habitat features (ie hollows and logs) would be salvaged for use in rehabilitation or habitat enhancement programs within ML 1535 and/or within the CGO's offset areas and RVEP areas.

CGO also proposes to engage an external consultant to prepare a seed supply and planting implementation strategy for CGO's rehabilitation program within ML 1535 and for implementation of the CGO's offset strategy. The strategy will include an assessment of the potential risks associated with the seed supply and planting implementation programs.

Revegetation at the CGO uses a combination of direct seeding and tubestock planting.

iii Fauna habitat enhancement

As detailed in CGO's Rehabilitation Management Plan, where practicable, vegetation clearance operations will be managed to maximise the re-use of cleared vegetative material and habitat resources/features. Habitat resources/features such as logs and hollows will be clearly marked (with flagging tape or similar) for salvage/relocation in the CGO's rehabilitation program (or for use within the CGO's offset enhancement areas or remnant vegetation enhancement program areas).

Vegetative material unsuitable for the rehabilitation program or for habitat enhancement may be mulched and stockpiled.

Potential impacts to fauna are currently managed through implementation of measures included in the Flora and Fauna Management Plan, Threatened Species Management Protocol, RMP, Compensatory Wetland Management Plan, Land Management Plan and Air Quality Management Plan.

Measures have been developed to keep threatened waterbirds away from the TSFs which include:

- minimising the area of open water in the TSFs to reduce the attractiveness of the TSFs to threatened waterbirds; and
- making the area non-conducive to the establishment of wildlife habitats (i.e. during operations revegetation of the outer batters of the TSFs is limited to pasture/grass cover only to provide minimal habitat for bird life).

Avifauna deterrence mechanisms would continue to be utilised at the TSFs (and the IWL once deposition commences) (e.g. audio and visual stimuli to scare/repel birds).

CGO will continue to undertake pest control activities including:

- regular property inspections to assess the status of pest populations on-site (including rehabilitation areas) and for all company-owned land;
- mandatory pest control for declared pests (ie rabbits, feral pigs, wild dogs and foxes) in accordance with Pest Control Orders under the *Local Land Services Act, 2013,* and management of plague locust species including the Australian Plague Locust, Migratory Locust and the Spur-throated Locust; and
- inspections to assess the effectiveness of control measures implemented and review these if necessary.

iv Erosion and sediment control

Erosion and sediment control management and mitigation measures are described in the approved CGO Erosion and Sediment Control Plan and include:

- for the majority of the disturbed areas within the proposed modification any eroded sediments will be contained (up to and including the design storm event). Contained turbid water is re-used on site;
- the sediment basins will be maintained on site until 70 per cent soil surface cover has been achieved on the rehabilitated surfaces and/or runoff meets the nominated water quality criteria;
- dispersive soils are managed with methods including gypsum treatment to reduce exchangeable sodium and exchangeable magnesium levels and the use of rock/soil matrices of slopes;
- progressive rehabilitation of disturbed areas is undertaken to reduce the area and duration of exposure;
- interim rehabilitation measures that are implemented to minimise the area exposed for dust generation include the topsoiling and establishment of a cover crop on landforms/areas and on long-term soil stockpiles to minimise area exposed for dust generation;
- rock mulch is applied as soon as practicable following the completion of landform shaping to minimise the potential for windblown dust from the surface waste rock and to reduce the potential for soil erosion from rainfall; and
- following re-profiling works and rock mulch and topsoil application, native pasture hay (or clean wheaten hay) applied on areas where the initial cover crop has not yet established to assist with stabilising and minimising the loss of topsoil resources.

v Weed management

The CGO's existing weed management program is aimed at minimising the possibility of new weed incursion and controlling the spread of any existing noxious weeds on-site and includes the following measures:

- identification of noxious weeds by annual site inspections;
- communication with other landholders/leaseholders and regulatory authorities to keep weed management practices in line with regional weed control activities;
- mechanical removal of identified noxious weeds and/or the application of approved herbicides in authorised areas (herbicide use in wetland areas would be strictly controlled);
- implementation of follow-up site inspections to determine the effectiveness of the weed control measures;
- where practicable, prevention of the establishment of new weeds on company-owned land by minimising seed transport of weed species through the use of a vehicle wash bay; and
- pest control activities.

Rehabilitation monitoring at the approved CGO also evaluates floristic diversity and documents the presence of exotic plant species in the rehabilitation areas. If present, weed incursion is recorded and control measures implemented where necessary.

6.12.8 Rehabilitation trials, monitoring and post closure maintenance

Rehabilitation monitoring will continue to be undertaken using analogue sites and Landscape Function Analysis (LFA) Landform Stability and Landscape Organisation to assess rehabilitation progress and success as detailed in the existing CGO Rehabilitation Management Plan and MOP. An annual rehabilitation report will be prepared, and a summary of this report will be included in the Annual Review.

Rehabilitation monitoring informs areas requiring maintenance and identify and address deviations from the expected outcomes. Rehabilitated areas are assessed against performance indicators (outlined in Appendix L) and regularly inspected for the following aspects:

- evidence of any erosion or sedimentation;
- success of initial establishment cover;
- natural regeneration of improved pasture;
- weed infestation (primarily noxious weeds, but also where rehabilitation areas are dominated by other weeds);
- integrity of diversion drains, waterways and sediment control structures; and
- general stability of the rehabilitation areas.

Where rehabilitation criteria have not been met, maintenance works will be undertaken in accordance with the Trigger, Action, Response Plan (TARP) provided in the CGO Rehabilitation Management Plan.

6.12.9 Completion criteria

Rehabilitation completion criteria are used as the basis for assessing when rehabilitation of the proposed modification is complete. Indicators are measured against the criteria, and are set for the six phases of rehabilitation, consistent with ESG3 as follows:

- Phase 1 – Decommissioning (ie removal of equipment and infrastructure);
- Phase 2 – Landform Establishment (ie land shaping);
- Phase 3 – Growth Medium Development (ie soil physical and chemical properties);
- Phase 4 – Ecosystem and Land Use Establishment (ie vegetation establishment);
- Phase 5 – Ecosystem and Land Use Sustainability (ie established vegetation is supporting post-mining land use); and
- Phase 6 – Land Relinquishment.

Rehabilitation criteria for the proposed modification have been developed with the current knowledge of rehabilitation practices and success in similar project environments. They consist of a set of objectives; rehabilitation criteria and evidence that criteria have been met using LFA and agricultural productivity measures or the like.

Whether rehabilitation criteria have been met depends on the trending of measurements over time compared to pre-mining or analogue site conditions.

Further details regarding the respective domains rehabilitation criteria and post-mining land use objectives are provided in Appendix L.

6.12.10 Final landform and land use

i Final landform

Key features of the final landform for the proposed modification include rehabilitated tailings storage facilities located near the western extent of ML 1535 and areas surrounding the rehabilitated WRE and tailings storage facilities associated with rehabilitated site infrastructure areas (ie the former process plant area and former soil stockpile areas).

ii Land use post mining

Condition 3.8 of DA 14/98 required CGO to develop a long-term land use strategy the CGO and is described below. No changes to the planned post-mining land use strategy are proposed as a result of the underground operations.

A complete discussion on the identification and assessment of land use options post-mining is provided in Chapter 4 of Appendix L. This section provides a summary of this discussion.

Rehabilitation of ML 1535 disturbance areas will aim to enhance and expand wildlife habitat values within ML 1535 and around Lake Cowal. CGO also recognises that the former land use within ML 1535 included grazing of cleared and semi-cleared areas of predominantly native pastures by livestock.

Therefore, it is proposed that at lease relinquishment, land use within ML 1535 would include fenced rehabilitation areas with grazing excluded and areas suitable for agricultural production including commercial and recreational fishing of lake areas or managed grazing by livestock.

Evolution-owned land outside ML 1535 (with the exception of the Compensatory Wetland and Northern and Southern Offset Areas) would continue to be used for farming/agricultural production by Evolution and/or licensees that sign agreements to conduct agricultural activities on Evolution-owned land. It is anticipated that areas of lakebed country would be available for commercial and recreational fishing when inundated and may be used for cropping and/or managed livestock grazing when dry, consistent with existing and historical uses of Lake Cowal.

Long-term protection of the CGO Offset Areas would be provided consistent with condition 3.4(b) of the development consent DA14/98 and CGO's Biodiversity Offset Management Plan. Consistent with the CGO's Land Management Plan (LMP), the Remnant Vegetation Enhancement Program (RVEP) Areas (refer Figure 4.1) would continue to be maintained for the term of Evolution's tenure of the land.

Some infrastructure may be retained and transferred to local landholders for use following lease relinquishment including electricity infrastructure, water storages, pipelines, bores and associated pump stations, if agreed with the Resources Regulator. If it is agreed with the Resources Regulator and the ultimate landholder that the CGO's BCPB, Eastern Saline Borefield and the saline groundwater bores within ML 1535 be retained for local use, the pipelines would remain in place (Evolution 2016).

6.13 Visual amenity

6.13.1 Introduction

A visual impact assessment (VIA) of the proposed modification was completed by EMM in accordance with the *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute and the Institute of Environmental Management and Assessment 2013). The assessment considered the impact of the proposed final height increase to the IWL of 1 m.

Other aspects of the proposed modification were considered but not assessed due to the absence of any potential visual impact, including:

- augmentation of dam D5A and other on-site water storages;
- ancillary surface infrastructure; and
- placement of additional waste rock.

The impact assessment includes an assessment of the visual magnitude of the proposed changes and the visual sensitivity the proposed changes will have on receptors within the primary view catchment (PVC) surrounding the site. The PVC represents the area within which views of the Underground Development Project are located and is limited to a radius of 13 km surrounding the site.

The PVC includes residential dwellings, tourist sites (mostly recreational areas) and roads which have a direct or obscured view of the site.

i Assessment requirements

Agency assessment requirements for Mod 16 were received on 27 September 2019 from DPIE. These comments were provided along with the SEARs issued by DPIE for the underground development component of the Underground Development Project.

No assessment requirements for visual amenity were received for the proposed modification. Notwithstanding, a VIA was carried out to test initial expectations that the modification would not affect the visual amenity of receptors within the PVC. A VIA was also necessary to demonstrate that the modification will not introduce any new impacts outside of the existing disturbance footprint of CGO.

ii Research method

The research method included establishment of the existing environment to establish the nature of the landscape and visual environment. To assess the visual impacts of the proposed changes, such variables as the visual magnitude and visual sensitivity of the proposed changes were considered.

a Visual magnitude

The visual magnitude relates to the visual effect of the proposed changes. It considers the size, scale, duration and reversibility of a proposed change to the landscape and defines the potential impact in a number of categories shown in Table 6.34. The assessment of visual magnitude was made for the final height increase to the IWL.

Table 6.34 Visual magnitude categories

Category	Meaning
Negligible	Barely perceptible change. The change comprises an almost imperceptible element within a viewshed; and/or the duration of the change is brief (days); and/or the change is immediately reversible.
Minor	Noticeable change. The change comprises a small element within a viewshed; and/or the duration of the change is moderate (months); and/or the change is reversible with small effort.
Moderate	Considerable change. The change comprises more than 10% of a viewshed; and/or the duration of the change is material (years); and/or the change is reversible but unlikely.
Significant	Dominant change. The change comprises the dominant element within a viewshed which will fundamentally later landscape character; and/or the duration of the change is essentially permanent (decades); and/or the change is not reversible.

b Visual sensitivity

Visual sensitivity describes the nature of the host environment (comprising locations and receptors) likely to be affected, relative to the nature of the effect likely to occur (ie the magnitude). It addresses overall ability of the existing environment to accommodate the proposed change. It is assessed as per the categories provided in Table 6.35 and considers the distance between the view point and the Underground Development Project, value of the view that is proposed to be changed, the visual compatibility of the Underground Development Project to confirm within the surrounding environment.

Table 6.35 Visual sensitivity categories

Category	Meaning
Negligible	Virtually no visual effects would be experienced as a result of the proposed change. A negligible sensitivity is either as a result of a proposed activity integrating successfully with the existing environment; and/or there are no sensitive receptors with potential views of the proposed activity; and/or the receptors have only momentary or predominantly obscured views.
Low	Very few visual effects would be experienced as a result of the proposed change. A low sensitivity is either as a result of a proposed activity integrating efficiently but not fully with the existing environment; and/or there are limited, or no, sensitive receptors with potential views of the proposed activity; and/or the receptors have very brief or partly obscured views.
Medium	Some visual effects would be experienced as a result of the proposed change. A medium sensitivity is either as a result of a proposed activity only partially integrating with the existing environment; and/or there are a few sensitive receptors with potential views of the proposed activity; and or the receptors have short term or filtered views.
High	Significant visual effects would be experienced as a result of the proposed change. A high sensitivity is either as a result of a proposed activity having no integration with the existing environment; and/or there are numerous sensitive receptors with potential views of the proposed activity; and or the receptors have sustained or uninterrupted views.

c Impact assessment

The visual impact assessment of the Underground Development Project has been based upon the rating schedule provided in Table 6.36. This impact has been determined based upon the magnitude of the visual effect of the Underground Development Project and the visual sensitivity of locations and receptors.

Table 6.36 Visual impact rating schedule

IMPACT	**MAGNITUDE**				
SENSITIVITY		**Significant**	**Moderate**	**Minor**	**Negligible**
	High	Major	Moderate to major	Moderate	Minor to moderate
	Medium	Moderate to major	Moderate	Minor to moderate	Minor
	Low	Moderate	Minor to moderate	Minor	Minor to negligible

	Negligible	Minor to moderate	Minor	Minor to negligible	Negligible

iii Results

a Visual magnitude

The proposed increase to the final height of the IWL by 1 m (ie from 245 m AHD to 246 m AHD) will result in a change to the visible form of the IWL at the northern TSF and southern TSF. This represents at most a 5 per cent increase. The topography of the surrounding landscape ranges from 215 AHD in the north, 225 AHD to the west and 220 m AHD to the south.

Lighting is likely to be associated with the adding of material the IWL, in addition to existing lighting at CGO. This will vary in location depending on where operations are taking place. This will mean the inclusion of this lighting within a viewshed for rural residences will vary over time. The lighting effect is not considered reversible other than at the end of the life of the mine when the full rehabilitation of the site will be undertaken.

The duration of these visual effects will continue until the life of mine of CGO, which is proposed until the end of 2040 under the modification. The duration of lighting impacts will be intermittent due to the varied location of operations associated with the IWL.

b Visual sensitivity

Residential receptors

The PVC captures residential receptors up to 13 km from CGO, which will likely be subjected to long viewing periods of the Underground Development Project from close proximity (refer Figure 6.16).

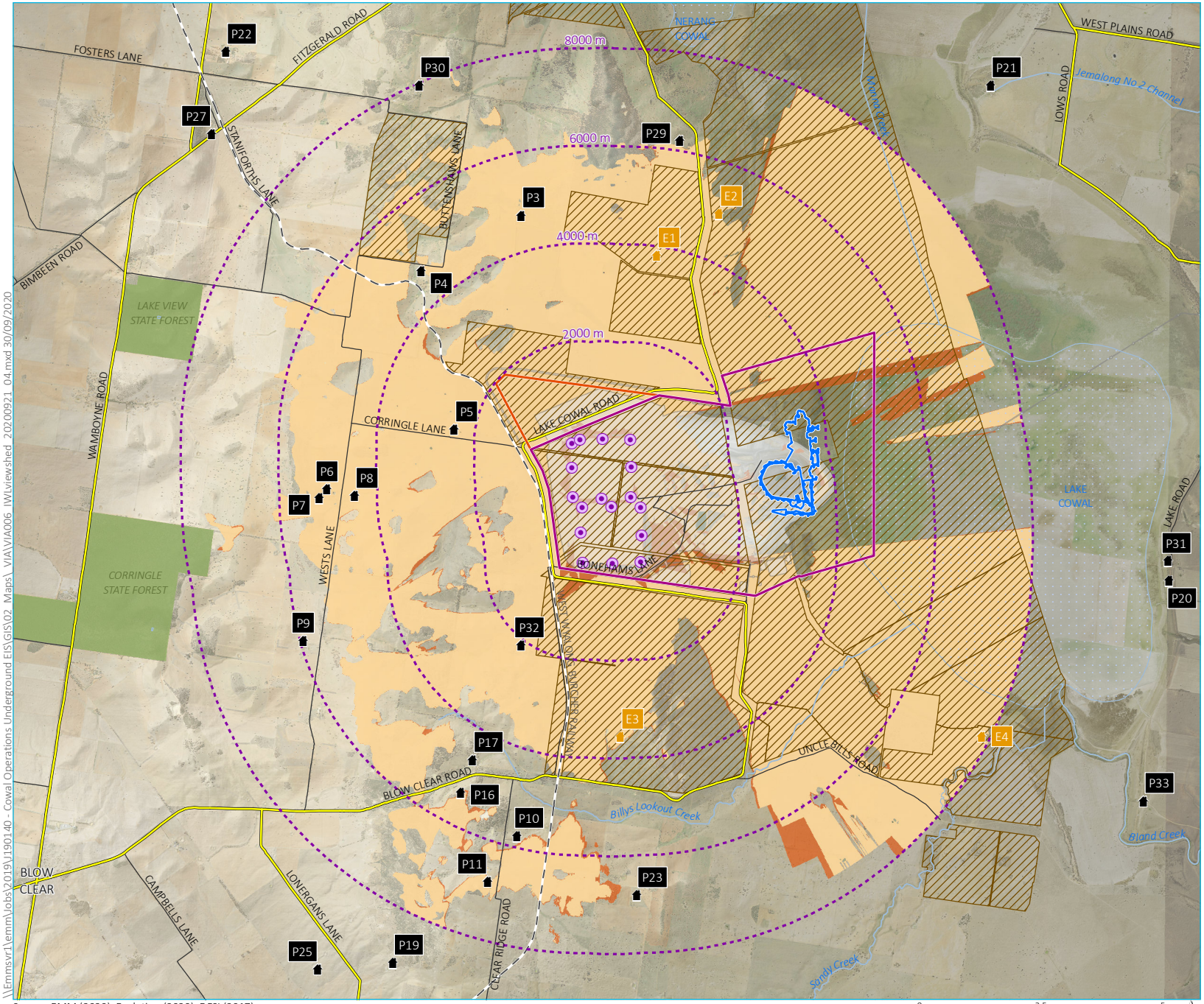
The proposed height increase of the IWL will be mostly visually absorbed due to the matching of texture and materials in the surrounding landform. Seventeen residential receptors are considered to have negligible or low sensitivity to the height increase of the IWL, due to a combination of distance and intervening topography (refer Table 6.37). This includes P3 – P11, P16, P17, P29, P32 and E1 – E4 (refer Figure 6.16).

Table 6.37 Sensitivity of residential receptors to the IWL

No.	Nearest road	Sensitivity	Reason/Notes
P1	Lake Road	Nil	Distance is ~13 km
P2	Lows Road	Nil	Distance is ~15 km
P3	Buttenshaws Lane	Negligible	Distance is ~4.5 km
P4	Buttenshaws Lane	Negligible	Distance is ~4.2 km; Vegetation and topography filtering
P5	Corringle Lane	Low	Distance is ~2.2 km; Light spill
P6	Wests Lane	Low	Distance is ~5 km; Light spill
P7	Wests Lane	Low	Distance is ~5 km; Light spill
P8	Wests Lane	Low	Distance is ~4.5 km; Light spill
P9	Wests Lane	Negligible	Distance is ~6 km; Vegetation and topography obscuring
P10	Clear Ridge Road	Negligible	Distance is ~6 km; Vegetation obscuring
P11	Clear Ridge Road	Negligible	Distance is ~7 km; Vegetation obscuring

Table 6.37 Sensitivity of residential receptors to the IWL

No.	Nearest road	Sensitivity	Reason/Notes
P12	West Plains Road	Nil	Distance is ~15 km
P13	Fitzgerald Road	Nil	Distance is ~9.5 km
P14	Fitzgerald Road	Nil	Distance is ~11 km
P15	Newell Highway	Nil	Distance is ~16 km
P16	Blow Clear Road	Negligible	Distance is ~5.5 km
P17	Blow Clear Road	Negligible	Distance is ~4.5 km
P18	West Plains Road	Nil	Distance is ~17 km
P19	Lonergans Lane	Nil	Distance is ~9 km
P20	Lake Road	Nil	Distance is ~10 km
P21	Lows Road	Nil	Distance is ~10 km
P22	Livingstone Road	Nil	Distance is~10.5 km
P23	Wilsons Lane	Nil	Distance is ~7 km
P24	Wilsons Lane	Nil	Distance is ~9 km
P25	Lonergans Lane	Nil	Distance is ~10 km
P26	Fitzgerald Road	Nil	Distance is ~9.5 km
P27	Wamboyne Road	Nil	Distance is ~9.5 km
P28	Newell Highway	Nil	Distance is ~15 km
P29	Lake Cowal Road	Negligible	Distance is ~6 km
P30	Buttenshaws Lane	Nil	Distance is ~8 km; Topography obscuring
P31	Lake Road	Nil	Distance is ~10 km
P32	Bonehams Lane	Low	Distance is ~2.2 km
P33	Newell Highway	Nil	Distance is ~11 km
E1	Lake Cowal Road	Low	Distance is ~3.8 km; Light spill
E2	Lake Cowal Road	Negligible	Distance is ~5 km
E3	Blow Clear Road	Low	Distance is ~3.5 km; Light spill
E4	Uncle Bills Road	Negligible	Distance is ~8 km



KEY

- Viewpoint location
- Viewpoint buffer (2000 m increments)
- Currently visible project infrastucture - bare earth surface
- Visible project infrastucture (assumed 1 m height increase) - bare earth surface
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Approved surface disturbance
- Rail line
- Main road
- Minor road
- Named watercourse
- Named waterbody
- State forest
- Evolution-owned land

Rural residences

- Evolution-owned
- Privately-owned

Source: EMM (2020); Evolution (2020); DFSI (2017)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02 Maps\ VIA\VIA006 |WI.viewshed 20200921 04.mxd 30/09/2020

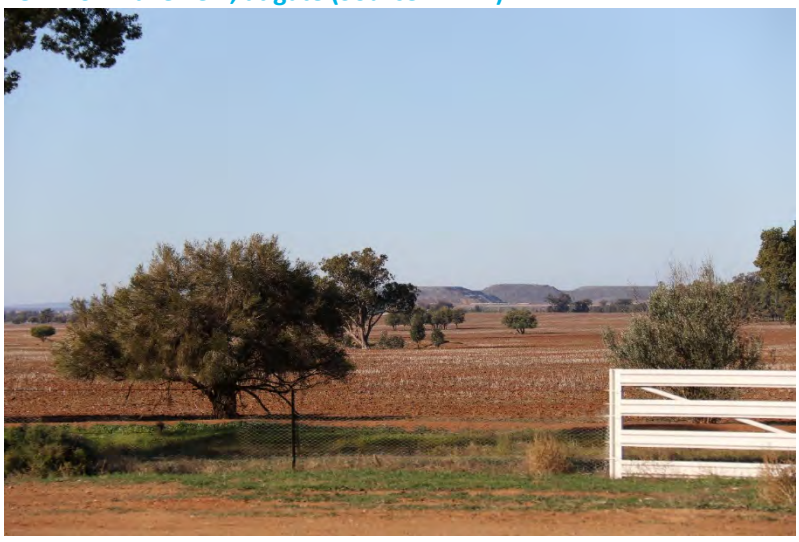
Viewshed for integrated waste landform

Evolution Mining
Cowal Gold Operations
Modification assessment report
Figure 6.16

EMM
creating opportunities

The visual sensitivity has been considered for specific residential receptors, including P6, P7 and P8 known as Lakeview, Lakeview II and Lakeview III. These residential receptors are located around 5 km south-west of CGO and currently have interrupted views of the southern and northern waste rock emplacements and current tailings storage facilities and will therefore be able to see the IWL when it is constructed (refer to Photograph 6.6).

Photograph 6.2 **View from Lakeview, at gate (Source: EMM)**



Photograph 6.3 **View from Lakeview, at gate, zoomed in with 400 mm lens (Source: EMM)**

Photograph 6.4 View from Lakeview, at office (Source: EMM)

Photograph 6.5 View from Lakeview, at house (Source: EMM)

Photograph 6.6 View from Lakeview, at tennis court (Source: EMM)

The proposed increase of the IWL over time will be unnoticeable to these residential receptors. As noted above this change will be visually absorbed due to the matching of texture and materials in the surrounding landform.

Roads

The visual sensitivity of roads surrounding CGO has been considered and summarised in Table 6.38. The visual sensitivity of these roads to the Underground Development Project is mostly ameliorated due to obscuring vegetation and topography. Where roads are located within 600 m of the site and the CGO is clearly visible, the Underground Development Project will be integrated into the existing site which will also improve visual sensitivity.

Table 6.38 Visual sensitivity of roads

Road	Direction from CGO	Description of visual sensitivity
Staniforths Lane	North	Glimpses of CGO are visible from Staniforths Lane, however the view is obscured by vegetation lining the road.
Buttenshaws Lane	North	Glimpses of CGO are visible from Buttenshaws Lane, however the view is obscured by vegetation lining the road.
Lake Cowal Road	North	Lake Cowal Road provides access to CGO and has clear views of the site, as it comes within 200 m. The proposed height increase to the will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Underground Development Project.
Bonehams Lane	North	The view of CGO from Bonehams Lane is obscured by vegetation.
Blow Clear Road	South	Glimpses of CGO are visible from Blow Clear Road, however the view is obscured by Fellmans Hill.
Uncle Bills Road	South	Glimpses of CGO are visible from Uncle Bills Road, however the view is obscured by Fellmans Hill.
Lake Cowal Road	South	Lake Cowal Road provides access to CGO and has clear views of the site, as it comes within 600 m. The proposed height increase to the will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Underground Development Project.
Bonehams Lane	South	Bonehams Lane provides access to CGO and has clear views of the site, as it comes within 600 m. The proposed height increase to the will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Underground Development Project.
Lows Road	East	There is no visibility of the Underground Development Project from Lows Road due to the lake protection buttress.
Lake Road	East	There is no visibility of the Underground Development Project from Lake Road due to the lake protection buttress.
Newell Highway	East	Glimpses of CGO are visible from the Newell Highway, however the view is obscured by vegetation and topography.
Wamboyne Road	West	Glimpses of CGO are visible from Wamboyne Road, however the view is obscured by vegetation and topography.
Wests Lane	West	Glimpses of CGO are visible from Wests Lane, however the view is obscured by vegetation and topography.
Corringle Lane	West	Corringle Lane provides access to CGO and has clear views of the site, as it comes within 600 m. The proposed height increase to the will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Underground Development Project.

Table 6.38 Visual sensitivity of roads

Road	Direction from CGO	Description of visual sensitivity
Lake Cowal Road	West	Lake Cowal Road provides access to CGO and has clear views of the site, as it comes within 600 m. The proposed height increase to the will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Underground Development Project.

Tourist sites

The visual sensitivity of tourist sites has been considered for Billys Lookout, Lake Cowal Public Reserve and Corringle State Forest and Lake View State Forest state forests.

Billys Lookout is located approximately 6 km south-west of CGO, and therefore will have a low visual sensitivity to the Underground Development Project. Lake Coal Public Reserve is approximately 5 km south-east of CGO. The view of CGO from Lake Cowal Public Reserve is obscured by Fellmans Hill and vegetation, which will result in low visual sensitivity to the Underground Development Project. Both state forests are over 8 km away from the CGO site and visual sensitivity is lowered by the dense vegetation. Therefore, the visual sensitivity to the Underground Development Project from tourist sites will also be low.

6.13.2 Existing visual environment

The area surrounding the site is generally flat to undulating, with occasional ridges. Land uses comprise of predominately flat agricultural land, State forests, vegetated ridges and surface water features such as Lake Cowal. Wamboyne Mountain and Billy's Lookout are the closest highpoints to the site. Wamboyne Mountain is 5 km north of the site and is 470 m AHD while Billy's Lookout is 7 km south-west of the site and 368 m AHD.

At night, despite shrouds around individual lights and downwardly-directed lighting at the CGO ore processing plant, the reflected light is visible in the sky for several kilometres in every direction as a soft orange glow.

6.13.3 Predicted impacts

The magnitude of the visual effect for all receptors in the PVC was assessed as negligible to minor. The visual sensitivity for all receptors to the Underground Development Project was assessed as negligible to low.

This is because most residential receptors are located at significant distances from the site where intervening landscape features and topography will restrict the view of the IWL, and the closest residences are surrounded by vegetated gardens which shield views of the site.

Travellers on local roads and visitors to tourist sites would also experience negligible visual impacts, due to intervening vegetation lining roads and dense vegetation at the tourist sites.

In accordance with the rating schedule in Table 6.36, the overall visual impact of the Underground Development Project in consideration of the visual magnitude and visual sensitivity rating is assessed to range in significance from negligible to minor.

The height increase of the IWL will be potentially visible from two residential receptors, P32 and E3. However, this would only result when operations at the IWL would create temporary mounds or stockpiles which may be distinguishable in the viewshed.

6.13.4 Mitigation measures

In order to effectively restrict the visual impacts of the proposed modification, the following mitigation measures could include:

- ensure reasonable matching between the existing IWL buttress material and the additional material to be added to the IWL; and
- establish any stockpiling of material in locations where view lines to the nearest residential receptors are obscured or filtered.

6.13.5 Summary and conclusion

A VIA has been completed to assess the proposed progressive height increase to the IWL of 1 m.

The visual impact assessment has considered the visual magnitude of this element and the visual sensitivity of receptors within the PVC to these elements. Receptors included residences, tourist sites (mostly recreational areas) and roads which have a direct or obscured view of the site.

For most residences, roads and tourist areas, the proposed modification will be indistinguishable from the surrounding landscape or will obscured by vegetation and topography resulting in a negligible visual sensitivity to the proposed changes.

A small number of residential receptors will be able to view the change to the IWL, however any change in impact will be mitigated by ensuring the Underground Development Project integrates into the existing site, by the use of vegetation screening and by shielding the lights on the IWL.

Overall, the visual magnitude and subsequent visual sensitivity of Mod 16 was assessed as having a negligible to minor significance on receptors within the PVC.

6.14 Hazards, public safety and health

6.14.1 Introduction

This section provides an assessment of the hazards, public safety and health aspects of the proposed modification in accordance with the assessment requirements.

It commences with an overview of the Evolution's current management of hazards, public safety and health under existing management plans and concludes with discussion of potential new risks specific to hazards, public safety and health arising from the proposed modification and proposed mitigation measures required to address them.

Potential geochemical risks associated with the proposed modification are summarised in section 6.8.

6.14.2 Assessment requirements

The EPA's hazards, public safety, and health requirements for Mod 16 and where they are addressed in this assessment report are listed in Table 6.39.

Table 6.39 Hazards, public safety, and health related assessment requirements

Requirement	Location in this document
Describe mitigation and management options that will be used to prevent, control, abate or mitigate identified potential environmental impacts associated with the project and to reduce risks to human health and prevent the degradation of the environment.	Section 6.14.5
Spill management measures, including items such as bunding, and emergency procedures should be clearly outlined	Section 6.14.5v

6.14.3 Overview of current operations and existing hazards to public safety and health

A Preliminary Hazards Analysis (PHA) (Barrick 1999) was prepared as part of the 2014 Environmental Impact Statement for CGO and identified potential hazards, environment, and public safety and health risks. The PHA concluded that the highest risks to the environment, public safety and public property from the now approved operations were the following:

- Risks to the environment, the public and public property:
  - spillage of material during transport;
  - a major spillage of material from on-site storage tanks coincident with catastrophic bund failure;
  - spillage of diesel fuel onto the ground outside the mine site; and
  - release of hazardous material in the event of a fire.
- Risks to animals:
  - wildlife entering the TSFs following damage to the fence incurring injury or death; and
  - birds using the TSFs when an accidental release of cyanide occurs incurring injury or death.

These risks are continuously being managed and reviewed during the operation of the project site through various management plans and policies. These existing risks are discussed below as they remain relevant and in part, to demonstrate that management and mitigations measures used to date have been effective.

Since the commencement of operations at CGO in 2006 no hazardous events or incidents have occurred that has resulted in any change to the consequence and likelihood ratings of these risks as defined in the original PHA.

i Risks to the environment

Environmental risk is dominated by the potential for road transport accidents leading to spillage of the load. This is mainly associated with the long distances to deliver goods to site. The original PHA determined that the risk of an accident as low, as the scenario contributing 80 per cent to the total estimated risk is that of a truck transporting sodium cyanide being involved in an accident resulting in a spillage of material. Safeguards and contingency plans have been established (outlined in Table 6.44)to address that particular scenario.

The highest risks to the Lake Cowal wetland arise from fires allowing hazardous material to leave the site. The risks are small, however, in comparison to the totality of risks to the environment as a whole.

ii Risks to animals

There are two scenarios associated with perceived risks to animals:

- The risk of bird deaths from the ingestion of cyanide should birds land on the tailings dams at a time when cyanide concentrations in the water are high (due to a system failure in the processing area).
- The risk of death or injury of stock and wildlife with access to the tailings storages should they become trapped in the tailings material.

In regard to the first scenario, measures to control and monitor cyanide levels in the tailings storage areas are implemented and detailed in the Cyanide Management Plan and Hazards and Operability Study (HAZOP study). This includes measures to maintain weak acid dissociable cyanide levels at the discharge point to the tailings dams within the prescribed limits. Mechanisms have also been developed to keep fauna and avifauna away from the tailings storages.

In regard to the second scenario, the tailings storages are monitored daily and seasonally for fauna usage. The perimeter of the storages are patrolled twice a day to observe and record fauna usage, fauna deaths or other effects or incidents.

iii Risks to the public

Risks to members of the public are mainly associated with transport scenarios. The risk of an accident has been determined to be low and, of the transport scenarios, the single biggest risk is that associated with a spill of sodium cyanide.

The risks to members of the public arising from explosions on-site are considered minimal as there is no public access to the site and the nearest residences are 5 km away. The low population density of the area and the distance to the site boundary contribute to low likelihood of either death or injury due to explosion overpressure.

iv Risks to public property

Risks to public property exist due to the potential for road transport accidents resulting in the impact of the transporting vehicle with a property (be it a house or car) or from an explosion.

v Bushfire risks

In accordance with Consent Condition 3.6(a) the onsite firefighting equipment maintained by Evolution meets the requirements of NSW Rural Fire Service (RFS) and emergency services, including:

- the stationing of a well maintained “emergency firefighting unit”; and
- hydrants, fire hoses and/or washdown hoses in the CGO area which could be used for firefighting.

The measures currently implemented on site address any potential bushfire risks.

6.14.4 The risk assessment process for the proposed modification

The steps for identifying new risks associated with the proposed modification are outlined below and in sections 6.14.4i to 6.14.4iii:

1. Identification of potential receptors in relation to the proposed modification.

2. Review Mod 16 scope of work and identify new activities that may affect current hazard, public health or safety risks. This step involves identifying equipment and situations that could potentially cause harm to people or the environment and requires consideration of the proposed equipment, materials and substances used and related tasks.

3. Assess the risks associated with the new activities. This step involves an assessment of the new activities identified in step two and associated, credible risks. The potential impact of these risks are then determined by combining the likelihood of their occurrence (refer Table 6.40) and the consequence (refer Table 6.41) of that occurrence. The outcome of this, a risk rating, is then used to prioritise the prevention or mitigation of those risks. Table 6.42 outlines the risk matrix used in the risk assessment.

4. Review risks with current management plans and make sure the most effective control measure that is reasonably practicable in the circumstances is in place or provide further mitigation measures. A residual risk rating can then be determined with these control measures in place.

Table 6.40 Likelihood criteria

Likelihood	Criteria
Almost certain	Expected in most circumstances
Likely	Will probably occur in most circumstances
Possible	Might occur at some time
Unlikely	Could occur at some time
Rare	May occur in exceptional circumstances

Table 6.41 Consequence criteria

Level of consequence	Criteria
Insignificant/acceptable	• No effect – or so minor that effect is acceptable. • Promptly reversible/trivial impact on air, water, soil, flora, and fauna.
Minor	• First aid treatment only; spillage contained at site. • Impact mostly confined to work area but potential for short term off-site impacts.
Moderate	• Medical treatment; spillage contained but with outside help. • Potential for medium term off-site impacts.
Major	• Extensive injuries; loss of production. • Potential for long term off-site impacts.
Catastrophic	• Death; toxic release of chemicals. • Permanent unconfined off-site impact.

Table 6.42 Risk assessment matrix

Likelihood	Consequences				
	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
5 Almost certain	6 High	7 Critical	8 Critical	9 Critical	10 Critical
4 Likely	5 High	6 High	7 Critical	8 Critical	9 Critical
3 Possible	4 Medium	5 High	6 High	7 Critical	8 Critical
2 Unlikely	3 Low	4 Medium	5 High	6 High	7 Critical
1 Rare	2 Low	3 Low	4 Medium	5 High	6 High

i Identification of potential receptors

The location of the CGO site is remote, situated in agricultural land used for cattle grazing or cropping. There are eight private residences within a 5 km radius of the underground development.

ii Identification of new hazards, public health and safety risks related to the proposed modification

New activities that may affect current hazard, public health and safety risks include:

- The increase in consumption of process consumables - there is an anticipated increase in annual consumption of process consumables (including cyanide) associated with the likely higher grade of the ore. Blasting required for the underground development will include an increased consumption of blasting consumables, including ammonium nitrate and ammonium nitrate emulsion which will be stored on site.

- The continued transport of materials to site. The risk is associated with the individual truck movements over a longer period of time – however the risk is the same for the current operations.

iii Risk assessment and management for new risks

As outlined in Section 6.14.4, step three of the risk assessment process assigns the likelihood and consequence criteria outlined in Table 6.40 and Table 6.41 respectively to determine a risk rating outlined in Table 6.42.

Table 6.43 provides an assessment of all risks associated with the new activities related to the proposed modification. The risk assessment also identifies the existing management controls already in place (if any) or new mitigation measures and assigns a residual risk rating after controls.

Table 6.43 Risk assessment and management

Activity	Associated risk	Risk rating	Risk mitigation measure/identification of existing management controls in place	Residual risk after controls
Increased consumption of consumables	Increased risk of spills with increased volumes in use	4 Medium	Existing management controls include: • Chemicals/consumables are stored and handled within bunded storage areas located in the process plant area. • A runoff collection drain (secondary collection) has been installed around the perimeter of the process plant and drains to the process plant contained water storage. • Any other consumable storage areas outside the process plant area are also bunded and are managed in accordance with the requirements of the applicable Safety Data Sheets (SDS), and in a manner that does not cause or aggravate land, air or water pollution (including sedimentation or soil contamination or erosion). • Liquid processing consumables and other potentially hazardous consumables are stored in either drums or tanks located in bunded areas to contain any fires or spills This risk is currently being managed and will continue to be managed with existing management plans detailed further in section 6.14.5.	3 Low
	Increased risk of injury with increased volumes in use	6 High	Existing management controls include: • To assist the operators with emergency response, gas monitors (eg hydrogen cyanide and sulphur dioxide) have been installed throughout the relevant plant areas. • Safety showers and eyewash stations are tested fortnightly throughout the site and prior to each chemical transfer. This risk is currently being managed and will continue to be managed with existing management plans detailed further in section 6.14.5.	4 Medium
	Ignition of fuels and other flammable materials on site	4 Medium	Existing management controls include: • Fire water to the facility is from the Lachlan River Regulated Water Source, Bland Creek Palaeochannel groundwater production bores or other on-site process or stormwater water dams. The fire water is stored in a 9 ML pond (dam) which is designed to constantly overflow to an adjacent dam. It is pumped via an electric or	3 Low

Activity	Associated risk	Risk rating	Risk mitigation measure/identification of existing management controls in place	Residual risk after controls
			diesel pump. These pumps are tested weekly to check the reliability. A smaller jockey pump is installed for small flow demands. • An annual flow test is performed on the fire water pumps. The pumps have been found to continue to provide acceptable flow /head. • The facility is ringed with dual hydrants. Fire extinguishers (powder chemical) and hose reels are also located throughout the plant. Additionally, predetermined equipment (eg hydraulic drives) have fixed spray systems. This risk is currently being managed and will continue to be managed with existing management plans detailed further in section 6.14.5.	
The additional transport of materials to site.	Vehicle transporting substances is involved in an accident	6 High	Existing management controls include: • Materials are delivered to site in either solid or liquid form. Solids are delivered in sealed wooden boxes and are moved via forklift to their storage areas. Bulk liquid chemicals (e.g. hydrochloric acid, sodium hydroxide and LPG) are delivered to the site by road tanker and unloading operations are performed by site inducted tanker drivers. There are containment systems for the unloading areas should spills occur. A Transport Study has been developed (latest addenda approved 2017 by the (then) NSW Department of Planning and Environment) and provides management measures for transporting these materials currently undertaken. Evolution ensures suppliers are maintaining their trucks and their drivers are properly licensed in the relevant sized truck and trained in driving skills, fatigue management and safe handling of the loads (inc. MSDS on board the trucks). This risk is currently being managed and will continue to be managed with existing management plans detailed further in section 6.14.5.	4 Medium
	Ignition of fuels and other flammable materials during transportation	4 Medium	This risk would be appropriately managed in the management plans detailed further in section 6.14.5.	3 Low

In the presence of control measures, all scenarios evaluated were low or medium risk.

All risks associated with the new activities for the proposed modification already have controls in place on site through various mitigation measures and managed plans discussed further in section 6.14.5.

6.14.5 Mitigation measures

The original PHA included several recommended risk reduction measures to reduce the likelihood or the consequences of incidents that could cause damage. These measures have been incorporated into relevant approved CGO management plans and implemented. Additionally, independent hazard audits are conducted annually in accordance with the Consent Condition 5.4(c).

Table 6.44 presents the summary of identified risks discussed in section 6.14.3 and the relevant current management plans and studies available to address them.

Table 6.44 Identified risks and relevant current management plans/studies to address them

Risk receptor	Source of risk	Current Evolution management plans and studies which identify or manage risk
Environment	Traffic accident leading to release of reagents or fuel or explosion/fire	• Transport Study; • HAZOP Study; • Final Hazard Analysis; • Fire Safety Study; • Emergency Response Plan; and • HWCMP.
Animals	Toxic levels of cyanide in tailings and physical entrapment in tailings	• Cyanide Management Plan; • FFMP; • Implementation Plan to Protect Fauna from Interactions with the Tailings Storage Facilities (Implementation Plan); and • HWCMP.
Public	Traffic accident leading to release of reagents or fuel or explosion/fire	• Transport Study; • HAZOP Study; • Final Hazard Analysis; • Emergency Response Plan; and • HWCMP.
Public property	Traffic accident leading to release of reagents or fuel or explosion/fire	• Transport Study; • HAZOP Study; • Final Hazard Analysis; • Emergency Response Plan; and • HWCMP.

A summary of the relevant management plans, assessments and studies is provided below. These management plans and studies would be updated in accordance with any additional requirements outlined in the Mod 16 consent conditions.

i Hazard and operability study

The HAZOP Study included areas of the process which store and/or handle dangerous goods or hazardous materials and/or have the potential for off-site impact in consultation with DIPNR. The HAZOP Study addresses the monitoring, control, alarm and shutdown systems associated with the cyanide process.

ii Final Hazard Analysis

A Fire Hazard Analysis (FHA) (Barrick 2006) has been undertaken for Evolution in accordance with Development Consent Condition 5.4(a)(iii). The results of the FHA indicated that the risk associated with the proposed development complies with the Hazardous Industry Planning Advisory Papers No. 4 and No. 6 Guidelines for tolerable fatality, injury, irritation and societal risk.

Also, the FHA concluded that the risks to the biophysical environment, the risk of propagation and the impact on cumulative risk in the area from releases are generally negligible. Overall, the FHA concluded the proposed facility does not pose any unacceptable levels of risk.

iii Fire Safety Study

A Fire Safety Study (Barrick 2004) has been prepared for Evolution in accordance with Development Consent Condition 5.4(a)(i). The objective of the Fire Safety Study was to ensure the proposed fire prevention, detection, protection and fighting measures are appropriate for specific fire hazards and are adequate to meet the extent of potential fires at the processing facility.

As described in the Fire Safety Study, the fire hazards are known and there are control measures in place to minimise the risk of fire related incidents involving sodium cyanide. The risks associated with sodium cyanide were reviewed by the HAZOP Study and no further actions to those detailed in the HAZOP were recommended by the Fire Safety Study.

iv Safety Management System

In accordance with Development Consent Condition 5.4(b)(iii), a safety management system covering all operations onsite and associated transport activities involving hazardous materials has been developed.

The document system specifies all safety related procedures, responsibilities and policies, along with details of mechanisms for ensuring adherence to procedures.

v Emergency Response Plan/Pollution Incident Response Plan

In accordance with Consent Conditions 5.4(b)(ii), a comprehensive Emergency Response Plan (Evolution 2018c) and detailed emergency procedures has been completed. The Emergency Response Plan details emergency response procedures to pollution incidents including procedures for spillage, clean-up, control and protection, and for the rescue of wildlife during the emergency.

The Emergency Response Plan also includes procedures for the safety of all people outside the Evolution site, who may be at risk from the development and includes procedures for spillage, clean-up, control and protection and rescue of wildlife during an emergency.

vi Blast Management Plan

The Blast Management Plan (BMP) (Evolution 2015b) was developed in accordance with the Development Consent conditions through provisions to measure and demonstrate compliance with the blast impact assessment criteria and operating conditions, review and assess blast monitoring data and evaluate blasting impacts on privately-owned residences, report on the implementation and effectiveness of blast management measures.

vii Cyanide Management Plan

The Cyanide Management Plan (Evolution 2018d) was developed in accordance with Development Consent Condition 5.3(b) and provides measures to contain cyanide contaminated waters entirely within the Evolution mine site, measures to maintain weak acid dissociable cyanide, contingency measures for cyanide reduction, and a cyanide monitoring programme.

viii Hazardous Waste and Chemical Management Plan

A HWCMP (Evolution 2018e) has been prepared in accordance with Development Consent Condition 5.7. The objective of the HWCMP is to incorporate the safeguards and contingency plans discussed in the Preliminary Risk Assessment, provide details on the appropriate transport, handling, disposal and recycling procedures for wastes generated on site, provide details on the appropriate emergency response procedures in the event of spillages, and outline the sites compliance with the relevant statutory considerations and Australian Standards.

ix Transport of Hazardous Materials Study

The Transport of Hazardous Materials Study was developed in accordance with Development Consent Condition 5.4(b)(i) and details the arrangements for the transport of hazardous materials (including cyanide), the routes to be used for the movement of vehicles carrying hazardous materials to and from the Evolution site.

The study also addresses issues associated with spills, clean-up procedures, training of clean-up teams, communication, and liaison with organisations.

x Flora and Fauna Management Plan

The Flora and Fauna Management Plan (FFMP) (Evolution 2015c) includes measures to keep fauna and avifauna away from tailings storages, wildlife rescue procedures, methods for monitoring daily and seasonal fauna usage of the tailings dams and contingency measures for reducing cyanide levels in the tailings dams in the event it is established that fauna deaths are occurring from cyanide in tailings dam water.

xi Implementation plan to protect fauna from interactions with the tailings storage facilities

The plan includes actions to deter fauna visitation to the tailings storage facilities, actions to apply best available technology and practices for monitoring fauna visitation and actions to apply best available technology and practices for monitoring fauna deaths caused by cyanosis.

6.14.6 Summary

This section provides an assessment of the hazards, public safety and health aspects of the proposed modification in accordance with the assessment requirements. The original PHA included several recommended risk reduction measures to reduce the likelihood or the consequences of incidents that could cause damage. These measures have been incorporated into relevant approved CGO management plans and currently implemented on site.

In the presence of control measures, all scenarios evaluated were low or medium risk. All risks associated with the new activities for the proposed modification already have controls in place on site through various mitigation measures and managed plans

6.15 Waste management

6.15.1 Introduction

Waste will be managed in accordance with the requirements of the POEO Act, *Waste Avoidance and Resource Recovery Act* 2001 (WARR Act), the *Protection of the Environment Operations (Waste) Regulation* 2014, the *Waste Classification Guidelines* (EPA 2014) and the Waste avoidance and resource recovery strategy 2014-21 (EPA 2014).

Evolution will continue to apply general waste minimisation principles such as reduce, reuse and recycle to minimise the quantity of waste disposal required off-site.

6.15.2 Assessment requirements

The assessment requirements for Mod 16 and where they are addressed in this assessment report are listed in Table 6.45.

Table 6.45 Waste-related assessment requirements

Requirement	Location in this document
The goals of the project should include the following:	
• It is in accordance with the principles of the waste hierarchy and cleaner production;	Section 6.15.4iv
• Where potential impacts associated with the handling, processing and storage of all waste materials generated at the premises are identified, these be satisfactorily mitigated;	Section 6.15.4and section 6.15.7.
• The beneficial reuse of all wastes generated at the premises are maximised where it is safe and practical to do so; and	Section 6.15.4iv and section 6.15.7
• No waste disposal occurs on site except in accordance with an Environment Protection Licence.	Section 6.15.4i
The Assessment Report needs to identify the proposed type, quantities and location of wastes to be stored and/or processed at the site. This should include a detailed plan for in-situ classification of waste material, including the sampling locations and sampling regime that will be employed to classify the waste under the EPA's Waste Classification Guidelines.	Section 6.15.3ii
Spill management measures, including items such as bunding, and emergency procedures should be clearly outlined.	Section 6.14.5

6.15.3 Relevant policy and law

The following legislation, guidelines and policies have been considered regarding the proposed modification's management of waste.

i Protection of the Environment Operations Act 1997

The POEO Act is the key environmental legislation and Section 3(d) of the Act states its objectives are, amongst other things:

> (ii) the elimination of harmful wastes,
>
> (iii) the reduction in the use of materials and the re-use, recovery or recycling of materials,'

The Act is administered by the EPA and the Protection of the Environment Operations (Waste) Regulation 2014 provides for enforcement measures by government in support of the POEO Act.

Schedule 1, part 3, clause 49 of the POEO Act outlines the different types of waste classifications, including general solid waste (non-putrescible), general solid waste (putrescible), hazardous waste, liquid waste, restricted solid waste and special waste. The different types of waste to be generated from the proposed modification have been classified as per the POEO Act (and the Waste Classification Guidelines (EPA 2014b)) and are further discussed in Section 6.15.4.

Additionally, the current EPL 11912 includes the following conditions regarding waste management on site:

- Waste condition L3, which prohibits the receipt of waste generated outside of the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.
- Monitoring and recording conditions M5 and M6, which require the licensee to keep a record of all complaints made in relation to pollution arising from a licensed activity and provide a telephone complaints line.
- Operating condition O1, which requires licensed activities to be carried out in a competent manner.
- Waste management condition O4.1, which stipulate the waste rock emplacement areas are to be designed to ensure all seepage from beneath the waste rock emplacement areas is to be directed to the open pit.
- Waste management condition O4.2, which states the tailings storage facilities, IWL and contained water storage facilities must have a basal barrier or impermeable liner and the tailings storage facilities.
- Operating condition O5, which outlines the bunding requirements for above ground flammable and combustible liquid store storage facilities.
- Reporting condition R2, which by reference to the POEO Act requires the licensee to notify the EPA of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident.

ii Waste and Resource Recovery Strategy 2014-21

The *Waste and Resource Recovery Strategy* 2014-21 (EPA 2014a) provides guidance on how to improve the wellbeing of the environment and community by reducing the environmental impact of waste and using resources efficiently. Amongst other things, it outlines the preferred approach and goals for efficient resource use and management.

Waste generated from the proposed modification is and will continue to be managed in accordance with the WARR Act and the *Waste and Resource Recovery Strategy* 2014-21 (EPA 2014a). The site's current Waste Management Strategy is implemented on site and implements the waste management hierarchy being avoidance, re-use, recycling, and treatment/disposal.

Therefore, before disposing of general wastes to landfill, the following recycling procedure are currently implemented on site:

- personnel are to consider recycling that may be possible on-site (eg secondary use of used office paper, cardboard and newspapers, reuse of clean containers for storage of inert goods, mulching pallets for rehabilitation);
- where possible, require consumable suppliers to collect and recycle packaging material (eg bulky boxes and pods);
- consider recycling or reuse options that may require an off-site component (eg returning printer cartridges to the supplier for refilling and reuse); and
- consider commercial and non-commercial/charity off-site recycling services that may be available (eg aluminium can and glass bottle recycling services).

iii Waste Classification Guidelines (EPA 2014)

The *Waste Classification Guidelines* (EPA 2014b) (the Waste Classification Guidelines) outlines a step-by-step process for classifying waste. It is split into five parts, which cover classifying waste, immobilising waste, waste containing radioactive material and acid sulfate soils.

Waste generated from the proposed modification will be classified in accordance with the *Waste Classification Guidelines* and as defined in Schedule 1, Part 3, Clause 49 of the POEO Act. This may include:

- special waste;
- liquid waste;
- hazardous waste;
- restricted solid waste;
- general solid waste (putrescible); and
- general solid waste (non-putrescible).

In accordance with the *Waste Classification Guidelines*, waste streams on site are kept separate, where practicable, to improve waste handling and classification, minimise costs associated with disposal and improve environmental outcomes. The following are examples currently implemented on site:

- classified wastes (eg hazardous wastes) are not mixed with non-classified wastes;
- where practicable, recyclable wastes are separated out from other wastes; and
- some wastes have lower disposal costs. Where practicable, these wastes are identified and kept separate from other waste types to reduce costs.

iv Other relevant government guidelines

Other relevant government guidelines include:

- Leading Practice Sustainable Development Program for the Mining Industry – Hazardous Materials Management (Commonwealth Government, 2016) - produced by the then Commonwealth Department of Resources, Energy and Tourism as a part of the Leading Practice Sustainable Development Program for the Mining Industry series, this handbook provides guidance on the leading practice for Hazardous Materials Management in the mining industry. The handbook provides guiding principles and leading practices in the handling and storage of hazardous materials throughout the mine life cycle.
- Minerals Industry Safety Handbook (Department of Mineral Resources, 2004) - the Minerals Industry Safety Handbook has been developed by the NSW Government with the contribution and commitment of industry stakeholders and other government mining authorities throughout Australia. The handbook has been produced specifically to assist miners in the metalliferous and extractive industries to attain and maintain a safe and healthy workplace.
- Code of Practice for the Safe Use of Pesticides including Herbicides in Non-Agricultural Workplaces (WorkCover NSW, 2006) - the code is a practical guide on how to comply with the relevant legislation relating to the use and storage of pesticides and herbicides in non-agricultural workplaces.
- Information Bulletin No. 53 Version 3 – Storage Requirements for Security Sensitive Ammonium Nitrate (Queensland Department of Natural Resources and Mines, 2008) - this guideline provides a useful summary of the requirements set out in AS 4326:2008 The Storage and Handling of Oxidising Agents (Appendix B) that are applicable to the storage of ammonium nitrate, appropriate separation distances from explosives stores, fire protection and appropriate signage.

6.15.4 Existing environment

i Identified waste streams

Currently, the following classes and quantities of waste are produced on site:

- domestic waste;
- sewage effluent;
- waste hydrocarbons including lubricating oils, hydraulic oils, degreasing fluids, distillate and petroleum fuels (North Limited, 1998);
- vehicle batteries and tyres;
- general construction waste; and
- contaminated spill recovery/clean-up materials.

Table 6.46 provides a summary of waste streams, including waste type, classification, source, handing and transport/disposal currently generated during operations (excluding waste rock and tailings).

Table 6.46 Existing waste classification, transport, handling and disposal

Waste type	Waste classification	Major source	Handling	Transport/disposal
Office and packaging waste	General solid waste (non-putrescible)	General office activities.	Waste collected on-site.	Removal from site for recycling or disposal on-site in waste rock emplacements only
Scrap metal	General solid waste (non-putrescible)	Construction site waste and process plant building waste.	Waste will be segregated and held on-site in designated areas. Removed by Contractor	Removal from site for recycling or disposal on-site in waste rock emplacements only.
Used lead acid batteries	Hazardous	Earthmoving fleet.	Used batteries will be stored in a bunded area. Up to 10 t of waste batteries can be safely stored on-site. Periodically removed from site by a Licensed Contractor to a recycling plant	Recycling by licensed contractor or disposed of at an EPA licensed waste facility, if necessary.
Degreasing fluids, diesel and other petroleum fluids	Hazardous	Earthmoving fleet and process plant.	Used and flammable petroleum liquid wastes stored in dedicated storage vessel(s). Removed by Licensed Contractor.	Removal from site by licensed contractor to an EPA licensed facility for recycling/disposal.
Lubricating oils and hydraulic oils	Liquid	Earthmoving fleet and process plant	Used and waste oils stored in dedicated storage vessel(s) prior to removal.	Removal from site by licensed contractor to an EPA licensed facility for recycling/disposal.
Used/rejected tyres	Special	Earthmoving fleet.	Tyres will be disposed regularly (quarterly) to prevent build up.	Disposal on-site in waste rock emplacements only.
Used oil/fuel filters	Hazardous	Earthmoving fleet and process plant.	Filters stored in dedicated bins prior to removal.	Removed by licensed contractor for recycling at an EPA licensed waste facility.
Drained/crushed oil/fuel filters	General solid waste (non-putrescible)	Earthmoving fleet and process plant.	Filters stored in dedicated bins prior to disposal.	Removed by licensed contractor for recycling at an EPA licensed waste facility.
Used absorbents – no free liquid	General solid waste (non-putrescible)	Spills associated with maintenance of earthmoving fleet	Absorbents with no free liquid stored in dedicated bins prior to disposal.	Removed by licensed contractor for recycling at an EPA licensed waste facility.
Used absorbents –free liquid	Hazardous	Spills associated with maintenance of earthmoving fleet.	Clearly marked to avoid mixing of incompatible substances. Transferred to clearly labelled drums or similar containers.	Removed by licensed contractor for disposal at an EPA licensed facility.
Domestic waste	General solid waste (putrescible)	Waste food scraps and other general domestic waste.	Domestic solid waste held in specific storage containers.	Removed from site for disposal to landfill or disposal on-site in waste rock emplacements.

Table 6.46 Existing waste classification, transport, handling and disposal

Waste type	Waste classification	Major source	Handling	Transport/disposal
Pesticide/ herbicide containers (water based)	General solid waste (non-putrescible)	Rehabilitation/weed control.	Containers washed/triple rinsed and wash fluids will be applied over the area just treated.	Recycled as part of the Drum Muster Programme where practicable or disposed on-site in waste rock emplacements only
Pesticide/ herbicide containers (solvent based)	Hazardous	Rehabilitation/weed control.	Stored securely. Re-use containers where possible or return to suppliers. If cleaned and washed by a solvent, re-use the washed liquid for the next application.	Recycle cleaned containers. These may be disposed of as solid waste as a last resort.
Used/empty bulk chemical containers	Hazardous	Processing reagents	Stored securely. Bulk chemical containers will be returned to the supplier, where practicable.	Removed by supplier vehicle at time of next delivery, or removal from site by licensed contractor to an EPA licensed facility for disposal.
Liquid waste from sewage system	Liquid	Human waste	Contents of septic systems pumped out as required (currently). Treated effluent from site sewage treatment facility disposed of via above ground pipeline to tailings storage. Solids from site sewage treatment facility pumped out as required via licensed contractor.	West Wyalong Wastewater Treatment Facility and tailings storage.
Laboratory wastes	Hazardous	Laboratory analysis of ore and tailings.	Diluted with water and added into the ore processing circuit.	Tailings storage.
Oversized trash screen waste	General solid waste (putrescible)	Ore processing	Stored securely.	Disposal on-site in waste emplacements. Following disposal, the waste will immediately be covered by 500 mm of waste rock material.
Material contaminated with hydrocarbons	General solid waste (putrescible)	Minor spills.	Treated in Bioremediation Facility	Disposal on-site in waste emplacements

ii Dangerous Goods and Hazardous and Liquid Wastes

The on-site storage and management of hazardous and dangerous goods and liquid wastes is undertaken in accordance with the CGO's approved HWCMP, which has been prepared in accordance with relevant state legislation, Australian Standards and industry codes of practice.

Further details regarding on-site storage and management of hazardous and dangerous goods and liquids is outlined in Section 6.14.

iii Tailings and waste rock emplacements

Waste rock is managed at three waste rock emplacement sites within the mine site, which are the northern, southern and perimeter waste rock emplacements. The northern waste rock emplacement is approved to a maximum height of 308 m AHD, the southern waste rock emplacement to 283 m AHD and the perimeter waste rock emplacement to 223 m AHD. Approximately 299 Mt of waste rock would be produced over the life of the approved CGO, and approximately 5.74 Mt of additional waste rock would be produced over the life of the underground mine. This additional waste rock would be accommodated within the existing approved limits.

The tailings are currently pumped at approximately 55 per cent solids and deposited in two tailing storage facilities, referred to as the northern and southern tailings storages (NTSF and STSF respectively). The pipeline to these storage facilities runs at ground level, through culvert road crossings and within a bunded corridor to the TSF.

The NTSF and STSF are to be constructed to approximately 240 m AHD and 248 m AHD respectively, and are approved to be combined with the northern waste rock emplacement to form the IWL, which would provide a life of mine tailings strategy. The IWL is approved to be developed to a final height of 245 m AHD. A height increase of one metre (from 245 m AHD to 246 m AHD) is required to the final height of the IWL, as a result of emplacing the residual tailings from the processing of the underground ore.

Monitoring associated with the waste emplacements and tailings storages is detailed in a number of management plans including the Surface Water, Groundwater, Meteorological and Biological Monitoring Programme (Evolution, 2015a), Monitoring Programme for Detection of Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls (Barrick Australia Limited, 2003b) and Cyanide Management Plan (Evolution, 2006).

iv Waste management strategy

The current Waste Management Strategy is implemented on site and based on the principles detailed in the *Leading Practice Sustainable Development Program for the Mining Industry – Hazardous Materials Management* (Commonwealth Government, 2016). It involves the following aspects:

- **Waste inventory** – an inventory of the waste types generated and the compilation of potential environmental hazards/impacts associated with each waste.
- **Waste management hierarchy** – the implementation of the waste management hierarchy from the National Waste Minimisation and Recycling Strategy (Commonwealth Environment Protection Agency, 1992) being avoidance, re-use, recycling, and treatment/disposal.
- **Waste recycling procedure** – before disposing of general wastes to landfill, the following recycling procedures are implemented:
    - consider recycling that may be possible on-site (e.g. secondary use of used office paper, cardboard and newspapers, reuse of clean containers for storage of inert goods, mulching pallets for rehabilitation);
    - where possible, require consumable suppliers to collect and recycle packaging material (e.g. bulky boxes and pods);
    - consider recycling or reuse options that may require an off-site component (eg returning printer cartridges to the supplier for refilling and reuse); and
    - consider commercial and non-commercial/charity off-site recycling services that may be available (e.g. aluminium can and glass bottle recycling services).

- **Personnel training** - education and training programmes are used to instruct employees and contractors on the management of waste.

- **Auditing waste management -** the CGO is subject to periodic audits and reviews. During the audit and review process, the operational phase waste management practices and procedures are assessed against relevant management plans. The most recent audit was conducted in June 2019.

6.15.5 Predicted impacts

The Proposed modification will not introduce any new waste streams and, as a result, no changes are required in the existing management measures for waste.

Similarly, as outlined in section 3.6, no change to the general arrangements for the emplacement of waste rock is planned; however, around 5.74 Mt of additional waste rock produced from the underground mine will be emplaced within the previously approved footprint of the IWL.

The anticipated tailings production arising from the processing of underground ore will result in the IWL increasing in height by one metre. Nevertheless, in accordance with the waste management hierarchy outlined in the CGO's current waste management strategy, Evolution will use a waste stream (tailings and waste rock) to provide ground support in the underground mine rather than other methods such as a combination of steel sets, rock bolts and mesh. While the primary objective of backfilling stopes is to maintain underground safety during ore extraction, it does have the added benefit of repurposing a waste and reducing potential impacts on the surface environment.

6.15.6 Monitoring and reporting

The site's existing waste management strategy provides a proactive and comprehensive monitoring of waste on site with an emphasises on initiatives that encourage improvement in staff skill levels and systems. There is a strong commitment to staff training, efficient recycling and the implementation of the waste management hierarchy. Where required, this is reported to government in annual reviews, independent audits and EPA licence annual returns.

6.15.7 Mitigation measures

Evolution's Hazardous Waste and Chemical Management Plan is reviewed and updated in accordance with updated consent conditions for Mod 16.

Additionally, the following mitigation measures will continue to be implemented to manage non-production waste:

- waste streams will continue to be classified and managed in accordance with the POEO Act, *Waste Avoidance and Resource Recovery Act 2001* and the *Waste Classification Guidelines* (EPA 2014);

- each waste stream will be appropriately segregated and prior to reuse, recycling or disposal;

- designated waste storage bins or areas or bins will be frequently inspected;

- designated waste storage bins and areas will be appropriately sign posted;

- site induction training for employees, contractors and visitors will include detail of the location on site for the correct disposal of each waste stream and mitigation measures to ensure non-production waste is reduced, reused or recycled where possible;

- performance in waste reduction and management, reuse, source separation and recycling initiatives will be tracked and reported;

- waste disposal will be conducted by an independent appropriately licenced contractor; and
- where practicable, fresh tailings will be diverted to paste used to backfill voids underground.

6.16 Social

A SIA was prepared by Elton Consulting in accordance with the *Social Impact Assessment Guidelines for State Significant Mining, Petroleum and Industry Development* (DPE 2017) (the SIA guidelines). The assessment identified the potential impacts and opportunities associated with both the construction and operational phases, as well as appropriate measures for managing adverse social impacts and enhancing potential benefits.

The SIA considers the social impacts associated with the underground development and the changes to surface infrastructure under Mod 16. Assessment Requirements

There were no formal assessment requirements issued for Mod 16 by DPIE. The relevant Secretary's Environmental Assessment Requirements for the underground development project and sections in which they are addressed are summarised in Table 6.47.

Table 6.47 Social impact related assessment requirements

Requirement	Location in the EIS
Social - an assessment of the likely social impacts of the development on the local and regional community in accordance with the *Social Impact Assessment Guidelines for State Significant Mining, Petroleum Production and Extractive Industry Development (2017*), including the likely impacts of the development on the local community, cumulative impacts (considering other mining developments in the locality), and consideration of workforce accommodation.	Section 6.18 Appendix N
During the preparation of the EIS, you must consult with the relevant local, State and Commonwealth Government authorities, infrastructure and service providers, community groups and affected landowners. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issued have been addressed in the EIS. During the preparation of the EIS and subsequent assessment process, you must operate a Community Consultative Committee for the development generally in accordance with the *Community Consultative Committee Guideline: State Significant Projects* (DPE November 2016).	Section 5.

6.16.1 Methods

The SIA adopted the approach and principles supported by both international and NSW best-practice guidance documents. The key components of the SIA are:

- determining the area of social influence;
- compiling demographic and socio-economic characteristics of affected communities;
- review of literature and strategic planning context;

- targeted consultation with local communities, councils and key project stakeholders;
- analysis of social impacts and evaluation of their significance; and
- development of mitigation and enhancement strategy to address impacts and opportunities.

6.16.2 Existing social environment

The social baseline analysis included inter alia the following key findings for communities within the area that could be influenced by the Project.

Overall, the analysis found that the region's communities depend on mining and agriculture with health care, social assistance, education and training industries also noted at top employers. However, there is limited industry diversification and job opportunities, which over time has led to job seekers moving out of the area. Bland and Lachlan LGA are therefore expected to experience population decreases while Forbes LGA is expected to experience population growth. Significant economic growth anticipated in nearby Parkes Shire over the coming years, as well as a number of other major projects in the pipeline in Bland, Forbes and Lachlan shires.

The analysis shows relatively high rates of violent, alcohol and domestic related assault in Forbes and Lachlan indicating potential fragmentation within or between community groups and socio-economic disadvantage is apparent within the community.

Residents predominately do not travel outside of their LGA for work indicating a dependency on local industries. The region is highly private-car dependent.

The population in the study area is disproportionately older and this is reflected by the number of skilled working age residents being lower in number than aged residents; this suggest a small labour pool and larger numbers of the population who strongly rely on access to social infrastructure and services. Forbes and Lachlan LGAs has a high proportion of people who identify as Aboriginal and Torres Strait Islander in but otherwise the population is relatively culturally homogenous.

Overall, the local community identity is strongly linked to rural lifestyles, farming livelihoods and supporting each other. Low resident mobility indicating the population is generally stable with high rates of volunteerism indicating the sense of community and social cohesion is strong. Community values include locally-run activities, facilities and events that bring people together, the picturesque, open and serene landscapes of the surrounding area, the local heritage and history.

Housing stress is being experienced in the region, with higher average weekly mortgage repayments compared to household income. The rental market is highly strained with little to no rental housing available, particularly in West Wyalong.

However, in terms of health and education services, mental health support for young people in the region, the availability of doctors in smaller towns and maternal health services have also been identified as service delivery gaps. Limited tertiary education opportunities and career pathways for young people has been identified as an ongoing challenge.

In terms of community services and facilities, the analysis shows that there is a lack of available and affordable childcare services in West Wyalong, which has presented employment barriers for residents with young children, particularly experienced by women and Aboriginal households. There are recreational facilities and useable open space for active recreation, indicating a strong active and sporting culture while community facilities, in particular youth centres and services, are lacking.

As the area is prone to drought, water security and access to water are highly important issues for the region.

Abundant environmental, social and cultural values associated with Lake Cowal; highly valued by community and environmental groups.

6.16.3 Summary of consultation

Around forty engagement activities were undertaken between May and September 2020 to inform the SIA. These activities included a range of social research methods, including semi-structured interviews, community information forums, one-on-one meetings or briefings, and a public survey. A diverse range of social impact matters were raised during these consultations and highlighted the nuanced perceptions, concerns, interests and priorities of the CGO's numerous stakeholders. Stakeholders consulted included:

- neighbouring or nearby landholders to the Project site;
- community members or residents of West Wyalong, Forbes and Condobolin;
- Council representatives from Bland, Lachlan and Forbes shires;
- Traditional Owners and Wiradjuri community members;
- hotel and motel owners in West Wyalong;
- West Wyalong real estate agents;
- local industry, environmental and community organisation representatives; and
- water users groups.

To inform the SIA, a number of different communication methods were used to ensure stakeholders were fully informed of the Underbround Development Project and had several options on how to provide feedback during the preparation of the EIS. The main methods used included an online survey available on a dedicated project website, online community information sessions and, meetings with the Bland Shire Council, Lachlan Shire Council, Forbes Shire Council and CGO's Community and Environmental Monitoring Consultative Committee.

In general, community and stakeholder engagement efforts have shown that many in the local community support the Underground Development Project and proposed modification due to several potential social and economic benefits that would result from the Project and continued operations at CGO.

6.16.4 Social risks

Through the interviews and consultation undertaken for the SIA, it is clear that the community consider a range of social and environmental matters important to them about the current operation of CGO, and they are interested in how the Project would relate to the social fabric of the region as it is developed. The interviewees generally support the mine, given its considerable and ongoing economic effect on the region.

In general, the key matters identified in the SIA interviews and consultation included:

- how the incoming workforce would be housed, and the effects of this on the local housing market and housing availability;
- the effect of population growth due to influx of new workers to the region;
- whether the Project would put pressure on local facilities, infrastructure and services; and
- the potential environmental impacts of the project.

The matters raised are summarised in Table 6.48, including a description of the risk, the likelihood of occurrence without any mitigation and a rating for the significance of the impact and consequence to the surrounding community.

The Underground Development Project is expected to bring several positive influences to bear on the local and regional communities. In particular, the SIA shows that people are interested in continuing employment opportunities and the potential for the creation of new jobs in the area. The Project will require an additional construction workforce of 159 FTE employees and operational workforce of 230 FTE employees.

Evolution plans to provide employment and upskilling opportunities in both the local and regional community as there will be new jobs created by the Project. The initial workforce will need to be specialised underground miners, of which there are none within the local area at present. This will require workers to relocate to the area from outside areas, or a fly-in-fly-out (FIFO) workforce. The additional workforce will result in a localised increased spending, including spending on goods, services and air travel for workers, while also diversifying the community.

However, given that there is not enough rental accommodation in the region and that new housing developments are not yet completed, Evolution has been considering options to house the incoming workforce, particularly in the early stages of the Project when there will not be sufficient specialised labour to operate the underground mine.

One option is for Evolution to house the additional workforce in a purpose-built accommodation facility in West Wyalong. This will avoid impacting on housing availability and avoids inflation of housing prices. A further benefit will be the economic opportunities from the use of local contractors and services during construction of the proposed accommodation facility. An accommodation village will also ensure that pressure on local facilities and services is limited.

The SIA has also identified potential negative risks associated with the additional workforce, however the assessment shows these impacts are on balance unlikely to eventuate. The SIA considers the possibility that the additional workforce will increase demand for services at nearby airports or that the incoming workforce in West Wyalong could increase alcohol-related recreation in the local community, which could impact the local community's character, and household compositions (ie it would be likely that a proportion of the incoming workforce would be single males). As summarised in Table 6.48, these impacts will have a minor to moderate impact on the local community and will be mitigated by consulting with regional airlines and ensuring that the incoming workforce adheres to a strict code of conduct.

In terms of potential environmental impacts, the SIA interviewees living near the mine were concerned about noise from the mine, traffic impacts and visual effects. Agricultural water users raised concerns about the availability of water for their farms. However, these comments were in relation to the existing operations at the mine rather than the potential impacts of the Project.

As described in this EIS for the Underground Development Project, the environmental impacts are unlikely to be materially different to that which have already been assessed and approved. Evolution has established systems and protocols in place and detailed monitoring procedures to make sure it operates within the strict regulatory framework placed on it by the NSW Government.

Table 6.48 Summary of potential social risks

Impact	Description of social risk without mitigation	Nature of potential impact without mitigation	Likelihood of occurrence	Significance	Consequence
Housing	Decrease in availability and increase of cost of rental properties.	Negative	Unlikely	Low	Minor
Local employment and skills development	Access to employment, higher paying jobs, skills development and economic stimulation of the local economy through indirect spending.	Positive	Likely	High	Major
	Increase in competition for skilled workers in the community, resulting in difficulty for other local industries to retain or source workers.	Negative	Unlikely	Low	Minor
Access to recreational activities and social interactions	Strain on the capacity of existing recreational facilities.	Negative	Unlikely	Low	Minor
	Increased alcohol-related recreation.	Negative	Possible	Low	Minimal
Community composition and character	Diversification of the existing population from new and skilled persons of working age.	Positive	Likely	High	Moderate
	Demographic of the additional workforce (ie mostly male and single) and the existing community's character, localised gender relations and household compositions.	Negative	Possible	Moderate	Minor
Community cohesion and functionality	Decreased level of community cohesion or public safety.	Negative	Unlikely	Low	Minor
Social infrastructure and services	Demand for health services, recreational facilities and commercial services resulting in under-supply or strain of these facilities and services.	Negative	Unlikely	Moderate	Moderate
	Increased spending on local services which will stimulate the local economy and expand service.	Positive	Likely	High	Moderate
Road transport	Project-related traffic on local roads, road conditions and usability.	Negative	Rare	Low	Minor
Air transport	Increased demand for existing flight services and reducing capacity for existing residences.	Negative	Possible	High	Moderate
	Increase demand for existing flight services increasing connectivity and mobility of existing regional communities.	Positive	Possible	High	Moderate

Table 6.48 Summary of potential social risks

Impact	Description of social risk without mitigation	Nature of potential impact without mitigation	Likelihood of occurrence	Significance	Consequence
Not for profit initiatives	Increased levels of community wellbeing, cohesion and social capital, particularly for vulnerable community groups through Evolution's existing not for profit initiatives,	Positive	Likely	High	Major
Cohesion to land	Impact on the community's connection to places of value.	Negative	Likely	Minor	Low
Workforce health and wellbeing	Decrease in mental and physical health due to family isolation for additional workforce.	Negative	Unlikely	Low	Minor
Impact to surroundings	Perception for decreased water availability to the local community over time.	Negative	Unlikely	Low	Minor
	Noise and vibration from the Project may impact nearby landowners causing irritation and decrease of personal wellbeing.	Negative	Unlikely	Low	Minor
Personal and property rights	Local economic inflation of goods and services, causing unaffordability for vulnerable community groups.	Negative	Unlikely	Low	Minor
Decision making systems	Decrease in social acceptance from the Wiradjuri community.	Negative	Possible	Moderate	Minor
Future of the community	Increased certainty of the community's future from the extended life of operations.	Positive	Likely	High	Moderate
	Increased economic diversity and opportunity for the development of new industries and livelihoods.	Positive	Likely	High	Moderate

6.16.5 Mitigation measures

The mitigation measures summarised in Table 6.49 will further ameliorate negative social impacts, as demonstrated in the improved residual significance rating, and enhance positive impacts resulting from the Project.

Mitigation measures will be implemented under a social impact management plan (SIMP) prepared for the Project and implemented through the construction and operational phases and informed by the community and stakeholder engagement plan. The objectives of the SIMP will include:

- to ensure community and stakeholder engagement is maintained through all phases of the Underground Development Project and proposed modification; and
- to align the Underground Development Project with regional and local strategic plans to support socio-economic dynamics in the region which may include new industry growth, growing populations and improved infrastructure and services.

Table 6.49 Summary of mitigation measures

Impact category	Significance and nature of impact before mitigation	Mitigation measures	Residual significance and nature of impact
Housing	Low (negative)	• Evolution Mining to encourage accommodation village contractor to engage local contractors and services and to jointly plan the facility with local stakeholders, with the aim of ensuring local and long-term socio-economic development opportunities are realised. • Coordinated approach for future planning of workforce housing requirements and residential transition with Bland Shire Council, Lachlan Shire Council and Forbes Shire Council and other key stakeholders including short-stay accommodation business owners, local business chambers, property and real estate agents.	Low (negative)
Local employment and skills development	High (positive)	• CGO's Community Strategic Plan to target local economic or skills diversification schemes such as community programs to focus on re-skilling or upskilling schemes for local job seekers or develop partnership programs with West Wyalong TAFE and local high schools to support career pathways for existing workers, residents, school leavers or general resident population. • Develop and introduce local procurement strategy to encourage local businesses and industry to participate and optimise local benefit. • Collaborate with councils, local chamber of commerce and business groups, to ensure strategy enables prioritisation of local industry, suppliers and businesses in procurement and to promote awareness on procurement and supplier opportunities, e.g. host supplier information nights in Forbes, West Wyalong and Condobolin (noting that Forbes Shire Council has made this recommendation based on a recently well-received similar event held by a solar developer). • Construction contractor to maintain a minimum target spend for local industry participation. • Operations to maintain a quota for locally sourced apprentices or trainees. • Aboriginal Cultural Awareness Training to be maintained and delivered to all Project personnel including subcontractors.	Extreme (positive)
Access to recreational activities and social interactions	Low (negative)	• Provide targeted support to local recreational facilities, groups or activities and collaborate with Bland Shire Council and local service providers to deliver shared value programs.	Low (negative)
Community composition and character	Moderate (negative)	• Ensure Workforce Code of Conduct is incorporates required standards of behaviour at the workforce accommodation village. • Coordinated approach for future planning of workforce housing requirements and residential transition with Bland Shire Council, Lachlan Shire Council and Forbes Shire Council. • Monitor changing gender balance in West Wyalong. • Provide relocation support or incentives for workers to relocate with their dependents or families.	Low (negative)

Table 6.49 Summary of mitigation measures

Impact category	Significance and nature of impact before mitigation	Mitigation measures	Residual significance and nature of impact
Community cohesion and functionality	Low (negative)	• Introduce penalties or disciplinary measures for off-site anti-social behaviour within Workforce Code of Conduct.	Low (negative)
Social infrastructure and services	Moderate (negative)	• Consider partnering with local health and emergency services to facilitate training and capacity-building to appropriately respond to mine-specific health and safety risks. • Explore opportunities to sponsor or support medical professionals to take up positions in the Bland LGA such as through the Bland Shire Council-run doctor's surgery. • Explore opportunities with West Wyalong Local Aboriginal Land Council (LALC) to deliver a childcare centre for Aboriginal and mine worker families. • Continue to ensure that CGO traffic flows utilise a standard road route as determined jointly with councils to reduce impacts on local road users, ensure all road works or traffic changes associated with the Project are effectively communicated with local landholders and other major road users (eg school bus) prior to the commencement of works. • Continue to utilise CGO buses for daily transport of workers to and from site. • Continue to consult with Bland, Lachlan and Forbes councils to jointly plan and implement road maintenance and upgrades in the Project locality, ensuring a continued local road funding scheme. • Consult with Parkes Airport, other major projects with FIFO workforce requirements, Parkes Shire Council, as well as Forbes, Lachlan and Bland councils to strategically plan for FIFO requirements for both construction and operations, aiming to ensure the FIFO workforce brings long-term benefit for regional infrastructure and air transport networks.	Low (negative)
Social infrastructure and services	Extreme (positive)	• Develop community benefit strategy as part of Social Impact Management Plan for CGO. • Explore targeted, strategic and collaborative partnership opportunities that focus on bringing together key project stakeholders, including the Lake Cowal Foundation, the West Wyalong LALC, the WCC and Bland Shire Council to develop shared value initiatives such as the InHabitat eco-tourism project and the proposed Lake Cowal Cultural Heritage Centre. • Explore opportunities to partner with West Wyalong LALC, WCC and other community partners to service and supply the workforce accommodation village.	Extreme (positive)

Table 6.49 Summary of mitigation measures

Impact category	Significance and nature of impact before mitigation	Mitigation measures	Residual significance and nature of impact
Culture	Low (negative)	• Continue to ensure delivery of open, consistent, accessible and transparent communications with the public and key project stakeholders on the environmental impacts and management plans for the Project. • Continue to proactively respond to stakeholder or community concerns of damage or effect to environmental, community, cultural or historical values to enable an improved public knowledge base. • Share cultural heritage data and management systems with Traditional Owners and other relevant stakeholders for shared value and improvements to local knowledge. • Consider facilitating an Aboriginal-led cultural heritage management process for the Project through the West Wyalong LALC. • Ensure cultural heritage management process maintained continued access to culturally or spiritually significance places or sites around Lake Cowal or on the Project site.	Low (negative)
Workforce health and wellbeing	Low (negative)	• Deliver FIFO worker support services such as mental health and wellbeing counselling services, provision of reliable communication options to foster connections with home, giving each worker their own dedicated accommodation space in an accommodation village, roster and shift structures that optimise mental health and wellbeing in line with the Centre for Transformative Work Design (2018) 'Impact of FIFO work arrangement in mental health wellbeing of FIFO workers'. • Ensure local health and emergency services are trained and have capacity to respond to underground health and safety risks.	Low (negative)
Impact to surroundings (water usage)	Low (negative)	• Continue to ensure delivery of open, consistent, accessible and transparent communications with stakeholders on water management plans. • Consult with local water user groups to integrate stakeholder and other water user issues into strategy and CSEP.	Low (negative)
Impact to surroundings (visual and noise impacts)	Low (negative)	• Continue to ensure delivery of open, consistent, accessible and transparent communications on matters of concern to neighbouring or nearby landholders through CSEP, such as blasting schedules, periods of increased site activity, lake access procedures for livestock grazing, road maintenance, traffic management plans, land access procedures (for water monitoring and exploration), land rehabilitation programs that the community may be able to participate in. • Consider supporting a research project on Lake Cowal to better understand crayfish and bird habitat changes Continue strategic support to Lake Cowal Foundation and associated activities.	Low (negative)
Personal and property rights	Low (negative)	• Develop local procurement strategy to encourage local businesses and industry to participate and optimise local benefit (as above).	Low (negative)

Table 6.49 Summary of mitigation measures

Impact category	Significance and nature of impact before mitigation	Mitigation measures	Residual significance and nature of impact
Decision making systems	Moderate (negative)	• Consult with Wiradjuri community members and representatives to understand diversity of views, priorities and interests. • Ensure that SIMP and CSEP contains targeted strategies specific to Traditional Owners, Aboriginal land rights and interests, based on an engagement process with Aboriginal groups and communities. • Support continued efforts by WCC and West Wyalong LALC to coordinate Wiradjuri communities to achieve shared and long-term benefit. • Continue partnerships with WCC and West Wyalong LALC to jointly implement CGO management plans. • Consider participatory review process of Native Title Agreement following engagement with Aboriginal parties and communities.	Low (negative)
Future of the community	High (positive)	• Consider strategic partnership with Bland Shire Council and other stakeholders, including industry and community groups or representatives, for future local economic diversification planning and skills diversification schemes, to be appropriately reflected in the SIMP and CSEP.	Extreme (positive)

6.16.6 Cumulative impacts

Major projects with current or future proposals with DPIE and in the same region as CGO which may contribute to cumulative impacts are summarised in Table 6.50.

Table 6.50 Major projects in proximity to CGO

Project name	LGA	Approval status	Construction phase duration	Potential construction period	New proposal or modification	Proposed construction workforce
Owendale Scandium Mine	Lachlan	Seeking approval	12 months	N/A	New	N/A (estimated workforce of 362 based on similar nearby projects)
CleanTeQ Sunrise	Lachlan	Approved	N/A	2019 onwards	Modification	1,000
West Wyalong Solar Farm	Bland	Approved	12 months	2019-2020	New	300
Wyalong Solar Farm	Bland	Approved	9 months	2019 onwards	New	150
Jemalong Solar Farm	Forbes	Approved	N/A	2019 onwards	New	N/A (estimated workforce of 203 based on similar nearby projects)
Daroobalgie Solar Farm	Forbes	Seeking approval	18 months	2019-2021	New	160

As Table 6.50 shows, most of these proposals are already approved by DPIE and were expected to have commenced construction already. Therefore, most of the listed projects may well have been built prior to commencement of the Project's construction phase. However, apart from the CleanTEQ Sunrise Project, the construction workforces of the projects are relatively small, and there may only a small overlap of each respective project's construction workforce.

Potential cumulative impacts resulting from the interaction of the Underground Development Project and other developments summarised above are provided in Table 6.51. This includes the likelihood of occurrence of each impact and the subsequent consequence and significance rating.

Table 6.51 Summary of potential cumulative impacts

Impact category	Description	Likelihood	Consequence	Significance and nature of impact
Housing	The increase in FIFO workforces caused by multiple concurrent major projects may place additional pressure on the local housing market, particularly affecting short-stay accommodation providers and the private rental market. This could marginalise existing renters and affect housing affordability for residents and newcomers alike. This impact has been assessed based on the assumption of the CGO workforce accommodation village would operate for the life of the Underground.	Unlikely	Moderate	Low (negative)
Local employment and skills development	The increase in demand for labour and contracting services in the local and regional economy, caused by multiple concurrent major projects requiring construction workers, would enable job creation and local economic stimulus, however may have effect on the cost of labour and availability for other industries. This impact has been assessed understanding the current economic downturn being experienced due to the COVID-19 pandemic.	Likely	Moderate	High (positive)
Access to recreational activities and social interactions	An increase in traffic on local loads and public highways such as the Newell Highway, especially heavy vehicles, caused by multiple construction projects underway concurrently, may increase the public safety risk for road-related accidents, and would increase the capacity and strain on existing road networks, affecting local road users and existing residents. This impact has been assessed as potentially minor due to the existing road capacity within the area of social influence.	Possible	Minor	Moderate (negative)
Access to recreational activities and social interactions	An increase in incoming FIFO workforces caused by multiple major projects in concurrent development may place additional pressures on existing infrastructure and services in nearby townships, in particular, emergency services, health services, childcare services and schools. This may marginalise existing users, particularly disadvantaged community groups. However, over time, continued economic development in the area of influence would likely contribute to improved or expanded provision of infrastructure and services.	Possible	Minor	Moderate (negative)

6.16.7 Summary and conclusion

A SIA was completed in consideration of *Social Impact Assessment Guidelines for State Significant Mining, Petroleum and Industry Development* (DPE 2017). The assessment identified the potential social risks and opportunities associated with both the construction and operational phases as well as appropriate measures for managing adverse social impacts and enhancing potential benefits.

Community and stakeholder engagement was completed by Elton during both the scoping and EIS preparation phases. Several communication methods were used to ensure community members that could be directly or indirectly affected by the Underground Development Project, and other relevant stakeholders, were kept informed about the Project and provided feedback so far.

In general, community and stakeholder engagement efforts have shown that there is widespread support for the mine in the local and regional community and there is support for the Underground Development Project due to the many potential social and economic benefits that would result from current and future operations at CGO.

A range of positive impacts will result from the continued operation of the mine. The proposed additional workforce will provide employment and upskilling opportunities for local and regional communities, whilst keeping he existing workforce employed for longer. This will provide continued economic opportunities to the local and regional economies due to several factors, including localised spending by the workforce on goods, services and air travel due to FIFO contracts. The additional workforce will diversify the existing population, bringing new and skilled persons of working age, whilst the life of mine extension at GGO will provide opportunity to sustain Evolution's existing not-for-profit and community-focused initiatives.

There are a range of negative social impacts, which relate to the potential impacts to the housing market in the region due to the influx of a new workforce. Evolution has set in train open discussions on options to house its workforce during the construction and operation of the project in order to limit the social effects of this issue.

Its options include plans for a purpose-built accommodation facility in West Wyalong. This will mitigate impacts to housing availability and subsequent localised inflation of housing prices and provide economic opportunities to the local economy from the use of local contractors and services during construction of the facility.

However, there is the possibility that the economic benefits to local towns may not be fully realised due to the incoming workforce being many of which will be FIFO or DIDO workers.

Other negative impacts relate to the environmental impacts to nearby landowners and local water users and communication with the Aboriginal community. These impacts and matters can be mitigated through open communication with stakeholders and transparent reporting of impacts to ensure that the mine continues to be a welcomed member of the community.

Other mitigation for negative social impacts include continuing the long standing partnership with groups in the West Wyalong area and the provision of economic support to recreational and sporting clubs.

Positive impacts will result to local and regional communities, primarily resulting from the positive impacts that the additional workforce and maintenance of the existing workforce will bring to these communities. Cumulatively, the Project is not expected to exacerbate social impacts when considering nearby major projects. There is likely to be only minor overlaps of construction workforces, and other major projects in proximity to CGO are unlikely to result in adverse environmental or social impacts due to the nature of solar farms.

Specific mitigation measures are recommended to be implemented which will aim to further address negative social of impacts to local and regional communities whilst optimising and enhancing positive impacts. A SIMP can ensure that stakeholder engagement is maintained through all phases of the Project and that the Project aligns with regional and local strategic plans to further enhance socio-economic impacts in the region.

6.17 Economic

6.17.1 Introduction

This chapter provides a summary of the economic impact assessment completed by AEC (2020) for the underground development, which is provided in full in Appendix O. The assessment holistically takes into consideration the economic effects of establishing the underground mine and ore mining and ore processing. It has therefore also considered the economic benefit and impact of the key activities subject to Mod 16. The assessment was prepared in accordance with the *Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals* (DPE 2015).

6.17.2 Assessment Requirements

There were no formal assessment requirements issued for Mod 16 by DPIE. However the economic impact assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements issued for the Underground Development Project.

6.17.3 Research Method

Two types of analysis were carried out as part of this study; a local effects analysis (LEA) and cost benefit analysis (CBA).

i Local effects analysis

The LEA assesses the impacts of the Underground Development Project in the locality, specifically impacts on local employment and non-labour Underground Development Project expenditure. It also considers social impacts on the local community in relation to the source of labour and accommodating the workforce for the Underground Development Project.

It uses Computable General Equilibrium (CGE) modelling techniques to model the impact of the Underground Development Project in the State and regional economy. The assessment identifies the economic impacts specific to the Underground Development Project compared to what would be anticipated if the Underground Development Project did not proceed.

The LEA considers the underground development project's:

- contribution to the economy;
- contribution to employment and wages, including impacts on place of work compared to place of usual residence;
- contribution to government revenues;
- impact on local property market; and
- impact on balance of payments.

The CGE modelling has been completed for two periods:

- 2020-21 to 2022-23 – representing the bulk of the construction works and first three years of analysis; and
- 2023-24 to 2039-40 – representing the operational impacts (plus some residual construction works in the first year of the period).

In interpreting the results of the modelling presented in this section it should be recognised that:

- As production is assumed to commence at the end of 2020-21, the impacts presented in 2020-21 and 2022-23 as part of the construction phase will include some impacts attributable to operational activity (though the vast majority of impacts over this period are considered to be attributable to construction impacts).
- Similarly, as some residual construction works would occur in 2023-24, the impacts for this year presented in the operational phase will include some impacts attributable to construction activity (though the vast majority of the impacts over this period are considered to be attributable to operational impacts).

ii Cost benefit analysis

CBA evaluates the net benefits to the State economy, by considering the relevant economic, social and environmental costs and benefits of the Underground Development Project.

The method used in the CBA is outlined in Appendix O. Other key considerations for the CBA include:

- Modelling has been undertaken starting from the financial year ending June 2021, with impacts examined to the year ending June 2040, aligning with the anticipated construction and operations period for the Underground Development Project. Consideration has also been given to potential impacts that may extend beyond this timeframe, however, given the nature of this Underground Development Project it is anticipated impacts extending beyond the life of the mine will be negligible.

- A base discount rate of 7% has been used for demonstration purposes (in line with many State and national standards for real discount rates used in economic appraisal of projects), with additional discount rates also examined (4% and 10%). As all values used in the CBA are in real terms, the discount rate does not incorporate inflation (ie it is a real discount rate, as opposed to a nominal discount rate).

6.17.4 Existing environment

The Catchment's population has been in decline for the past two decades: from just under 22,000 people in 2019, equating to 0.3% of the population in NSW, it recorded a consistent annual decline of 1.3% on average between 2001 and 2006, likely due to the harsh drought conditions and reduced liveability of the region. Mining and exploration projects have assisted in slowing population decline since 2006 (including the commencement of production at CGO in 2006).

The Catchment's population is anticipated to continue to decline marginally year on year to 2041 and is anticipated to decline by 0.2% per annum on average to just over 21,000 residents by 2041.

The Catchment's economy is heavily influenced by fluctuations in mining and agricultural activity: In 2018-19, the Catchment's economy recorded a Gross Regional Product (GRP) of approximately $1.5 billion in chain volume terms[6]. Annual growth over the period since 2006-07 has been volatile, with mining and agriculture, forestry and fishing contributing 18.8% and 16.8% of total sector Gross Value Added (GVA) activity, respectively, in 2018-19.

Mining was the most prominent industry in the Catchment in terms of contribution to total sector GVA in 2018-19. Currently approximately 385 workers are employed at CGO, most of whom are local employees and contractors. In 2019-20, 251,500 ounces of gold were produced.

Construction activity has trended in line with mining expansion/development activity, contributing to 7.1% of activity in 2018-19. Construction activity has tracked that of the mining investment phase, peaking in 2012-13 in line with the mining boom and declining thereafter. In recent years, construction activity has surpassed the levels recorded at the peak of the mining boom.

Agricultural activity is a significant local employment source. Since 2006-07, the number of workers (by place of work) in the Catchment has declined marginally- by 0.1% per annum on average- to reach approximately 9,280 workers in 2018-19. Agricultural activity has a significant impact on employment growth, although it is strongly influenced by climatic conditions eg drought. In line with agriculture, forestry and fishing activity, the number of workers in the Catchment was at its highest levels between 2006-07 and 2010-11 (averaging around 9,600 workers). Since this period, employment has hovered around 9,000 workers.

[6] Chain volume measures are derived by linking together (compounding) movements in volumes, calculated using the average prices of the previous financial year, and applying the compounded movements to the current price estimates of the reference year

The unemployment rate has been volatile since 2010: between 2006 and 2010, the unemployment rate in the Catchment trended similar to the State but has since fluctuated moderately. The unemployment rate in the Catchment was higher than the State between mid-2012 and 2016 but has averaged just below that of the State over the past three years (at 4.4% compared to 4.7% respectively).

The Catchment is both highly self-sufficient and self-contained: the Catchment is 91.2% self-sufficient, indicating that the majority of jobs in the local area are held by residents and there is an appropriate match between skillsets held by residents and the jobs that are available. This is largely due to the high number of agricultural, forestry and fishing workers who live and work in the Catchment, and likely reflects that many farmers work on their own properties. The Catchment has a higher self-containment rate (93.7%), reflecting that the vast majority of residents of the Catchment found suitable work in their region of residence, or relocated to the region for work purposes.

Residential approval activity has performed strongly in recent years compared to the rest of the state: residential approval volumes in the Catchment grew by 8.7% per annum on average since 2012-13 compared to just 5.0% for NSW. Growth in residential approvals is indicative of increased dwelling development in the region, which is reflective of some level of demand for housing supply. It is important to note that these growth estimates are off small volumes, ranging between 29 and 61 approvals between 2012-13 and 2018-19, and hence are not indicative of significant residential development activity. The value of residential approvals has grown modestly as well (6.5% per annum on average).

Within the Catchment, housing and rental market activity is primarily centred in the Forbes LGA. Since June 2017, residential house sales activity in the Forbes LGA has averaged around 40 sales per quarter, whilst Bland and Lachlan LGAs recorded fewer than 30 sales per quarter on average. Rental activity shows a similar trend.

i COVID-19

The COVID-19 pandemic is having a major impact on global, national, and state economies and financial systems. The spread of the virus has resulted in restrictions to the movement of people across borders, social distancing measures, and consequent loss of jobs, incomes, and businesses.

An indicative estimate of the impact of COVID-19 to the NSW and Catchment economy to 30 May 2020 has been developed based on data from the (ABS 2020a) outlining impacts on employment at the State level by industry. Employment impacts for the Catchment were developed assuming the proportional change in industry activity at the State have been experienced in the Catchment as well. Impacts on GRP were estimated assuming the value-added activity per employee in 2018-19 holds constant.

Based on these indicative estimates, as of 30 May 2020, the pandemic has resulted in a decline of approximately 650 employees (or 7.0%) in the Catchment compared to 2018-19 estimates. This is in line with that of the State, which is estimated to have experienced a 7.0% decline in employment over the same period. The impact on GVA has been slightly less pronounced, with the Catchment recording a decline of approximately $67.6 million due to the pandemic, a decline of 5.1%, compared to a decline of 5.3% for the State.

The JobKeeper Payment Scheme was introduced in April 2020 to support businesses and individuals during the pandemic by providing $1,500 payments to employers for eligible employees each fortnight. Within the Catchment, approximately 2,900 businesses applied for JobKeeper in April, followed by approximately 3,300 businesses in May (Australian Government Treasury 2020). It is anticipated that some of the small-medium enterprise businesses covered by the JobKeeper payment may struggle to recover once the payment ends.

With the Catchment's economy heavily influenced by fluctuations in agricultural activity, until trade activity returns in the longer term, it is anticipated that the economy will continue to be adversely affected by lower international demand for Australian agricultural produce. As with most of regional Australia, lower population growth is expected over the next few years, due to reduced migration resulting from the international travel ban implemented in March 2020. Property market activity prospects remain subdued; CoreLogic (2020) revealed that whilst regional areas have recorded higher growth in dwelling values than cities, there has still been a slowdown in property market activity as a result of the pandemic.

6.17.5 Local effects analysis

The modelling outcomes identified throughout this impact assessment depict the value and percent change in a range of economic indicators anticipated as a result of the Underground Development Project. These estimates represent the net change in the respective indicators compared to projected growth in the Catchment (and State) economy without the Underground Development Project proceeding. Assumptions used in developing baseline estimates of growth are outlined in Appendix O.

The direct activity associated with each stage (construction and operations) is outlined in section ii. CGE modelling outlines how this direct activity will deliver impacts to the Catchment and NSW economies both directly and through flow-on activity (eg supply chain impacts as well as increased consumption by households). However, CGE modelling does not examine separate stages of project activity (eg construction versus operations) or disaggregate impacts between direct and flow-on activity; rather it examines the direct and flow-on impacts of the Underground Development Project in aggregate across all relevant stages of activity each year.

i Potential beneficial impacts

Key beneficial impacts arising from the Underground Development Project are outlined in Table 6.52. Beneficial impacts are examined in the context of what would otherwise occur if the Underground Development Project did not proceed.

Table 6.52 Beneficial impacts

Impact	Description
Economic Growth	The Underground Development Project will contribute to economic growth through increased industry output and GRP during construction and operation (ie production), flowing from both direct and flow-on impacts. The Underground Development Project is estimated to support an additional: • $38.9 million in GRP per annum in the Catchment during construction; and • $106.3 million GRP per annum in the Catchment during operations. At peak, the Underground Development Project is estimated to result in an average annual increase in GRP of 5.0% compared to what would be expected to occur without the Underground Development Project (2024-25 to 2031-32).

Table 6.52 Beneficial impacts

Impact	Description
Employment and Incomes	The Underground Development Project will increase employment during construction and operations, compared to what would occur without the Underground Development Project, flowing from both direct and flow-on impacts. Including both direct and flow-on (supply chain) impacts, the Underground Development Project is estimated to support an additional: • 159 FTE jobs per annum in the Catchment during construction; and • 236 FTE jobs per annum in the Catchment during operations. The increase in employment will also deliver increased incomes in the Catchment and NSW, both directly as a result of the jobs supported as well as through a small lift in real wages generated by increased competition for labour. Overall, the Underground Development Project is estimated to support: • $11.1 million in additional incomes per annum in the Catchment during construction, with a further $39.6 million elsewhere in NSW. • $12.5 million in additional incomes per annum in the Catchment during operations, with a further $57.5 million elsewhere in NSW.
Support for Local Businesses	The Underground Development Project will create opportunities to secure new contracts and increase sales of goods and services to the Underground Development Project with associated flow-on impacts in the supply chain during all phases of the Underground Development Project. This will provide a boost for businesses in the Catchment and in the broader NSW economy. Prominent industry beneficiaries from flow-on from this Underground Development Project include business services, trade, public services, health and education. The Underground Development Project will also support local suppliers and contractors, providing additional security and longevity of business incomes (and employment) in the region.
Government Revenue	The Underground Development Project will provide a lift in State and Australian government taxation revenues through a variety of taxes and duties. Overall, the Underground Development Project is estimated to deliver a total of: • $556.6 million in additional revenue to the Australian Government, through personal income tax, fringe benefits tax, company tax and GST, compared to what would occur without the Underground Development Project; and • $174.8 million in additional revenue to the NSW Government compared to what would occur without the Underground Development Project, primarily through royalty payments. These additional revenues can be used by government to provide additional infrastructure and services to support business and households throughout Australia.

Source: AEC.

ii Potential adverse impacts

Table 6.53 summarises the predicted impacts in consideration of what would otherwise occur if the Underground Development Project does not proceed. This table also includes assessment of impacts on local property values and the Australian dollar / exchange rates, which can provide both beneficial consequences for some stakeholders and adverse consequences for others.

Table 6.53 Adverse impacts

Impact	Description
Impacts on Local Businesses from Competition for Resources	There will be increased competition for labour and resources, leading to inflationary pressure and increased costs to businesses as well as potential difficulties for local businesses attracting and retaining staff. The increase in real wages also highlights the increasing costs to businesses as real wages are higher than the base case throughout the mine life. As a result, some industries such as the manufacturing industry are expected to see a small decline in activity and employment relative to the base case, including such industries as manufacturing and agriculture, forestry and fishing. However, compared to base case activity (ie without the Underground Development Project), the impacts of the Underground Development Project on real wages and industry output are estimated to be relatively small, and will be offset to some degree by the benefits generated throughout the supply chain.
Impacts on Local Property Values	The majority of the Underground Development Project's workforce is expected to be sourced from outside the Catchment and will need to be accommodated during the periods they are working within the Catchment. At its peak, this is expected to result in approximately 180 beds being required at one time (in late 2022). Longer term, around 100 to 110 beds are estimated to be required at any one time. Workforce accommodation strategies are being investigated. The primary option for consideration is the construction of an accommodation village in West Wyalong. Lease/acquisition of existing commercial accommodation facilities in the local area is also being considered. In terms of impacts on the local property market, the construction of an accommodation village would result in negligible impacts on local property values, as all non-local workers would be accommodated in the village. Lease/acquisition of commercial accommodation would result in some contraction in the availability of commercial accommodation for non-Underground Development Project-related travellers to the area. This may be expected to result in some tightness in the market during peak visitor periods, with high occupancy rates and increased commercial accommodation room rates.

iii Contribution to the economy

The Underground Development Project will generate considerable output and gross product, both:

- **Directly**, through construction activity and the extraction and export of saleable gold.
- **Indirectly**, through additional demand for goods and services to support the Underground Development Project, household consumption effects as a result of additional wages and salaries paid, and government expenditure through additional taxation revenues.

a Gross and regional state product

During the construction phase, there will be a steady annual increase in the GRP and Gross State Product (GSP) each year, followed by a moderate annual increase during the operational phase.

During the construction period, the Underground Development Project's contribution to the economy is expected to average $66.2 million in GSP and $35.5 million in GRP. During the operational period, the contribution to the economy is expected to average $141.10 million in GSP and $89.3 million in GRP. This will result in increase in the GRP by 4.5% between peak construction and operational phases of 2023 to 2024 and 2027 to 2036. It will gradually decrease to 4% from 2035 to 2036. The GSP and GRP is expected to significantly decrease towards the end of the operational period from 2036 to 2038

During the construction and operational phases, approximately 54% and 63% of the GSP respectively will be captured locally in the Catchment.

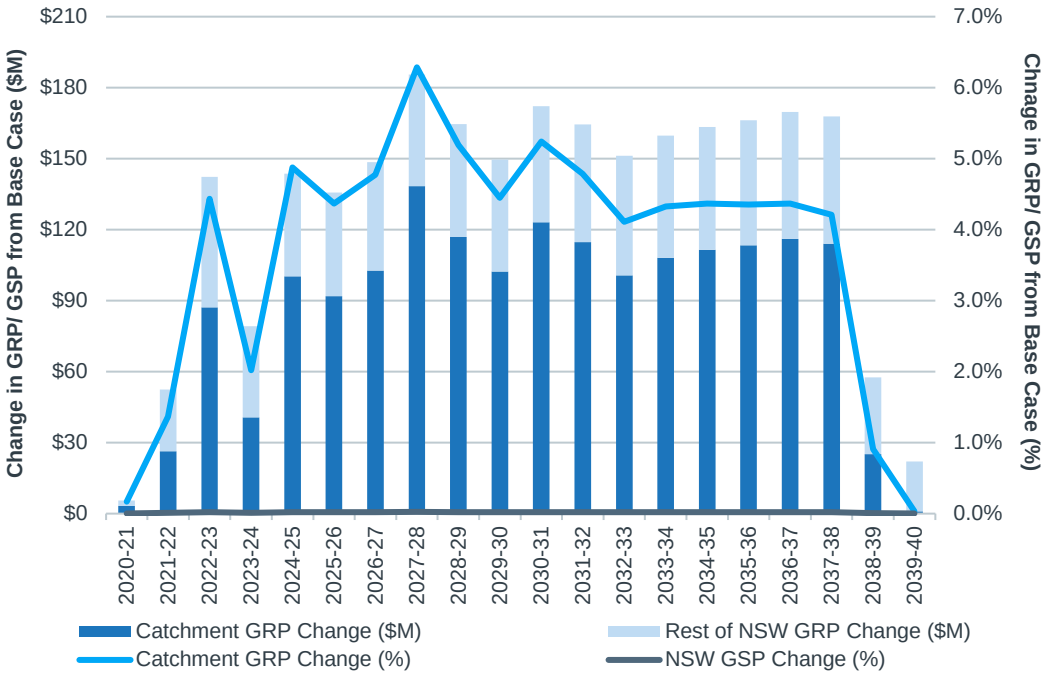


Figure 6.17 Annual impact of the Underground Development Project's GRP and GSP

b Industry output

The industry output considers the Underground Development Project's economic impact on agriculture, forestry and fishing, mining, manufacturing, electricity and water, construction, trade, transport and storage, communication, finance and insurances and business services.

The construction and mining sector will benefit the most from the Underground Development Project, as the economic output of the underground development project within the Catchment will increase the revenue of these sectors by 51.7% and 32.8% respectively during the construction phase.

Other industries that will experience increases include business services, trade and public services, health and education. This is due to an increase in demand of these services and household income associated with the Underground Development Project's workforce.

Industries that may experience a decrease in economic output, like agriculture, forestry and fishing, manufacturing, electricity and water and finance and insurance. This is primarily due to such factors as competition for labour resources and increased costs for businesses due to competition for resources.

The modelled change in industry output is shown in Table 6.54.

Table 6.54 Industry output

Industry	Construction				Operations			
	Catchment		NSW		Catchment		NSW	
	Change in Industry Output ($M)	**Change in Industry Output (%)**	**Change in Industry Output ($M)**	**Change in Industry Output (%)**	**Change in Industry Output ($M)**	**Change in Industry Output (%)**	**Change in Industry Output ($M)**	**Change in Industry Output (%)**
Agriculture, forestry & fishing	-$3.0	-0.3%	-$5.1	0.0%	-$1.8	-0.2%	-$5.3	0.0%
Mining	$24.2	4.3%	$16.9	0.0%	$204.5	31.1%	$195.9	0.3%
Manufacturing	-$3.1	-1.0%	-$38.4	0.0%	-$5.7	-1.7%	-$59.4	0.0%
Electricity and water	-$1.9	-3.6%	-$11.8	0.0%	-$1.8	-3.0%	-$10.1	0.0%
Construction	$124.0	46.3%	$120.0	0.1%	$7.3	2.5%	$4.5	0.0%
Trade	$5.2	1.4%	$12.7	0.0%	$3.6	0.8%	$15.2	0.0%
Transport and storage	$1.0	0.6%	-$0.5	0.0%	$1.8	0.9%	-$1.6	0.0%
Communication[1]	-$0.5	-1.3%	-$1.5	0.0%	-$0.5	-1.1%	-$3.0	0.0%
Finance and insurance	-$0.4	-0.6%	$4.5	0.0%	-$0.7	-1.0%	-$1.5	0.0%
Business services[2]	$4.9	3.0%	$20.4	0.0%	$5.4	3.0%	$17.5	0.0%
Public services, health and education	$3.0	0.7%	$7.7	0.0%	$1.6	0.3%	$13.8	0.0%
Recreation and other services	$0.1	0.3%	$0.6	0.0%	$0.3	0.5%	$2.2	0.0%
Ownership of dwellings	$2.9	1.2%	$7.8	0.0%	$1.4	0.4%	$15.7	0.0%
Total Change	**$156.4**	**4.1%**	**$133.2**	**0.0%**	**$215.4**	**4.9%**	**$183.9**	**0.0%**

Note: (1) Includes postal and courier services and telecommunication services; (2) Includes services to mining, property and business services, professional services, administrative services and personal / household goods hiring.
Source: Prime Research (unpublished).

iv Contribution to employment and wages

a Employment

Jobs supported by the Underground Development Project (including direct and flow-on jobs) are estimated to grow during construction, peaking at around 290 in the Catchment in 2022-23. This year includes considerable overlap between construction and operations workforces, with a total of around 270 construction and operations workers directly engaged by the Underground Development Project in aggregate in 2022-23, with the remaining 20 workers representing the net additional workers supported through flow-on activities for the year.

Between 2023-24 and 2037-38, the Underground Development Project is expected to result in a net increase in employment of around 250 to 265 FTEs annually in the Catchment compared to what would be expected to occur without the Underground Development Project, before dropping to around 110 FTEs in 2038-39 and five FTEs in 2039-40 as production tails off in the last two years of operations.

The Underground Development Project's contribution to employment and wages considers the impact to FTE employees per industry in the Catchment and State as a result of the Underground Development Project. This is summarised in Table 22.4 including the change per FTE employee and percentage change.

Employment increases are mostly associated with the construction industry during the construction phase, which will increase by 120 FTE jobs in the Catchment, and mining industry during the operational phase, which will increase by 215 FTE jobs in the Catchment.

Self-evidently, the Underground Development Project will extend the life of mining operations in the Catchment. The operations phase of the Underground Development Project can largely be considered as retaining jobs (both directly and through supply chain impacts) that otherwise may be lost (although construction activity will represent an increase over existing activity).

COVID-19 is having a significant short-term impact on the NSW and Catchment economy and labour market, and these impacts are anticipated to continue in the longer term. This gives added importance to the Underground Development Project and the boost it provides to both the Catchment and to NSW.

The modelled change in employment is shown in Table 6.55.

Table 6.55 Change in employment

Industry	Construction				Operations			
	Catchment		NSW		Catchment		NSW	
	Change in Employment (FTEs)	**Change in Employment (%)**	**Change in Employment (FTEs)**	**Change in Employment (%)**	**Change in Employment (FTEs)**	**Change in Employment (%)**	**Change in Employment (FTEs)**	**Change in Employment (%)**
-7	-0.2%	-15	0.0%	-2	0.0%	-16	0.0%	
22	4.8%	12	0.0%	214	42.9%	205	0.5%	
-6	-1.2%	-46	0.0%	-10	-2.2%	-83	0.0%	
-2	-3.3%	-10	0.0%	-2	-3.0%	-9	0.0%	
111	20.4%	86	0.0%	9	1.6%	-18	0.0%	
16	1.0%	47	0.0%	10	0.6%	37	0.0%	
Transport and storage	1	0.5%	-4	0.0%	2	0.8%	-25	0.0%

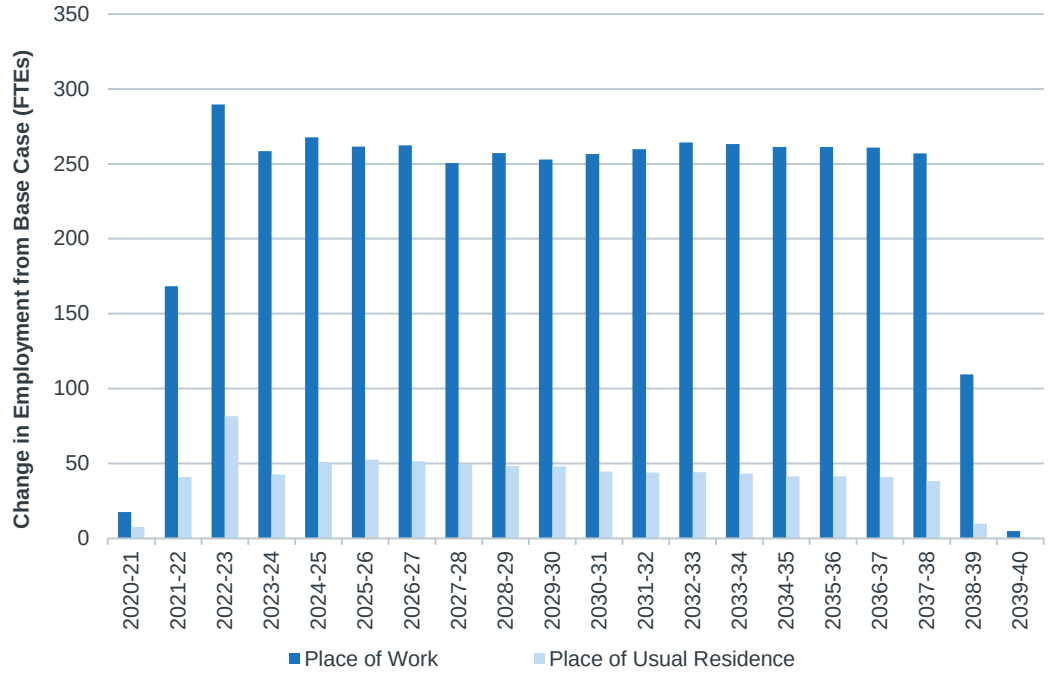
Table 6.55 Change in employment

Industry	Construction				Operations			
	Catchment		NSW		Catchment		NSW	
	Change in Employment (FTEs)	**Change in Employment (%)**	**Change in Employment (FTEs)**	**Change in Employment (%)**	**Change in Employment (FTEs)**	**Change in Employment (%)**	**Change in Employment (FTEs)**	**Change in Employment (%)**
Communication[1]	-1	-1.3%	0	0.0%	-1	-1.2%	-1	0.0%
Finance and insurance	0	-0.5%	7	0.0%	-1	-0.8%	3	0.0%
Business services[2]	11	2.4%	51	0.0%	10	2.1%	38	0.0%
Public services, health and education	13	0.6%	41	0.0%	6	0.2%	58	0.0%
Recreation and other services	0	0.1%	3	0.0%	1	0.4%	7	0.0%
Ownership of dwellings	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total Change	**159**	**1.5%**	**171**	**0.0%**	**236**	**2.1%**	**198**	**0.0%**

Note: (1) Includes postal and courier services and telecommunication services; (2) Includes services to mining, property and business services, professional services, administrative services and personal / household goods hiring.
Source: Prime Research (unpublished).

b Place of work compared to place of residence

Around 25% to 30% of total jobs supported in the Catchment during construction will be filled by local people. This figure drops to under 20% of jobs in the Catchment during operations, however this represents a worst-case scenario, and CGO will implement strategies to encourage the mining workforce to relocate to the region. Where workers relocate, the share of jobs filled by locals would be expected to increase over time.



Source: Prime Research (unpublished).

Figure 6.18 Annual Impact on Employment in the Catchment, Deviation from the Base Case, Place of Work versus Place of Usual Residence

6.17.6 Contribution to Government Revenues

i Approach

Estimates of taxation revenue to the NSW and Australian Government have been developed based on benchmarks of taxation revenue received compared to relevant NSW and Australian measures and applied to results from CGE modelling. The following benchmarks were applied by taxation item:

- Personal income tax (Australian Government): total income tax received (ABS 2020b) compared to total wages and salaries paid to Australian employees (ABS 2020c, ABS 2020d) between the financial years of 2009-10 and 2018-19. This was applied to estimates of incomes paid in Australia from the CGE modelling.
- Fringe benefits tax (Australian Government): total fringe benefits tax received (ABS 2020b) compared to total wages and salaries paid to Australian employees (ABS 2020c, ABS 2020d) between the financial years of 2009-10 and 2018-19. This was applied to estimates of incomes paid in Australia from the CGE modelling.
- Company income tax (Australian Government): total company tax received (ABS 2020b) compared to total gross profit of businesses in Australia (ie total GDP less total wages and salaries paid to employees) (ABS 2019; ABS 2020c, ABS 2020d) between the financial years of 2009-10 and 2018-19. This was applied to estimates of GDP less incomes paid in Australia from the CGE modelling.
- Goods and Services Tax (GST) (Australian Government): total GST received (ABS 2020b) compared to total Australian GDP (ABS 2019) between the financial years of 2009-10 and 2018-19. This was applied to estimates of GDP from the CGE modelling.
- Payroll tax (NSW Government): total payroll tax received (ABS 2020b) compared to total wages and salaries paid to NSW employees (ABS 2020c, ABS 2020d) between the financial years of 2009-10 and 2018-19. This was applied to estimates of incomes paid in NSW from the CGE modelling.

Both direct and flow-on impacts are included in the estimation of the above taxation revenues.

In addition to the above, Evolution Mining will also pay the NSW Government royalties for the sales of gold. Royalty payments were estimated using royalty rates set by the NSW Government (NSW Government 2020). The royalty rate for gold is an ad valorem royalty with a base rate of 4% of 'ex-mine' value[7]. In estimating the royalty rate, all processing costs have been deducted on the assumption that these represent allowable deductions.

ii Tax Revenues

The NSW Government is expected to receive around $175 million in additional revenue, primarily through royalty payments, over the life of the Underground Development Project and the Australian Government is estimated to receive more than $550 million in various taxes. It should be noted that a portion of Australian Government revenues is likely to provide benefits to NSW, with the State allocated a portion of GST revenue as well as through the subsequent expenditure and redistribution of Australian Government revenues to provide services and infrastructure throughout Australia (including NSW).

Additional Government revenues are shown in Table 6.56.

Table 6.56 Additional Government revenues

Impact	**Estimated Revenue** ($M)	**Proportion of Additional Government Revenue** (%)
NSW Government Revenues		
Payroll Tax	$45.3	25.9%
Royalties	$129.5	74.1%
Total	**$174.8**	**100.0%**
Australian Government Revenues		
Personal Income Tax	$374.4	67.3%
Fringe Benefits Tax	$9.4	1.7%
Company Tax	$81.6	14.7%
GST	$91.3	16.4%
Total	**$556.6**	**100.0%**

Note: Totals may not sum due to rounding.

Source: ABS (2019), ABS (2020b), ABS (2020c), ABS (2020d), NSW Government (2020b), AEC.

6.17.7 Cost benefit analysis

The CBA identifies that the Underground Development Project is economically desirable for NSW with the benefits outweighing the costs across all discount rates examined (4%, 7% and 10%) (refer Table 6.57).Assuming a discount rate of 7%, the Underground Development Project would result in the following:

- a Net Present Value (NPV) of $314.4 million over the assessment period with total present value (PV) benefits of approximately $2,107.9 million compared to an aggregated PV costs of approximately $1,793.5 million; and
- a benefit-cost ratio (BCR) of 1.18, highlighting that the Underground Development Project is estimated to return $1.18 for every dollar cost.

[7] The ex-mine value refers to the value of the mineral once it is mined and brought to the surface. In some cases, the costs associated with the processing or treatment may be allowable deductions. However, the costs associated with exploration, development and mining of the ore body and the rehabilitation of the site are not allowable deductions (NSW Government 2020).

Table 6.57 CBA results

	Total Value ($M)	PV ($M) – 4% Discount Rate	PV ($M) – 7% Discount Rate	PV ($M) – 10% Discount Rate
Costs				
Construction Costs	$319.4	$296.8	$281.6	$267.8
Operating and Closure Costs	$2,702.1	$1,891.2	$1,490.2	$1,200.8
Value of Foregone Economic Activity	Negligible			
Air Quality Impacts	Negligible			
Greenhouse Gas Emissions	$16.7	$12.3	$10.0	$8.3
Noise Impacts	Negligible			
Visual Amenity Impacts	Negligible			
Groundwater Impacts	Negligible			
Surface Water Impacts	Negligible			
Subsidence Impacts	Negligible			
Ecological Impacts	Negligible			
Traffic / Transport Impacts	$21.4	$15.6	$12.7	$10.6
Total Costs	***$3,059.6***	***$2,215.1***	***$1,793.5***	***$1,486.3***
		Benefits		
Value of Gold Product	$3,688.5	$2,514.4	$1,939.5	$1,528.3
Benefits to Labour	$309.9	$214.9	$168.4	$135.2
Total Benefits	***$3,998.4***	***$2,729.3***	***$2,107.9***	***$1,663.5***
		Summary		
Net Present Value (NPV)	**-**	**$514.2**	**$314.4**	**$177.2**
Benefit Cost Ratio (BCR)	**-**	**1.23**	**1.18**	**1.12**

6.17.8 Sensitivity Analysis

The sensitivity analysis has been undertaken using a Monte Carlo analysis (refer to Appendix O) across the key assumptions used in the CBA modelling (the base assumptions used are outlined in section 6.17.7).

Each of the assumptions has been tested in isolation with all other inputs held constant, meaning the modelled change in NPV resulting from the variance in the base assumptions was at a discount rate of 7%. The results are summarised in Table 6.58. The final row of the table examines each assumption simultaneously to provide a "combined" or overall sensitivity of the model findings to the assumptions used. The table also outlines the distribution used allowing for a 10% confidence interval, with the "5%" and "95%" representing a 90% probability that the distribution and NPV will be within the range outlined in the table.

The table shows that, at a discount rate of 7%, there is a 90% probability the Underground Development Project will provide an NPV between -$85.7 million and $715.9 million. Sensitivity testing returned a positive NPV across 89.6% of the 5,000 iterations run in Monte Carlo analysis, with the analysis most sensitive to the value of gold product. Given gold prices used in the analysis are considerably below current gold prices the sensitivity analysis is considered likely to overstate the probability of returning a negative NPV.

Table 6.58 Sensitivity Analysis Summary at a Discount Rate of 7%

Variable	NPV ($M)	
	5%	95%
Costs		
Construction Costs	$264.5	$351.1
Operating and Closure Costs	$69.2	$559.4
Greenhouse Gas Emissions	$311.5	$317.4
Traffic / Transport Impacts	$310.2	$318.6
Benefits		
Value of Gold Product	-$4.8	$633.4
Benefits to Labour	$286.7	$342.1
Combined	**-$85.7**	**$715.9**

Notes: The percent distributions used for each variable are provided below:
- Construction costs: maximum 30% higher, minimum 20% lower.
- Operating and closure costs: normally distributed with standard deviation of 0.1.
- Cost of greenhouse gas emissions: normally distributed with standard deviation of 0.2.
- Increased cost of transport: normally distributed with standard deviation of 0.2.
- Value of gold product: normally distributed with standard deviation of 0.1.
- Benefits to labour: normally distributed with standard deviation of 0.1.

Source: AEC.

6.17.9 Mitigation measures

CGO has identified and intends to implement a range of plans and strategies to mitigate impacts. These include:

- encouraging contractors engaged to source labour locally wherever possible and provide training opportunities where appropriate to upskill the local workforce and current CGO employees working in the open-cut;
- continued support for local business by utilising established supply networks and providing sufficient opportunities and information for local business to secure new supply contracts; and
- provision of sufficient and suitable accommodation for the non-local workforce to minimise impacts on the local property market and housing affordability.

These strategies are already part of CGO's Underground Development Project planning and modelling of impacts in this report has been based on their implementation however, modelling has assumed a "worst case" scenario where the underground mining workforce is sourced from outside the Catchment and does not relocate to the Catchment during the life of the Underground Development Project.

i Mitigation Strategy 1: Support Local Employment and Training

While the economic modelling has assumed the majority of construction and mining labour will be sourced from outside the Catchment, it also reflects the different set of skills required for underground mining compared to open-cut operations. Currently, these skills not readily available locally.

To maximise local benefits derived from the Underground Development Project, CGO and its contractors will be endeavour to source labour locally where practicable and to upskill through training. CGO aims to encourage existing CGO open-cut workers to transition and relocate to the local area over time.

ii Mitigation Strategy 2: Support Local Business to Secure Supply Contracts

CGO has long-standing relationships with local businesses and an established supply chain in the region for its existing activities. To maximise local benefits derived from the Underground Development Project, CGO (and contractors engaged by the proponent) will continue to support local business by using established supply networks and providing sufficient opportunities and information to local business to secure new supply contracts where they are competitive in cost and meet the standards of service required by CGO.

iii Mitigation Strategy 3: Minimise Impacts on the Local Property Market

The Underground Development Project is likely to yield some inward migration to Bland, in particular West Wyalong, to take up jobs generated by the Underground Development Project either directly or indirectly. Without mitigation, this is expected to have a high risk of constraining supply and increasing housing rental and purchase prices. Whilst workforce accommodation strategies are being investigated, the primary option under consideration is the construction of an accommodation village in West Wyalong. Potential sites for a village are being explored. The other option being investigated is the lease/acquisition of existing commercial accommodation facilities such as motels in the local area to house the workers.

6.17.10 Summary and conclusion

The cost benefit analysis and local effects analysis both show that the Underground Development Project is expected to yield a range of economic benefits to the region, the State and to Australia. In particular:

- A NPV of $314.4 million over the assessment period with total PV benefits of approximately $2,107.9 million compared to an aggregated PV costs of approximately $1,793.5 million.
- A benefit-cost ratio of 1.18, highlighting that the Underground Development Project is estimated to return $1.18 for every dollar cost.
- Royalties to the State of $174M and taxation revenue of $556M.

The Underground Development Project will result in an additional 290 FTE jobs during the peak construction phase of 2022 to 2023. From 2023 to 2028, an additional 270 FTE jobs will result from the Underground Development Project. A large proportion of the construction and initial operational workforce will be FIFO or DIDO for the Underground Development Project, and Evolution will implement strategies over time to integrate the workforce into the regional community.

Mitigation measures to offset adverse economic effects include:

- encouraging contractors to source labour locally wherever possible and provide training to upskill the local workforce and existing CGO open-cut employees;

- continued support for local business by using established supply networks and providing sufficient opportunities and information for local business to secure new supply contracts; and
- provision of sufficient and suitable accommodation for the non-local workforce to minimise impacts on the local property market and housing affordability.



Chapter 7 Conclusion

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7 Evaluation of merits

7.1 Modification impacts

This modification report has examined the potential impacts that may result from the construction and operation of additional infrastructure and a change to the IWL at CGO. The assessment of impacts has been multi-disciplinary (refer section 6) and followed consultation with DPIE and other key stakeholders (refer section 5).

This report has shown that Mod 16 will not result in significant environmental, social, cultural heritage or economic impacts over those already assessed and approved at site. It has also identified that unavoidable and minor residual impacts can be appropriately managed through under existing regulatory frameworks including the conditions of consent in DA14/98, Environmental Protection Licence 11912 and Mining Lease 1535.

7.2 Modification benefits

As described in section 1.5, Mod 16 has been subject to a range of specialist studies to ensure the underground development has the necessary ancillary infrastructure and can operate safely, efficiently and with minimal adverse impacts. It allows Evolution to maintain continuity of ore and gold production up to 2040. It will also create temporary construction jobs and the continuity of employment and job security for the existing workforce and local contractors.

When considered in conjunction with the underground development project that it supports, Mod 16 is anticipated to contribute in net production benefits to the local and regional economies (over and above the economic benefits of the approved CGO), expenditure by Evolution and the workforce on goods and services, royalty and tax revenue to the NSW Government (around $179 million) and the Commonwealth (around $556 million).

Mod 16 will assist in bringing significant economic benefits to NSW of $314.4M (net present value at 7% discount rate) which will accrue from the development of the underground mine. In turn, this will facilitate and support a direct additional employment for an average of around 160 people during the operation of the underground mine. The underground development project, which is not separable from Mod 16, is estimated to support an additional $38.9 million in GRP per annum in the region during construction, and $106.3 million GRP per annum in the region during operations. At its peak, the underground development is estimated to result in an average annual increase in GRP of 5.0% compared to that expected to occur without it (2024-25 to 2031-32).

7.3 Ecologically sustainable development

Under Section 516A of the EPBC Act, Commonwealth organisations have a statutory requirement to report on environmental performance and how they accord with, and advance, the principles of Ecologically Sustainable Development (ESD).

Australia's *National Strategy for Ecologically Sustainable Development* (AGESDSC 1992), defines ESD as "using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased". The principles of ESD, for the purposes of the EP&A Act, are provided in Clause 7(4) of Schedule 2 of the EP&A Regulation. The four principles of ESD are:

- precautionary principle – the precautionary principle states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;

- inter-generational equity – the principle of inter-generational equity is that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;

- conservation of biological diversity and maintenance of ecological integrity – the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; and

- improved valuation and pricing of environmental resources – improved valuation, pricing and incentive mechanisms should be promoted.

An assessment of the overall Project against the principles of ESD is provided below.

The overall objectives of ESD are to use, conserve and enhance natural resources. This ensures that ecological processes are maintained, facilitating improved quality of life, now and into the future. Evolution is committed to the principles of ESD and understands that biophysical, social and economic objectives are interdependent. Evolution acknowledges that a well-designed and effectively managed operation will avoid significant and/or

costly environmental impacts or degradation.

7.3.1 Precautionary principle

The development of the current configuration of Mod 16 was based on multiple design iterations through the pre-feasibility assessment and feasibility assessment, to arrive at a design which avoids impacts or, if unavoidable, minimises them to acceptable levels. Importantly, the principle of avoidance has been adopted wherever possible.

Mod 16 is designed to be wholly within the existing disturbed areas of CGO, which ensures that any unavoidable impacts will be managed within existing environmental management systems. The additional 1 metre height increase of the IWL takes into consideration the potential visual impact from viewpoints outside the mine. The additional waste rock that will need to be managed will be emplaced in existing areas approved for that purpose and within exiting approved limits.

Additional infrastructure necessary to be constructed to facilitate the processing of ore and tailings management at CGO, including the ore receival hopper and conveyor, the elution circuit and tailings deslimer. These components will be managed within the existing strict management protocols and in accordance with the standards set by the conditions of consent.

Unavoidable impacts to surrounding residential receptors or the physical environment will meet applicable regulatory criteria and mitigation measures will be implemented to further ameliorate these impacts.

Further, in relation to uncertainty, the technical assessments prepared in support of this modification report have been prepared by suitably qualified and experienced technical experts in each relevant field, some considered to be pre-eminent industry experts. The engagement of suitably qualified and experienced consultants has ensured that the planning, design and environmental assessment phases have been transparent. The contents of this modification report has enabled the potential implications of Mod 16 to be fully understood, and the management strategies, mitigation measures and monitoring activities required to be appropriately developed.

Mod 16 therefore addresses the precautionary principle because there will be no serious or irreversible environmental damage, and the management strategies that will continue to be implemented on site will ensure that this remains the case throughout the life of the modified project.

7.3.2 Inter-generational equity

The primary land use surrounding CGO is cattle grazing and cropping. This land use will not be impacted by Mod 16, as it will be located wholly within the existing disturbance area of CGO. This also ensures natural resources are not impacted by the Project, as no vegetation clearing is required. The site will be progressively rehabilitated to a range of final landforms, ranging from grassland/scattered Eucalypt woodland, Eucalypt woodland or riverine woodland/freshwater communities. Dedicated rehabilitation areas will be fenced from areas suitable for agriculture production.

The processing of additional ore will require additional water usage for operation of the processing plant and for construction requirements and haul road dust suppression for a longer period. This may increase the reliance on external water sources including from the ESB and BCPB in the early years of the underground development project, as there will be concurrent processing of ore from the open-cut pit and the underground mine. However, the approved sources of water will not change, and water extractions will be within limits allowed under the mine's Water Access Licences.

Effects on groundwater from Mod 16 will be small to negligible, as groundwater drawdown will be mostly contained within the mining leases and predicted groundwater inflows will not impact the surface water of Lake Cowal.

A natural resource that will be extracted is the gold ore. About 27 million tonnes of additional ore will be processed on-site to produce around 1.8 million ounces of gold. Gold is a recyclable metal that can be reused for generations, meaning there will be no disadvantage to future generations from the loss of valuable materials. Further, the revenue generated by the Project will be used to employ and up-skill the additional workforce required to support the Project and this will have benefits for future generations, including local and regional communities that currently support the CGO.

7.3.3 Conservation of biological diversity and maintenance of ecological integrity

Mod 16 will not result in new surface disturbance or vegetation clearing. Additionally, no surface water or groundwater impacts are predicted to occur as a result of the Project, therefore further preserving the biodiversity values of Lake Cowal and any potential GDEs.

7.3.4 Improved valuation and pricing of environmental resources

Economic benefits of the Project have been considered cumulatively with the underground development, as the underground development cannot operate in isolation without associated surface changes.

The principle of improved valuation and pricing of environmental resources is based on environmental factors being included in the valuation of assets and services. The cost associated with causing an impact on the environment or an environmental resource is seen as a cost incurred for the use of that resource.

Section 6.17 provides estimates of the monetary value of all material costs and benefits associated with Mod 16 combined with the underground development project. It includes estimates of the value of intangible (or non-traded) factors, such as noise and visual amenity impacts. The costs and benefits have been compared transparently to provide an estimate of the Project's net benefit. The result is a reliable estimate of the economic value of the Project that provides useful guidance to decision-makers and other interested parties about its overall merit.

7.4 Conclusion

Evolution owns and operates the open-cut gold mine known as the CGO near West Wyalong, in the central west region of New South Wales. Evolution is seeking approval to construct and operate an underground mine at CGO, the CGO Underground Development Project, to gain access to a deeper orebody containing approximately 1.8 Moz of gold.

The underground mine will require new mine infrastructure to be developed to allow the ore extracted from underground to be handled and processed, and an augmentation of the existing IWL to emplace the tailings that will be produced when the ore is processed.

These changes are being sought under a modification to the existing development consent (Mod 16) under Section 4.55(2) of the EP&A Act 1979. This report fully describes the changes and how the environmental impact of their construction and operation will be avoided, managed and mitigated.

Mod 16 also seeks to extend the life of the mine by 8 years – from 2032 to 2040 – to allow the processing of ore to continue throughout the life of the underground mine.

These changes will not change the key operating functions of the existing mine, which will remain substantially the same as it was when it was first approved.

The potential impacts of Mod 16 have been comprehensively assessed in accordance with relevant legislation, policies and guidelines. The assessment shows that the modification will be able to be constructed and operated in a manner where resulting impacts can be managed in accordance with existing site systems and under the strict management plans approved by the NSW Government.

Mod 16 will be wholly located within the existing disturbance area of CGO and therefore, avoids impacts to the biophysical environment. It will be constructed and operated to meet the strict standards and limits already in place at the mine. While there are some minor and unavoidable impacts to surrounding residential receptors, Mod 16 is necessary to ensure the underground development project has the necessary ancillary infrastructure to allow the full functionality of the ore processing system in the production of gold can operate safely and efficiently and gold production can continue. Minor and unavoidable impacts will be further ameliorated by mitigation measures implemented in the construction and operational phases.

Mod 16 is consistent with the relevant objects of the EP&A Act, including the principles of ESD, as described above. It will facilitate significant ongoing economic investment and employment benefits both locally and regionally. All aspects relating to environmental management will continue in accordance with existing approved management plans and the environmental management strategy approved for CGO.



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Abbreviations

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Abbreviations

µS/cm	microsiemens per centimetre
ABCC	Acid buffering characteristic curve
ABN	Australian Business Number
ACN	Australian Company Number
AEC	AEC Group Pty Ltd
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal heritage impact permit
AMD	Acid and metalliferous drainage
ANC	Acid neutralising capacity
ASX	Australian Stock Exchange
AQIA	Air quality impact assessment
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Calculator
BAR	Basic right
BC Act	NSW *Biodiversity Conservation Act 2016*
BCD	Biodiversity and Conservation Division
BCPB	Bland Creek Palaeochannel Borefield
BCR	Benefit-cost ratio
BDAR	Biodiversity development assessment report
Bland LEP	Bland Local Environmental Plan 2011
BSC	Bland Shire Council
BMP	Blast Management Plan
BoM	Bureau of Meteorology
BQL	Back of queue length
CEMCC	Community Environmental Management Consultative Committee
CGE	Computable General Equilibrium

CGO	Cowal Gold Operations
CHL	Commonwealth Heritage List
CIL	Carbon-in-leach
CMP	Cyanide Management Plan
CN	Cyanide
CN_{WAD}	Weak acid dissociable cyanide
DA	Development approval
DAWE	Commonwealth Department of Agriculture, Water and the Environment
db	Decibels
DDGs	Dust deposition gauges
DEL	Delay per second
DoI	Department of Industry
DOS	Degree of saturation
DPE	NSW Department of Planning and Environment
DPIE	Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EC	Electrical conductivity
Ecologically Sustainable Development	ESD
EMM	EMM Consulting Pty Limited
EIS	Environmental Impact Statement
Elton	Elton Consulting
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESCMP	Erosion and Sediment Control Management Plan
ESB	Eastern Saline Borefield
ETL	Electricity transmission line
EPA	NSW Environment Protection Authority
EPL	Environmental Protection Licence
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW Environmental Planning and Assessment Regulation 2000

Evolution	Evolution Mining (Cowal) Pty Limited
FFMP	Flora and Fauna Management Plan
FHA	Fire Hazard Analysis
FIFO	Fly-in-fly-out
FTE	Full time equivalent
g/t	Grams per tonne
GEM	Geo-Environmental Management Pty Ltd
GHG	Greenhouse gas
GRP	Gross Regional Product
GVA	Gross Value Added
Ha	Hectares
HAZOP study	Hazards and Operability Study
HEC	Hydro Engineering & Consulting Pty Ltd
HCN	Hydrogen cyanide
HEC	Hydro Engineering & Consulting Pty Ltd
HIPAPs	Hazardous Industry Planning Advisory Papers
HMP	Heritage Management Plan
HVAS	High Volume Air Sampler
HWCMP	Hazardous Waste and Chemical Management Plan
IACHMP	Indigenous Archaeology and Cultural Heritage Management Plan
ICDS	Internal Catchment Drainage System
ICNG	*Interim Construction Noise Guideline*
ILUAs	Indigenous Land Use Agreements
INP	*NSW Industrial Noise Policy*
IWL	Integrated Waste Landform
JLWMPSPC	Jemalong Land and Water Management Plan Steering Plan Committee
JORC	Joint Ore Reserves Committee
Km	Kilometres
Kg	Kilograms

kL	Kilolitres
kV	kilovolt
LALC	Local Aboriginal Land Council
LEA	Local effects analysis
LEP	Local environmental plan
LOS	Level of Service
LPB	Lake protection bund
MCC Handbook	*The Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry*
Mg/l	Milligrams per litre
MIC	Maximum instantaneous charge
ML	Mining leases
Mining SEPP	*State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*
mm	Millimetres
MNES	Matters of national environmental significance
Mod 16	Modification 16 of DA 14/98
Mt	Million tonnes
Mtpa	Million tonnes per annum
MOP	Mining Operations Plan
MOP guidelines	The *ESG3 – Mining Operations Plan (MOP) Guidelines*
Moz	Million ounces
MR Handbook	*The Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry*
NAF	Non-acid forming
NAG	Net acid generation
NGAF	National Greenhouse Accounts Factors
NHL	National Heritage List
NMP	Noise Management Plan
NNTT	National Native Title Tribunal
NTSF	Northern Tailings Storage Facility

NPfI	*Noise Policy for Industry*
NPV	Net Present Value
NSW	New South Wales
NT	National Trust of Australia
NVIA	Noise and vibration impact assessment
OEH	Office of Environment and Heritage
Oz	Ounces
PAF	Potentially acid forming
PAX	Potassium amyl xanthate
PCTs	Plant community types
PHA	Preliminary Hazards Analysis
$PM_{2.5}$	Particulate matter less than 2.5 µm in aerodynamic diameter
PM_{10}	Particulate matter less than 10 micrometres (µm) in aerodynamic diameter
PNTLs	Project noise trigger levels
PO	Post Offices
POEO Act	NSW *Protection of the Environment Operations Act 1997*
POEO Regulation	Protection of the Environment Operations (Clean Air) Regulation 2010
PRP	Pollution reduction programmes
PVC	Primary view catchment
Qld	Queensland
RAPs	Registered Aboriginal Parties
RBL	Rating background level
RFS	NSW Rural Fire Service
RO	Reverse osmosis
ROM	Run-of-mine
RMR Plan	Riverina Murray Regional Plan 2036
RNE	Register of the National Estate
RNP	*NSW Road Noise Policy*
SDS	Safety Data Sheets

SEPPs	State environmental planning policies
SEPP 33	*State Environmental Planning Policy No 33 – Hazardous and Offensive Development*
SHI	State Heritage Inventory
SHR	State Heritage Register
SIMP	Social impact management plan
SFMC	The *Strategic Framework for Mine Closure*
SIA	Social Impact Assessment
SIA guidelines	*Social Impact Assessment Guidelines for State Significant Mining, Petroleum and Industry Development*
SRLUP	Strategic Regional Land Use Policy
SSD	State significant development
STSF	Southern Tailings Storage Facility
SWGMBMP	Surface Water, Groundwater, Meteorological and Biological Monitoring Programme
TECs	Threatened ecological communities
TDS	Total dissolved solids
TIA	Traffic impact assessment
TMP	Transport Management Plan
TSF	Tailings storage facilities
TSR	Travelling stock route
TSP	Total suspended particles
UCDS	Up-Catchment Diversion System
VLAMP	Voluntary Land Acquisition and Mitigation Policy
VIA	Visual impact assessment
VIS	Vegetation information system
WA	Western Australia
WAD	Weak acid dissociable
WAL	Water access licence
WARR Act	*Waste Avoidance and Resource Recovery Act* 2001
Waste Classification Guidelines	*Waste Classification Guidelines*



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