

Cowal Gold Operations Underground Development
Environmental Impact Statement

MAIN REPORT

Prepared for Evolution Mining (Cowal) Pty Limited
October 2020

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MINING

Declaration

For submission of an environmental impact statement (EIS) under Part 4 of the NSW Environmental Planning and Assessment Act 1979.

EIS prepared by

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Applicant

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Description of development

Cowal Gold Operations Underground Development Project
Refer to Chapter 3 of this EIS for a description of the proposed development

Land to be developed

Refer to Figure 1.3 of the EIS for a map of the Project area. The land to which to the development applies is listed in Chapter 4 of this EIS.

Declaration

We confirm that we have prepared this EIS in accordance with the Environmental Assessment Requirements issued for the Cowal Gold Operations Underground Development Project and that the:

- EIS has been prepared in accordance with Schedule 2 of the EP&A Regulation 2000;
- EIS contains all available information that is relevant to the environmental assessment of the proposed development; and
- Information in the EIS is neither false or misleading.

Paul Freeman
Associate Director
14 October 2020

Robert Morris
Associate Director
14 October 2020

Cowal Gold Operations Underground Development

Environmental Impact Statement

Report Number

J190140 RP10

Client

Evolution Mining (Cowal) Pty Limited

Date

14 October 2020

Version

v2 Final

Prepared by

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14 October 2020

Approved by

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Associate Director
14 October 2020

Executive Summary

ES1 Introduction

Evolution Mining (Cowal) Pty Limited (Evolution) is seeking development consent for the construction and operation of an underground mine (the Project) at Cowal Gold Operations (CGO) in the Central West Region of New South Wales (NSW).

CGO is an existing open-cut gold mine targeting the E42 mineral deposit. It has been operating since 2005 under the authority of Ministerial Development Consent DA 14/98. It also operates under the authority of mining lease (ML) 1535 and ML 1791. Under its development consent, Evolution is approved to mine up to approximately 167 million tonnes (Mt) of ore over a 28-year mine life span. It is also approved to process the ore at an on-site processing plant at a rate of up to 9.8 million tonnes per annum (Mtpa).

CGO is owned and operated by Evolution Mining Limited, which is a publicly listed company on the Australian Stock Exchange (ASX:EVN). Evolution Mining Limited operates five wholly-owned mines, with four mines in Australia and one mine in Canada, and has an economic interest in one additional mine in Australia that is operated by a Joint Venture partner.

The Project will provide access to up to an additional 27 Mt of ore, by targeting the GRE46 mineral deposit, which will be extracted at a rate of up to 1.8 Mtpa until 2039. It is expected that around 1.8 million ounces of gold will be produced over the life of the Project.

To facilitate the Project, two separate consents are required under the *Environmental Planning and Assessment Act 1979* (EP&A Act):

- a State significant development (SSD) application under section 4.38(2) of the EP&A Act for the new **underground** components, as described in the Environmental Impact Statement (EIS) (this document); and
- an application for modification of DA 14/98 under section 4.55(2) of the EP&A Act for the ancillary **surface** facilities required to support the Project, referred to as Mod 16 and considered in a separate Modification Report.

Evolution is also considering a range of options to accommodate and support the required construction and operational workforces for the Project. Its preferred option is the development of a purpose-built accommodation village in West Wyalong which, if selected, would require a separate development application to Bland Shire Council under Part 4 of the EP&A Act.

The purpose of this EIS is to inform government authorities and other stakeholders about the Project and the measures that will be implemented to minimise, mitigate, manage and monitor potential impacts, together with a description of the residual social, economic and environmental impacts. This EIS addresses the specific requirements provided in the Department of Planning, Industry and Environment (DPIE) Secretary's Environmental Assessment Requirements (SEARs), which were first issued on 27 September 2019 and re-issued on 26 August 2020.

ES2 Project area

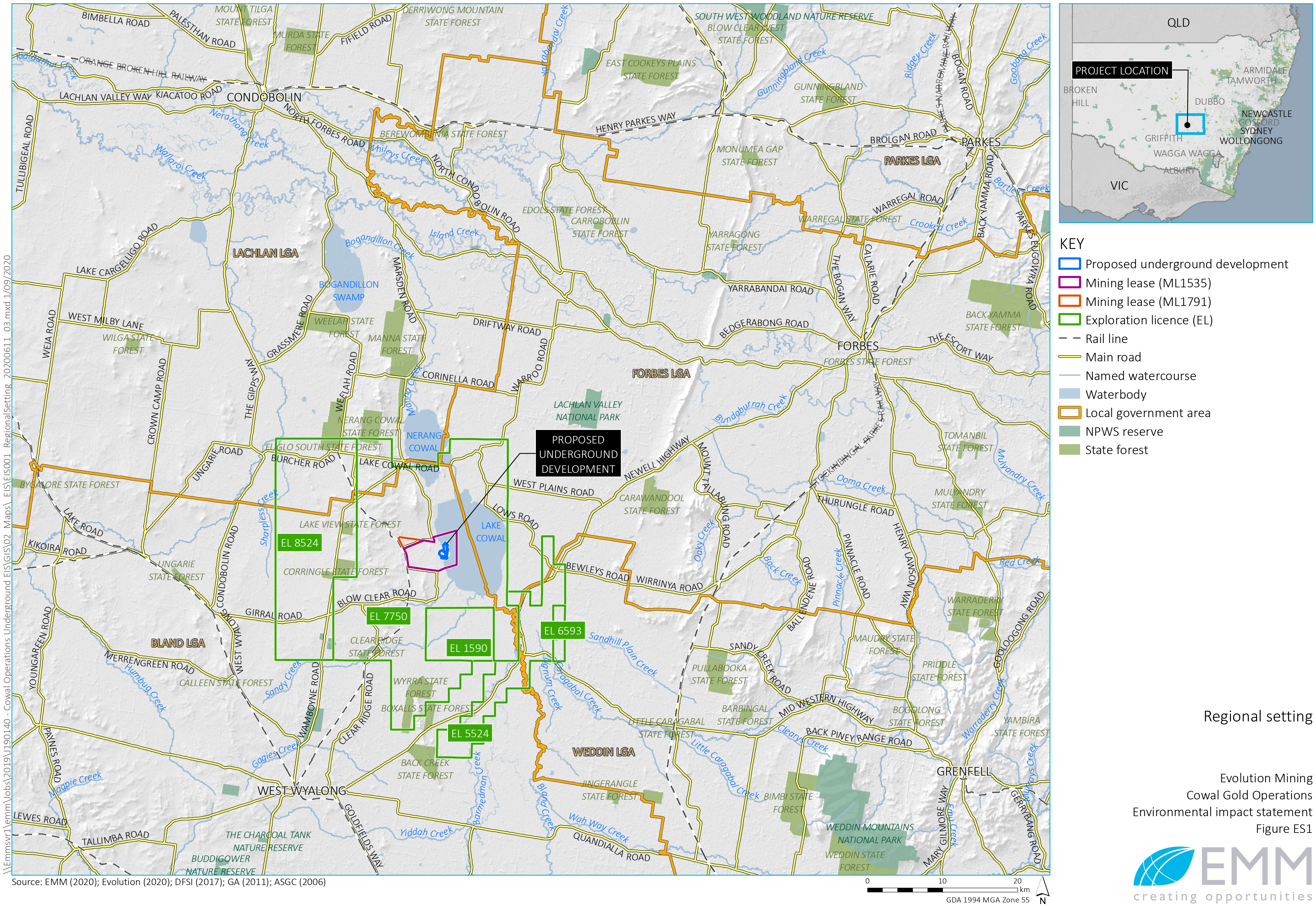
The Project is in the Central West Region of NSW, approximately 38 kilometres (km) north-east of West Wyalong, 60 km south-west of Forbes and 350 km west of Sydney (refer Figure ES1 and Figure ES2).

CGO is in the Bland Shire local government area (LGA) and the site is wholly zoned RU1 Primary Production under the *Bland Shire Local Environmental Plan 2011*. Land adjacent to CGO is used primarily for pastoral activities, including cropping and grazing, which is typical of the broader Bland Shire region. There are eight private residences within a 5 km radius of CGO. The closest private residence is approximately 2 km west of the site.

There are a number of state forests which surround CGO, the closest being the Lake View State Forest and Corringle State Forest which are 7 km north-east and east respectively. Other state forests in proximity to CGO include the state forests Euglo South, Nerang Cowal, Clear Ridge, Wyrra, Boxhall, Back Creek, Little Blow Clear, Blow Clear and Hiawatha. Evolution also manages six biodiversity offset areas which are located within a 5 km radius of CGO, covering a total area of 486.5 hectares (ha).

The Project is located on the three land parcels owned by Evolution (Lot 23 DP753097, Lot 24 DP753097 and Lot 2 DP530299) and two land parcels held by the Crown (Lot 7001 DP1029713 and Lot 7303 DP1143731).

The Project will extend north from the existing open-cut pit within the existing ML 1535 and will be partially located below the western shoreline of Lake Cowal. Lake Cowal is a shallow, freshwater, ephemeral lake which is located in the alluvial fan of the Lachlan River, known as the Jemalong Plains. The lake is a nationally important wetland and waterbird breeding habitat, however when dry, the lake is used for agricultural purposes.



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

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Regional setting

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure ES1

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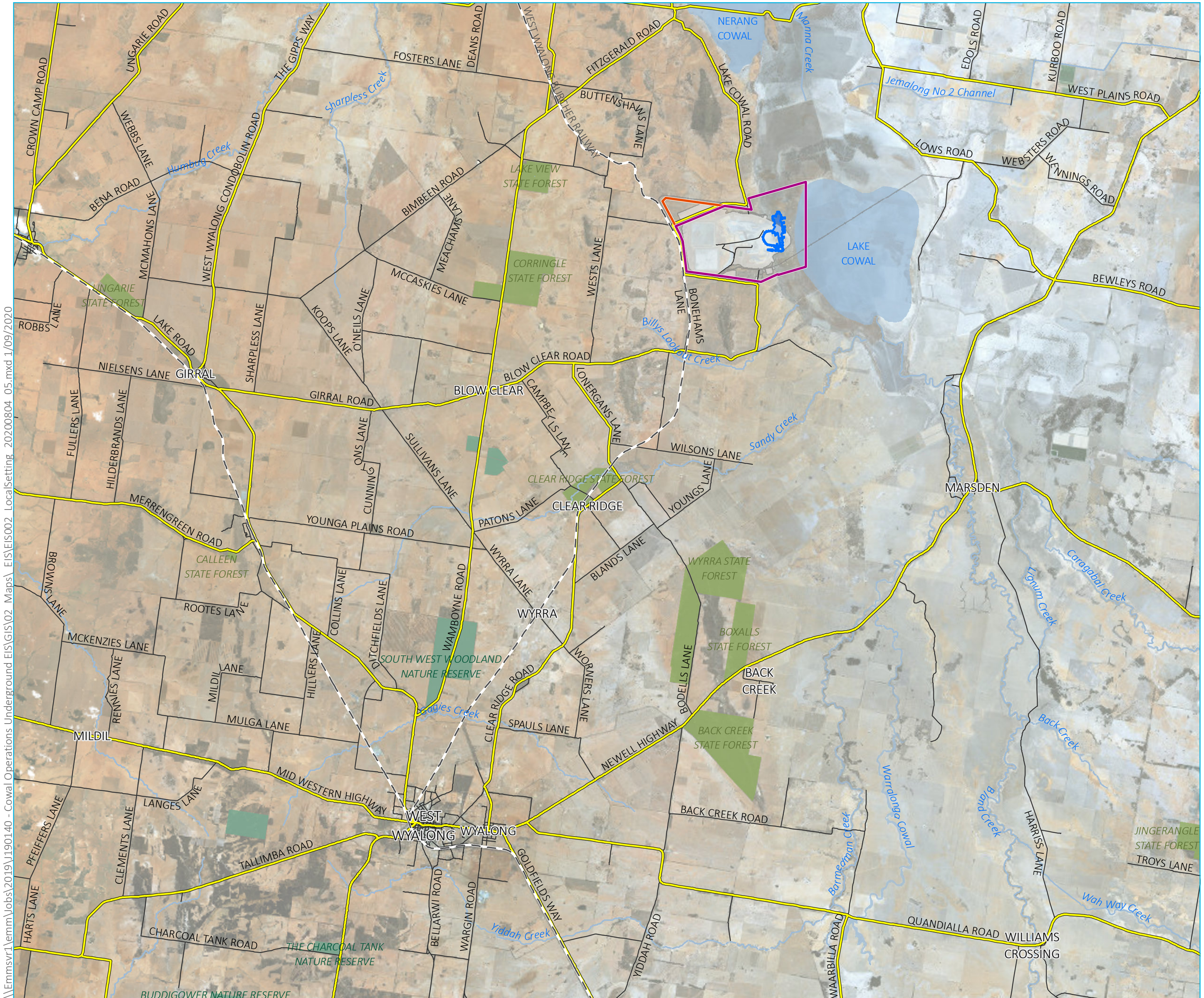

KEY
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Approved surface disturbance
- Rail line
- Main road
- Minor road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

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

Local setting

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure ES2

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ES3 Project overview

The Project is classified as a SSD pursuant to Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP). Evolution is seeking SSD consent under section 4.38(2) of the EP&A Act to develop and operate the Project.

The design of the Project represents the current optimised conceptual configuration. This design has been developed by Evolution in a collaborative, multi-disciplinary and iterative process through the completion of various design phases.

The Project comprises the following key components:

- Excavation of two declines to provide underground access and ventilation: one decline via a portal on the existing open-cut pit and the other via a box-cut. The declines will be approximately 6 metres (m) wide by 6m high and will extend approximately 1.5 km to the point at which the first production drive commences. The final depth of the underground mine will be approximately -850 m Australian Height Datum (AHD) or approximately 1,050 m below ground surface.

- Development of a box-cut entry adjacent to the open-cut pit, which will be the main access for personnel and materials to the underground mine and will be used to transport ore to the surface for processing.

- Development of stopes via conventional and mechanised drill and blast techniques.

- Production of ore via mechanised long hole open stoping with paste backfill.

- Load-Haul-Dump (LHD) vehicles used to remove rock from development and production areas and loading into diesel trucks for transport to the surface.

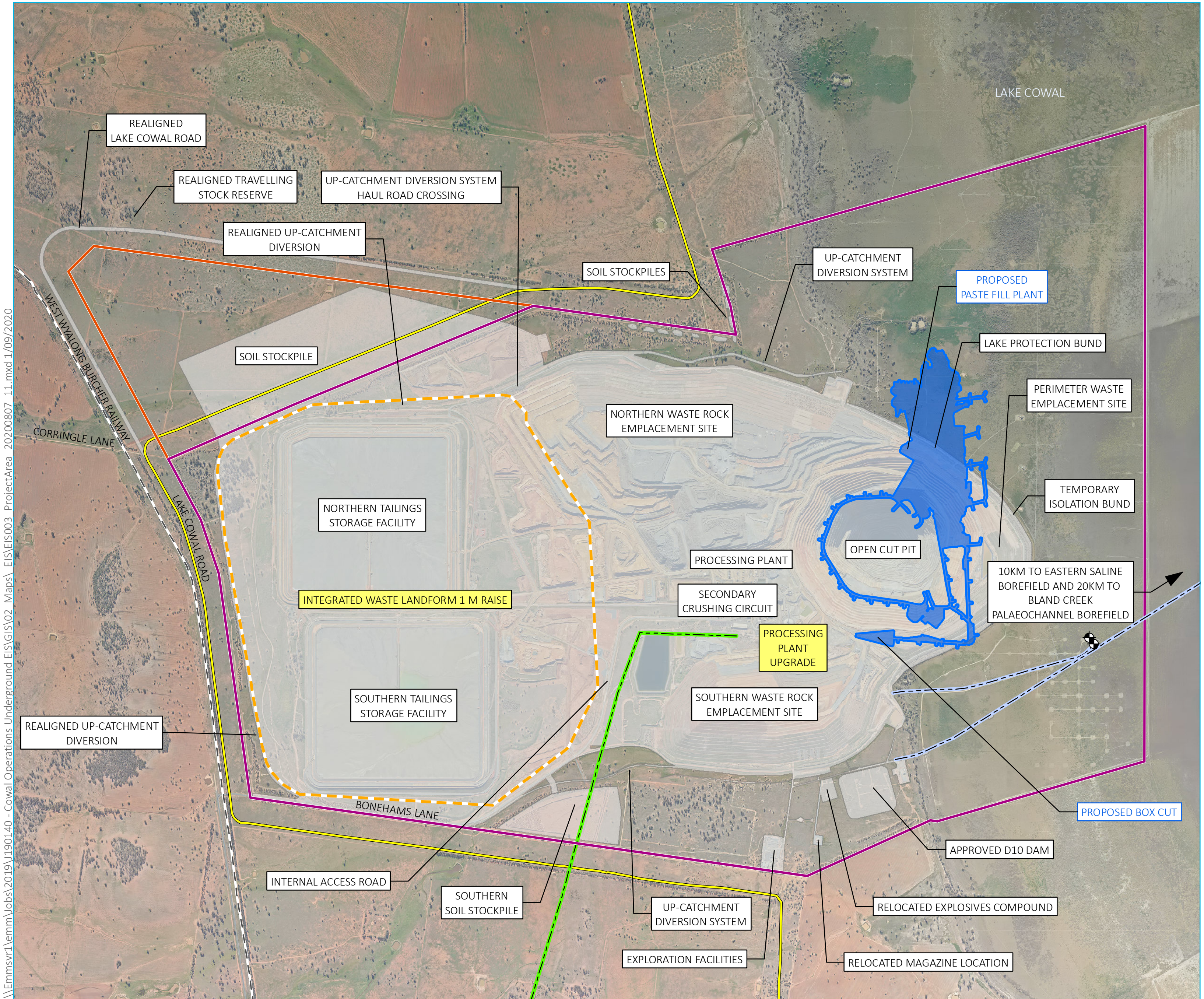
- Development of a paste fill plant, and backfilling excavated stopes with cemented paste fill made from cement and tailings.

- Installation of services, including power, water and communications, which will be distributed underground to serve the workings. An underground workshop area will provide facilities including wash bay, heavy vehicle service area, ablutions, crib room and office.

The Project layout is shown on Figure ES3.

Ore extraction from the Project will take place using sub-level open stoping (SLOS). This mining method will involve developing stopes from the top down, starting from a depth of approximately -80 m AHD and progressively excavating more than 1,000 stopes to a final depth of approximately -850 m AHD over the life of the Project. Following ore extraction, open stopes will be backfilled using cemented paste made at the proposed paste fill plant.

A peak construction workforce of up to approximately 160 full time equivalent (FTE) employees and contractors is currently anticipated for the development of the Project, including modifications to ancillary surface infrastructure. The operational workforce for the Project is estimated to be up to approximately 230 FTE additional employees.



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

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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

Project area

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure ES3

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ES4 Impact assessment

Numerous comprehensive technical assessments have been undertaken to assess all potential environmental and social impacts associated with the Project. The assessments have also identified suitable mitigation measures to avoid or mitigate those impacts.

The findings of the detailed technical assessments are summarised in the body of this EIS and are provided in full in the appendices. The following sub-sections provide an overview of the main findings; however, to gain a proper understanding of the Project and identified impacts, the detailed assessments should be read in their entirety.

ES4.1 Air quality

A network of 12 dust deposition gauges and one high volume air sampler, which measures total suspended particles (TSP), has been established by Evolution at CGO. A meteorological station is also located on-site at CGO.

An air quality impact assessment (AQIA) was completed by EMM for the Project to cumulatively assess both the SSD Project and surface changes proposed under Mod 16.

Atmospheric dispersion modelling was completed to assess the impact of particulate matter emissions resulting from the Project on nearby residential receptors. The results of this modelling show that over the life of the Project, the predicted concentrations and deposition rates of particulate matter, including TSP, particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM_{10}), particulate matter less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$) and dust, will remain well below the applicable impact assessment criteria for all residential receptors.

An assessment of cumulative impacts was also undertaken by combining modelled emissions of the Project with existing emissions of the open-cut mining at CGO and with background levels. This assessment shows that air quality impacts will lessen in the longer term as CGO transitions from open-cut mining only to include underground mining.

The air quality management and mitigation measures contained within the existing Air Quality Management Plan (AQMP) will be applied to the Project.

ES4.2 Noise, vibration and blasting

EMM's noise and vibration impact assessment (NVIA) cumulatively assessed both the Project and surface changes proposed under Mod 16.

The assessment predicted that even under worst-case noise-enhancing meteorological conditions, future construction and operational noise levels will remain below the existing development consent limits for day, evening and night periods. The sleep disturbance assessment demonstrates that night-time maximum $L_{Aeq,15min}$ (the continuous sound pressure level measured over a 15 minute period) and L_{Amax} (the maximum sound pressure level received during a measuring interval) noise levels are predicted to satisfy the relevant screening criteria at all residential receptors. Road traffic noise associated with the Project will remain within the criteria of the *NSW Road Noise Policy* (EPA 2011).

The existing Noise Management Plan (NMP) for CGO will be applied to the Project.

ES4.3 Subsidence

A subsidence assessment was completed for the Project by Beck Engineering Pty Ltd (Beck) to assess the potential for ground movement associated with the proposed underground mine, based upon three-dimensional numerical modelling of the SLOS mine method over the life of the Project.

The mine design has been progressively developed due to the initial findings of the subsidence assessment report. This included the removal of 19 stopes from the mine plan, which were located close to lower strength rock layers and were considered to have an elevated risk of failure (ie chimneying from the mine to the surface). Progressive development of the mine plan has also included the implementation of a minimum stope width to crown pillar thickness ratio of 1:2 and relocation of crown pillars to more stable fresh rock rather than within less stable oxide layers.

The subsidence assessment predicts vertical subsidence of less than 15 millimetres (mm) and uplift of around 25 mm. These subsidence and upsidence levels are negligible and are within the natural variation of soils shrinking and swelling due to moisture.

Underground mining is unlikely to impact the hydrological processes of Lake Cowal, as the Lake is hydraulically separated from the groundwater system. Displacement of the underground mine in proximity to the open-cut pit is expected to occur inwards and upwards due to excavation of rock from the open-cut pit. This is a very low and negligible interaction between the open-cut pit and underground mining.

Monitoring for subsidence and in situ stress measuring will be carried out, particularly when the upper-most stopes are being developed. Stope failure to surface (chimneying) is a risk at all stope mines and will be considered very carefully as the mine proceeds into detailed design. A comprehensive range of mitigation measures is proposed to be implemented to prevent stope overbreak and chimney failure.

ES4.4 Groundwater

A groundwater assessment was completed for the Project by Coffey Services Australia Pty Ltd (Coffey) using predictive numerical modelling based upon an existing numerical groundwater flow model.

Regionally, groundwater resources are present in the Bland Creek Palaeochannel and include the Cowra and Lachlan Formations. Locally, the groundwater system consists of four key hydrological units, including the Transported, Saprolite, Saprock and Primary units.

During underground mining, impacts to groundwater levels will be minor. Groundwater drawdown resulting from stopes, access tunnels and the existing open-cut pit will be mostly contained with ML 1535 and ML 1791, apart from small areas to the north and south where the 1 m drawdown contour is marginally outside of ML 1535. No external water bores or users will be affected by the drawdown.

Post mining, groundwater will continue to flow into the open-cut pit and gradually increase its water level. There is predicted to be a slight recovery in groundwater heads around the open-cut pit in the Transported, Saprolite and Saprock units of around 5 m between 2038 and 2058 and then a negligible change between 2058 and 2138. Combined groundwater inflows into the proposed stopes and access tunnels are predicted to range from approximately 1 ML/day in 2020 to 2.8 ML/day between 2031 and 2038 and inflow to the open-cut pit is predicted to fall from 1 ML /day in 2020 to 0.5 ML /day between 2031 and 2038.

A key consideration of the groundwater assessment has been the potential for the underground mine to affect Lake Cowal. Lake Cowal is a surface water fed water body, originating from Bland Creek and occasional flooding of the Lachlan River. It is separated from the proposed underground development by a 120 m combined thickness of lake sediments and extremely weathered to fresh rock, with vertical permeabilities of less than 1 x 10^{-3} m^3/day. As a result of the low vertical permeabilities, the majority of groundwater inflow (up to 1.8 ML/day) will be from deep groundwater originating in the rock surrounding the underground development and not from Lake Cowal.

When Lake Cowal is full it occupies an area of 13,000 hectares and would thus lose on average 200,000 ML/day to evaporation (assuming 1.5 m net pan evaporation). This means that the average rate of evaporation from the surface of Lake Cowal is approximately 100,000 times the predicted maximum rate of groundwater inflow to the whole underground development. As such, the impact of mine groundwater inflow on the water levels of Lake Cowal is considered to be negligible.

ES4.5 Surface water

The surface water assessment for the Project was prepared by Hydro Engineering & Consulting Pty Ltd (HEC).

The Project will not materially affect the operation of CGO's surface water management system, which includes an internal catchment drainage system (ICDS), up-catchment diversion system (UCDS) and the on-site lake protection bund to protect Lake Cowal from CGO's mining activities, and the mine from flooding from Lake Cowal.

The Project will also not affect the way water is sourced on-site and from external sources, which involves:

- capture and re-use of mine process water;
- capture and re-use of runoff from areas within the ICDS;
- using groundwater inflows to the open-cut pit;
- sourcing groundwater from supply bores within ML 1535;
- operating the Eastern Saline Borefield, located approximately 10 km east of Lake Cowal's eastern shoreline;
- extracting water under licence from the Bland Creek Palaeochannel Borefield, which is located approximately 20 km to the east-northeast of the CGO site;
- extracting from saline groundwater supply bores, located approximately 1 km south-east of the open-cut pit within ML 1535; and
- sourcing water accessed from the Lachlan River, which is supplied via a pipeline from the Jemalong Irrigation Channel.

The existing water management system will not be impacted by the construction of the box-cut, which will be integrated into the existing ICDS. The paste fill plant will require water usage in the order of 1.2 ML/day which will be sourced from internal sources. Water will also be required for dust suppression and ventilation requirements, in the order of approximately 2.5 ML/day, also from internal sources. These water demands are minor in the context of the total volume of water used on site.

The proposed surface infrastructure changes associated with the Project are to be contained within the current approved disturbance area. Therefore, no impacts to inflows or water quality to Lake Cowal will occur as a result of the Project.

The existing Water Management Plan for CGO, which includes a detailed surface water monitoring program, will continue to be implemented through the construction and operation of the Project.

ES4.6 Biodiversity

EMM prepared a biodiversity development assessment report (BDAR) which shows that impacts to biodiversity values would not be significant. The BDAR included review of multiple databases and past ecological reports to provide context of the flora and fauna species, populations, communities and habitats in proximity to the Project including:

- previous ecological reports relating to CGO and Lake Cowal;
- BioNet Atlas of NSW Wildlife for previous threatened species records; and
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) likely to occur within the Project area.

The Project will be wholly underground and therefore will have negligible surface impacts outside of the existing and approved disturbance area of CGO. The Project will have no impact on habitats of threatened species or interfere with habitat connectivity. Considering that no surface water or groundwater impacts are predicted to occur as a result of the Project, the biodiversity values of Lake Cowal will also not be affected.

There are no priority groundwater dependent ecosystems (GDE) located within 5 km of the Project area, including those listed on the NSW Murray-Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan or Upper Lachlan Alluvial Groundwater Source Water Sharing Plans. Several GDEs with varied degrees of potential listed on the Bureau of Meteorology (BoM) Atlas of Groundwater Dependent Ecosystems are located within proximity to the Project area. On examination, none of these habitats were considered to be supported by groundwater and the Project is not predicted to affect groundwater in these areas.

The impact of stope failure (chimneying) could lead to serious or irreversible impacts to Lake Cowal's hydrological processes, impacting the Lake's biodiversity values or threatened ecological communities. As described above, subsidence at surface from underground mining will be less than 15 mm and uplift is expected to be less than 25 mm. Considering specific mitigation measures will be implemented during development, in addition to the iterative Project design in response to the Project's subsidence assessment, stope failure is extremely unlikely to occur.

ES4.7 Aboriginal heritage

CGO operates within Aboriginal Heritage Information Permit (AHIP) Consent 1467/Permit 1468 and the Indigenous Archaeology and Cultural Heritage Management Plan (IACHMP).

An Aboriginal heritage due diligence (AHDD) assessment was completed for the Project by EMM, which considered the Project development in the context of local Aboriginal cultural heritage, consultation undertaken to date with relevant registered Aboriginal parties (RAPs) and assessed the likely impact of the Project on Aboriginal cultural heritage values. A draft version of the AHDD assessment report was provided to RAPs on 25 August 2020 for review.

No sites listed on the Aboriginal Heritage Information Management System (AHIMS) or native title claims or land claims listed on the National Native Title Tribunal (NNTT) are registered within the disturbance footprint of the Project. A site inspection was completed on 6 June 2020, which discovered no Aboriginal objects or scar trees.

The Project is wholly underground and will not result in additional surface disturbance or discernible changes in ground level. The footprint of the Project does not contain any known Aboriginal objects and is unlikely to feature unknown Aboriginal objects. Therefore, the Project is unlikely to impact any Aboriginal cultural heritage values or objects. Mitigation measures under the AHIP Consent 1467/Permit 1468 and IACHMP will be applied to the Project.

ES4.8 Historic heritage

An historical heritage assessment assessed the impact of the Project on historical heritage items, their cultural value and archaeological resources.

One heritage item is listed in Schedule 5 of the Bland LEP and located in existing facilities of CGO within ML 1535: *Cowal West Group comprising homestead, quarters, sheds and stables* (heritage item I11). Despite this listing, the heritage elements to which this listing relates have either been relocated and reconstructed or demolished.

The footprint of the Project therefore does not contain any known historical heritage items or is unlikely to feature unknown historical heritage items. The Project will have negligible impact on historical heritage items, cultural values and archaeological resources.

ES4.9 Traffic

A traffic impact assessment (TIA) prepared by EMM considered the impact of Project related traffic on the local and regional traffic network, including the impact of light and heavy vehicle movements associated with the increased workforce and deliveries during the construction and operational phase.

The Project will result in increased light and heavy vehicle traffic along existing transport routes between CGO, West Wyalong, Forbes and Condobolin, particularly during the construction stage of the Project. The use of Evolution’s shuttle bus for its workers will be expanded for the Project workforce, which will limit road traffic impacts. Mine Access Road and Lake Cowal Road will experience the largest increase in vehicle usage. As these roads are currently primarily used by vehicles associated with CGO and therefore, this increase is not likely to affect other road users. Ungarie Road, Blow Clear Road, Bonehams Lane and Wamboyne Road will experience an increase in Project-related traffic. However, the performance of key intersections will not be impacted by Project-related traffic, and no additional road upgrades are required for the Project.

The existing Transport Management Plan (TMP) for CGO will be applied to the Project to manage residual traffic impacts.

ES4.10 Rehabilitation and closure strategy

The Rehabilitation and Closure Strategy for the Project prepared by EMM outlines the strategy to create safe, stable and non-polluting post-mining landforms that are consistent with agreed post-mining land uses.

Rehabilitation of the site will be undertaken as is currently approved at CGO. The site will be rehabilitated to a range of final landforms ranging from grassland/scattered Eucalypt woodland, Eucalypt woodland or riverine woodland/freshwater communities. For the most part, areas to be disturbed by mining within ML 1535 will be rehabilitated to enhance and expand wildlife habitat values. The void and permanent water management infrastructure will for the most part be retained post mining, however, it will be rehabilitated to ensure a safe and stable landform remains post mining.

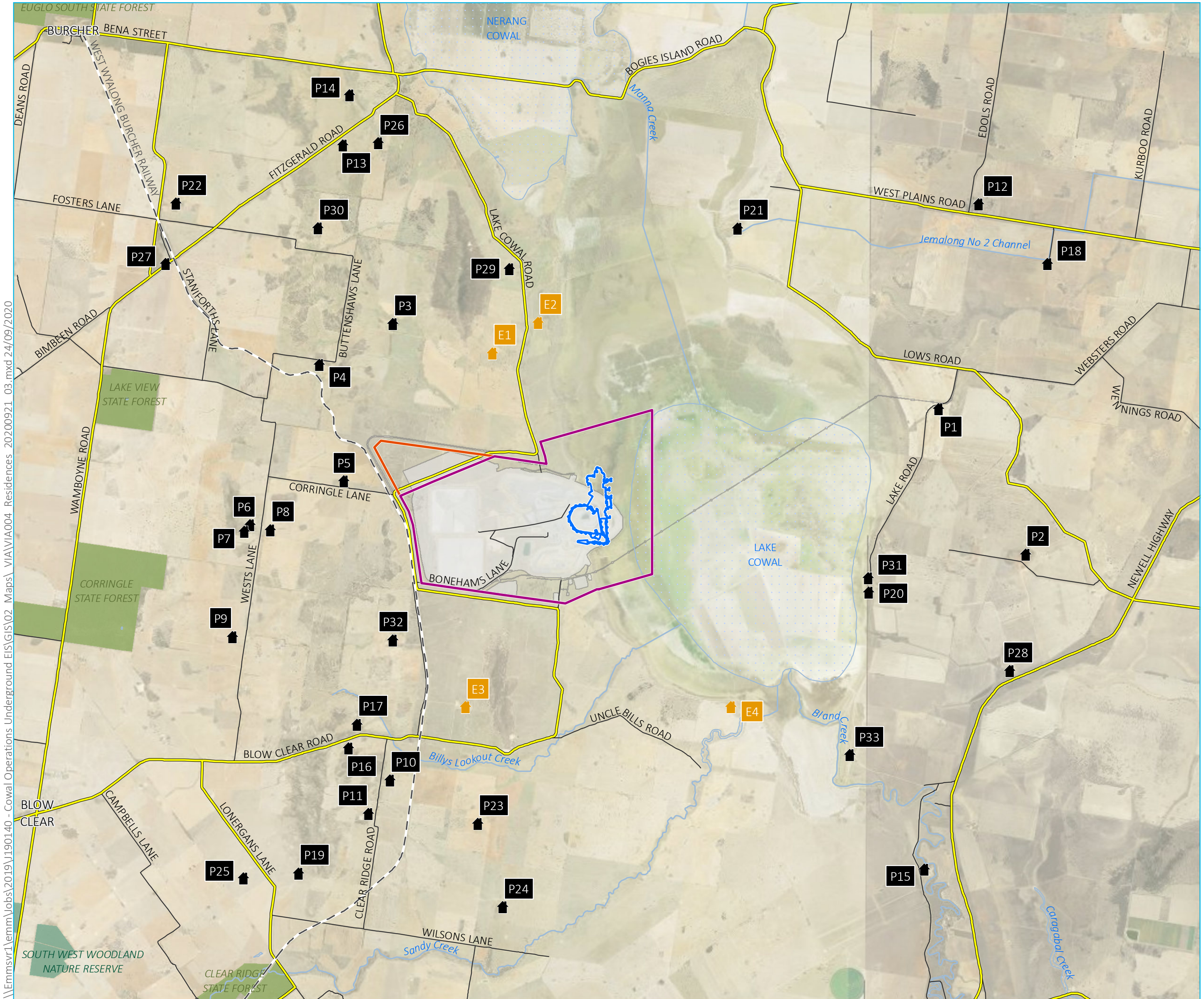
ES4.11 Visual amenity

A visual impact assessment (VIA) prepared by EMM considered the visual magnitude of the proposed paste fill plant and associated lighting and the visual sensitivity of receptors (residences, tourist sites and roads) within the primary view catchment (PVC) to these elements.

Some elements of the paste fill plant will be visible to residential receptors, including P3, P20, P29, P31, E1 and E2 (refer Figure ES4), however this element is mostly visually absorbed due to distance and intervening topography. Additional lighting associated with the paste fill plant will be absorbed into the glow of existing lighting.

Mitigation measures will be implemented to promote the visual integration of the paste fill plant into the surrounding landscape and include such measures as ensuring the external cladding matches the colour of the surrounding landscape, is non-reflective and buffered by screening plants. As is already required under DA 14/98, Evolution will continue to take all reasonable and feasible measures to mitigate visual and off-site lighting impacts.

For most receptors, including the remaining residential receptors, tourist sites and roads, the Project elements will mostly be indistinguishable from the surrounding landscape, visually absorbed to features behind the element or obscured by vegetation and topography.



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

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Rural residences

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Figure ES4

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ES4.12 Greenhouse gas

EMM assessed the potential greenhouse gas (GHG) emissions from the Project and cumulatively assessed both the Project and the surface facilities proposed under Mod 16.

The Project will increase both Scope 1 and 2 emissions by 19% in comparison to Scope 1 and 2 emissions reported for CGO in financial year 2019 (FY19) under the *National Greenhouse Energy Reporting Act 2007* (the NGER Act). This is due to increased consumption of diesel, electricity and explosives.

It was found that GHG emissions (Scope 1, 2 and 3) will be minimal, only making minor contributions to the total GHG emissions of NSW and Australia (0.04% and 0.01% respectively) based upon the National Greenhouse Gas Inventory for 2017.

The existing GHG minimisation measures in the AQMP for CGO will be applied to the Project.

ES4.13 Hazards, public safety and health

EMM has considered the potential hazards and risks using an assessment matrix, which assesses the consequence of the hazard against the likelihood of occurrence.

Blasting has been identified as a risk associated with the Project, specifically as ground vibration may unsettle birds which use Lake Cowal as a feeding and breeding ground. This is considered to have a low risk and will be managed through the continued implementation of CGO's management plans, which considers past hazard assessments completed for CGO.

An environmental geochemistry assessment was also completed for the Project by Geo Environmental Management Pty Ltd (GEM). It considers the geochemical characteristics of the waste rock, mine rock, ore, low grade ore and tailings to be produced from the Project and identifies any impacts which may arise from the processing, stockpiling and storage of this material as proposed under Mod 16. The environmental geochemistry assessment found that the waste rock and mine rock hold no geochemical risk to the surrounding environment. Small amounts of potentially acid forming material (PAF) may be present in ore produced from the Project. Mitigation measures will be implemented to manage geochemical risks during the stockpiling of ore prior to processing and tailings at the IWL.

ES4.14 Waste management

Waste streams generated from the Project will likely include domestic waste, sewage effluent, waste hydrocarbons, vehicle batteries, tyres, general construction waste, spent spill recovery/clean-up materials, waste rock and tailings. The Project will not introduce any new waste streams to CGO.

Waste from the Project will be handled and disposed of in accordance with the existing on-site waste management system. Hazardous waste will be managed in accordance with CGO's Hazardous Waste and Chemical Management Plan (HWCMP), which will be updated as required to consider hazardous waste generated from the Project. Waste rock produced from the Project will be stored at the existing waste rock storage emplacement areas in accordance with existing management strategies. Tailings waste will be reused at the proposed paste fill plant to make paste for backfilling of the stopes.

ES4.15 Social

A social impact assessment (SIA) was completed for the Project by Elton Consulting Pty Ltd (Elton), which identified the potential impacts and opportunities associated with both the construction and operational phases of the Project, as well as appropriate measures for managing adverse social impacts and enhancing potential benefits.

The community consultation undertaken in parallel with the SIA found that the local and regional community was very supportive of CGO's current operation and positive about Evolution's plans for a new Project and new investment in the area.

The Project will provide several social benefits to the local and regional community. The Project will provide employment to new workers and upskilling opportunities to the existing workforce. This will result in localised spending on goods and services, providing economic opportunities to the local economy, whilst diversifying the existing local community. It will also provide opportunity to sustain Evolution's existing not for profit and community focused initiatives.

Impacts to housing availability and potential localised inflation of housing prices was identified as a concern in the SIA. Evolution has identified a range of options that it is considering to mitigate the impact of its new workforce on the local housing market. Its preferred option is to house its workers in a purpose-built village in West Wyalong. The purpose-built accommodation village would provide economic opportunities to the local economy from the use of local contractors and services during construction and operation. A range of other potential, low significance social impacts are noted in the SIA which can all be managed though transparent communication and appropriate mitigation.

Potential cumulative impacts resulting from the construction of a number of industrial (eg. energy generation) Projects in the region were considered in the SIA in terms of local population effects. This assessment shows that the proposed accommodation strategy will assist in mitigating potential social impacts of the interaction of the Project with other developments.

ES4.16 Economic

An economic impact assessment (EIA) was completed for the Project by AEC Group Pty Ltd (AEC). This included a cost benefit analysis (CBA) and local effects analysis (LEA) to identify the economic effects of the Project, including both the Project and Mod 16.

The assessment concluded that the Project will likely result in several economic benefits for the local community and broader region. Based on modelled predictions and current assumptions, this includes a net present value (NPV) of $314.4 million over the life of the mine and total present value benefits of approximately $2,107.9 million. Royalties to the State are estimated to be $174 million with a taxation revenue of $556 million, based on current assumptions and predicted gold prices.

Evolution will implement strategies to ensure the local and regional community benefits economically from the Project, including sourcing the additional workforce and materials from the local community where possible and ensuring sufficient accommodation is available to minimise impacts to the local property market, local businesses and other stakeholders.

ES5 Justification and conclusion

The Project will provide a range of direct and indirect economic benefits to the local area, the region and the State.

Global gold production is projected to fall in 2020, as some long and large established mine projects in Australia and other major gold producing countries reach the end of their mine life. Australian gold production is expected to decline by 7.3 % annually in 2023 to 2024. Therefore, to offset this predicted decline, new mines will need to be developed. The Project represents a feasible option to address the decline in gold production. It will extract up to 27 Mt of ore over its life, which will result in the production of around 1.8 million ounces of gold.

The Project will provide employment for up to approximately 160 additional workers during the construction phase and up to approximately 230 additional workers during the operations phase. It will also facilitate the continuity of long-term employment for the existing workforce by providing job security for local mine employees and contractors.

All aspects relating to environmental management will be undertaken in accordance with existing management plans approved for CGO.

In conclusion, it is considered that the proposed Project is consistent with the relevant objectives of the EP&A Act, including the precautionary principle and the principles of ecologically sustainable development. The Project will result in significant and ongoing economic investment and employment benefits both locally and regionally.

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Part A – The Project



Part A – The Project

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 the existing CGO mine 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 the authority of Ministerial Development Consent for development application (DA) 14/98 and within mining leases (ML) ML 1535 and ML 1791 (refer Figure 1.2). DA 14/98 allows Evolution to:

- extract 167 million tonnes (Mt) of ore by open-cut methods until 2032;
- process this ore on-site at a rate of up to 9.8 million tonnes per annum (Mtpa);
- produce up to 6.1 million ounces (oz) 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; and
- progressively rehabilitate the site.

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

The current open-cut mine and surface infrastructure is wholly contained within ML 1535. ML 1791 accommodates part of the IWL and soil stockpiles.

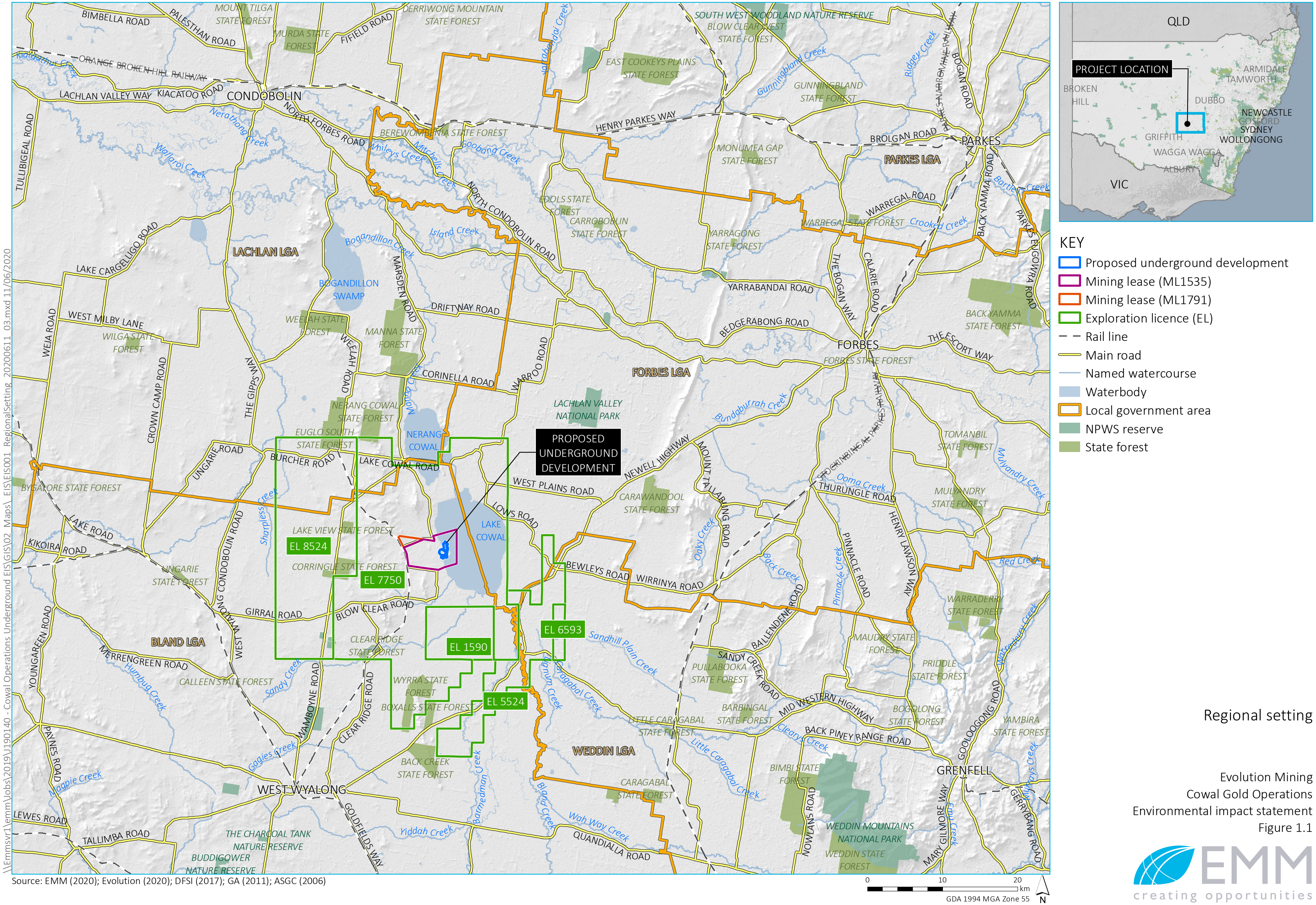
The CGO site also hosts a range of ancillary infrastructure to support the open-cut mine. This includes an ore processing plant, the IWL, waste rock emplacements, ore stockpiles, workshops, offices, reagent storage and explosives magazine.

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).

1.1.1 Overview of existing Cowal Gold Operations

Evolution mines gold ore from the open-cut pit at CGO using standard drill and blast techniques. Broken rock is hauled from the pit for either processing through the ore processing plant or, for barren waste rock, to the IWL for disposal. Following gold extraction in a conventional carbon-in-leach (CIL) cyanide leaching circuit, the barren ore residue (known as tailings) is pumped as a slurry to the IWL for permanent disposal.

Under the current approvals, CGO will mine and process approximately 167 Mt of ore over the 28-year life span of the open-cut mine, at a rate of up to 9.8 Mtpa.



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

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Regional setting

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 1.1

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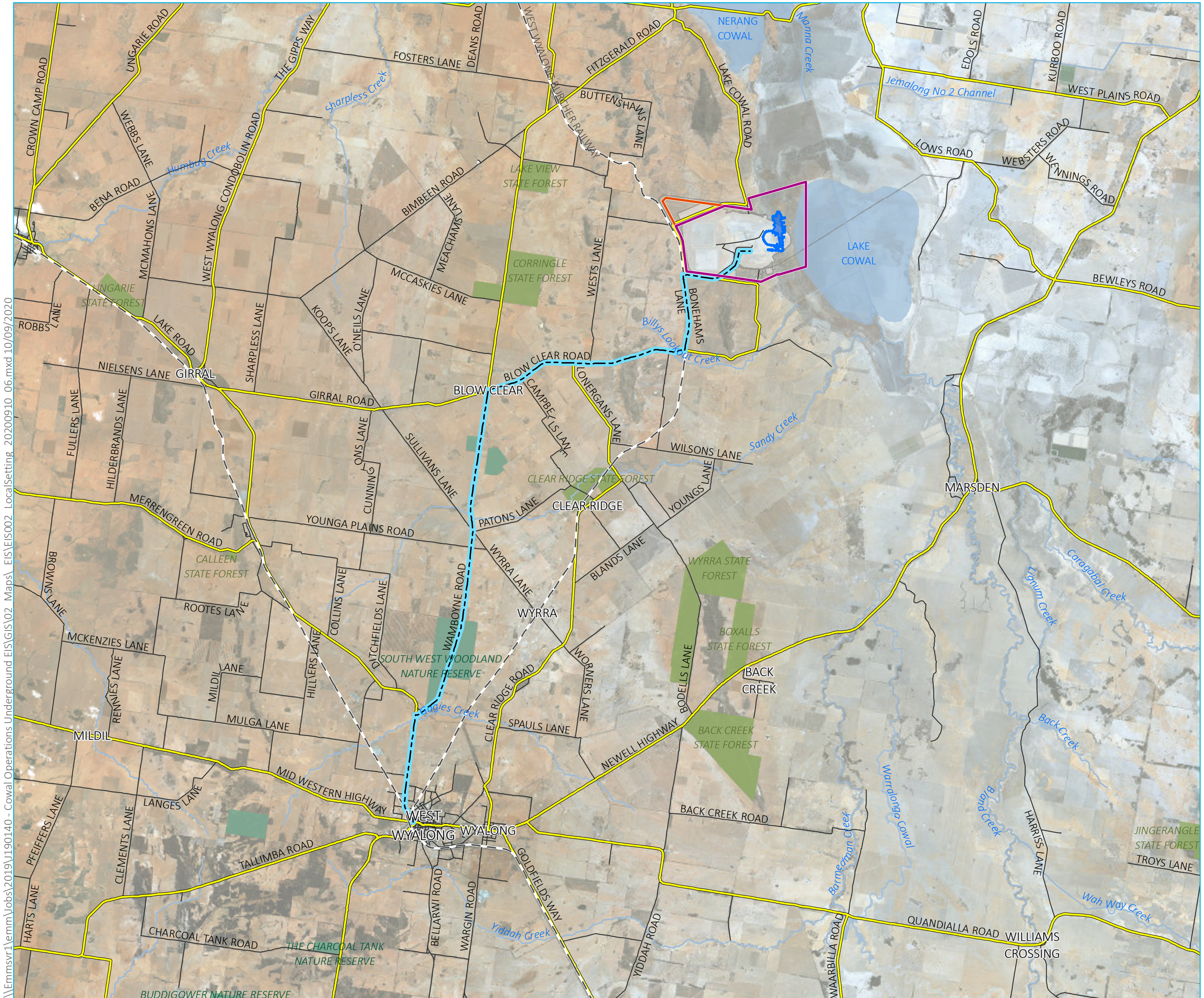

Source: EMM (2020); Evolution (2020); DFSI (2017)

KEY
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Approved surface disturbance
- West Wyalong preferred transport route
- Rail line
- Main road
- Minor road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest

Local setting

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 1.2

EMM
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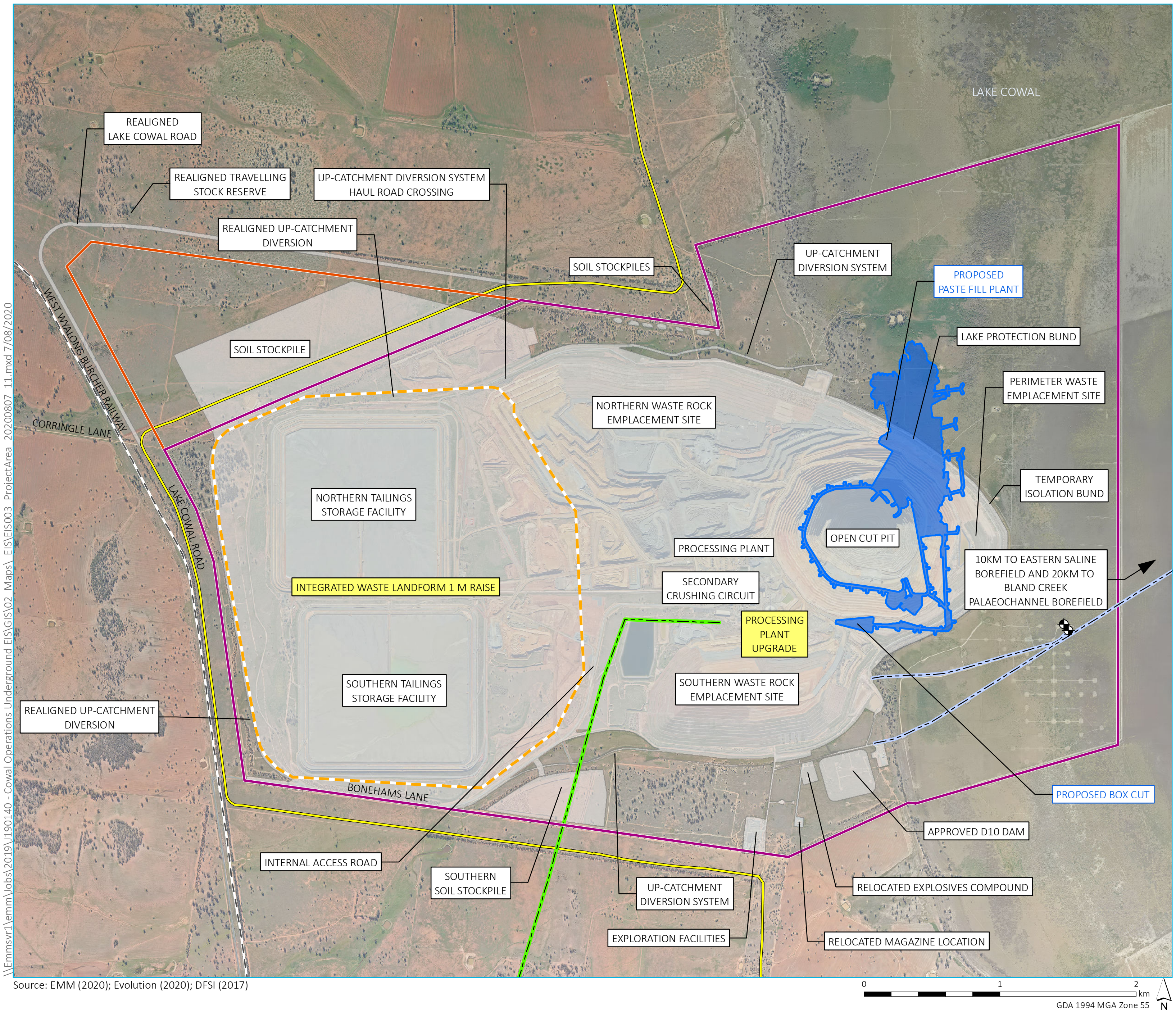


Source: EMM (2020); Evolution (2020); DFSI (2017)

Project area

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 1.3

EMM
creating opportunities

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.
TSFs	• integrated waste landform; • 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.
Water management structures	• lake protection bund; • temporary isolation bund (TIB); • water supply pipeline; • saline groundwater supply bores within ML 1535; and • water diversion systems (including Up-Catchment Diversion System (UCDS) and Internal Catchment Drainage System (ICDS)) and drainage. Evolution also operates the Bland Creek Palaeochannel Borefield, which is approved under DA 14/98. The Bland Creek Palaeochannel Borefield 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 Bland Creek Palaeochannel Borefield.
Ancillary facilities	• access roads, internal roads and haul roads; • electricity transmission lines; • waste storage and transfer facility; • workshop facilities; and • administration and bathhouse buildings.

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.

1.2 Underground Development Project

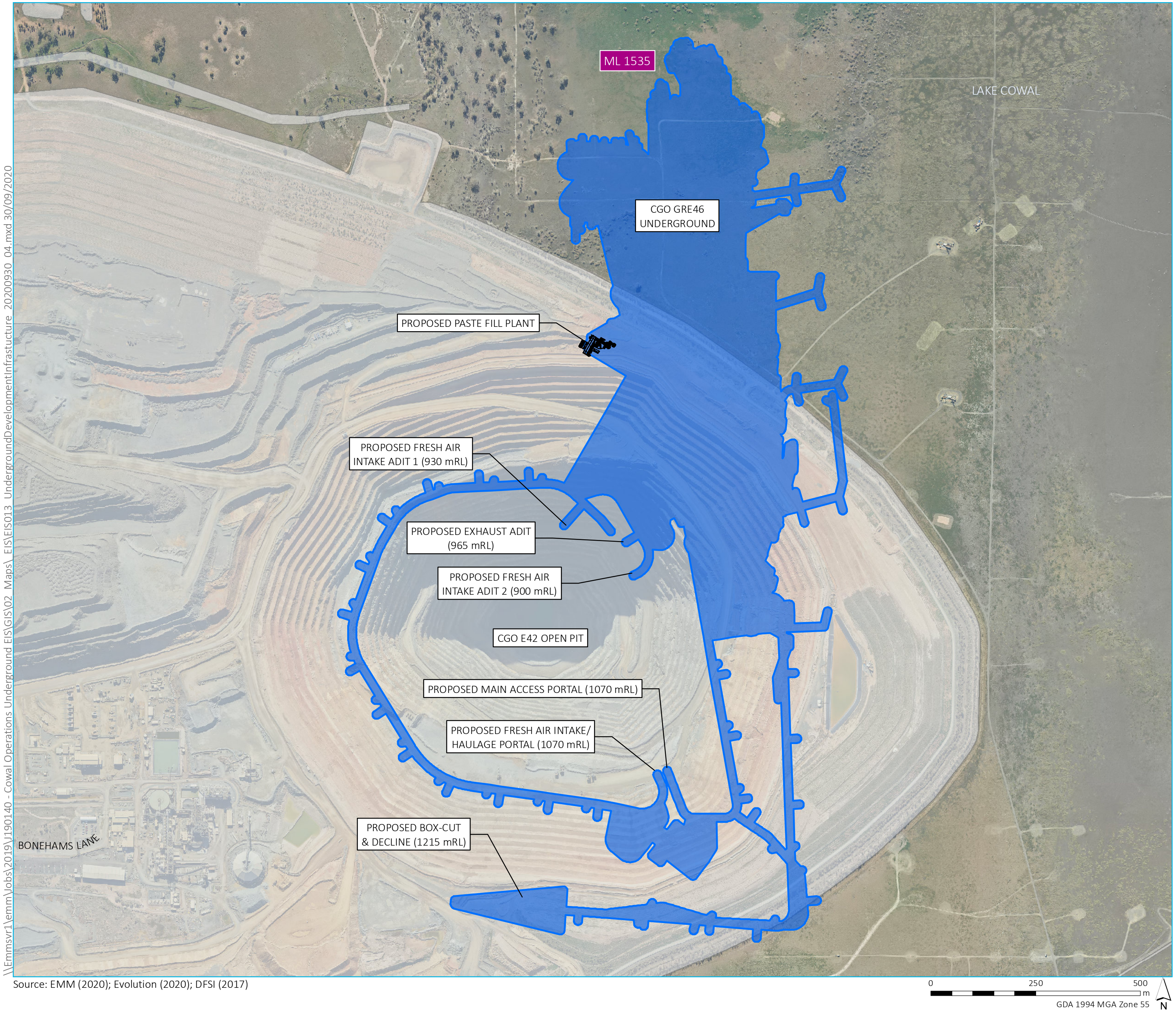
Evolution now seeks approval to construct and operate an underground mine at CGO, the CGO Underground Development Project (the Project), to provide access to another 1.8 million ounces (Moz) of gold. A summary of existing operations at CGO, proposed new Project components and the approvals approach is provided in the following sub-sections.

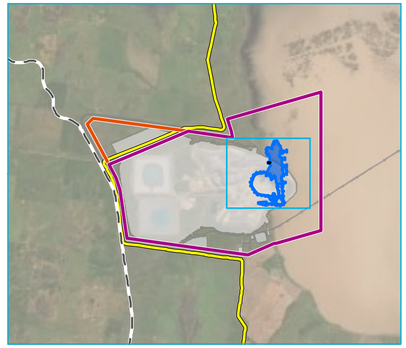
1.2.1 Overview of the proposed development

The conceptual Project detail is shown in Figure 1.4 and described in detail in Chapter 3. The Project includes the following key components which will support underground mining:

- Excavation of two declines to provide underground access and ventilation: one decline via a portal on the existing open-cut pit and the other via a box-cut. The declines will be approximately 6 metres (m) wide by 6 m high and will extend approximately 1.5 km to the point at which the first production drive commences. The final depth of the underground will be approximately -850 m Australian Height Datum (AHD).
- Development of a box-cut entry adjacent to the open-cut pit, which will be the main access for personnel and materials to the underground mine and will be used to transport ore to the surface for processing.
- Development of stopes via conventional mechanised drill and blast techniques.
- Production of ore via mechanised sub-level open stoping subsequently stabilised with cemented paste fill.
- Load-Haul-Dump (LHD) vehicles used to remove rock from development and production areas and loading into diesel trucks for transport to the surface.
- Development of a paste fill plant, and backfilling excavated stopes with cemented paste fill made from cement and tailings.
- Installation of services, including power, water and communications, which will be reticulated underground to serve the workings. An underground workshop area will provide facilities including wash bay, heavy vehicle service area, ablutions, crib room and office.

The Project is proposed to produce of up to 1.8 Mtpa of ore until mid-2039.





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

Project detail

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 1.4

EMM creating opportunities

1.2.2 Project objectives

The design of the Project, presented in Chapter 3, represents the current optimised conceptual configuration for the Project. This conceptual design has been developed by Evolution in a collaborative, multi-disciplinary process through the completion of various concept, pre-feasibility and feasibility studies. Section 3.2 of Chapter 3 provides an overview of the assessment stages undertaken by Evolution in the concept design development, including the alternatives considered in selecting the Project configuration that forms the basis of this EIS.

The conceptual Project design identified by Evolution seeks to meet the following objectives:

- to extract a further 1.8 Moz of gold not accessible by the open-cut operations;
- to maintain continuity of mining and extend ore production at the site beyond 2032;
- to optimise the recovery of gold in the underground development area;
- to safely mine an economically extractable resource;
- to provide further stability and secure employment for its workers and to generate economic activity and wealth for the local, regional and State communities; and
- to effectively manage impacts on surrounding residents and the local environment during construction and operations and achieving, at a minimum, compliance with relevant statutory requirements.

1.3 Approvals approach

The proposed development of the Project will require various changes to the current surface infrastructure at CGO. It may also require 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 Project configuration and scheduling, the full execution of the Project will require various separate consents. This document supports the application for one of those consents. The consents required for the Project are outlined below and discussed in further detail in Chapter 6.

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, this document)** – 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** – a request for modification (Modification 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.
2. To house the construction workforce and specialised underground workforce during production, Evolution is considering the option to develop of a purpose-built accommodation village in West Wyalong. The accommodation village would be the subject of a separate Development Application to BSC. This application would run in parallel with those for the underground development and surface changes modification approval processes.

1.3.1 Purpose of this document

The Underground Development Project is classified as State Significant Development (SSD) pursuant to Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP). Accordingly, approval is required under Part 4, Division 4.1 of the EP&A Act for the Project.

This EIS has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Evolution to support the SSD application for development consent under sections 4.12 of the EP&A Act. It has been prepared to the form and content requirements set out in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

The primary objective of this EIS is to inform government authorities and other stakeholders about the Project and the measures that will be implemented to minimise, mitigate, manage and monitor potential impacts, together with a description of the residual social, economic and environmental impacts. It addresses the specific requirements provided in the Department of Planning, Industry and Environment (DPIE) Secretary's Environmental Assessment Requirements (SEARs) issued on 27 September 2019, as outlined below.

1.3.2 Secretary's Environment Assessment Requirements

This section outlines the SEARs and additional agency requirements received for the underground development on 27 September 2019 from DPIE. The SEARs, and where they have been addressed in this EIS for the underground development, are provided in Table 1.2. Additional agency assessment requirements from relevant statutory authorities are also provided in Appendix A.

Table 1.2 SEARs and additional agency requirements and where they have been addressed

Requirement	Location in the EIS
General requirements	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. In particular, the EIS must include:	
• a stand-alone executive summary;	Refer to the executive summary of this EIS
• a full description of the development:	Refer to Chapter 3
– the resource to be extracted, demonstrating efficient resource recovery within environmental constraints;	Refer to section 3.1
– the mine layout and scheduling;	Refer to Chapter 3
– minerals processing;	Refer to section 2.5
– surface infrastructure and facilities (including any infrastructure that will be required for the development, but the subject of a separate approvals process);	Refer to Chapter 3
– a waste (overburden, tailings, etc.) management strategy;	Refer to section 2.6 for tailings management Refer to section 2.9 for waste rock management Refer to section 3.5 for the proposed paste fill plant
– a water management strategy;	Refer to section 2.13
– a mine closure and rehabilitation strategy;	Refer to Chapter 16

Table 1.2 SEARs and additional agency requirements and where they have been addressed

Requirement	Location in the EIS
– the likely interactions between the development and any other existing, approved or proposed mining related development in the vicinity of the site;	Not applicable
• details of the approvals that must be obtained before the development may commence;	Refer to Chapter 5
• the terms of any proposed voluntary planning agreement with the relevant local council;	Yet to be negotiated
• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:	Refer to Chapter 7 to Chapter 22
– a description of the existing environment likely to be affected by the development, using sufficient baseline data;	Refer to Chapter 4
– an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice;	Refer to Chapter 7 to Chapter 22
– a description of the measures that will be implemented to avoid, mitigate and/or offset the likely impacts of the development, and an assessment of:	Refer to Table 23.1
▪ whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented;	Refer to Table 23.1
▪ the likely effectiveness of these measures, including performance measures where relevant;	Refer to Table 23.1
▪ whether contingency plans will be necessary to manage any residual risks;	Refer to Table 23.1
– a description of the measures that will be implemented to monitor and report on the environmental performance of the development if it is approved;	Refer to Table 23.1
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all commitments made in the EIS;	Refer to Table 23.1
• consideration of the development against all relevant environmental planning instruments (including Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007);	Refer to section 5.5
• a conclusion evaluating the merits of the development as a whole, having regard to the requirements in Section 4.15 of the Environmental Planning and Assessment Act 1979;	Refer to section 5.2

Table 1.2 SEARs and additional agency requirements and where they have been addressed

Requirement	Location in the EIS
• a signed statement from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	Refer to the signed declaration at the beginning of this EIS
The EIS must consider all environmental planning instruments, guidelines, policies, and plans which may be relevant to the environmental assessment of this development. Attachment 1 lists some of the relevant resources.	Refer to Chapter 5
In addition to the matters set out in Schedule 1 of the Environmental Planning and Assessment Regulation 2000, the development application must be accompanied by a signed report from a suitably qualified and experienced person that includes an accurate estimate of the capital investment value (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived.	Refer to the signed declaration at the beginning of this EIS Refer to Chapter 22 for the Project's capital investment value
Key issues	
• Subsidence – including an assessment of the likely conventional and non-conventional subsidence effects, and the potential consequences of these effects and impacts on the natural and built environment, paying particular attention to features that are considered to have significant economic, social, cultural or environmental value, and taking into consideration:	Refer to Chapter 9 and Appendix E
– recorded regional and historic subsidence levels, impacts and environmental consequences;	Refer to Chapter 9
– the potential extent of fracturing of the strata above the underground mine;	Refer to Chapter 9
– the implementation of a comprehensive subsidence monitoring program which is capable of detecting vertical, horizontal and far-field subsidence movements;	Refer to Chapter 9
• Land – including: – an assessment of the likely impact of the development on landforms (topography), including the long-term geotechnical stability of any new landforms on site; and	Refer to section 9.5 for subsidence impacts Refer to Chapter 16 for the Project's rehabilitation and closure strategy
– an assessment of the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007, paying particular attention to the agricultural land use in the region;	Refer to section 5.5.1
• Air quality– including: – an assessment of the likely air quality impacts of the development in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW; and	Refer to Chapter 7 and Appendix C

Table 1.2 SEARs and additional agency requirements and where they have been addressed

Requirement	Location in the EIS
– an assessment of the likely greenhouse gas impacts of the development;	Refer to Chapter 18 and Appendix C
• Water – including: – an assessment of the likely impacts of the development on the quantity and quality of regional surface water and groundwater resources;	Refer to Chapter 10 for groundwater impacts and Appendix F Refer to Chapter 11 for surface water impacts and Appendix G
– an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users;	Refer to Chapter 10 for groundwater impacts and Appendix F Refer to Chapter 11 for surface water impacts and Appendix G Refer to Chapter 12 for biodiversity impacts and Appendix H
– identification of the proposed water supply for the development;	Refer to section 2.10, section 2.11 and section 2.12
– a detailed site water balance, including a description of site water demands, water disposal methods (including the location, volume, and frequency of any water discharges and management of discharge water quality), water supply arrangements, water supply and transfer infrastructure and water storage structures; and	Refer to Appendix G
– a detailed description of the proposed water management system (including sewerage), beneficial water re-use and proposed measures to monitor and mitigate surface water and groundwater impacts;	Refer to section 2.13 for the CGO's water management system Refer to section 10.4.4 for groundwater mitigation measures Refer to section 11.6 for surface water mitigation measures
• Noise and blasting / vibration – including: – an assessment of the likely operational noise impacts of the development (including construction noise) under the Noise Policy for Industry (EPA), and the Voluntary Land Acquisition and Mitigation Policy;	Refer to Chapter 8 and Appendix D
– if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline;	Refer to Chapter 8
– an assessment of the likely road noise impacts of the development under the NSW Road Noise Policy; and	Refer to Chapter 8
– an assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZECC guidelines;	Refer to Chapter 8
• Biodiversity – including: – an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method (BAM)and documented in a Biodiversity Development Assessment Report (BDAR),unless the Planning Secretary determines that the proposed development is not likely to have any significant impacts on biodiversity values; and	Refer to Chapter 12 and Appendix H

Table 1.2 SEARs and additional agency requirements and where they have been addressed

Requirement	Location in the EIS
– the BDAR must document the application of the 'avoid, minimise, offset' framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM;	Refer to Chapter 12 and Appendix H
• Heritage – including an assessment of the likely Aboriginal cultural heritage and historic heritage (cultural and archaeological) impacts of the development;	Refer to Chapter 13 and Appendix I for the Aboriginal heritage assessment Refer to Chapter 14 for historic heritage assessment
• Transport – including an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the local and State road network;	Refer to Chapter 15 and Appendix J
• Hazards - including an assessment of the likely risks to public safety, bushfire risks, and the handling and use of any dangerous goods;	Refer to Chapter 19
• Waste – including identification, quantification and classification of the likely waste streams likely to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste;	Refer to Chapter 20
• Rehabilitation and final landform – including: – a conceptual final landform design, including justification of the final landform design, long-term geotechnical stability, and nominated final land uses, having regard to relevant strategic land use planning, resource management plans or policies;	Refer to Chapter 16
– progressive rehabilitation measures that will be implemented for the development;	Refer to Chapter 16
– rehabilitation objectives, performance standards and completion criteria; and	Refer to Chapter 16
– - decommissioning of surface infrastructure;	Refer to Chapter 16
• Social & economic – including: – 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; and	Refer to Chapter 21
– an assessment of the likely economic impacts of the development, paying particular attention to the:	Refer to Chapter 22
▪ significance of the resource;	Refer to Chapter 22
▪ economic benefits of the development for the State and region; and	Refer to Chapter 22

Table 1.2 SEARs and additional agency requirements and where they have been addressed

Requirement	Location in the EIS
▪ demand for the provision of local infrastructure and services.	Refer to Chapter 21
Consultation	
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).	Refer to Chapter 6 and Appendix B
Further consultation after 2 years	
If you do not lodge a Development Application and EIS for the development within 2 years of the issue date of these SEARs, you must consult further with the Planning Secretary in relation to the preparation of the EIS.	This development application has been lodged within 2 years of the issue date of the SEARs.

1.3.3 EIS structure

The EIS is structured as follows:

- **Part A – The Project** introduces the applicant, the existing mine operations, the origins of the Project and concludes with a detailed description of the Project and the surrounding environment. Part A also provides an outline of feasible alternatives that were considered for the Project.
- **Part B – statutory context and engagement** outlines the statutory context relevant to the Project (Chapter 5) and describes the stakeholder engagement completed, discusses the issues raised throughout this engagement, and how the issues have been addressed in the EIS (Chapter 6).
- **Part C – Impact assessment:** assesses the potential environmental and social impacts of the Project and the proposed management and mitigation measures to address these impacts. Chapter 23 provides a summary of the management, mitigation and monitoring measures.
- **Part D – Justification and conclusion** provides a detailed Project justification and conclusion.
- **Part E – References, abbreviations and glossary** details a list of all materials referenced in this EIS and defines the acronyms and terms used throughout.

1.3.4 Terminology

A summary of key terminology used throughout the EIS is provided in Table 1.3. A full glossary and list of abbreviated terms are provided in Part E of the EIS.

Table 1.3 Key Project 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 Project	The proposed **underground** development at CGO to which this EIS applies, as shown in Figure 1.3 and as described in Chapter 3.
Environmental Impact Statement	EIS	The documentation supporting the **SSD application** for the Project under section 4.38 of the EP&A Act for the Project.
Modification 16 to DA 14/98	Mod 16	The proposed **surface** changes to the existing CGO development consent (DA14/98) supporting the Project, as described in the Modification Report.

1.4 The applicant

Evolution is the owner and operator of CGO and the applicant for the Project. Evolution is a publicly listed gold, silver and copper production 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
- 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 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/.

1.5 Study team

This EIS has been prepared by EMM on behalf of Evolution to support the SSD application for development consent under section 4.12 of the EP&A Act for the Project. Technical environmental assessments to inform this EIS have been completed by EMM and other external sub-consultants, including:

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



Part A – The Project

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 operations 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 Bland Creek Palaeochannel Borefield water supply pipeline, under Part 4 of the EP&A Act.

A subsequent modification for expansion of the Project was subject to proceedings in the NSW Land and Environment Court. This modification was ultimately approved subject to comprehensive 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 developments 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) of the development consent 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 of the development consent 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 2 years.
7	11 February 2009	Amendment to Condition 1.1 and 6.4 of the development consent to amend the allowed noise exceedances during operation of CGO.
8	28 August 2009	Amendment to Condition 1.1 of the development consent to allow for modification to the waste emplacement areas, ore processing and external water supply sources.
9	17 January 2011	Update to development consent to reflect an increase of the life of mine, as approved under Mod 6.
10	6 July 2011	Introduction of saline groundwater from the Eastern Saline Borefield to the existing water supply of CGO.
11	22 July 2014	Extension of life of mine for 5 years to allow an additional production of 0.7 Moz of gold.
12	13 May 2016	Amendment of various clauses of the development consent and the biodiversity offset strategy.
13	7 February 2017	Extension of life of mine for 8 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.

Table 2.1 Summary of approvals history for DA 14/98

Modification number	Approval date	Description
15	23 August 2019	Removal of Condition 9.2(b) of the development consent to remove the requirement for an 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.

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 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 Eastern Saline Borefield, 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 Australian Securities Exchange (ASX) announcement detailing the Maiden Underground Ore Reserve for the 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 oz, supporting the development of the 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.
- 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.
- 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% 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.

Previous geochemical investigations undertaken for the CGO have identified that (GEM 2020):

- the waste rock, low-grade ore and tailings have high concentrations of arsenic and reactive sulfides, but due to their high acid buffering potential, these materials are non-acid forming (NAF); and
- the un-oxidised waste rock and tailings have low salinity and sodicity. However, when oxidised, these materials are expected to be highly saline and sodic.

Further detail of the site's geology and hydrogeology is provided in sections 4.4.2 and 4.4.4, respectively.

2.3 Open-cut pit design

The design of the existing E42 open-cut pit at CGO (refer Figure 1.3 and Figure 1.4) 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[1]), or around 531 m below the ground surface. Currently (September 2020), 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 and 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-cut 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 this EIS.

1 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.

Current open-cut pit design parameters are summarised in Table 2.2.

Table 2.2 E42 open-cut pit design parameters

Design parameter	Oxide zone	Primary zone
Batter angle	45°	90°
Batter height	9 m	18 m
Pit wall angle (Inter-Ramp Angle)	25°	61°
Berm width	10.3 m	10 m
Road width	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, run-of-mine (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 carbon-in-leach (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 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.

Operation 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 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 or raise. 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;
- use of a seepage drainage system consisting of perimeter collector pipes and sumps; and
- continued monitoring for groundwater and surface water quality at the TSF.

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 back 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.

Previous geochemical investigations undertaken for the CGO (GEM 2020) have classified the waste rock as either oxide waste rock which is NAF and saline or primary waste rock which is also NAF and non-saline. Therefore, no specific management measures for AMD or salinity 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 several internal and external sources, and in large volumes, primarily as a transport media during ore processing with lesser amounts used in reagent preparation, dust control and potable water supply. Significantly, 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[2], typically only suitable for industrial and some stock watering use. The proportion of water recycled on-site is also very high at around 50%.

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-cut pit sump which is stored in contained water storages D2, D6 and D9 (process water supply storages);

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

- runoff water from the waste rock emplacements, open-cut 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;

- External water sources (ie outside the ICDS):

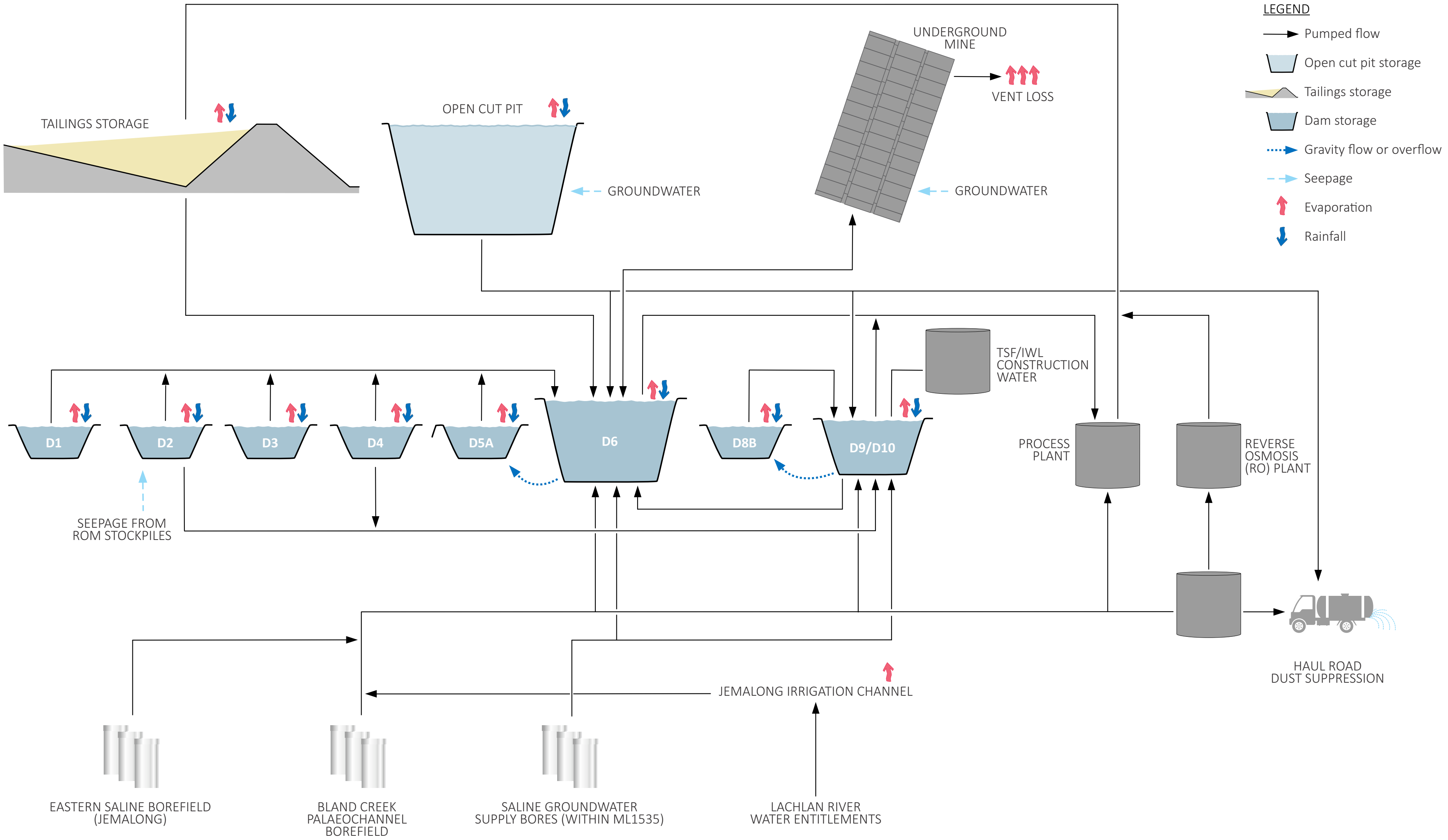
  - water from the saline groundwater supply bores within ML 1535;

  - water from the Eastern Saline Borefield, located approximately 10 km east of Lake Cowal's eastern shoreline;

  - water from the Bland Creek Palaeochannel Borefield, which is pumped from four production 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

Environment Impact Statement

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 Eastern Saline Borefield and the Bland Creek Palaeochannel Borefield. 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 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

Evolution holds development consent DA 2011/64 for the operation of the Eastern Saline Borefield, which consists of two bores extracting water from the Cowra Formation. The Eastern Saline Borefield is 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:

- Bland Creek Palaeochannel Borefield area: Bore GW036553 - trigger levels of 137.5 m AHD and 134 m AHD;
- Billabong area: Bore GW036597 - trigger level 145.8 m AHD; 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 Project. Under the Groundwater Contingency Strategy, pumping from the Bland Creek Palaeochannel ceases if the 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 Water Access Licence (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-cut 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 comprises a series of isolation embankments designed to prevent the inflow of water from Lake Cowal into the open-cut pit, including: the lake protection bund, the TIB and the perimeter waste rock emplacement. These structures were established early in the development of the Project and have been successful in preventing inundation of the open-cut pit by lake waters, and also water from the operational mine entering Lake Cowal.

The open-cut pit is designed to ensure the long-term stability of the lake isolation system. Stability of the Lake Protection Bund is monitored through the Monitoring Programme for Detection of any Movement of Lake Protection Bund, 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 2.3.

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

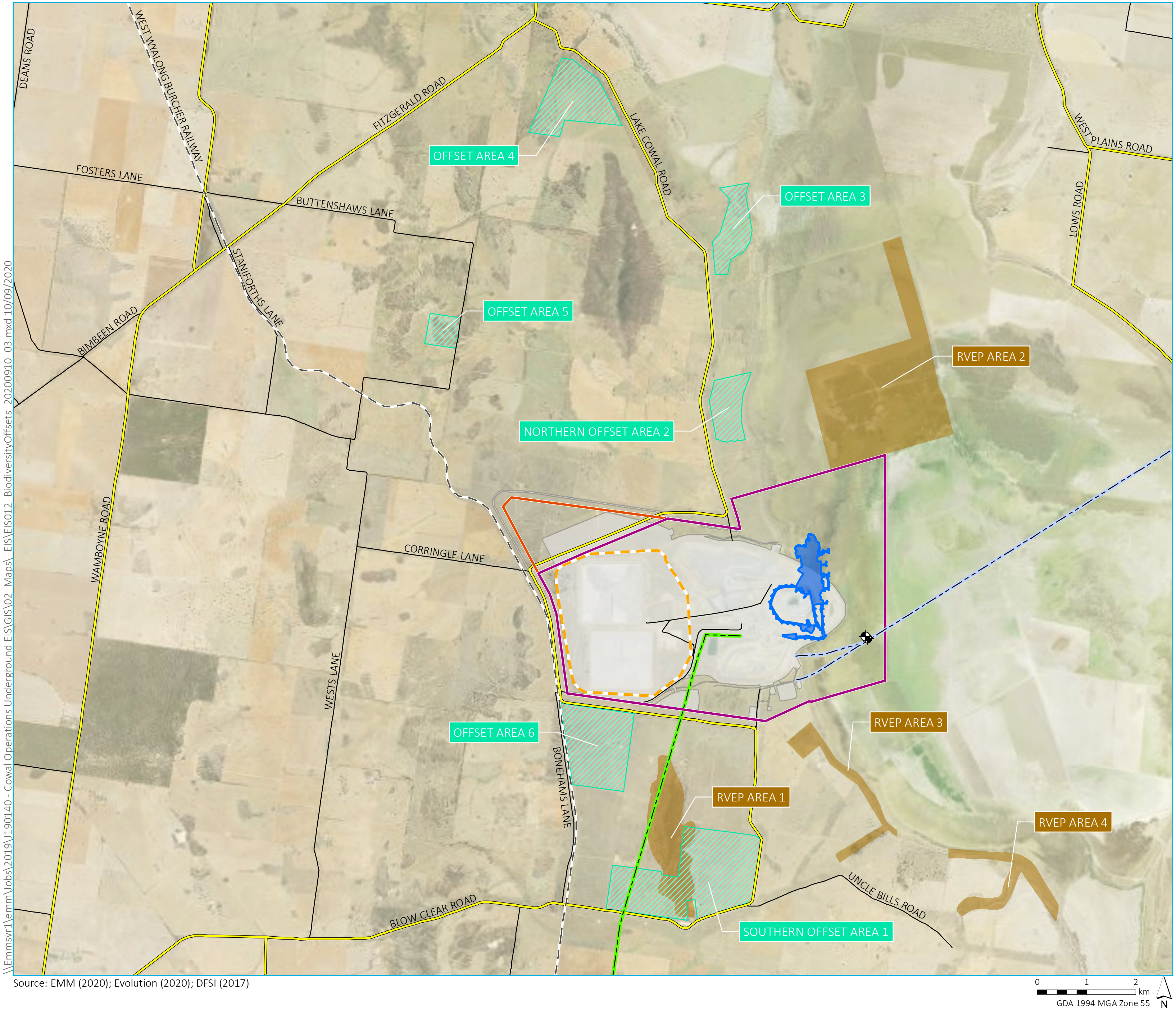
Site water storages are summarised in Table 2.3.

Table 2.3 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) within the site. When 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 941 ha (refer Figure 2.2).



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

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Biodiversity offset areas

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 2.2

EMM
creating opportunities

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

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 2.4 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 1.2)	• 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 2.4 Preferred and alternate traffic routes

Alternate route to/from Forbes when the water level is high in Lake Cowal/Nerang Cowal	• 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	• 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. It is generally proposed to continue the existing systems and methods for handling waste streams at CGO. These are outlined below in sections 2.18.1 to 2.18.6.

2.18.1 General liquid waste

i 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)

i Recyclables

Recyclable materials produced on site such as cardboard, paper, plastic, glass and aluminium cans are stored temporarily in designated areas before being collected on a regular basis by external contractors.

2.18.3 General solid waste (putrescible)

i Trash screen oversize waste

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

Damaged or bald tyres from the CGO heavy equipment vehicle fleet are buried within designated areas of the waste rock emplacements.

2.19 Workforce

CGO has an existing approximate workforce of 395 people and up to 445 during peak periods (which includes contractors).

2.20 Hours of operation

The approved hours of operation for the CGO are shown in Table 2.5.

Table 2.5 Hours of operation

<table>
<tr><th>Activity</th><th>Hours</th></tr>
<tr><td>Construction of TSF lifts or rock buttress</td><td rowspan="2">7:00 am to 6:00 pm, 7 days a week</td></tr>
<tr><td>Supplementary IWL activities</td></tr>
<tr><td>Construction of Lake Cowal water supply pipeline (excluding construction at the western side of Lake Cowal</td><td rowspan="2">7:00 am to 6:00 pm, Monday to Friday
8:00 am to 1:00 pm, Saturday
No activities on Sundays or Public Holidays</td></tr>
<tr><td>Lake Cowal Road Realignment construction</td></tr>
<tr><td>All other activities</td><td>24 hours a day, 7 days a week</td></tr>
</table>



Part A – The Project

Chapter 3 The Project

EMM
creating opportunities

Evolution
MINING

3 The Project

3.1 Overview

Evolution is proposing to construct and operate an underground mine to extract an additional 1.8 Moz of gold over a period of 17 years from deeper extensions of the orebody adjacent to the existing open-cut pit. The site location is shown in Figure 1.2. The conceptual layout of the underground mine infrastructure is shown in the plan views in Figure 1.3 and Figure 1.4.

For ease of visualisation, the conceptual design of the underground mine in relation to the existing E42 open-cut pit and the GRE46 underground ore deposit is shown in the orthogonal view in Figure 3.1.

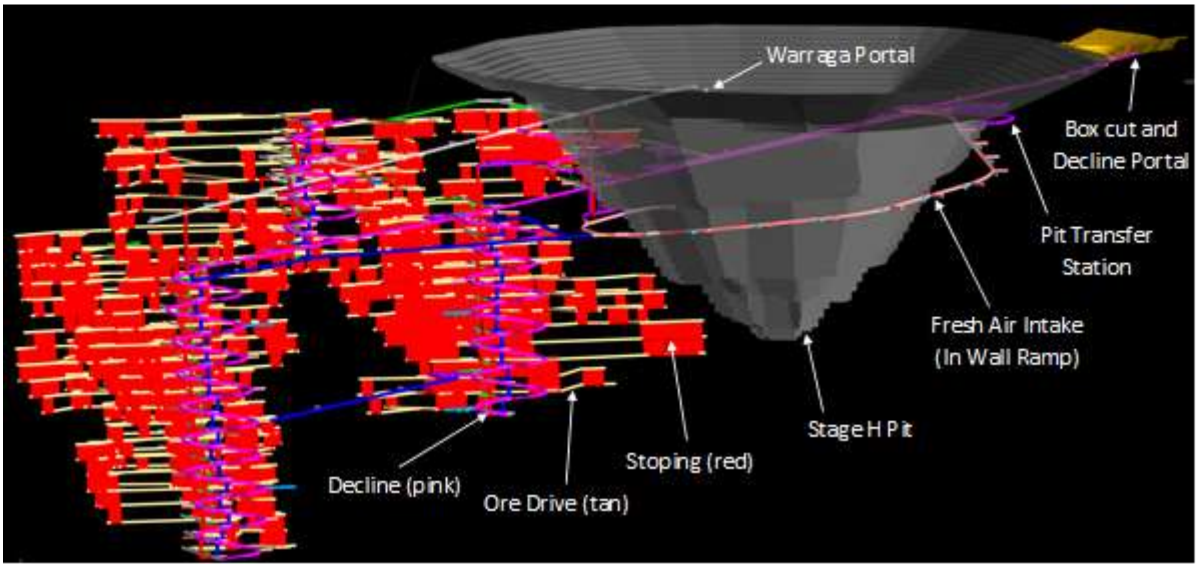


Figure 3.1 Conceptual design of the underground mine

Underground access will be provided by two declines and ore extraction will take place using sub level open stoping (SLOS). Following ore extraction, open stopes will be backfilled using cemented paste fill.

The Project also involves the construction and operation of related infrastructure including development drives, mine ventilation system and dewatering system.

Evolution has prepared this document in support of a development application for a SSD application under Division 4.1 of Part 4 of the EP&A Act to construct and operate the underground gold mine.

As noted in Chapter 1, other applications will be made under other legislation for related developments both on-site at CGO and off-site. This development application only covers the underground mining activities and new directly associated infrastructure. Changes to existing surface infrastructure which are required to support underground mining, are not part of this development application; they will be considered under Mod 16 to the existing CGO development consent (DA14/98).

The major Project components are summarised in Table 3.1 and their layout is shown in Figure 1.4. Detailed descriptions of mine development components, including their construction and operation, are provided in sections 3.4 to 3.11.

Table 3.1 Underground Development Project – key components overview

Aspect	Description
Tenement	The underground mine is located within ML 1535.
Development application area	The development application area is shown in Figure 1.2.
General description	Construction and operation of an underground mine at the CGO to extract the GRE46 mineralisation, which includes: • a box-cut entry to the underground workings; • two declines to provide underground access and ventilation: one decline via a portal on the existing open-cut pit and the other via a box-cut, providing access for personnel and maintenance; • six access points to the main decline for access, ore haulage, ventilation circuit, underground services and emergency egress; • a network of underground tunnels to provide access to the ore, transportation to the surface and ventilation; • use of SLOS to extract the ore; • production of up to 27 Mt of ore at a rate of 1.8 Mtpa; • production of approximately 5.74 Mt of waste rock; • delivery of extracted ore to the surface by truck; • development of a paste fill plant, and the delivery of cemented paste fill via a borehole and the backfilling underground stopes with the paste; and • development of ancillary underground infrastructure to support the underground operation, including dewatering infrastructure, ventilation system, electrical reticulation.
Project duration	A Project life of 19 years comprising: • construction of the decline and development drives over a period of up to two years; and • ore production of the currently known economic resource over 17 years.
Mineral Deposit	The mine would develop the GRE46 mineral deposit.
Estimated Resource	As at 30 April 2020, the Cowal Underground Mineral Resources and Ore Reserves were estimated as follows (ASX announcement 23 July 2020): • 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 have been classified as Indicated category under JORC (2012) code.
Mining method	• Top down SLOS to a depth of -850 m AHD (159 RL) with approximately 1,106 stopes developed over the life of the mine. • Backfilling of stopes with cemented paste.
Mine development layout and progression	• The underground mine layout is shown in Figure 1.3 and Figure 1.4. • The underground mine will be developed progressively, as the decline is excavated laterally and to depth. • Development of the underground mine with six access points to the decline off the existing open-cut pit. These will provide access for personnel and maintenance, ore haulage, ventilation and emergency egress.

Table 3.1 Underground Development Project – key components overview

Aspect	Description
Stope backfill	• Stopes to be fully backfilled with cemented paste material made from dewatered tailings and cement. • Paste material to be produced in a purpose-built paste plant on the surface. • Paste material will be delivered to the underground workings via a borehole near the paste fill plant.
Annual mine extraction rate	Up to 1.8 Mtpa of ore to be extracted over the Project life.
Ore transport	Ore will be transported to the surface by truck.
Underground mining fleet	Underground mining equipment includes, but is not limited to: • development drills; • production drills; • load-haul-dump vehicles; • trucks; • integrated tool carriers; • graders; • explosives machine; • ground support installation equipment; and • agitator trucks for shotcrete.
Workforce	• Construction: estimated workforce of up to approximately 160 full time equivalent (FTE) employees and contractors, which will be used to develop the underground mine Project and the supporting surface infrastructure. • Operations: estimate additional workforce of up to approximately 230 FTE employees working over two shifts.
Hours of operation	The underground mine will operate 24 hours a day, 7 days a week, except for periods of scheduled maintenance.

3.2 Assessment of alternatives

The design of the Project represents the current optimised conceptual configuration. This conceptual design has been developed by Evolution in a collaborative, multi-disciplinary process through the completion of various concept, pre-feasibility and feasibility studies.

The following sub-sections provide an overview of the assessment stages undertaken by Evolution in the concept design development, including the alternatives considered in selecting the Project configuration that forms the basis of this EIS.

3.2.1 Assessment stages

The pre-development phase of a mining Project typically involves three phases of assessment, with each phase usually completed and a decision made before proceeding to the next. The three stages are:

- Concept and/or scoping phase: the scoping phase of a Project, whereby a conceptual mine plan is outlined and potential production outputs and costs are estimated at a high level (typical accuracy of 30 to 35%).

- Pre-feasibility (PFS) phase: the preliminary assessment phase of a Project, whereby more detailed exploration results help to delineate the orebody and proposed mining, processing and waste management methods are identified. Potential significant environmental, social and cultural heritage constraints are also described. Potential production outputs and costs are estimated with more accuracy (typical accuracy of 20 to 25%).

- Feasibility phase: the critical assessment phase of a Project used to determine its viability, comprising a detailed mine plan including mining method, production rates, supporting infrastructure and budget forecast. Predicted environmental, social and cultural heritage risks and impacts and potential management measures to address these are also described. Potential production outputs and costs are estimated with more accuracy (typical accuracy of 10 to 15%).

The assessment phases are undertaken with the general objectives being to establish the financial and technical feasibility of the Project and to define the Project in sufficient detail as to provide a basis for a forward work plan for further investigations. If the proposed mining Project is found to be feasible, it may proceed to detailed front-end engineering design for all Project infrastructure.

At the time of writing, the PFS phase had been completed for the Underground Development Project, with a feasibility study currently in progress.

3.2.2 Concept design development

The development of the Project is subject to a range of constraints that will influence Evolution's capacity to develop the Project successfully, and the extent to which Project stakeholders (local communities and regulators) support its development. These constraints include:

- Physical: the fixed location of the orebody, site-specific geological, topographic, climatic and other factors.

- Environmental: the existing environmental values, including groundwater, surface water, soils, biodiversity and other factors.

- Social: the characteristics, values, lifestyle, expectations and concerns of community stakeholders.

- Cultural heritage: the cultural heritage values, expectations and concerns of traditional owners.

- Economic – the commercial viability of the Project and the values, expectations and concerns of Evolution's shareholders.

The conceptual design considered in this EIS and supporting assessment represents the current optimisation of the Project, taking into consideration all physical, environmental, social, cultural heritage and economic considerations. Engineering design and other assessments, including environmental studies, are continuing and there is potential that aspects of the proposed Project design, layout and schedule, including the alternatives described, may change.

3.2.3 Alternatives considered

The CGO site is an existing open-cut mining operation with an established disturbance footprint and substantial existing surface infrastructure. Much of the existing surface infrastructure will be utilised to support the Underground Development Project, with some modifications to support processing of underground ore from the GRE46 mineral deposit. As such, key alternatives considered by Evolution during concept, scoping and PFS phases focused on:

- the use of conventional open-cut versus underground mining methods; and
- the use of stoping versus other underground mining methods.

During the concept and scoping phase, mining of the GRE46 mineral deposit was evaluated using conventional open-cut pit versus underground mining methods. This evaluation concluded that mining the GRE46 mineral deposit at depth using conventional open-cut methods was sub-economic, primarily due to the nominal orebody width, high strip ratios and the overall depth of the deposit. A subsequent evaluation was completed to determine whether the GRE46 mineral deposit could be economically extracted using conventional underground methods. This evaluation, which was further refined during the PFS phase, demonstrated that SLOS with paste fill backfilling was economic.

Other underground mining methods, such as sub level caving and block caving were effectively ruled out early in the PFS due to their likely impact on subsidence in Lake Cowal. Mining methods such as sub level caving and block caving also require a much higher upfront capital cost to establish steady state underground operations which would negatively impact the Project economics. SLOS with paste fill was selected as the most suitable option considering all relevant physical, environmental, social, cultural heritage and economic factors.

Given that the GRE46 mineral deposit is situated primarily beneath Lake Cowal, key considerations during early planning were to ensure that:

- there is zero surface disturbance outside of the existing approved disturbance footprint;
- negligible subsidence impacts occur on the surface of Lake Cowal; and
- very importantly, there is negligible possibility of a failure (such as chimneying) to the surface.

Stope failure to the surface is commonly known as 'chimneying'. It is a relatively rare failure mechanism in underground mining, such as stope mining, where rock above a stope collapses inwards and, over time, 'unravels' to the surface often in a tubular or chimney shape. When it occurs, it is generally because the area being mined intersects with a fault, or an area of weakened or weathered rock. The awareness of this potential failure risk is commonplace for underground mining operations and a range of controls are applied to proactively manage the risk.

Should it occur, a failure to the surface would not only have unacceptable and potentially major ecological impacts on Lake Cowal and its biodiversity, assuming the lake was inundated, it would also likely have the following major impacts and implications for CGO and Evolution:

- it would flood and possibly sterilise the resource in the underground mine;
- it would possibly cause a health and safety incident for workers; and
- it could potentially flood and sterilise the existing open-cut pit, as water could back flow through the underground mine access declines into the open-cut pit.

This extremely unlikely event could have major reputational, social and economic implications for Evolution and the regional community. Given the potential major implications of failure, CGO will continue to evolve the conceptual design and management and mitigation measures of the underground mine during the feasibility, detailed design and operational design processes with a primary focus on ensuring the risk of failure is eliminated to a negligible risk.

3.2.4 Design iteration process

The initial stope design that was modelled by Beck identified 19 stopes that were located in close proximity to the weathered cover sequence geology, or within the cover sequence layers. Seven of these stopes extended into the hard oxide (a weak to moderate strength rock mass that has been weathered) and some were in close proximity to the top of fresh rock contact with a small crown pillar thickness in strong fresh rock.

Some stopes also extended close to the base of the soft oxide, which is geotechnically very weak. These stopes were seen to have a significantly elevated risk of chimneying to surface due to the close proximity of the weak cover layers. Chimneying to surface would have potentially catastrophic impacts on the lake and to the underground mine should stope failure reach the surface or groundwater table. Due to the elevated risk of crown pillar instability and chimneying potential of these stopes, they were removed from the mine design, and an updated mine design without these stopes was adopted.

3.3 Mine geology

The gold orebody at CGO is situated in rock that is part of the Lake Cowal Volcanic Complex, an assemblage of massive and stratified, nonwelded pyroclastic debris, overlying a partly brecciated lava sequence and volcanic conglomerate interbedded with siltstone and mudstone (Coffey 2020a). The stratigraphic units at the site are consistently oriented 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.

With respect to groundwater, there are four key hydrogeological units that have been identified at the CGO site (Coffey 2020a):

- The Transported unit, which represents the near surface layers and comprises around 20 m of alluvium (thick clay sequences and more permeable zones of gravel within sandy clay), of the Quaternary-aged Cowra Formation.
- The Saprolite unit, which underlies the Transported unit and is of relatively low hydraulic conductivity and comprises around 35 m of extremely weathered rock and weathered clay.
- The Saprock unit, which underlies the Saprolite unit and occurs in the weathered fractured surface of the Lake Cowal Volcanics and comprises around 30 m of highly to moderately weathered rock with some zones of clay.
- The Primary Rock unit, which consists of the fresh rock underlying the Saprock unit. This unit is generally considered to be less fractured and less permeable than the Saprock.

The conceptual hydrogeological model of the site, as developed by Coffey (2020a) and adapted by EMM, is presented in Figure 3.3, with a more detailed description provided in Chapter 10. Hydrogeological investigations undertaken to date (Coffey 2020a) indicate that the groundwater table in the Project area ranges between approximately 123 and 216 m AHD (6 and 81 m BGL), with groundwater elevations highest in the western portion of the site beneath the TSF cells (Transported unit) and lowest in the eastern portion of the site directly east of the open-cut pit (Saprock unit). Groundwater elevations are lowest in the Saprock unit where lower permeabilities result in perching related to dewatering campaigns in the open-cut pit.

3.4 Mining

3.4.1 Mining method

Stope mining methods will be used to extract the ore. Stope mining involves the sequential extraction of ore in discrete blocks of ore through a process of drilling, blasting, excavation of broken rock (bogging) and, at this site, backfilling using paste. This method allows a great degree of flexibility in how the mine is developed. Stope mining is also a selective mining method with little dilution of ore by barren rock. Further, it uses significant pillars of undisturbed rock between stopes to maintain ground stability and to protect worker safety.

SLOS is one method of 'blasthole' stope mining, which is best suited to mining of the GRE46 mineral deposit given its characteristics. A conceptual illustration of SLOS is provided in the schematic in Figure 3.2. A 'drift' is driven along the bottom of the ore body, and this is eventually enlarged into the shape of a trough. At the end of the trough, a 'raise' is driven to the drilling level above.

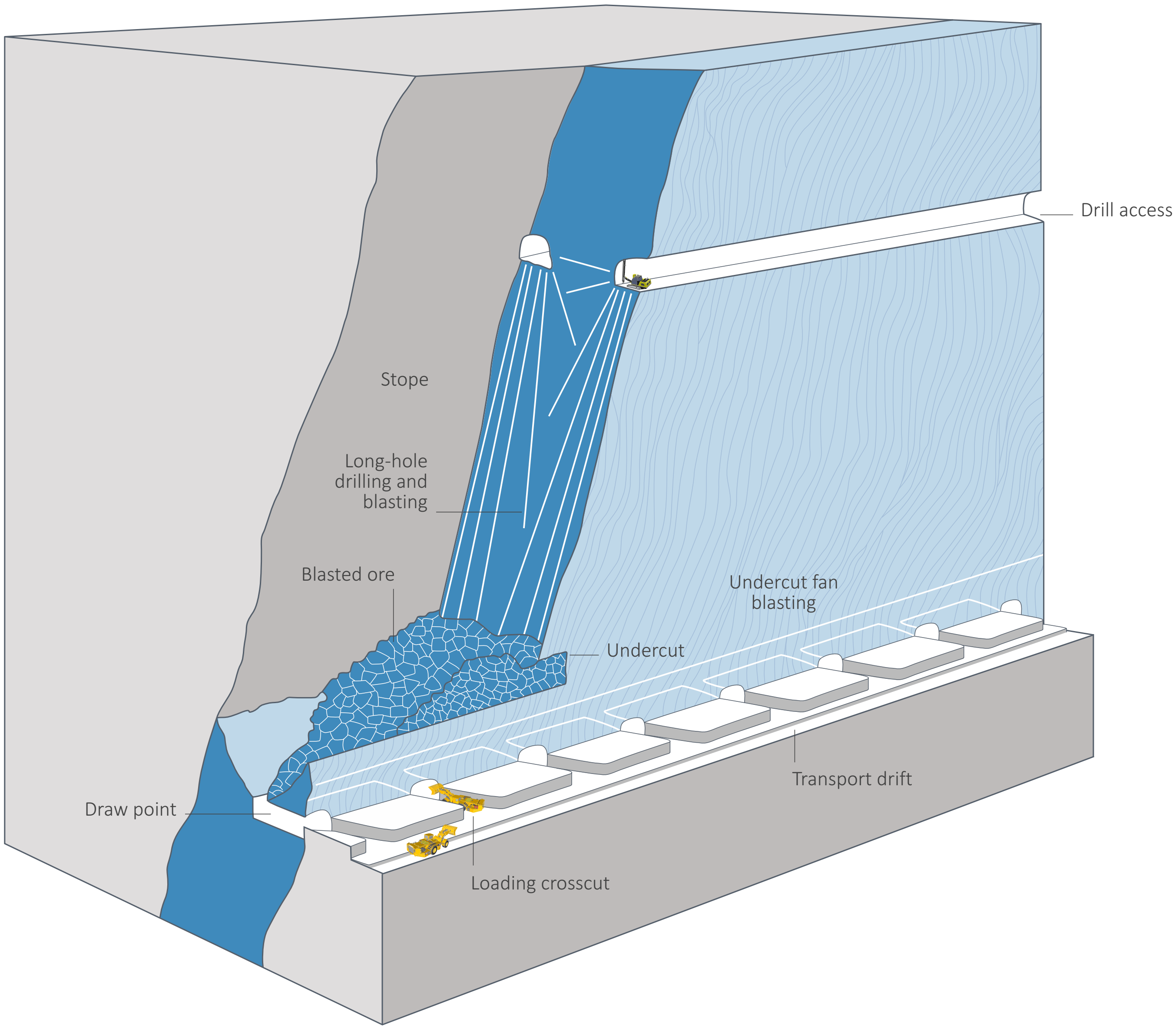
This raise is enlarged by blasting into a vertical slot extending across the width of the ore body. From the drilling level, long blastholes are drilled, typically 100 to 150 mm in diameter, drilled either parallel to each other or radiating out from the drilling level. Blasting is then conducted, beginning at the slot. As mining retreats down the drilling drift, blasting successive slices from the slot, a large void develops. Several techniques are available for extracting blasted ore from the trough bottom. In the case of the Project, trucks will be used to remove ore to the surface. In sub level stoping, shorter blastholes are drilled from sub levels located at shorter vertical intervals along the vertical stope.

SLOS is a large scale, yet still selective mining method easily adapted to ore bodies between 6 – 30 m wide and with near-vertical dips of between 70 – 90 degrees (as is the case of the GRE46 mineral deposit). It is also compatible with backfilling.

The advantages of using SLOS include, but are not limited to:

- the ability to extract higher amounts of ore, which maximises economic recovery;
- the ability for stopes to be backfilled;
- easy adaptation by using other geotechnical controls (ie the use of pillars);
- it allows extraction to be highly mechanised; and
- it is a proven, highly safe method of extraction.

SLOS is the largest scale, most cost effective and highest recovery extraction method without resorting to caving techniques such as sub-level or block caving (for example as used at the Cadia and Ridgeway mines near Orange, NSW) and the associated risk of surface subsidence. The bulk nature of SLOS mining with backfilling reduces costs and allows for the economic extraction of a high proportion of the resource without inducing surface subsidence.



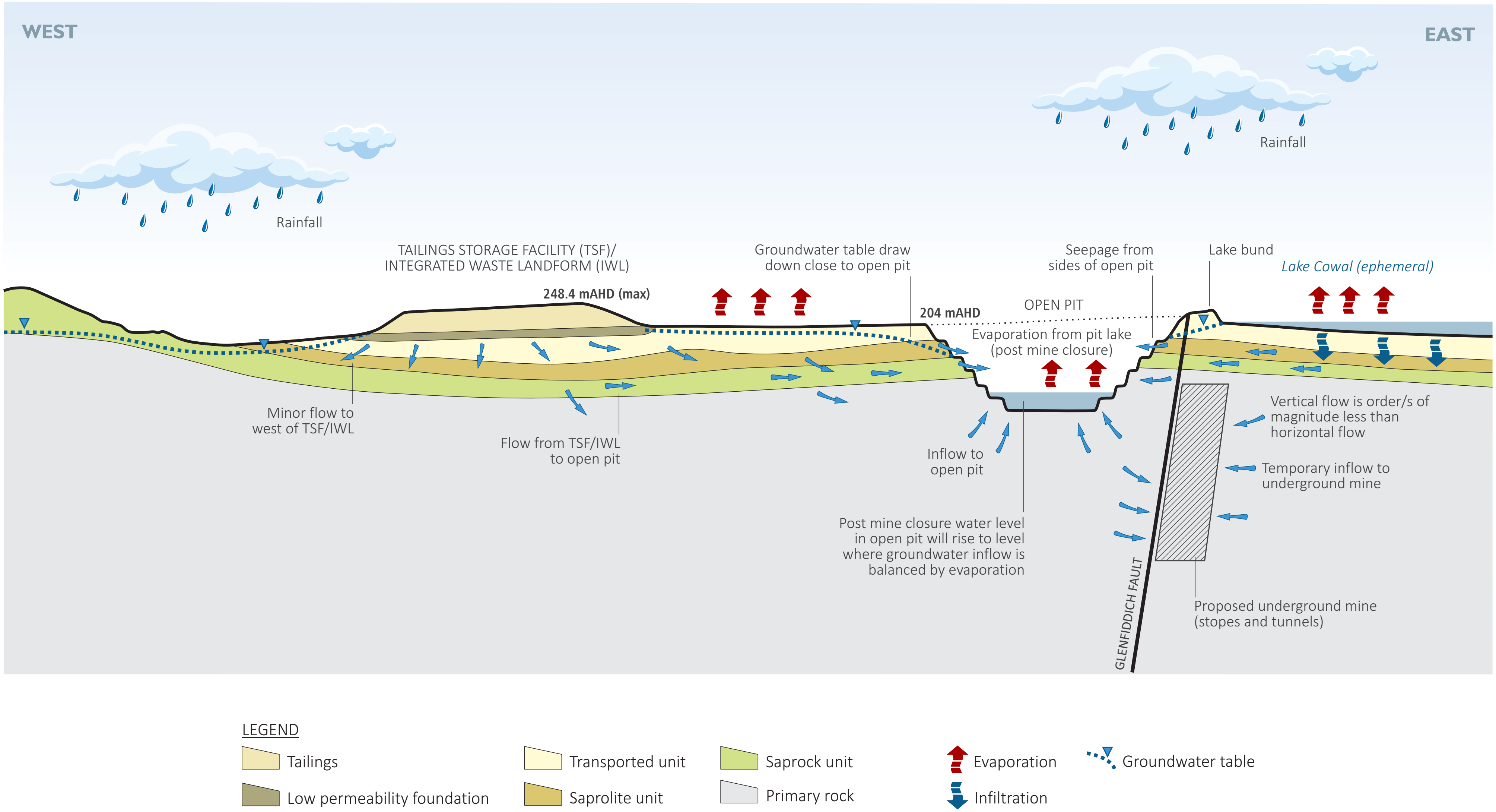
Conceptual schematic of SLOS method

Evolution Mining

Environmental Impact Statement

Figure 3.2

EMM creating opportunities



SOURCE: Coffey (2020)

Conceptual hydrogeological model

Evolution Mining
Environmental Impact Assessment
Figure 3.3

3.4.2 Mining sequence

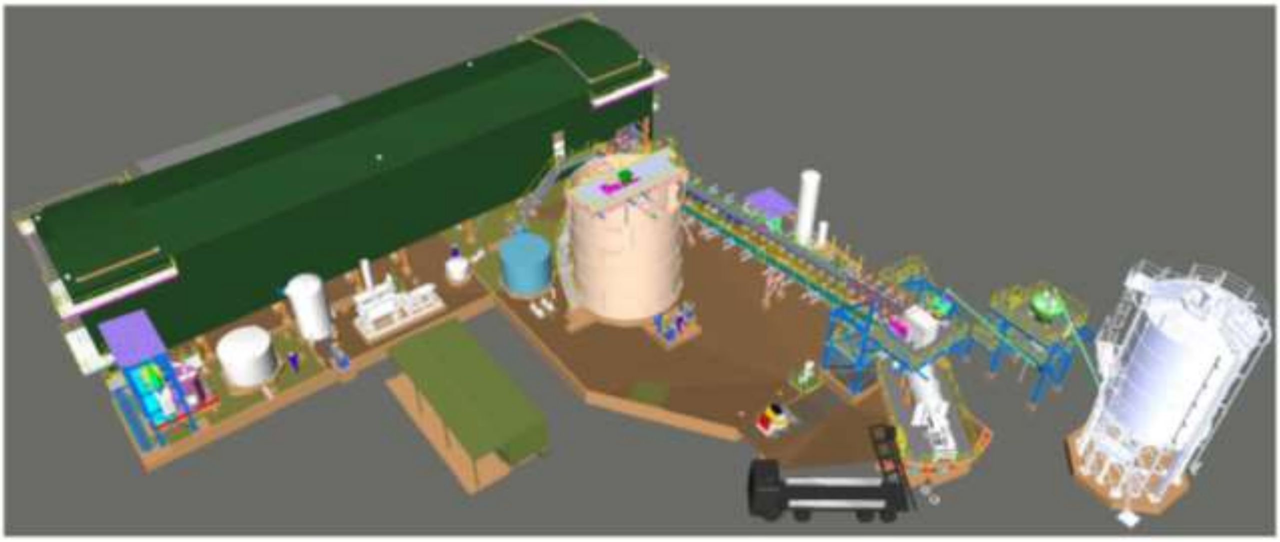
Extraction will occur in a top-down end-on retreat sequence for the entirety of the Project. There will be around 1,106 stopes developed across the life of the Project. The following general extraction sequence is expected to be used:

- excavation of an access drive to the stope;
- an initial slot void is then established;
- trimming/stripping blast is then undertaken (to establish full free firing face);
- regular production blasting will be undertaken until the entire stope is developed;
- the stope will then be bogged (ie broken rock excavated from the stope by an underground loader);
- a wall is then constructed in preparation for filling with cemented paste fill;
- the stope will then be backfilled with the cemented paste fill material; and
- the backfilled stope will be left to cure.

3.5 Paste plant

To maximise resource recovery and minimise the risk of surface subsidence, stopes will be backfilled with a cemented paste produced in a dedicated paste plant on the surface. The paste plant will have a production capacity of up to 200 cubic metres (m^3) per hour.

The paste fill plant generally comprises a tailings storage tank, dewatering facility, paste mixer and delivery boreholes. The proposed general arrangement of the past fill plant is shown in the isometric view in Figure 3.4.



Source: Appendix D (Drawing No. P6058—P01-0003) of Outotec (2020)

Figure 3.4 Paste fill plant general arrangement isometric view

The paste production process will involve pumping tailings from the processing plant to the paste plant holding tank using a new transfer pump and pipeline. From the tailings storage tank, a portion of the tailings will be further dewatered while another tailings stream (filter bypass slurry) is pumped directly to a vortex mixer positioned over the paste mixer. In the vortex mixer, slurry is combined with cement powder and that mixture then flows under gravity into the paste mixer.

The cemented slurry is combined with tailings filter cake in the paste mixer to produce a cemented paste fill with the desired characteristics. The cemented paste fill is then pumped underground via two boreholes to backfill the recently mined stopes.

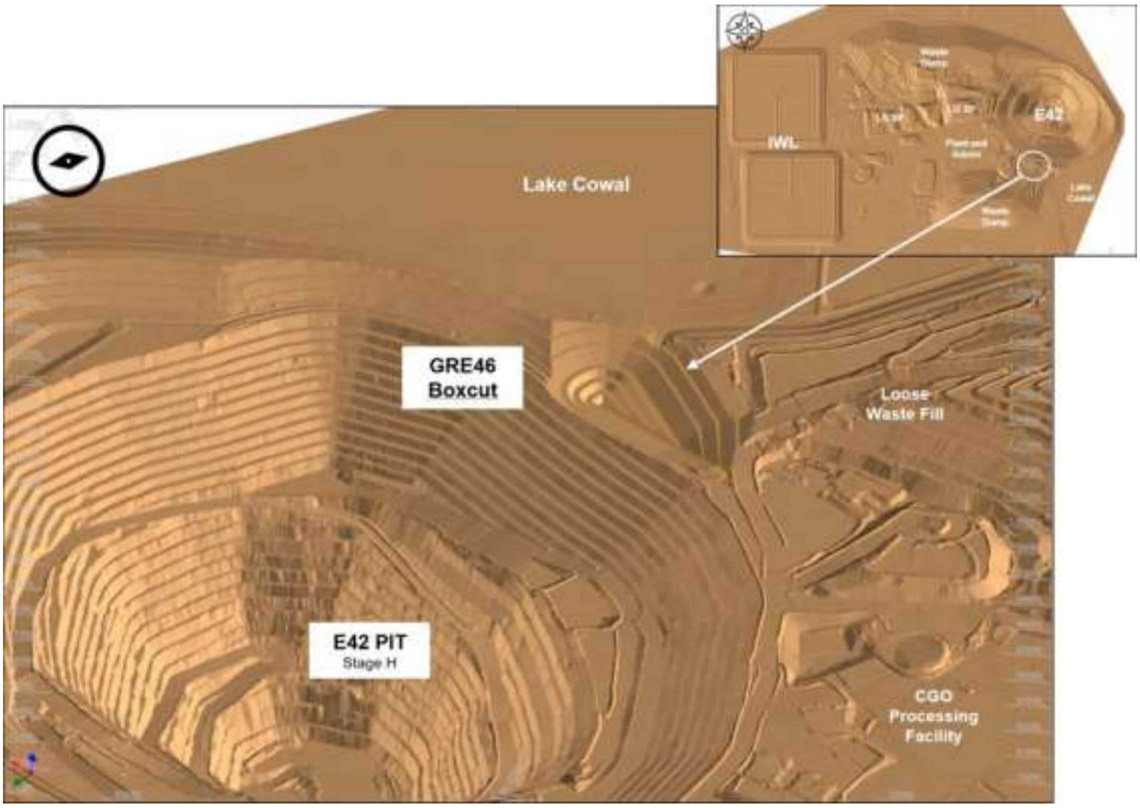
3.6 Mine entry and access

Entry to the underground mine will be provided by a box-cut and decline from the surface. The box-cut will be located adjacent to the southern boundary of the open-cut pit (refer Figure 1.4). An isometric view of the proposed box-cut is provided in Figure 3.5.

There will be six access points in total into the underground workings (refer Figure 3.6) as summarised in Table 3.2. This includes three primary access points (refer Figure 3.7) and three secondary access points (refer Figure 3.8), each with its own connecting drives to the main decline. While the secondary access points also provide ingress and egress in the event of emergencies, their main purpose is as part of the ventilation circuit.

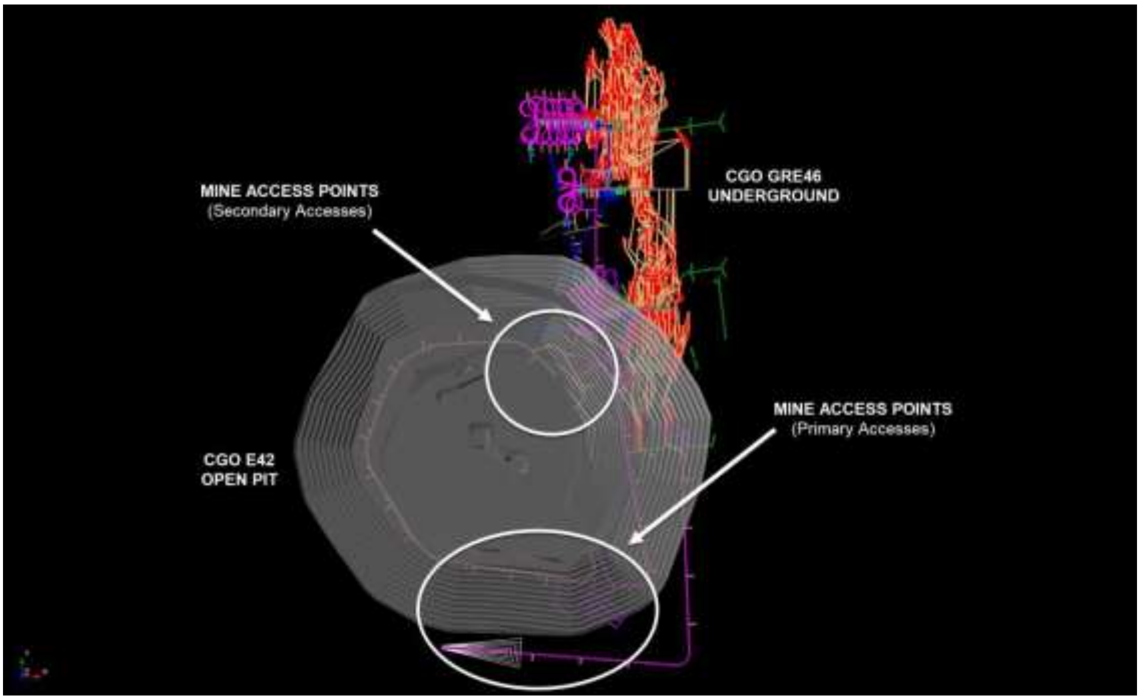
The box-cut will be the main access point to the underground mine. It will allow worker and material access, access for maintenance vehicles and will allow ore to be hauled to the processing facility at the surface.

The box-cut will be developed in the softer rock of the perimeter waste emplacement and take around five months to construct. It will be excavated using standard earthmoving plant and equipment such as excavators and front-end loaders. Construction will involve standard excavation techniques to create the portal and stabilise the sides of the box-cut. The box-cut will be excavated using existing fleet available at CGO. No drill and blast activities are anticipated to be required. This is based on historic data of mining through oxide/hardpan materials in the open-cut pit and surrounds.



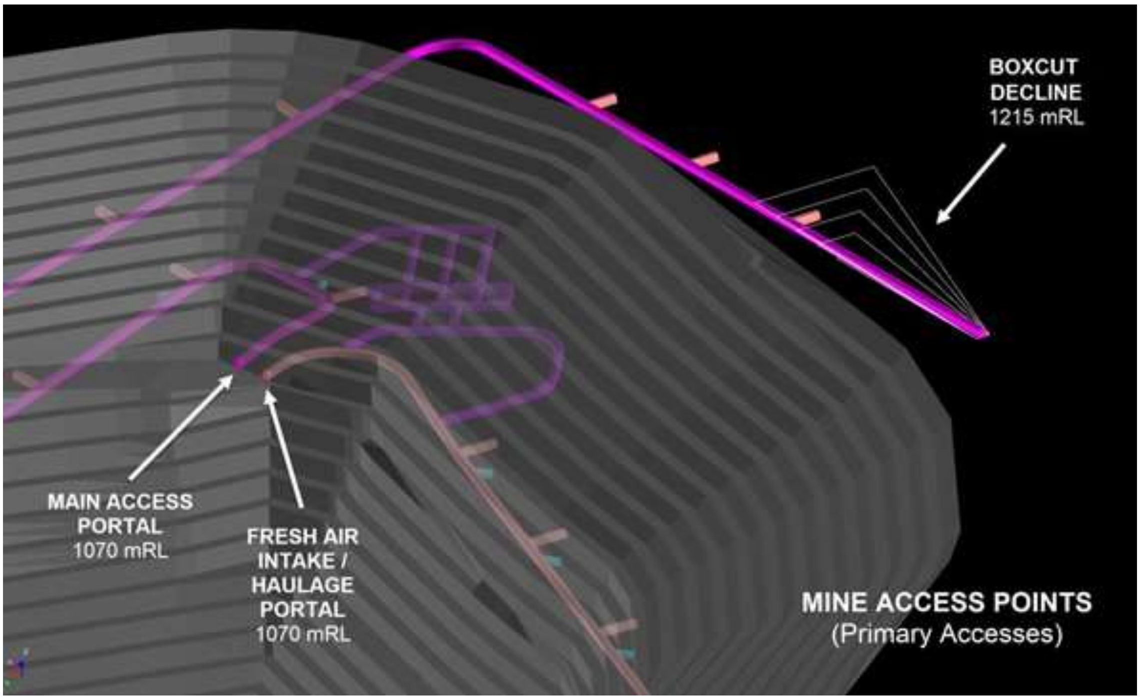
Source: Figure 1 from Resolve Mining Solutions memorandum: GRE46 UG Project Box Cut Establishment (dated 20 May 2020)

Figure 3.5 Box-cut and E42 open-cut pit isometric view



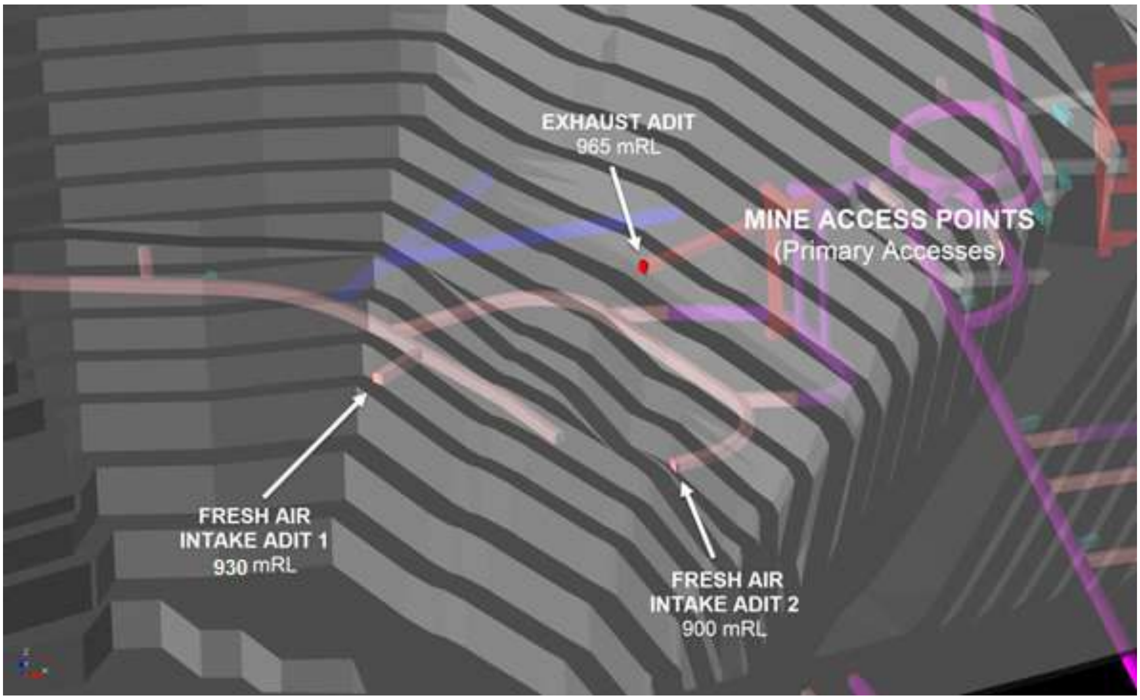
Source: Figure 1 from Resolve Mining Solutions memorandum: GRE46 UG Project Mine Entry and Access (dated 12 May 2020)

Figure 3.6 Underground mine access points overview



Source: Figure 2 from Resolve Mining Solutions memorandum: GRE46 UG Project Mine Entry and Access (dated 12 May 2020)

Figure 3.7 Primary access points to underground mine



Source: Figure 3 from Resolve Mining Solutions memorandum: GRE46 UG Project Mine Entry and Access (dated 12 May 2020)

Figure 3.8 Secondary access points to underground mine (source: Resolve Mining Solutions)

Table 3.2 Mine entry and access points summary

Name	Purpose	RL (CGM)	Elevation
Main Access Portal	The main service entry for the underground mine for personnel and vehicles.	1,070 m	61 m AHD
Fresh Air Intake/Haulage Portal (also referred to as 'in-wall ramp')	Provides a fresh air connection for lower working areas, an emergency egress route from underground workings and an alternate haulage route.	1,070 m	61 m AHD
Box-cut Decline	Provides personnel and material access to the mine and provide access for maintenance light vehicles.	1,215 m	206 m AHD
Fresh Air Intake Adit 1	Provides a fresh air ventilation for the lower stope working areas.	930 m	-79 m AHD
Fresh Air Intake Adit 2	Provides a fresh air ventilation for the material transfer points and for atmospheric dust control.	900 m	-109 m AHD
Exhaust Adit	Provides exhaust air connection for material transfer points and for atmospheric (dust and air quality) control.	965 m	-44 m AHD

3.7 Blasting

The decline will be excavated in accordance with the open-cut pit blasting conditions approved under DA 14/98. Nevertheless, the blasts during decline and drive development will be considerably smaller (ie fewer holes with less charge weight) than those used in the open-cut pit and will use specialised equipment.

Small blasts will be required to develop the underground stopes. This will require a small increase in the consumption of blasting consumables, including ammonium nitrate and ammonium nitrate emulsion.

Blasting activities will be designed and carried out to meet EPA blasting criteria and manage potential impacts on adjacent land uses. In practice, decline development blasts are most likely to be heard (if at all) in the section of the decline closest to the surface. This will diminish as the mine deepens and with changes in direction as it spirals downwards.

Blasting material, including explosives and ammonium nitrate emulsion will be stored approximately 1 km to the north north-west of the open-cut pit, as shown in Figure 1.3, in a facility which is designed to meet the separation and design requirements in *AS2187.2 2006 Explosives – Storage, Transport and Use.* The management of any additional hazardous materials which are required to be handled at the surface will be dealt with under Mod 16.

The noise and vibration impact assessment (EMM 2020a) prepared for the underground mine development includes an assessment of blasting overpressure and vibration impacts (refer Appendix D). A summary of the assessed impacts and proposed management measures is provided in Chapter 8.

3.8 Underground workings dewatering

Hydrogeological investigations undertaken in December 2019 (Coffey 2020a) indicate that the groundwater table in the Project area ranges between approximately 123 and 216 m AHD (6 and 81 m BGL), with groundwater elevations highest in the western portion of the site beneath the TSF cells (MON02B ≈ 216 m AHD) and lowest in the eastern portion of the site directly east of the open-cut pit (PD03A ≈ 123 m AHD). Once excavations intercept the groundwater table, groundwater seeps from the fractured rock aquifer into the mining void. Removal of this water to surface for reuse and to facilitate dry and safe mining conditions underground will be carried out using collection sumps and a pumping system.

Since the commencement of the CGO, the underlying aquifers surrounding and intercepting the open-cut pit have been depressurised as a result of inflows to the open-cut pit and active pit dewatering.

Despite Lake Cowal becoming inundated, groundwater inflows to the open-cut pit have remained relatively uniform at or below historical levels. This is likely because the lacustrine sediments that form the lake bed have a very low vertical permeability and act as an aquitard between the lake water and underlying strata (Coffey 1997).

Water that is able to enter the underground workings will be removed using a series of dewatering bores, sumps and pumping infrastructure. Dewatering will be required as the mine is developed to ensure the safe operations of the underground workings. Some water will be used for dust suppression underground, while the balance will be pumped to the surface for use as process water in the ore processing facility.

The groundwater assessment for the Project, (Coffey 2020a) provided in Appendix E, includes estimates of groundwater inflows into underground workings and the open-cut pit over the life of the underground mine. Predicted mine dewatering rates for the open-cut and underground mining combined will peak in around Year 11 at approximately 2.8 ML/day.

The assessment also shows that the open-cut pit will need to be continually dewatered for the life of the Underground Project, given that the pit will be used to access the underground mine. However, the dewatering rate will decline as mining in the open-cut pit is expected to cease in 2026 and remain steady thereafter as inflows and rainfall are managed in the pit.

Additional water will be required for use in the processing plant, construction activities and dust control on roads. The processing plant will require additional water usage as ore from both the underground development and open-cut pit will be mined simultaneously. The maximum water demand will peak in 2024 and estimated at 25 ML/day. This will decrease to 18 ML/day during 2032 to 2034 and then 2.9 ML/day during 2035 to 2038.

3.9 Life of Mine

After a construction period of up to two years, ore production from the underground is expected to continue for around 17 years to 2039.

3.10 Mining extent

Development of the underground mine will be staged, as the main declines are progressively extended and the mine progresses deeper. The orebody is generally narrow in shape, and the overall footprint of the underground mine is therefore also relatively narrow.

Stoping will occur in a strip approximately 1.6 km long and 100 m wide that extends north from the eastern edge of the open-cut pit to a point approximately 800 m past the northern edge of the lake protection bund. The network of access tunnels will extend approximately 200 m further west of the western edges of the stopes.

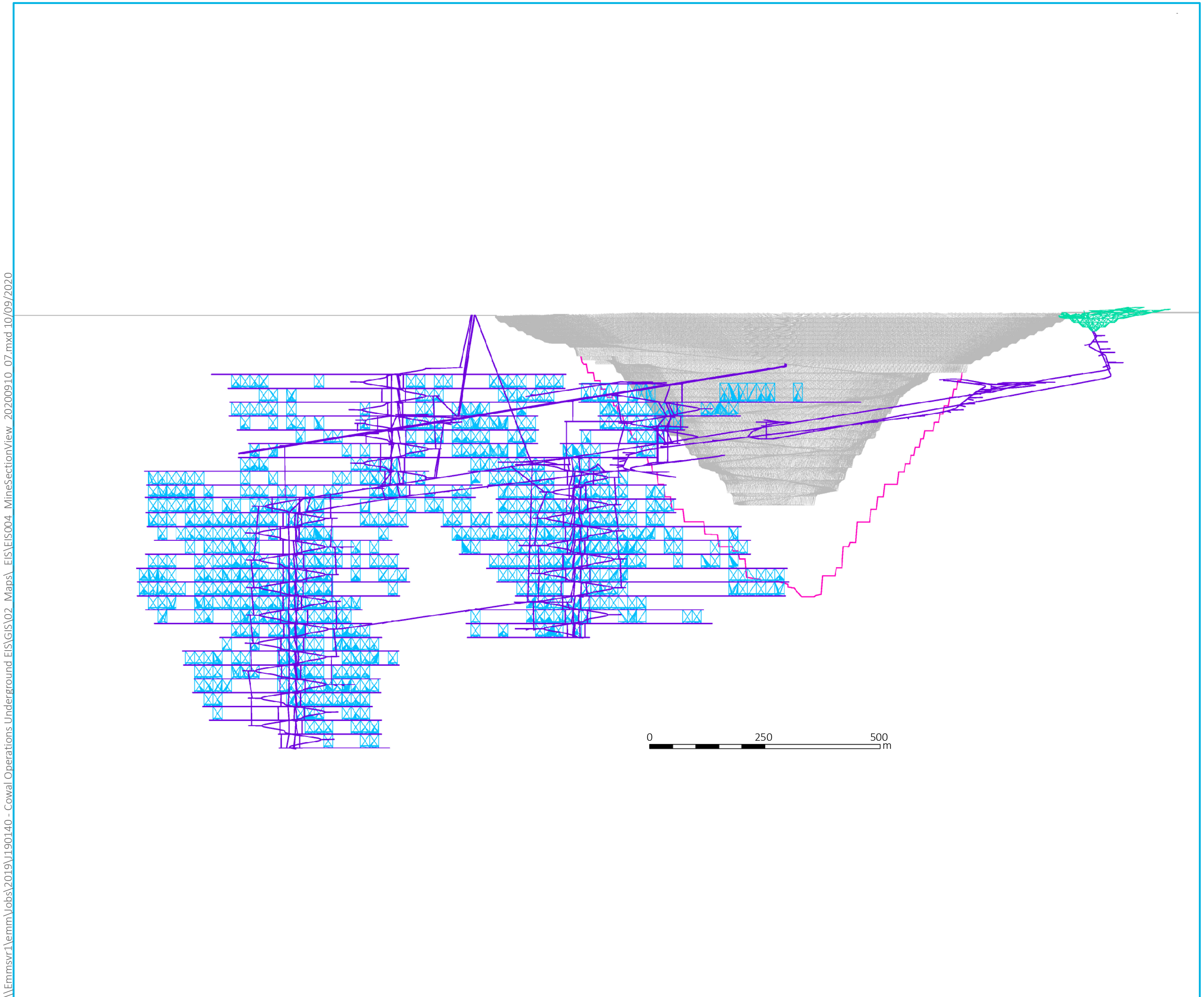
The subsurface footprint of the underground mine is estimated to be approximately 135 ha, as shown in the sectional view in Figure 3.9.

3.11 Waste rock management

Approximately 5.74 Mt of waste rock will be produced from the underground mine over its life and the majority of this will be during the excavation of the decline and development drives that provide access to the stopes. Stoping is a highly selective process and most rock removed from stopes will be classified as 'ore' and sent for processing with negligible amounts of waste rock.

During mining, overburden and material that has insufficient gold mineralisation to justify processing will be hauled to the waste rock emplacement area for disposal or used to make paste for backfill.

Approvals for the surface handling and emplacement of waste rock have been addressed under Mod 16.



KEY
- Existing E42 open-cut pit
- Currently approved final open-cut pit shell
- Proposed underground access infrastructure
- Proposed stopes
- Proposed box-cut

Proposed underground development (section view)

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 3.9

creating opportunities

Source: EMM (2020); Evolution (2020)

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3.11.1 Employment

A peak construction workforce of up to approximately 160 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.

The construction of the decline will be carried out by a specialist contractor due to the scarcity in the local area of the skillset required to undertake the works safely and competently. The construction and early operational workforces are expected to be transient and work under a fly-in fly-out (FIFO) or drive-in drive-out (DIDO) contract during the construction period and the early stages of operations.

Various accommodation options are being considered by Evolution to support both the construction and operational workforces. The preferred option is the development of a purpose-built accommodation village in West Wyalong, which would be developed under a separate development application with Bland Shire Council. Evolution is currently planning for the selected accommodation option to be in place throughout the Project to accommodate the non-local workforce. However, it is Evolution’s intention to assist in facilitating a localisation of the operational workforce as soon as it is economically viable and sufficient housing is available in the local area. Where workers relocate to the local area over time, there may be opportunities to either close, divest or reduce capacity of the accommodation village.

Part A – The Project

Chapter 4 Site and surrounds

EMM
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4 Site and surrounds

4.1 Project location and character

4.1.1 Location

The CGO site is located in the Bland Shire Local Government Area (Bland LGA), approximately 38 km north-east of West Wyalong, 60 km south-west of Forbes and 350 km west of Sydney (refer Figure 1.1).

4.1.2 Surrounding land-use

The closest town to the CGO site is West Wyalong, located approximately 38 km south-west of CGO. West Wyalong is the commercial centre of Bland Shire. Land uses in West Wyalong are primarily agricultural, residential, retail, hospitality and industrial.

The small settlement of Burcher is the closest village to CGO and is located approximately 16 km north-west of the underground development. Burcher comprises a few rural dwellings, camping grounds, general store, post office, hotel, pub and church.

The site is wholly zoned RU1 Primary Production under the Bland Shire *Local Environmental Plan 2011* (LEP) (refer Figure 4.1). RU1 is primarily for use as farming. There is a small parcel of land zoned SP2 Infrastructure to the immediate west of the site, on which the alignment of the West Wyalong Burcher Railway is located.

There are eight private residences within a 5 km radius of CGO. The closest private residence is approximately 2 km west (refer Figure 4.2).

The primary land-use of the area to the north, south and west of CGO is cattle grazing and cropping (refer Figure 4.3). This is typical of the broader Bland Shire region. To the east of the mine, agricultural areas are interspersed with rocky, vegetated outcrops running north-south. The nearest public recreation area to CGO is the Lake Cowal public reserve, which is a parcel of Crown Land around 5 km south of the mine.

The proposed underground workings extend north from the existing open-cut pit and are largely sited below the western shoreline of Lake Cowal. Lake Cowal itself has also been used for agricultural purposes during dry periods. This includes cattle grazing and cropping including wheat, barley, canola, sunflowers and oats. When the lake is full, large flocks of native water birds may breed there. Evolution owns approximately half of the land within Lake Cowal and does not allow agricultural production on this portion of the land.

There are also a number of vegetated parcels of land near CGO that form the mine's biodiversity offset areas (refer Figure 2.2).

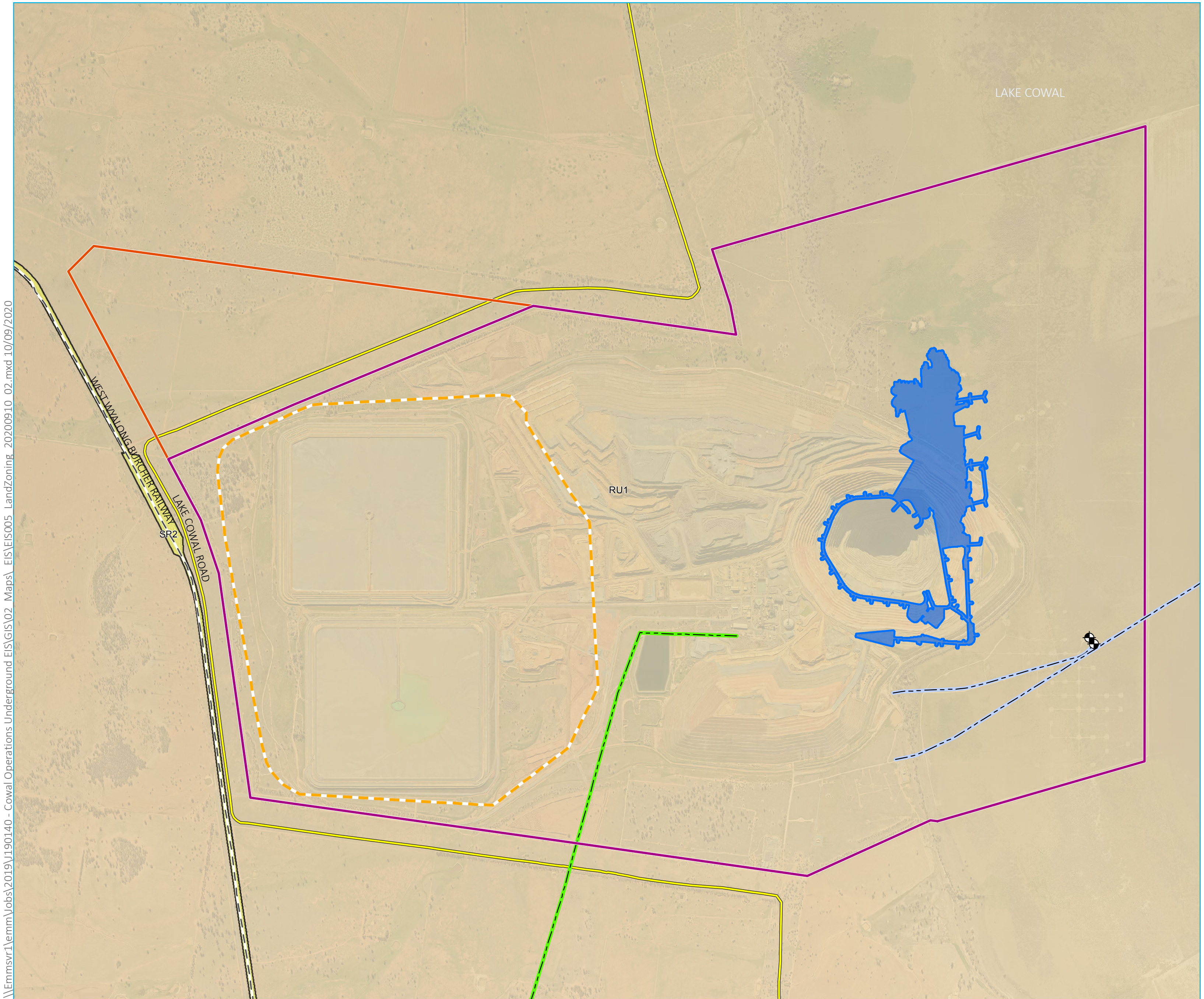
There are a number of State Forests (SF) in the local area located between 7 and 18 km from CGO. The State Forests are pine plantations, and include Euglo South SF and Nerang Cowal SF located north, Lake View SF and Corringle SF located west, Clear Ridge SF, Wyrra SF, Boxhall SF and Back Creek SF located south and Little Blow Clear SF, Blow Clear SF and Hiawatha SF located south-west.

4.1.3 Road network

The Newell Highway (A39) is 12 km away at its closest point to CGO and extends from Forbes to the B64, which connects to West Wyalong.

Lake Cowal Road, which extends from Bonehams Lane in the south to Fitzgerald Road and Bena Street in the north, extends along the western perimeter of CGO and Lake Cowal.

Access to the CGO site is via an approximately 4.3 km section of Bonehams Lane; a sealed two-lane road, that runs south of CGO to Blow Clear Road (refer Figure 1.3).



KEY

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

Land zone

- RU1 Primary Production
- SP2 Infrastructure

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

0 1 2 km

GDA 1994 MGA Zone 55

N

Land zoning of the underground development

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 4.1

EMM creating opportunities

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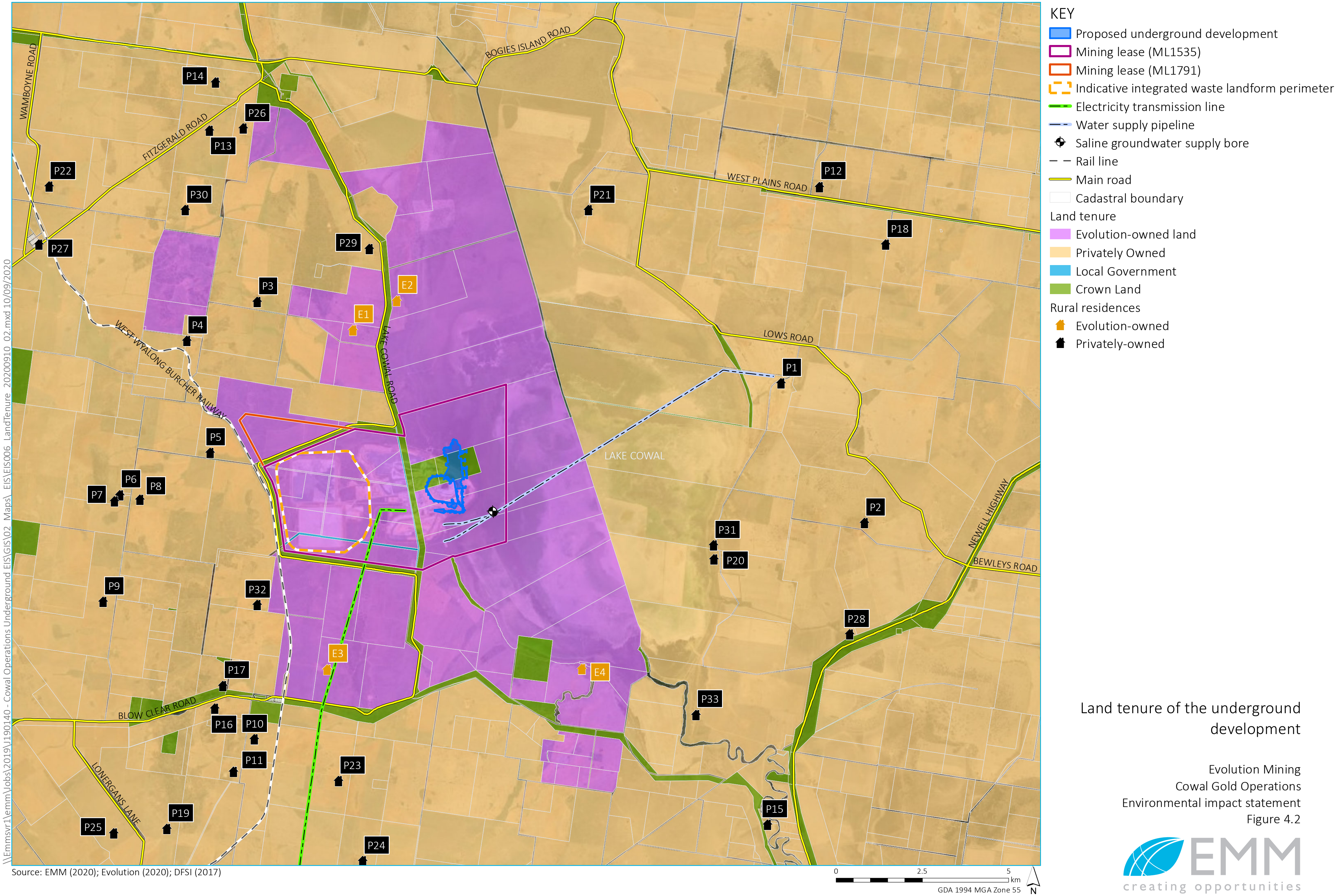
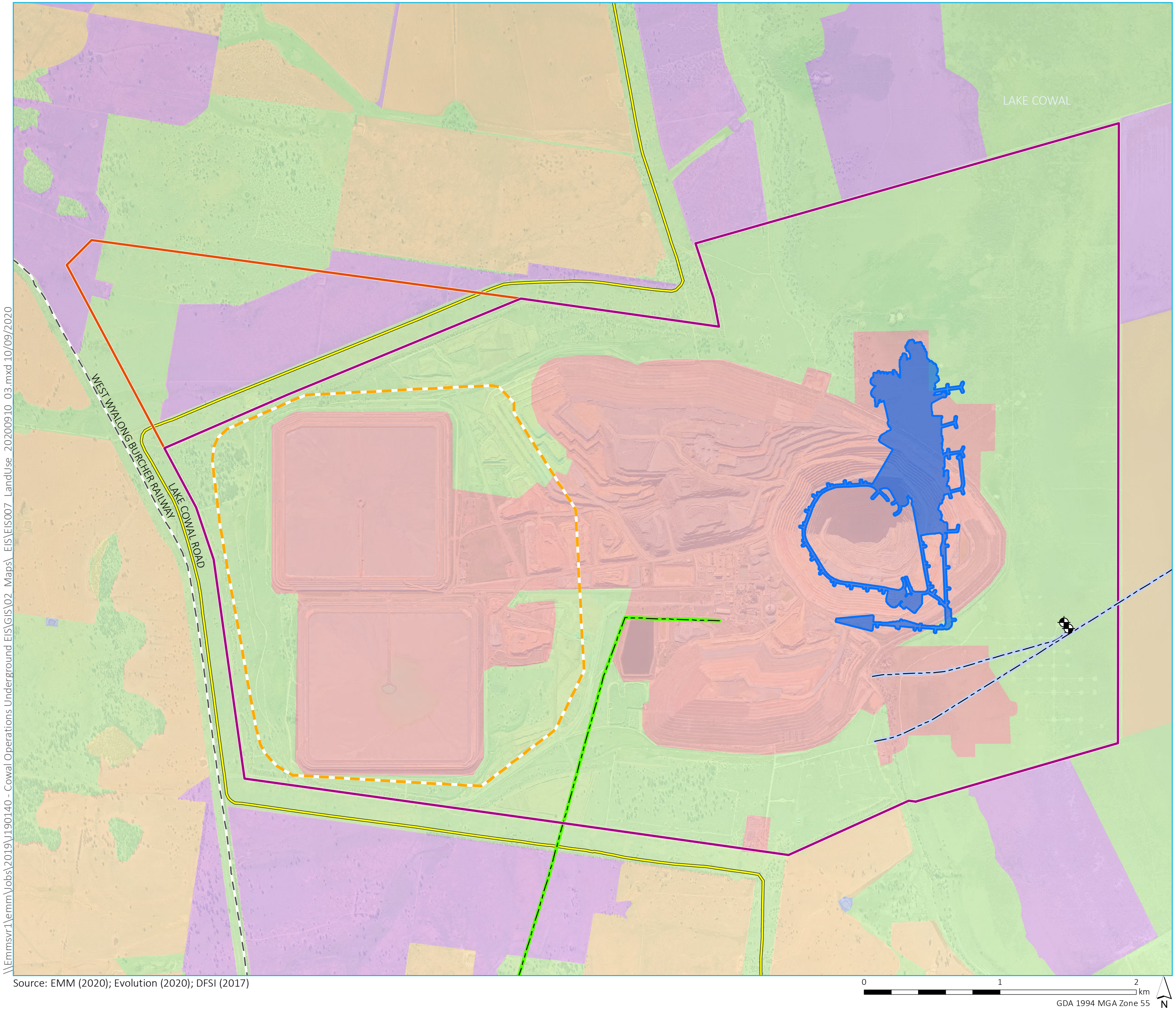


Source: EMM (2020); Evolution (2020); DFSI (2017)

Land tenure of the underground development

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 4.2



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

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Land use of the underground development

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 4.3

creating opportunities

4.2 Socio-economic

The Bland LGA has an estimated current population of 5,959 people, the majority of which are in West Wyalong (3,141 people), covering 8,559 square kilometres (ABS 2016). Bland Shire Council's dominant industries include agriculture, forestry and fishing and mining. West Wyalong is surrounded by several smaller towns including Naradhan, Weethalle, Tallimba, Mirrool, Barmedman, Ungarie and Wyalong. Regionally, the Central West's economy is expanding, predominantly driven by mining and agriculture, which is expected to support population growth over the coming years (DPIE 2017).

Lachlan Shire LGA borders Bland LGA to the north and has a population of 6,195 people, centred in Condobolin, approximately 100 km north-west of the CGO site by road. Lachlan Shire's largest industry is agriculture, with smaller proportions working in construction, real estate and an emerging tourism sector. Forbes Shire LGA borders Bland LGA to the north-east, with the Project situated approximately 70 km from the Forbes township. The Forbes LGA has a population of 8,432 people and is currently growing in population and economic diversity (ABS 2016).

4.3 Heritage

4.3.1 Aboriginal cultural heritage

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).

The existing CGO site is highly disturbed due to current mining operations and historical agricultural and pastoral activities and has been the subject of past extensive archaeological investigations, prior to the disturbance associated with CGO.

The existing CGO site and proposed underground development Project footprint do not contain any known Aboriginal objects and are unlikely to feature unknown Aboriginal objects based on extensive previous archaeological investigations. There are no Aboriginal Heritage Information Management System (AHIMS) sites registered within the proposed Project footprint and no existing native title, land claims or Indigenous Land Use Agreements (ILUAs) are in place.

The existing CGO site operates under Aboriginal Heritage Information Permit (AHIP) Consent 1467/Permit 1468. CGO also operates under the Indigenous Archaeology and Cultural Heritage Management Plan (IACHMP) (Barrick 2003a).

4.3.2 Historical heritage

Historically, agricultural and pastoral activities, such as cropping, and livestock grazing have occurred in and surrounding Lake Cowal and the existing CGO site.

One heritage item is listed within the CGO site boundary (Lot 7 DP753083) in Schedule 5 of the Bland LEP: *Cowal West Group comprising homestead, quarters, sheds and stables* (heritage item I11). 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.

Lake Cowal itself is listed on the Register of the National Estate (RNE) (non-statutory archive), 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 CGO or the proposed disturbance footprint of the Project which are listed on the remaining relevant statutory and non-statutory heritage databases and inventories. No evidence of potential relics has been identified during site inspections conducted to date.

The existing CGO site operates under a Heritage Management Plan (HMP).

4.4 Biophysical

4.4.1 Topography and soils

Lake Cowal is in the NSW South Western Slopes (NSS) Bioregion within the Lower Slopes subregion (EES 2016). It is within the Cowal Lakes, Swamps and Lunettes landscape unit, which is characterised by ephemeral lakes, swamps and associated channels and lunettes. Lake Cowal is at an elevation of approximately 200 m AHD in an area of minimal relief that ranges from 10 to 15 m locally.

The topography which overlies the underground development is part of the broad alluvial plain of Lake Cowal typical of the regional landscape of flat plains and low hills. The area is also part of the foothills of the western edge of the Great Dividing Range.

The underground development is located below the Lake Cowal Soil Landscape, which spans the lakebed of Lake Cowal (refer Figure 4.4). 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. The soil surrounding Lake Cowal is heavily compacted due to long-term grazing and cropping.

4.4.2 Geology

Regionally, the 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 ML 1535, approximately 500 m west of the CGO open-cut pit (Coffey 2020a).

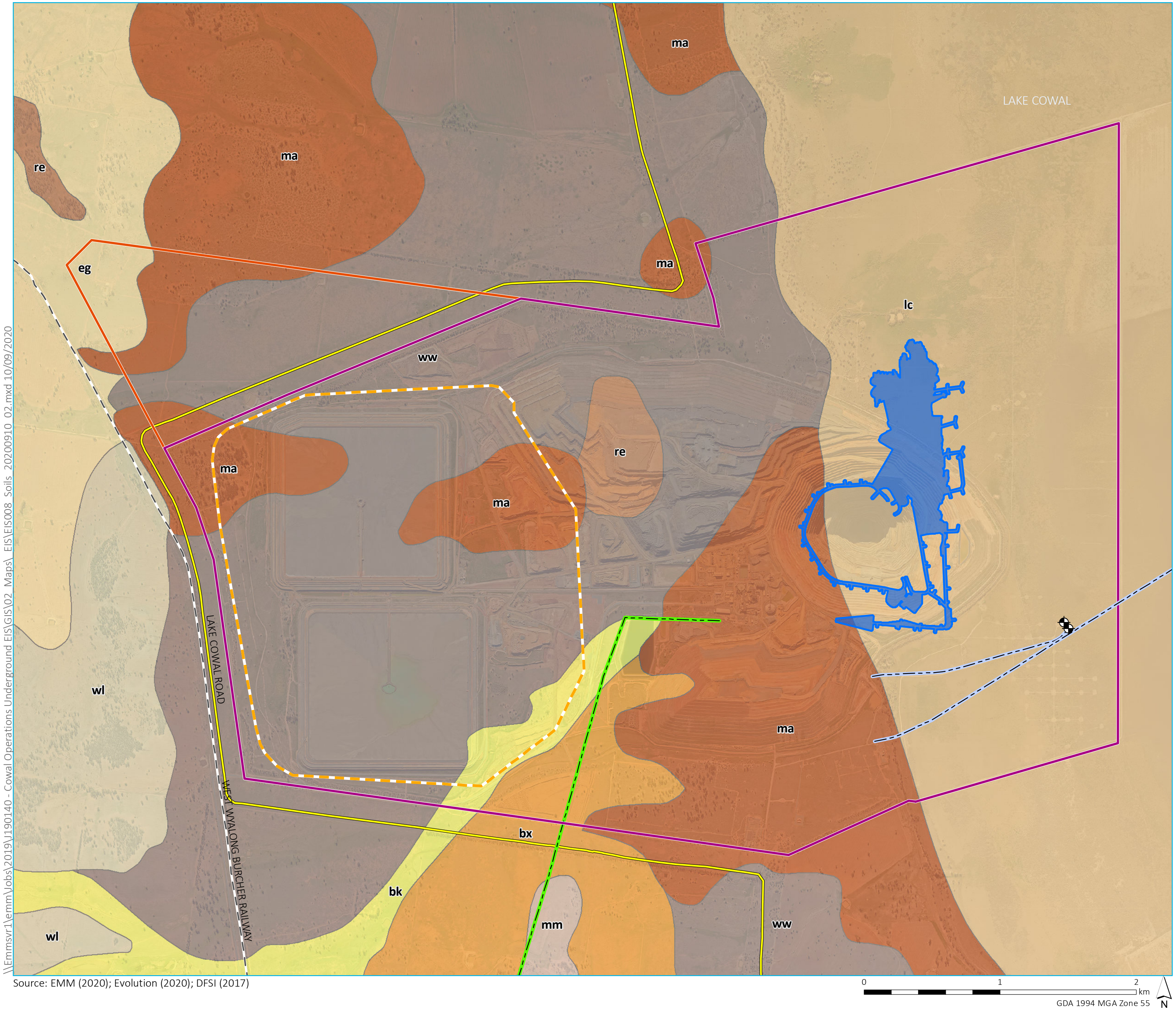
The fault separates a Late Ordovician volcaniclastic sequence (referred to as the Lake Cowal Volcanic Complex) from the Siluro Devonian sedimentary basement to the west. Siluro Devonian sedimentary rocks also occur east of the Lake Cowal Volcanic Complex on the eastern side of Lake Cowal, where the basement 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 these sediments is over 100 m. Locally, Pleistocene Cowra alluvium overlies ML 1535 and thick Quaternary lacustrine sediments underlie Lake Cowal

Locally, the existing open-cut pit and underground development are 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). Within the Lake Cowal Volcanic Complex are diorite and gabbro intrusions, one of which is intersected by the 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 (Saprock and Primary) is a Tertiary age laterite (Saprolite), which averages about 20 m and varies in thickness across the CGO from 15 to 55 m. Quaternary age sediments of predominantly lacustrine clay (Transport Alluvium) characteristically cover the Tertiary laterite. The depth of sediments across CGO and the underground development ranges from 14 to 55 m.

The mine-scale geology of the underground development is shown in Figure 4.5.



KEY

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

Soil Landscape

- Barmedman Creek (bk)
- Boxalls (bx)
- Euglo (eg)
- Lake Cowal (lc)
- Manna Mtn (mm)
- Marsden (ma)
- Reefton (re)
- Wah Way (ww)
- Weelah (wl)

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

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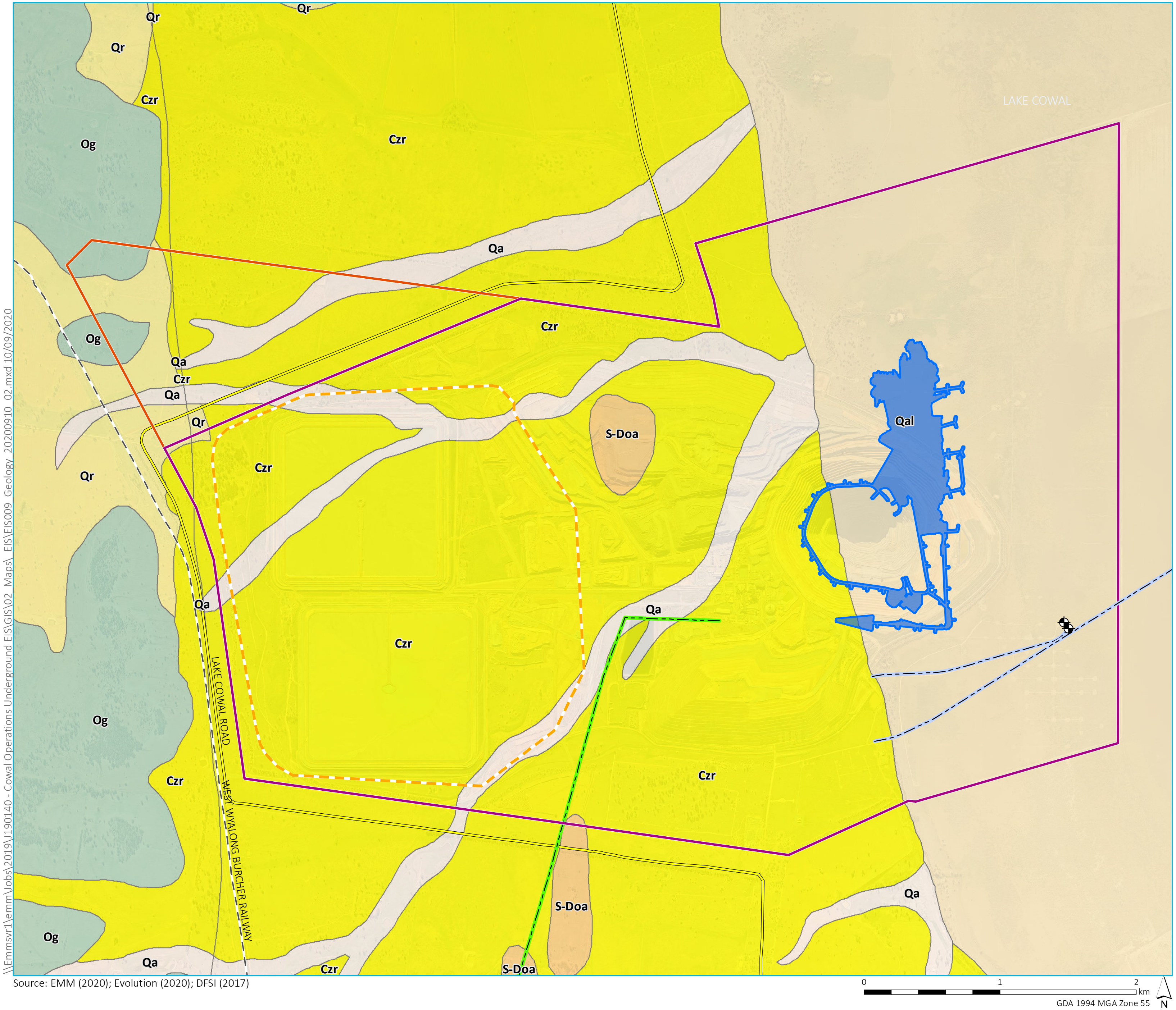
Soils of the underground development

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 4.4

EMM creating opportunities



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

KEY

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

Wyalong Geology 100K

Quaternary
- Undefined (Qa)
- Undefined (Qal)
- Undefined (Qr)

Tertiary
- Undefined (Czr)

Silurian/Devonian
- Manna Conglomerate (S-Doa)

Ordovician
- Girilambone Group (Og)

Geology of the underground development

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 4.5

EMM creating opportunities

4.4.3 Surface water

The underground development is located below the western shoreline of Lake Cowal. Lake Cowal is located in the alluvial fan of the Lachlan River, known as the Jemalong Plains and is part of the Riverina landform.

Lake Cowal is a freshwater, shallow and ephemeral lake. It is approximately 21 km long, 9 km wide and covers an area of 13,000 ha, making it the largest natural inland lake in NSW. When full, it holds approximately 150 gigalitres of water and is up to 4 m deep.

The presence of large, mature trees throughout the lakebed attest to its highly ephemeral nature, with the lake bed itself periodically used for grazing and cropping. There are several streams that discharge into Lake Cowal on its western and southern perimeter.

Lake Cowal is fed by floodwaters from Bland Creek to the south and overflow from the Lachlan River system in the north. Flows in the Lachlan River near Lake Cowal are regulated by releases from Wyangala Dam. Lake Cowal has a highly variable flooding and drying cycle of between 3-18 months to up to 30 years. Without inflows, Lake Cowal dries out due to evaporative losses, which usually takes two to three years from full storage. Lake Cowal is connected by Manna Creek to the smaller Lake Nerang Cowal around 1.5 km to its north. When flows are sufficient, the lakes ultimately overflow and drain into the Lachlan River via Bogandillon Creek.

Historically, Lake Cowal contains water around 50% of the time, however prolonged dry periods of up to 30 years have occurred since the early 20th century. From the commencement of mining by CGO in 2005, Lake Cowal was dry until June 2010. Rainfall then filled Lake Cowal, after which it slowly dried out by late 2014. Heavy rain again fell between June and September 2016, filling Lake Cowal to a peak water level of 207.49 m AHD in October 2016. Lake Cowal dried out until August 2020 when the lake received a minor amount of localised inflows.

The hydrology of the site is shown in Figure 4.6. Further detail of the existing site hydrology is provided in Chapter 10.

4.4.4 Groundwater

Regionally, groundwater systems are present in the Bland Creek Palaeochannel, which includes the Cowra and Lachlan geological formations. Locally, the underground development is located within the following four hydrogeological units:

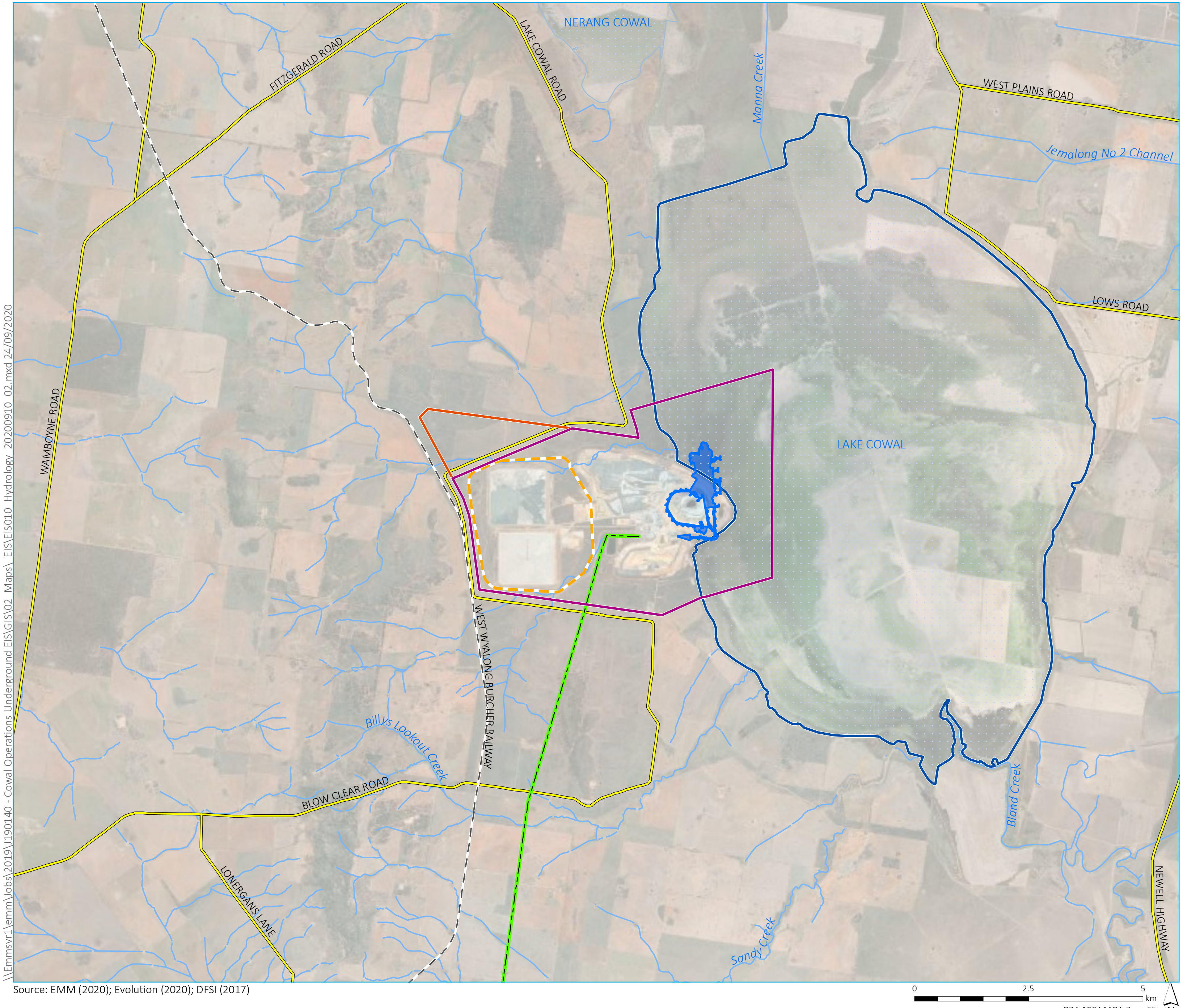
- Transported – comprises alluvium (thick clay sequences and more permeable zones of gravel within a sandy clay matrix) of the Quaternary-aged Cowra Formation;
- Saprolite – underlies the Transported unit and is of relatively low hydraulic conductivity;
- Saprock – underlies the Saprolite unit and occurs in the weathered fractured surface of the Lake Cowal Volcanics; and
- Bedrock/Primary Rock – underlies the Saprock unit and is more massive and less permeable.

Hydrogeological investigations undertaken in December 2019 (Coffey 2020a) indicate that the groundwater table in the Project area ranges between approximately 123 and 216 m AHD (6 and 81 m BGL), with groundwater elevations highest in the western portion of the site beneath the TSF cells (MON02B ≈ 216 m AHD) and lowest in the eastern portion of the site directly east of the open-cut pit (PD03A ≈ 123 m AHD).

Since commencement of mining at CGO, the underlying aquifers surrounding and intercepted by the open-cut mining have been depressurised as a result of inflows to the open-cut pit and active pit dewatering. Despite Lake Cowal becoming inundated in 2010 and 2016, groundwater inflows to the open-cut pit are shown to have been relatively uniform during these periods and therefore are not impacted to any significant degree by weather events.

This is most likely because the lacustrine sediments that form the lakebed of Lake Cowal have a very low vertical permeability and act as an aquitard (a low permeability layer) between water of Lake Cowal and underlying aquifers.

The conceptual hydrogeological model of the site, as developed by Coffey (2020a), is presented in Figure 3.2 and is described in more detail in Chapter 10.



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

Hydrology of the underground development

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 4.6

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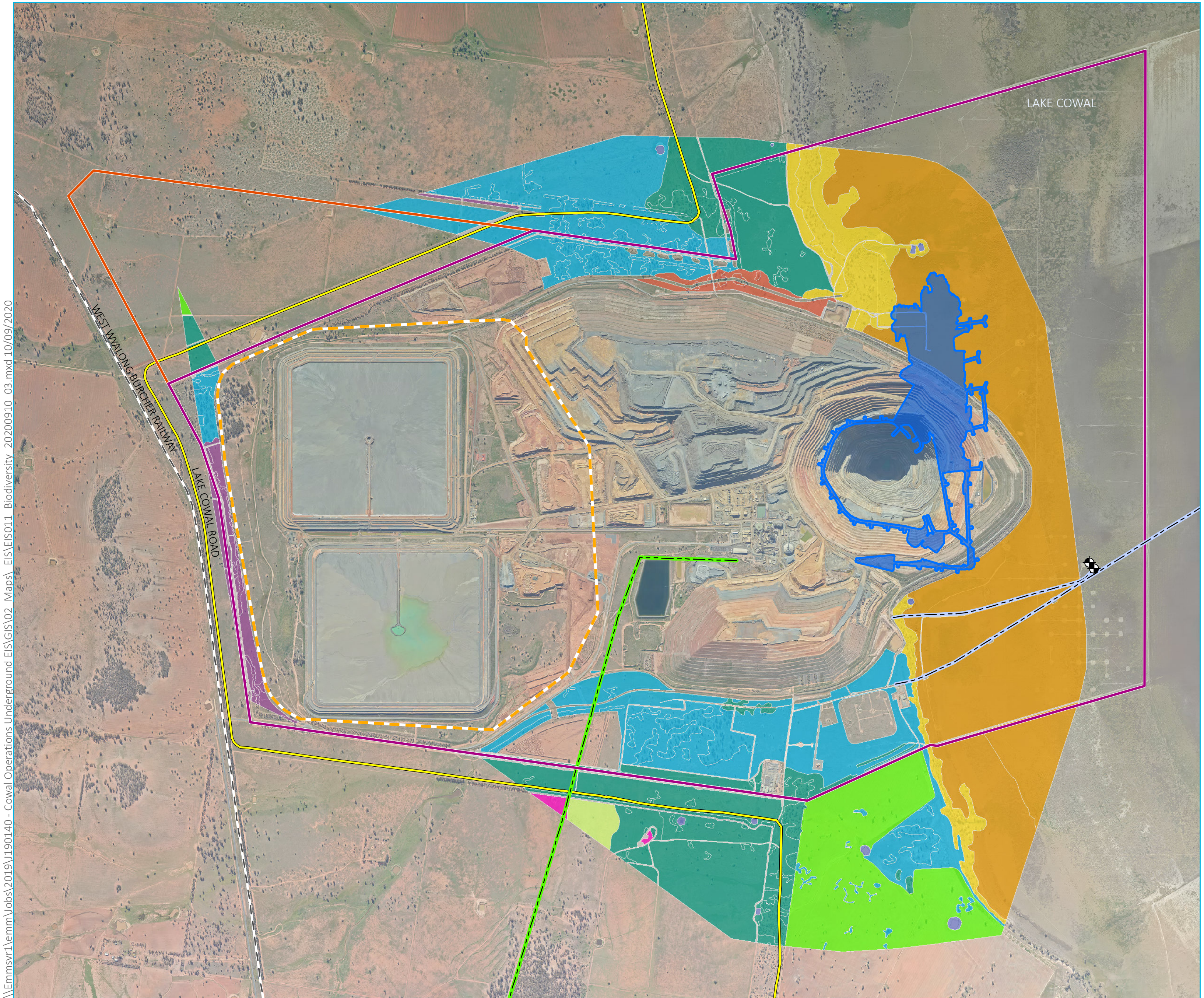

Source: EMM (2020); Evolution (2020); DFSI (2017)

0 1 2 km

GDA 1994 MGA Zone 55

N

KEY

- Proposed underground development
- Mining lease
- Mining lease
- Indicative integrated waste landform perimeter
- Electricity transmission
- Water supply
- Saline groundwater supply
- Rail
- Main

Vegetation

- 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
- Exotic

Biodiversity of the underground development

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 4.7

EMM creating opportunities

4.4.5 Biodiversity

The majority of vegetation in Lake Cowal has been heavily cleared with remnant regrowth restricted to elevated rocky areas. When the lake is dry, the area overlying the underground development is thickly grassed.

When the lake holds water, it attracts a diverse range of water birds to breed around the edge of the lake. A total of 277 species of birds have been recorded or are considered possible occurrences in the Lake Cowal region. The Grey Teal, Eurasian Coot and the Australian Pelican are the most abundant birds recorded. Great Egret, Royal Spoonbill, Pacific Black Duck, Australasian Shoveler, Masked Lapwing, Latham's Snipe and Silver Gull are also common species.

The lake is also home to up to 14 fish species, five of which are introduced species, and has been known historically to sustain commercial yabby fishing.

The portion of the underground development which extends north beyond the ML 1535 boundary at CGO, is located within Plant Community Type (PCT) 53 Shallow Freshwater Wetland Sedgeland in Depressions on Floodplains on Inland Alluvial Plains and Floodplains (refer Figure 4.7).

The underground development is located within the Lachlan River Endangered Ecological Community (EEC), which is listed under the NSW *Fisheries Management Act 1994* (FM Act). This EEC provides protection for "all fish and aquatic invertebrates within all natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands, paleochannels, floodrunners, effluent streams (those that flow away from the river) and the floodplains of the Lachlan River within the State of New South Wales, and including Lake Brewster, Lake Cargelligo and Lake Cowal" (DPI 2006).

Further detail of the existing biodiversity in the vicinity of the site is provided in Chapter 12.

4.4.6 Climate

The climate of the Lake Cowal area is temperate with no dry season and hot summers, as classified by the Koppen climate classifications system.

A detailed description of the prevailing meteorology for the local area is provided in Appendix B and is based on data obtained from the CGO meteorological station, installed near the southern boundary of ML1535. Further analysis of long-term climatic trends has also been made based on data from the closest Bureau of Meteorology (BoM) monitoring site at Wyalong Post Office, located approximately 30 km south-west of the site.

A dominant south-easterly wind is observed at the CGO site, with average wind speeds and percentage of calms being consistent for each year with wind speeds ranging from 3.0 metres per second (m/s) to 3.2 m/s and calms ranging from 2.2 m/s and 3.6 m/s.

Based on historical data recorded at West Wyalong, rainfall for the region is considered low, with a long-term annual rainfall of 479 mm. Analysis of the CGO data for the period 2013-2018 shows that the average annual rainfall over the last six years (535 mm) is similar to the long-term average for West Wyalong. Average rainfall data shows no seasonal trend. Pan evaporation is at a maximum in summer months and at a minimum in winter months. A rainfall deficit occurs for all months except June and July. Average annual pan evaporation is over four times the average annual rainfall.

Further detail of the climate in the vicinity of the site is provided in Chapter 7.

4.5 Land ownership

The mining leases (ML1535 and ML1791) are located within a number of land parcels outlined in Table 4.1 and shown in Figure 4.2.

Table 4.1 Land ownership details

Lot No.	Plan No.	Land tenure
23	DP753097	Freehold
7001	DP1029713	Crown
2	DP530299	Freehold
7303	DP1143731	Crown
7323	DP1157291	Crown
101	DP1059150	Freehold
45	DP753083	Freehold
104	DP1059150	Freehold
103	DP1059150	Freehold
1	DP1060709	Freehold
1	DP1060907	Local Government Authority
2	DP1060907	Local Government Authority
7	DP753083	Freehold
38	DP39733	Freehold
100	DP1059150	Crown
107	DP1059150	Freehold
106	DP1059150	Freehold
105	DP1059150	Freehold
102	DP1059150	Freehold
2	DP1060709	Freehold
37	DP39733	Crown
25	DP753097	Freehold
24	DP753097	Freehold

The proposed underground development and infrastructure is located specifically within the following land (refer Figure 4.2):

- Lot 23 DP 753097 (Freehold – Evolution-owned);
- Lot 24 DP 753097 (Freehold – Evolution-owned);
- Lot 2 DP 530299 (Freehold – Evolution-owned);
- Lot 7001 DP 1029713 (Crown); and
- Lot 7303 DP 1143731 (Crown).

Evolution owns all Freehold land on which the proposed underground development is located. Evolution also owns isolated properties along Lake Cowal Road northwards to Fitzgerald Road. These are surrounded by other parcels of Freehold and Crown land (refer Figure 4.2).

Within an approximate 14 km radius of the underground development, there are 33 private residences and 4 residences owned by Evolution (refer Figure 4.2). As noted in section 4.1, there are eight private residences within an approximate 5 km radius of the underground development. The closest private residence is approximately 2 km west of the existing surface facilities associated with CGO.



Part B – Statutory context and engagement

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Part B – Statutory context and engagement

Chapter 5 Statutory context

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5 Statutory context

5.1 Introduction

This section describes the relevant regulatory and policy framework under which the Project will be assessed and determined.

Evolution must obtain development consent for the Project under Division 4.7 of Part 4 of the EP&A Act.

Pursuant to section 4.42 of the EP&A Act, a number of authorisations under other NSW legislation must be granted for approved SSD Projects on terms substantially consistent with the SSD consent (refer section 5.3). Further, section 4.41 of the EP&A Act provides that a number of authorisations under other NSW legislation are not required for approved SSD. These authorisations are described below in section 5.4.

5.2 NSW Environmental Planning and Assessment Act 1979

5.2.1 Overview

The EP&A Act and the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) form the statutory framework for land-use planning decisions in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning and Public Spaces, State government authorities and local government authorities. The requirement for development consent under the EP&A Act is regulated by environmental planning instruments (EPIs), including State environmental planning policies (SEPPs) and local environmental plans (LEPs).

5.2.2 State significant development

i SSD provisions

Part 4, Division 4.7 of the EP&A Act specifically relates to the assessment of SSD. Under section 4.36 of the EP&A Act, a development is SSD if it is declared to be SSD by any SEPP.

The relevant SEPP which declares the development proposed by the Project to be SSD is *State Environmental Planning Policy (State and Regional Development) 2011* (the SRD SEPP). In particular, clause 8(1) of the SRD SEPP states:

> (1) Development is declared to be State significant development for the purposes of the Act if-
>
> (a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and
>
> (b) the development is specified in Schedule 1 or 2.

In this regard, item 5(1) of Schedule 1 of the SRD SEPP relevantly states:

> **5 Mining**
>
> (1) Development for the purpose of mining that-
>
> (a) is coal or mineral sands mining, or
>
> (b) is in an environmentally sensitive area of State significance, or
>
> (c) has a capital investment value of more than $30 million.

(3) Development for the purpose of mining related works (including primary processing plants or facilities for storage, loading or transporting any mineral, ore or waste material) that-

(a) is ancillary to or an extension of another State significant development project, or

(b) has a capital investment value of more than $30 million.

The Project is development for the purpose of mining that has a capital investment value of more than $30 million.

Accordingly, the Project is SSD and is subject to the provisions of Division 4.7 of Part 4 of the EP&A Act.

ii Consent authority

Under section 4.5(a) of the EP&A Act, the Independent Planning Commission (IPC) is the consent authority for SSD if the development is a type for which the IPC is declared to be the consent authority by an EPI. Otherwise, the Minister for Planning and Public Spaces is the consent authority.

Pursuant to clause 8A(1) of the SRD SEPP, the IPC is the consent authority for the following types of SSD (unless the application to carry out the development is made by or on behalf of a public authority or the development is declared to be State significant infrastructure, neither of which is the case for the Project):

a) development in respect of which the council of the area in which the development is to be carried out has duly made a submission by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act,

b) development in respect of which at least 50 submissions (other than from a council) have duly been made by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act,

c) development the subject of a development application made by a person who has disclosed a reportable political donation under section 10.4 to the Act in connection with the development application.

Accordingly, if any of the above sub-clauses are met, the Project will be determined by the IPC; otherwise the Minister for Planning and Public Spaces will be the consent authority.

iii Development application

Clause 49 of the EP&A Regulation concerns the making of a development application. It relevantly states:

(1) A development application may be made—

(a) by the owner of the land to which the development application relates, or

(b) by any other person, with the consent of the owner of that land.

(2) The consent of the owner of the land is not required for a development application made by a public authority, or for a development application for public notification development, if the applicant instead gives notice of the application—

(a) to the owner of the land before the application is made, or

(b) by publishing a notice no later than 14 days after the application is made—

(i) in a newspaper circulating in the area in which the development is to be carried out, and

(ii) in the case of an application made by a public authority, on the public authority's website, or, in the case of public notification development, on the NSW planning portal.

(3) Despite subclause (1), a development application made by a lessee of Crown land may only be made with the consent given by or on behalf of the Crown.

(3A) Despite subclause (1), a development application made in respect of land owned by a Local Aboriginal Land Council may be made by a person referred to in that subclause only with the consent of the New South Wales Aboriginal Land Council.

(4) Subclause (3) does not require the consent of the Crown if the development application is for State significant development made by a public authority or public notification development.

(4A) The consent of an owner or other person under this clause is not required to be in writing.

(5) In this clause—

…

public notification development means—

(i) State significant development set out in clause 5 (Mining) or 6 (Petroleum (oil and gas)) of Schedule 1 to *State Environmental Planning Policy (State and Regional Development) 2011* but it does not include development to the extent that it is carried out on land that is a state conservation area reserved under the *National Parks and Wildlife Act 1974*, or

(ii) State significant development on land with multiple owners designated by the Planning Secretary for the purposes of this clause by notice in writing to the applicant for the State significant development.

The proposed development is classified as public notification development under clause 49(5) of the EP&A Regulation as it is SSD set out in clause 5 (Mining) of Schedule 1 to the SRD SEPP. Therefore, pursuant to clause 49(2) of the EP&A Regulation, the consent of the owner of the land is not required for a development application, if the applicant instead gives notice of the application:

a) to the owner of the land before the application is made, or

b) by publishing a notice no later than 14 days after the application is made-

(i) in a newspaper circulating in the area in which the development is to be carried out; and

(ii) on the NSW planning portal.

Evolution owns all the land to which the development application relates, except for three parcels of Crown land under which the Applicant currently holds lease agreements with the Crown.

To satisfy clause 49(2), Evolution will place an appropriate advertisement in the West Wyalong Advocate and notice on the NSW planning portal within 14 days of the application being made.

Section 4.12(8) of the EP&A Act requires that a development application (DA) for SSD be accompanied by an EIS prepared in the form prescribed by the EP&A Regulation. The EIS must be prepared in accordance with Schedule 2 of the EP&A Regulation.

Before preparing an EIS under the EP&A Act, an applicant must request the Secretary's Environmental Assessment Requirements (SEARs) from the Secretary of DPIE, which specifies the matters that must be addressed in the EIS.

The SEARs for the Project was initially issued by the DPIE on 27 September 2019. An updated version of the SEARs was issued on 26 August 2020.

The SEARs (as issued on 26 August 2020), and where they have been addressed in this EIS, are provided in Table 1.2.

The relevant matters to be considered in the assessment and determination of the Project are addressed in the sub-sections below.

5.2.3 Permissibility

i Mine development

The Project area is on land zoned RU1 Primary Production under the *Bland Local Environmental Plan 2011* (Bland LEP), as shown in Figure 4.1. Under the Bland LEP, development for the purpose of underground mining falls within the general category of development which is prohibited in this land use zone.

Notwithstanding this prohibition in the Bland LEP, the permissibility of mining developments is governed by the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP). In this regard, clause 5(3) of the Mining SEPP provides that the Mining SEPP prevails to the extent of any inconsistency with a LEP. Clause 7 of the Mining SEPP provides for development that is permissible with consent, and relevantly states:

> (1) **Mining** Development for any of the following purposes may be carried out only with development consent-
>
> (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*,
>
> ...
>
> (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
>
> …

Accordingly, as the Project is for the purpose of underground mining, the Project is permissible with development consent under the EP&A Act.|

5.2.4 Objects of the Act

The objects of the EP&A Act are specified in section 1.3 of the EP&A Act and seek to promote the management and conservation of natural and artificial resources, while also permitting appropriate development to occur. The relevant objects of the EP&A Act are reproduced below, followed by consideration of the consistency of the Project with these objectives.

> (a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State’s natural and other resources

The Project will facilitate the production of approximately 1.8 Moz ounces of gold. Evolution will develop a valuable resource by providing the necessary capital and skills, without which the resource would remain in situ and the economic benefits (refer Chapter 22) and social benefits (refer Chapter 21) would be not be realised.

The natural resources in the Project application area include gold, land suitable for agricultural production and water resources. There is land within the Project application area which has been and is currently the subject of mining activities. The land north of the current open-cut mine that is within the Project area is known to have biodiversity and heritage values. However, on that land, the Project will be wholly underground and has been designed to efficiently recover the gold resource without resulting in unacceptable environmental impacts to existing surrounding land uses and the values they hold.

The Project would also make use of existing surface infrastructure and approved disturbance areas. Impacts to surface water and groundwater resources have also been assessed as being minimal, with all potential impacts to surface water users and stream environments assessed as insignificant in accordance with the *Significant impact guidelines* (DoE 2013). Groundwater impacts are dealt with in Chapter 10 and Appendix E and surface water impacts are dealt with in Chapter 11 and Appendix F.

Evolution is committed to continuing to employ local residents where possible. A specialised underground mine workforce would be required in the early years until a local workforce is trained to undertake these roles. An average of around 160 personnel will be employed for the Project when the underground mine is fully operational, bringing associated flow-on benefits to surrounding local communities where these employees will reside. Evolution's local procurement policy will continue to be adopted for the Project, which will see local goods and services used in the Project's construction and operation where possible and maximising opportunities for local businesses.

> (b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment

The concept of ecologically sustainable development (ESD) when used in the EP&A Act has the same extended meaning as that set out in section 6(2) of the NSW *Protection of the Environment Administration Act 1991*.

Additionally, the Commonwealth Government's 1992 *National Strategy for Ecologically Sustainable Development* 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".

A comprehensive stakeholder engagement, planning and environmental assessment process has ensured that the principles of ESD, as defined in the EP&A Act, are addressed by the Project. Notably, an extensive baseline monitoring program and previous assessments at the site have ensured that impacts can be confidently predicted as outlined in this EIS. With respect to the 'precautionary principle', a range of mitigation and management measures have been identified to minimise the impacts of the Project.

The Project will enhance community resources by generating employment and public revenues through royalties and taxes, contributing to improvements to local, State and National economies. The Project will also conserve community resources directly by establishing offset areas and indirectly through effective impact mitigation.

> (c) to promote the orderly and economic use and development of land

The orderly and economic use of land is best served by appropriate and economic development which is permissible under the relevant planning regime, is in accordance with the prevailing planning controls and which does not unduly restrict other beneficial uses around the Project site.

The Project is a permissible land-use under the EP&A Act and is consistent with the relevant planning controls, as documented in this chapter. The Project will recover a valuable mineral resource without significant residual impacts, and will bring significant social and economic benefits to the region. The current land above the Project area is the site of an ephemeral lake which can sustain agricultural use when dry. This capability will not change as a result of the Project.

The Project is predicted to result in a net economic benefit to NSW. Wages for labour will contribute to the regional economy, as well as regional spending for production related inputs. Economic benefits are detailed in Chapter 22 and Appendix N.

The Project is also responsive to its surroundings. The Project design has evolved throughout the environmental assessment process in order to minimise impacts on surrounding land uses. Where residual impacts are still predicted to occur, mitigation measures have been proposed to address these impacts, so that the Project will not displace other beneficial uses in the locality.

> (d) to promote the delivery and maintenance of affordable housing

Accommodation for the construction workforce and the early stage operational workforce would be provided by the development of an accommodation village in West Wyalong. This village is subject to a separate development application, which will likely be assessed and determined by Bland Shire Council.

By developing the village, the local housing market will be protected from inflated pricing increases and therefore would maintain the promotion and delivery of affordable housing in the regional area.

Skilled employees will be preferentially sourced from local areas and within the region (including the LGAs of Bland, Forbes and Lachlan Shires). Therefore, the Project will not result in a significant population increase or pressure on housing availability at any specific location. Further detail on local housing supply impacts is provided in the SIA attached as Appendix M and summarised in Chapter 21.

> (e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,

The Project has been designed to protect the environment as far as practicable, including by avoiding any vegetation clearance or impacts on groundwater-dependent ecosystems.

> (f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)

The Project has been designed to avoid any disturbance of Aboriginal cultural heritage sites and there are no historic heritage items within the Project area. There are specific mitigation measures required to manage heritage impacts, however a strict chance find protocol would be in place to manage unforeseen impacts.

> (g) to promote good design and amenity of the built environment

The Project involves underground mining and would not be visible from surrounding areas. It therefore would not affect the current amenity of the areas surrounding the mine.

> (h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants

Evolution has a strong safety culture, with well established and sophisticated safety management systems in place at the mine. All buildings required to be included in the Project will be constructed in accordance with applicable construction standards. to promote the sharing of the responsibility for environmental planning assessment between the different levels of government in the State.

Commonwealth, State, and local government agencies that have an interest in the Project have been consulted prior to, and during, the preparation of this EIS. This consultation will continue as the Response to Submissions (RTS) report is prepared following public exhibition. All levels of government have been involved to date and this will continue as the Project is assessed and determined.

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

As detailed in Chapter 6, Evolution has consulted extensively with the community about the Project over a number of years. This process included numerous one on one meetings with landholders, a number of public information sessions, distribution of newsletters, interviews with local businesses and regular meetings with CGO's Community Environment Management Consultative Committee (CEMCC).

Evolution has maintained a strong local presence in Bland, Forbes and Condobolin since the very early stages of the open-cut mine. A local office was established in Bland, giving members of the public an opportunity to find out about the CGO and their plans, including this Project.

Community feedback has helped shape the Project and given local input to the EIS, as discussed in Chapter 6. The public will also be involved through the exhibition of the EIS. All public submissions will be reviewed by Evolution and, where relevant, a response to the issues raised will be forwarded to DPIE for consideration during the assessment of the SSD application.

5.2.5 Section 4.15 matters for consideration

When assessing and determining a DA for SSD, the consent authority is required to take into consideration the matters identified in section 4.15 of the EP&A Act. These matters are addressed in Table 5.1.

Table 5.1 Matters for consideration – Section 4.15 of the EP&A Act

Provision	Relevance to the Project
Any environmental planning instrument	The relevant environmental planning instruments identified in the SEARs are addressed in section 5.5 of this document
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.	There are no such proposed instruments relevant to the Project.
Any development control plan	Clause 11 of the SRD SEPP states that development control plans do not apply to SSD. With respect to the interaction between clause 11 and section 4.15 of the EP&A Act, sections 4.40 and 4.43 of the EP&A Act relevantly state: 4.40 - Section 4.15 applies, subject to this Division, to the determination of the application. 4.43 - The provisions of this Division, the regulations of this Division and any other provisions of or made under this Act with respect to State significant development prevail to the extent of any inconsistency with any other provisions of or made under this Act relating to development to which this Part applies.
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.	Section 7.4 of the EP&A Act relates to planning agreements, which are defined as: … a voluntary agreement or other arrangement under this Division between a planning authority (or 2 or more planning authorities) and a person (the ***developer***): … (b) who has made, or proposes to make, a development application or application for a complying development certificate, or (c) who has entered into an agreement with, or is otherwise associated with, a person to whom paragraph (a) or (b) applies, under which the developer is required to dedicate land free of cost, pay a monetary contribution, or provide any other material public benefit, or any combination of them, to be used for or applied towards a public purpose. Section 7.4 enables the proponent of a development to enter into a planning agreement or other arrangement with planning authorities.

Table 5.1 Matters for consideration – Section 4.15 of the EP&A Act

Provision	Relevance to the Project
	The Applicant will enter into discussions with Bland Shire Council in relation to the content and timing of a planning agreement.
The regulations (to the extent that they prescribe matters for the purposes of this paragraph),	The requirements of the EP&A Regulation are addressed in section 5.2.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	This EIS comprehensively describes the likely impacts of the Project based on the SEARs, including environmental impacts on both the natural and built environments, and social and economic impacts and economic and social benefits in the local area, region and State. It also describes commitments proposed by Evolution to mitigate and manage these impacts. These descriptions are based on technical studies prepared by specialists, which are appended to this EIS. The technical studies were prepared using the most recent and accurate scientific data relevant to the Project in consideration of current policies and legislation.
The suitability of the site for the development	Part of the Project area is an existing operational mine and is suitable for further mine development as it will efficiently recover an economic gold resource from privately owned land where mining is permissible and using low intensity underground stope mining methods. Further, a range of commitments have been made by Evolution to mitigate potential impacts on surrounding land uses to ensure the Project can co-exist with surrounding uses. As a result of the application of the mitigation measures proposed, the Project is unlikely to have significant land use impacts. A detailed justification for the Project, including consideration of the suitability of the site, is provided in Chapter 3 (The Project) and Chapter 24 (Justification).
Any submissions made in accordance with this Act or the regulations.	This EIS will be placed on public exhibition for a minimum of 28 days by DPIE and submissions will be sought from local and State government authorities and the community. Any submissions received by DPIE will be reviewed and forwarded to Evolution to consider and respond to (via a Submissions report). The consent authority will consider the submissions received during the public exhibition period on the Project, as well as the EIS and Submissions Report and the outcomes of any public hearing/meeting (if held), in assessing the Project.
The public interest	To assist the consent authority in confirming that the Project is in the public interest, this EIS provides a justification for the Project (refer to Chapter 24), taking into consideration its potential environmental, social and economic impacts and the suitability of the site. It also considers the Project against the principles of ESD. The consent authority will also be required to consider all submissions received during the public exhibition of the EIS.

5.3 Requirements of other NSW legislation

5.3.1 Overview

In addition to obtaining development consent, the Project will require several other authorisations under NSW legislation. Under section 4.42 of the EP&A Act, the following authorisations cannot be refused and are to be substantially consistent with the SSD development consent:

a) an aquaculture permit under section 144 of the *Fisheries Management Act 1994*;

b) an approval under section 15 of the *Mine Subsidence Compensation Act 1961*;

c) a mining lease under the *Mining Act 1992*;

d) a production lease under the *Petroleum (Onshore) Act 1991*;

e) an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act);

f) a consent under section 138 of the *Roads Act 1993*; and

g) a licence under the *Pipelines Act 1967*.

Of the above authorisations, only a Mining Lease and Environment Protection Licence (EPL) are relevant to the Project.

In addition, water access licences will be required for the Project under the *Water Management Act 2000* (WM Act). The other approvals that are relevant to the Project are discussed below.

5.3.2 Mining Act 1992

The *Mining Act 1992* (Mining Act) regulates mining in NSW and provides for the granting of mining authorities. It also places controls on methods of exploration and mining, disposal of mining waste, land rehabilitation and environmental management activities. It is an offence under section 5 of the Mining Act to mine for minerals except in accordance with a valid authorisation. Section 6 of the Mining Act provides that an authorisation is also required to carry out designated ancillary mining activities.

The Project will be operated within ML 1535, which was granted under the Mining Act prior to the commencement of mining operations (refer Figure 1.3). The Project requires the preparation of an updated Mining Operations Plan (MOP), which is a condition of the ML and details how mining operations would be undertaken.

5.3.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations 1997* (POEO Act) is the principal NSW environmental protection legislation.

Schedule 1 of the POEO Act lists the ‘scheduled activities’ which are required to be regulated by an environment protection licence (EPL).

The existing EPL for the Cowal Gold Project, EPL 11912, authorises the following scheduled activities under the POEO Act: concrete works; crushing, grinding or separating; extractive industries; mineral processing; and mining for minerals.

It is expected that EPL 11912 will be varied in order to also authorise the Project for the purposes of the POEO Act.

5.3.4 Biodiversity Conservation Act 2016

Pursuant to section 1.7 of the EP&A Act, the EP&A Act has effect subject to the provisions of Part 7 of the NSW *Biodiversity Conservation Act 2016* (BC Act). 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 ESD. It establishes the regulatory framework for assessing and offsetting biodiversity impacts for proposed development.

Section 7.9 of the BC Act requires a Biodiversity Development Assessment Report (BDAR) to be prepared for SSD applications. Section 7.9 states:

> Biodiversity assessment for State significant development or infrastructure
>
> (1) This section applies to—
>
> (a) an application for development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* for State significant development, and
>
> (2) Any such application is to be accompanied by a biodiversity development assessment report unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values.
>
> (3) The environmental impact statement that accompanies any such application is to include the biodiversity assessment required by the environmental assessment requirements of the Planning Agency Head under the *Environmental Planning and Assessment Act 1979*.

A BDAR has been prepared for the Project by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the Biodiversity Conservation Act 2016. The BDAR has concluded:

- there will be no vegetation clearing required for the Project and therefore no direct impacts to biodiversity values would result from the Project; and
- indirect impacts to biodiversity values are unlikely, as they relate to the risk of a hydraulic connection being created between Lake Cowal and the underground mine, which would be minimised through only mining ore from the more competent deeper fresh rock layers and through detailed geotechnical design and careful sequencing of stopes.

5.4 Exemptions from other NSW approval requirements

Pursuant to section 4.41 of the EP&A Act, the following authorisations under other NSW legislation are not required for an approved SSD project:

- a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act);
- an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* (Heritage Act);
- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974* (NPW Act)*;*
- a bush fire safety authority under section 100B of the *Rural Fires Act 1997* (RF Act); and
- a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the WM Act.

While the above authorisations are not required, this EIS assesses environmental impacts relevant to those authorisations. Sections 5.4.1 to 5.4.4 briefly addresses this.

5.4.1 Fisheries Management Act

The FM Act aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. It lists threatened aquatic species and ecological communities and contains measures to conserve these.

In this regard, the Project is not predicted to have any impact on threatened species, populations or ecological communities listed under the FM Act, within the aquatic or riparian environments of Lake Cowal, which is an ephemeral lake system.

5.4.2 Heritage Act 1977

The Heritage Act aims to protect and conserve the natural and cultural history of NSW, including scheduled heritage items, sites and relics. No items listed on the Bland LEP, or the State Heritage Register, are within the Project area.

In this regard, the potential heritage impacts of the Project are assessed in detail in Chapter 14.

5.4.3 National Parks and Wildlife Act 1974

The NPW 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.

In this regard, the potential Aboriginal heritage impacts of the Project are assessed in detail in Chapter 13. No Aboriginal cultural heritage sites deemed to be of high significance have been identified in the mine development Project area.

5.4.4 Rural Fires Act 1997

The RF Act aims to prevent, mitigate, and suppress bushfires and other fires in local government areas of the State.

In this regard, the bushfire management protocols in Evolution's Emergency Response Plan will continue to apply to the Project, as part of the site's Environmental Management System.

Further discussion on hazard and risk, including bushfire, is provided in Chapter 19.

5.5 Environmental Planning Instruments

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

The Mining SEPP provides for the proper management and development of mineral, petroleum and extractive resources for the social and economic welfare of NSW. It also establishes planning controls to encourage ecologically sustainable development within the mining, petroleum and extractive sectors. The Mining SEPP provides for the permissibility of mining projects, and additional matters that must be considered by a consent authority when evaluating and determining development applications for mining projects.

i Aims

Clause 2 of the Mining SEPP sets out the aims of the policy as follows:

> The aims of this Policy are, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries-
>
> (a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and
>
> (b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and
>
> (b1) to promote the development of significant mineral resources, and
>
> (c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources, and
>
> (d) to establish a gateway assessment process for certain mining and petroleum (oil and gas) development-
>
> (i) to recognise the importance of agricultural resources, and
>
> (ii) to ensure protection of strategic agricultural land and water resources, and
>
> (iii) to ensure a balanced use of land by potentially competing industries, and
>
> (iv) to provide for the sustainable growth of mining, petroleum and agricultural industries.

This EIS, and in particular section 5.2.3, provides a justification of the Project's accordance with these aims.

ii Permissibility

The Mining SEPP has the effect of making the Project permissible with development consent under the EP&A Act, as discussed in section 5.2.3.

iii Matters for consideration

a Non-discretionary development standards

Clause 12AB of the Mining SEPP sets out a number of non-discretionary development standards that are to be considered in accordance with sections 4.15 (2) and (3) of the EP&A Act for mining developments.

These standards relate to cumulative air quality levels and noise levels, airblast overpressure, ground vibration and aquifer interference. These standards are addressed in chapters 7, 8 and 10 respectively for air quality, noise and vibration and water resources.

If these development standards are complied with, clause 12AB prevents the consent authority from requiring more onerous standards for those matters (but does not prevent the consent authority granting consent even though any such standard is not complied with).

b Compatibility of the mine with other uses

Clause 12 of the Mining SEPP requires a consent authority to consider the compatibility of the development with other land uses. It states:

> Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must-
>
> (a) consider:
>
> (i) the existing uses and approved uses of land in the vicinity of the development, and
>
> (ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and
>
> (iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and
>
> (b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a)(i) and (ii), and
>
> (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).

Land uses near the Project are described in Chapter 4, and predominately include mining-related infrastructure, agricultural and recreation uses. Potential impacts on these existing and approved land uses have been assessed in this EIS, demonstrating that the Project will not have a significant impact on, or be incompatible with, existing and approved land uses around the Project or, having regard to land use trends, the likely preferred uses of land in the vicinity of the Project.

c Consideration of voluntary land acquisition and mitigation policy

Clause 12A of the Mining SEPP requires the consent authority to consider the voluntary acquisition and mitigation policy before determining SSD mining applications. The policy referred to in clause 12A is the *Voluntary Land Acquisition and Mitigation Policy* (VLAMP), which was published by the Minister for Planning in the Government Gazette on 19 December 2014 and revised in September 2018. The VLAMP describes how the consent authority is to deal with predicted noise and dust impacts from SSD mining proposals when determining DAs.

The VLAMP establishes a framework for ensuring that if noise and dust impacts from a development exceed the relevant assessment criteria, affected landowners are provided with:

- a negotiated agreement; or
- mitigation measures or acquisition of the land, in accordance with the conditions of a development consent.

The noise and air quality impacts of the approved CGO are regulated by the existing development consent and existing negotiated agreements.

As detailed in this EIS, the Project is not predicted to result in any significant increase in the existing noise or air quality impacts of the approved CGO. As such, the consent authority can be satisfied that the Project can be carried out in accordance with the requirements of the VLAMP.

d Compatibility of the proposal with mining

Clause 13 of the Mining SEPP relates to matters that a consent authority must take into consideration when determining, relevantly, an application for development on land that is in the vicinity of an existing mine, petroleum production facility or extractive industry.

Clause 13(2) states:

> Before determining an application to which this clause applies, the consent authority must-
>
> (a) consider-
>
> (i) the existing uses and approved uses of land in the vicinity of the development, and
>
> (ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and
>
> (ii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and
>
> (b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery referred to in paragraph (a)(i) and (ii), and
>
> (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).

Save for the existing approved CGO, there are no existing mines, petroleum production facilities or extractive industries in the vicinity of the Project. Further, Evolution holds all of the MLs and ELs across the mine development Project area as shown in Figure 1.3. The mine development will not adversely affect any other MLs or ELs.

There is one extractive industry in the region, which is the Millers Metals Quarry, approximately 35 km southwest of the existing operating CGO. Due to the large distance between the Project area and this quarry, the Project will not directly or indirectly impact this quarry.

The existing uses and approved uses of land in the vicinity of the Project are considered in Chapter 4 of this EIS.

The Project is not likely to have any significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials, and is not considered to be incompatible with any existing or approved uses of land or current or future extraction or recovery in the vicinity of the Project.

e Natural resource and environmental management

Clause 14 of the Mining SEPP states:

> (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:
>
> (a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,
>
> (b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,
>
> (c) that greenhouse gas emissions are minimised to the greatest extent practicable.

> (2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.
>
> (3) Without limiting subclause (1), in determining a development application for development for the purposes of mining, the consent authority must consider any certification by the Chief Executive of the Office of Environment and Heritage or the Director-General of the Department of Primary Industries that measures to mitigate or offset the biodiversity impact of the proposed development will be adequate.

With respect to impacts on significant water resources, the Project is wholly located underground and may result in both subsidence and upsidence within a range of -15 to +25mm that would be indistinguishable across the existing variance in topography across the landscape. As such, the Project is not predicted to result in any impacts to surface water resources, and drawdown levels are not predicted to significantly affect groundwater resources. Assessments of groundwater resources and surface water resources are addressed in Chapter 10 and Chapter 11 respectively.

With respect to impacts on threatened species and biodiversity, the Project is not expected to have any significant impacts, as:

- will be no direct impacts to biodiversity values as a result of the Project as there is no vegetation clearing required; and
- indirect impacts to biodiversity values relate to the risk of a hydraulic connection being created between the lake and mine, which would be minimised through only mining in the deeper fresh rock layers and through detailed geotechnical design and careful sequencing of stopes.

The assessment of biodiversity matters is detailed in Chapter 12 of this EIS.

With respect to greenhouse gas emissions, an assessment of greenhouse gas emissions is addressed in Chapter 18, which shows that any increase in emissions associated with the Project would be minimal in the context of the current emissions at the mine, as they relate to the potential increase in electricity use for the underground operations and the operation of underground mining equipment.

f Resource recovery

Clause 15 of the Mining SEPP states:

> (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.
>
> (2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.
>
> (3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.

The Project has adopted a mine plan and mining method that optimises resource recovery without causing unacceptable environmental impacts. The Project has been developed after several years of detailed geological, metallurgical, engineering, environmental, financial and other technical investigations; a process which included the investigation of several alternatives, which are discussed in detail in Chapter 22. The Project presented in this EIS is the most practical and appropriate method for recovering the resource.

g Transport

Clause 16 of the Mining SEPP states:

> (1) Before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following—
>
> > (a) require that some or all of the transport of materials in connection with the development is not to be by public road,
> >
> > (b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,
> >
> > (c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.
>
> (2) If the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within 7 days after receiving the development application, provide a copy of the application to—
>
> > (a) each roads authority for the road, and
> >
> > (b) the Roads and Traffic Authority (if it is not a roads authority for the road).
>
> (3) The consent authority—
>
> > (a) must not determine the application until it has taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application, and
> >
> > (b) must provide them with a copy of the determination.
>
> (4) In circumstances where the consent authority is a roads authority for a public road to which subclause (2) applies, the references in subclauses (2) and (3) to a roads authority for that road do not include the consent authority.

As discussed in Chapter 15 all ore extracted by the mine will be processed onsite and, as a result, there will be no heavy vehicle haulage of ore from the mine on public roads. Heavy vehicle movements to and from the site will be limited to the delivery of reagents and goods required at the mine, which have been assessed as part of Mod 16 to the existing consent.

h Rehabilitation

Clause 17 of the Mining SEPP states:

> (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.
>
> (2) In particular, the consent authority must consider whether conditions of the consent should—
>
> > (a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or
> >
> > (b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or
> >
> > (c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under clause 3 of Schedule 6 to the Act and the *Contaminated Land Management Act 1997*), or
> >
> > (d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.

The Project will rehabilitate all land that is disturbed by mining operations, which includes the underground portals from the open-cut pit and the box-cut into the mine, as described in Chapter 16.

i Mining on strategic agricultural land and site verification certificates

Part 4AA of the Mining SEPP concerns ‘mining or petroleum development’ on strategic agricultural land.

Clause 17A provides a definition of mining and petroleum development for the purposes of Part 4AA. It states:

> (1) In this Part, ***mining or petroleum development*** means:
>
> (a) development specified in clause 5 (Mining) of Schedule 1 to *State Environmental Planning Policy (State and Regional Development) 2011*, but only if:
>
> (i) a mining lease under the *Mining Act 1992* is required to be issued to enable the development to be carried out because:
>
> (A) the development is proposed to be carried out outside the mining area of an existing mining lease, or
>
> (B) there is no current mining lease in relation to the proposed development, or
>
> …

The Project is development specified in Clause 5 (mining) of the SRD SEPP and a mining lease is required. However, the Project would be carried out within the mining area of the existing ML 1535 and therefore Part 4AA of the Mining SEPP does not apply to the Project.

5.5.2 State Environmental Planning Policy (State and Regional Development) 2011

Under *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP State & Regional Development), various categories of development are declared to be SSD. The relevance of SEPP State & Regional Development to the Project is discussed in section 5.2.2.

5.5.3 State Environmental Planning Policy No. 33 - Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) may require the consent authority to consider a Project’s potential to cause hazards or be offensive, including consideration of the location of the development and the way in which it is to be carried out. Clause 13, which applies to development for the purpose of a "potentially hazardous industry" or "potentially offensive industry", states:

> In determining an application to carry out development to which this Part applies, the consent authority must consider (in addition to any other matters specified in the Act or in an environmental planning instrument applying to the development):
>
> (a) current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development, and
>
> (b) whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply, and
>
> (c) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and
>
> (d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), and
>
> (e) any likely future use of the land surrounding the development.

The proposed development, which includes underground mining and transport of ore to the surface and the construction and operation of the box-cut and paste fill plant, is not considered to meet the classification of a "potentially hazardous industry" under SEPP 33. Therefore, a preliminary hazard analysis has not been prepared for the Project.

5.5.4 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—
>
> a) where practicable and safe, vehicular access to the land is provided by a road other than the classified road, and
>
> b) the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the development as a result of:
>
> > i) the design of the vehicular access to the land, or
> >
> > ii) the emission of smoke or dust from the development, or
> >
> > iii) the nature, volume or frequency of vehicles using the classified road to gain access to the land, and
>
> 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 Project is an underground mine and would not result in any additional impacts 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.

5.5.5 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 would be undertaken on land within Lake Cowal which is not contaminated land and on land within the existing CGO site on which there is no evidence of known contamination.

The proposed development does not involve a change of use on any of the land specified in clause 7(4) of SEPP 55.

5.5.6 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 land subject to the development application is wholly within Bland Shire local government area. Bland Shire LGA is not listed in Schedule 1 and, as such, this SEPP does not apply to the Project.

The Project is not predicted to have any impacts on koalas.

5.5.7 Local Environmental Plans

The Project is within the Bland LGA. Consideration of the relevant land use zones and permissibility of the development in the Bland LEP is discussed in section 5.2.3.

While development for the purpose of underground mining falls within the general category of development prohibited under the Bland LEP, the provisions of the Mining SEPP which make such development permissible under the EP&A Act prevail to the extent of any inconsistency with the Bland LEP.

The development is permissible with development consent under the EP&A Act and is considered to be generally consistent with the relevant aims and objectives of the Bland LEP.

The particular aims of the Bland LEP are (clause 1.2(2) of the Bland LEP):

a) to protect, enhance and conserve agricultural land through the proper management, development and conservation of natural and man-made resources,

b) to encourage a range of housing, employment, recreation and facilities to meet the needs of existing and future residents of Bland,

c) to promote the efficient and equitable provision of public services, infrastructure and amenities,

d) to conserve, protect and enhance the environmental and cultural heritage of Bland,

e) to promote the twin townships of West Wyalong and Wyalong as the major commercial and community service centres for Bland,

f) to encourage the sustainable growth of the villages of Bland.

The Project is generally consistent with the particular aims of the Bland LEP, as:

- It would have no effect on any additional land not already disturbed for mining activities and will therefore conserve existing agricultural land stock.
- It would require the development of accommodation for the mine workforce, and strategies will be implemented to integrate the workforce into the region. Therefore, it will encourage a range of housing, employment, recreation and facilities to be developed within Bland Shire.
- The mine has been designed to not affect the environmental and cultural heritage of Bland.
- The Project's workforce would be integrated into the region over a number of years, allowing the sustainable growth of the villages of Bland.

The objectives of the RU1 Primary Production zone, and how the Project is consistent with the objectives, are detailed in Table 5.2.

Table 5.2 RU1 Primary Production zone objectives

Objective	Consistency review
To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	The Project would 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 Project would not affect the diversity in primary enterprises and systems appropriate for the area, as the mine would be partially located beneath Lake Cowal and partially beneath land already established and used for mining activities
To minimise the fragmentation and alienation of resource lands.	The Project is an underground mine with surface components 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 Project is an underground mine with surface components on an established mine site. There will be no new land disturbed for mining operations and therefore no land-use conflicts between land-uses in this zone would result from developing the Project.
To ensure that development on land within this zone does not unreasonably increase the demand for public services or public facilities.	The Project is an underground mine with additional surface components on an established mine site. It does not rely on public services or public facilities at the site. The workforce would reside in a purpose-built village away from the site which is proposed to be developed under a local development application and is not part of this application.

5.6 Strategic policies

5.6.1 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 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. As outlined above, the Project does not require a gateway certificate or site verification certificate under Part 4AA of the Mining SEPP

The Project is not predicted to have any significant adverse impacts on valuable agricultural land, valuable water resources or other land uses in the vicinity of the Project.

5.6.2 NSW Aquifer Interference Policy

The Aquifer Interference Policy (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 outlines 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 considerations 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 under the AIP.

An assessment of the Project against the minimal impact considerations in Table 1 of the AIP is set out in in Appendix B of the Groundwater Assessment (Coffey 2020a), refer to Appendix F of this EIS.

With respect to licensing under the *Water Management Act 2000* (WM Act), the AIP states:

A water licence is required under the *Water Management Act 2000* (unless an exemption applies or water is being taken under a basic landholder right) where any act by a person carrying out an aquifer interference activity causes:

- the removal of water from a water source; or
- the movement of water from one part of an aquifer to another part of an aquifer; or
- the movement of water from one water source to another water source, such as:
  - from an aquifer to an adjacent aquifer; or
  - from an aquifer to a river/lake; or
  - from a river/lake to an aquifer.

The predicted water 'take' associated with the Project, and a justification of how this predicted water take will be accounted for under the WM Act, is discussed in Chapter 11 of this EIS.

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

5.6.3 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 building 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 RMR 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 Project will have limited environmental impacts, such as air quality, noise, biodiversity, ground water and surface water. It will also 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 Project can therefore be considered to be consistent with the abovementioned directions and goals of the RMR Plan.

5.7 Commonwealth legislation

5.7.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the legal framework to protect and manage internationally and nationally important flora, fauna, ecological communities, heritage places and water resources which are deemed to be matters of national environmental significance (MNES). MNES, as defined under the EPBC Act are:

- World Heritage properties;
- places listed on the National Heritage Register;
- wetlands of international significance listed under the Ramsar Convention;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining) and;
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, actions that will, or are likely to, have a significant impact on a MNES are controlled actions and require the approval of the Commonwealth Minister for the Environment.

The Project was referred to the Commonwealth Minister and subsequently determined by a delegate of the Commonwealth Minister not to be a controlled action under section 75 of the EPBC Act on 5 November 2019.

5.7.2 Native Title Act 1993

The Commonwealth *Native Title Act 1993* (NT Act) recognises and protects native title in Australia. It protects native title from unlawful interference by establishing a regime that governs all dealings with land and waters after 1 January 1994 that affect native title (called 'future acts') and by prescribing standards for those dealings. A future act is invalid to the extent if affects native title, unless it is otherwise validated by a provision of the NT Act.

Different future acts attract different procedural rights, depending on the nature of the dealing. The grant of a mining lease over land where native title may exist is a future act that attracts the right to negotiate (RTN) process under the NT Act. Registered native title claimants and registered native title bodies corporate have the right to negotiate about the grant of the mining lease and the conduct of mining operations on the land. Failure to comply with the RTN process means the grant is invalid as against native title.

ML 1535 was granted in 2003 following completion of the RTN process under the NT Act. The Project will be carried out pursuant to and in reliance on the rights conferred by ML 1535, and will be conducted entirely within the boundaries of ML 1535. As such, no further RTN process is required for the purposes of the Project.

There are currently no native title claims or determinations over the CGO.

5.8 Summary of approval requirements

A summary of the licences, approvals and permits that are likely to be required for the Project are provided in Table 5.3.

Table 5.3 Summary of required licences approvals and permits

Legislation	Authorisation	Consent or approval authority
EP&A Act	Development consent	Minister for Planning and Public Spaces or IPC
Mining Act	Mining Lease	Minister for Regional New South Wales, Industry and Trade
POEO Act	EPL	EPA
WM Act	Water access licences	Minister for Water
Water Act	Licensing of monitoring bores	Minister for Water
Work Health and Safety Act	Licensing of dangerous goods (e.g. diesel and ANFO magazine storage)	NSW WorkCover Authority

Part B – Statutory context and engagement

Chapter 6 Engagement

EMM
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MINING

6 Engagement

6.1 Introduction

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

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 Project, including members of the local community, neighbouring landowners, Bland Shire Council, Forbes Shire Council, Lachlan Shire Council and CGO's existing 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 Project, which included meetings with all stakeholders and the CEMCC. The engagement process has been guided by Evolution's core values of accountability, excellence, respect and safety.

6.2 Consultation requirement

The EP&A Act objects include:

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

Accordingly, consultation has been an important part of the preparation of the Project's EIS.

Consultation has been undertaken in accordance with the relevant requirements of the final SEARs (reissued) received for the Project on 26 August 2020, in which DPIE emphasised the importance of effective and genuine community consultation in preparing the EIS for the Project. It also asked that the process ensure that the community has a good understanding of the 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 Project.

CGO's existing CEMCC was consulted on the Project during the scoping phase and during the preparation of the EIS, in accordance with the Project's Community and Stakeholder Engagement Plan.

6.3 Stakeholder engagement approach

6.3.1 Stakeholder engagement tools

Stakeholder engagement for the Project used several different communications methods to consult, record and respond to those stakeholders and is outlined in Table 6.1. 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 Project and could use at least one of several options to provide feedback on the Project during the preparation of the EIS.

Table 6.1 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 Project's consultation process, a copy of the Community Newsletter and direction on where to direct enquires about the Project.
Website	A website was created for the Project (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 Project's 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 on the Project
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 Project, 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 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 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 efforts that have been made to minimise potential environmental impacts. In total, there were seven participants across the three meetings.

6.4 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 Project by Elton (2020b) and summarised in Chapter 21. The SIA provides further detail and context on the Project's social impact to local and regional stakeholders.

6.4.1 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 6.2.

Table 6.2 Summary of online community information sessions

Key theme	Items discussed
Community benefits	• Regional benefits of the Project, including employment opportunities and contribution to local businesses.
Accommodation options	• Location of the accommodation village. • Opportunity for local accommodation businesses in the area to be utilised during the early stages of the Project.
Water usage	• The Project's impact on surface water and groundwater. • Proposed mitigation measures to ameliorate impacts on neighbouring landowners.
Toxicity impacts to soil	• Cyanide usage at the mine and potential seepage from the tailings facilities.
Safety	• Safety of underground mining as it is a new mining method for CGO.
Visual impacts	• Visual impact of the Project 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.

6.4.2 Survey

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

- awareness of the Project and the associated accommodation village;
- general perception of the Project;
- elements of the 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 Project. The survey results also show:

- perception of the Project is positive to very positive for those who are aware of the Project;
- issues of most interest included:
  - potential local employment benefits;
  - the Project's impact on usage of public infrastructure, services and facilities;
  - the Project's impact on water security;
  - population change as a result of the 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.

6.4.3 Stakeholder meetings

i Council meetings

Evolution met with Bland Shire Council, Forbes Shire Council and Lachlan Shire Council to discuss the Project and to update the councils on the progress of the EIS studies. The Project was perceived as a positive for the region by the councils. Items discussed at each of the council meetings are summarised in Table 6.3.

Table 6.3 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 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 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 Mining to consider improving the surface of local roads.

In general, the landowners acknowledged that interactions with the Evolution Mining 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 Project which was positively received and consultation in relation to the 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 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 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.

6.4.4 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 Project;
- 29 likes and 11 shares of social media posts; and
- one telephone enquiry, and no email enquiries.

6.5 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 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 Project develops.

6.6 Summary and conclusion

Evolution has undertaken a comprehensive consultation program in accordance with the SEARs. The results of the consultation show that, in general, many members of the local community support the Project due to the potential social and economic benefits that would accrue from the continued operation of the mine and the jobs it would continue to sustain and the new jobs it will 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 Project and how it would be managed.

The online survey on the Evolution website resulted in a mostly positive response to the 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 Project.



Part C – Impact assessment

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Part C – Impact assessment

Chapter 7 Air quality

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7 Air quality

7.1 Introduction

An air quality impact assessment (AQIA) has been prepared by EMM (2020b) for the Project and is included as Appendix C.

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

7.2 Assessment requirements

The SEARS require an assessment of the Project's potential impact on air quality. The requirements and EIS sections where they are addressed are listed in Table 7.1.

Table 7.1 Air quality related SEARs

Requirement	Location in EIS
Air quality – including: an assessment of the likely air quality impacts of the development in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW;	Section 7.2 specifically references the assessment guidelines and this chapter outlines the proposed method and results.

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).

7.3 Existing environment

Meteorological conditions have been described and characterised in Appendix B 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 Project, Appendix Chas also characterised the existing ambient air quality environment primarily from data from the air quality monitoring program at 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 C.

7.4 Assessment locations

The area surrounding the Project 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 Project have been selected as discrete model prediction locations. Details are provided in Table 7.2 and their locations are shown in Figure 7.1.

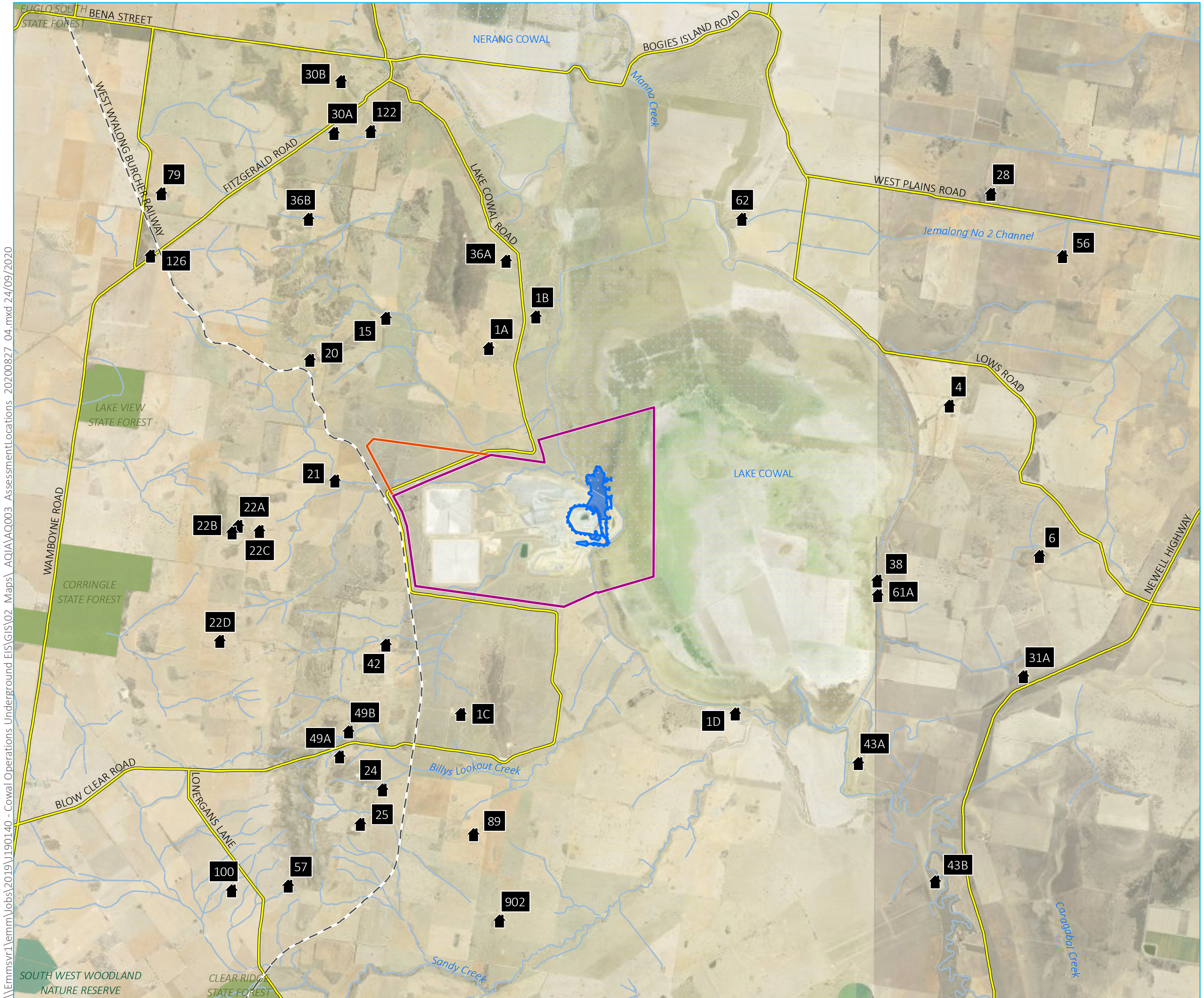
The selected residences are referred to as assessment locations. Assessment locations 1a to 1d are classified as mine-owned residences, while the remaining are classified as private residences.

Table 7.2 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
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

Table 7.2 Air quality assessment locations

Figure ID	Assessment location type	Easting (MGA Zone 55 GDA94)	Northing (MGA Zone 55 GDA94)
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



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

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KEY
- Receptor location
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

Air quality assessment locations

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 7.1

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7.5 Assessment criteria

7.5.1 Impact assessment criteria for particulate matter

This assessment focusses on emissions to air and impacts to human health 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 7.3.

Table 7.3 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

7.5.2 Voluntary land acquisition and mitigation policy

In September 2018, the then 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 B 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.

7.5.3 POEO (Clean Air) Regulation

The statutory framework for managing air emissions in NSW is provided in the POEO Act[3] 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 Project will operate under an EPL and will comply with the associated requirements, including emission limits, monitoring and pollution reduction programmes (PRPs).

[3] http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N

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

7.5.4 Odour

There are no significant sources of odour identified for the 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 Project and therefore no further assessment of odour is presented in this report.

7.6 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 at the Project and Mod 16.

The proposed mining schedule for the Project is shown in Figure 7.2, along with the approved material movement for the open-cut pit. The total material movement for the Project peaks in financial year 2024 (FY24); however, when the 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 proposed underground development compared to the open-cut mining will be minimal. As shown in Figure 7.2, even when the open-cut component has closed (by FY26) and the underground development is running at full capacity, it still only amounts to ~10% of the material movements of the open-cut 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.

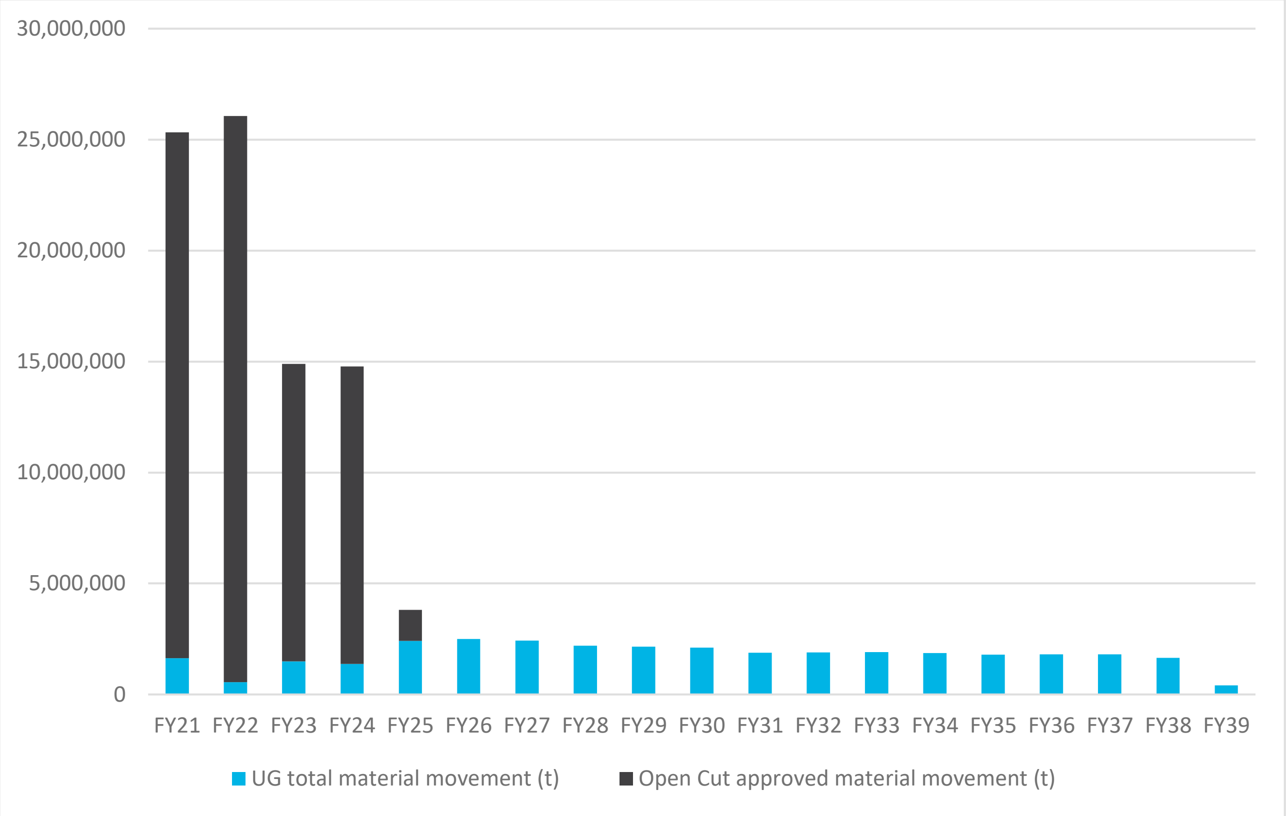

Figure 7.2 Proposed mining schedule for Project (UG) and open-cut total material movement

In addition to the emission estimates for existing (approved) operations, the following activities are considered in the dust emission estimates for the underground development and surface changes modification.

The Project

- 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; and
- 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.

Mod 16

- 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.

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 significant dust sources.

The Project's contribution to annual dust emissions by source type is provided in Figure 7.3 and further detail is provided in Appendix B. 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 Project is associated with hauling of materials and wind erosion. This is typical for facilities involving open-cut mining operations.

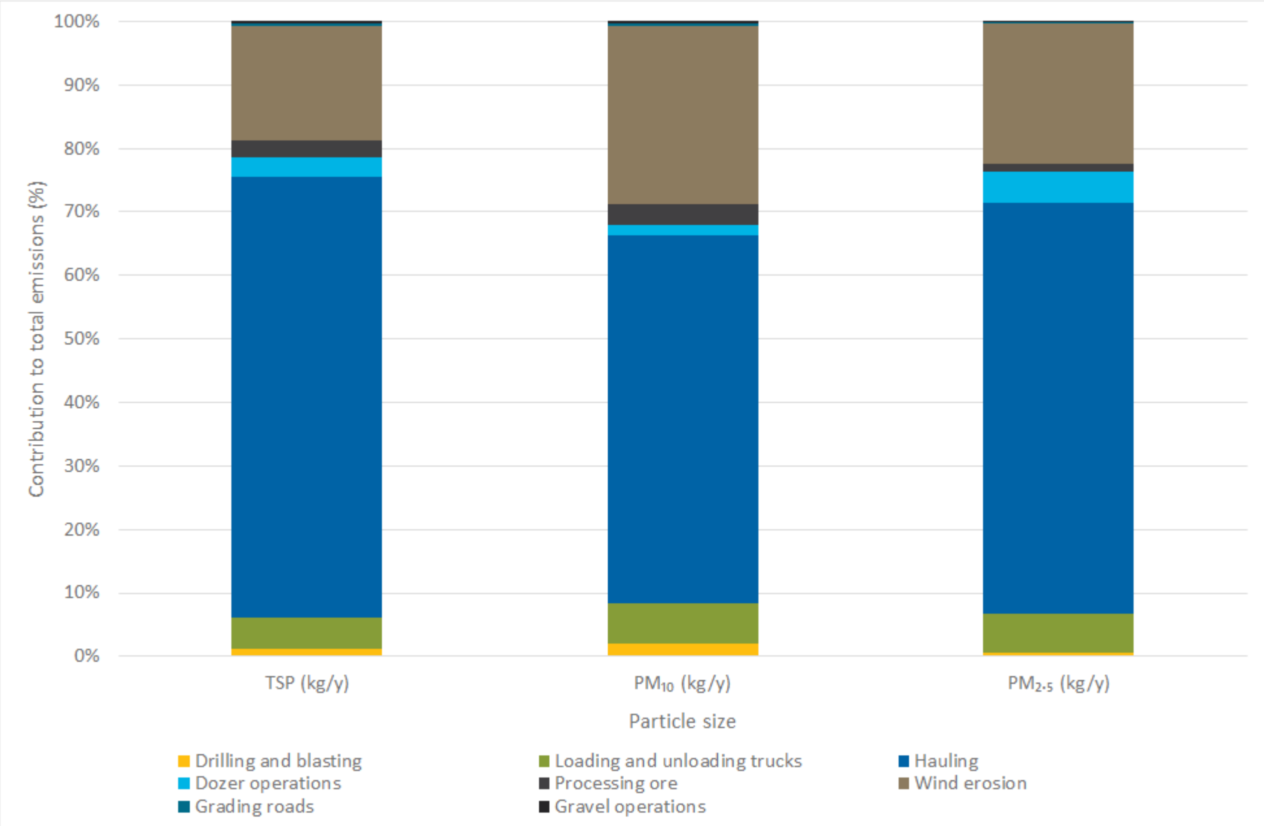

Figure 7.3 Contribution to annual emissions by emissions source type and particle size

A comparison of the estimated emissions from the approved open-cut operations, the Project and Mod 16 is shown in Figure 7.4 and further detail is provided in Appendix B. The emissions data show that the Project will contribute only 3 to 4% of the emission levels of the already approved open-cut operations.

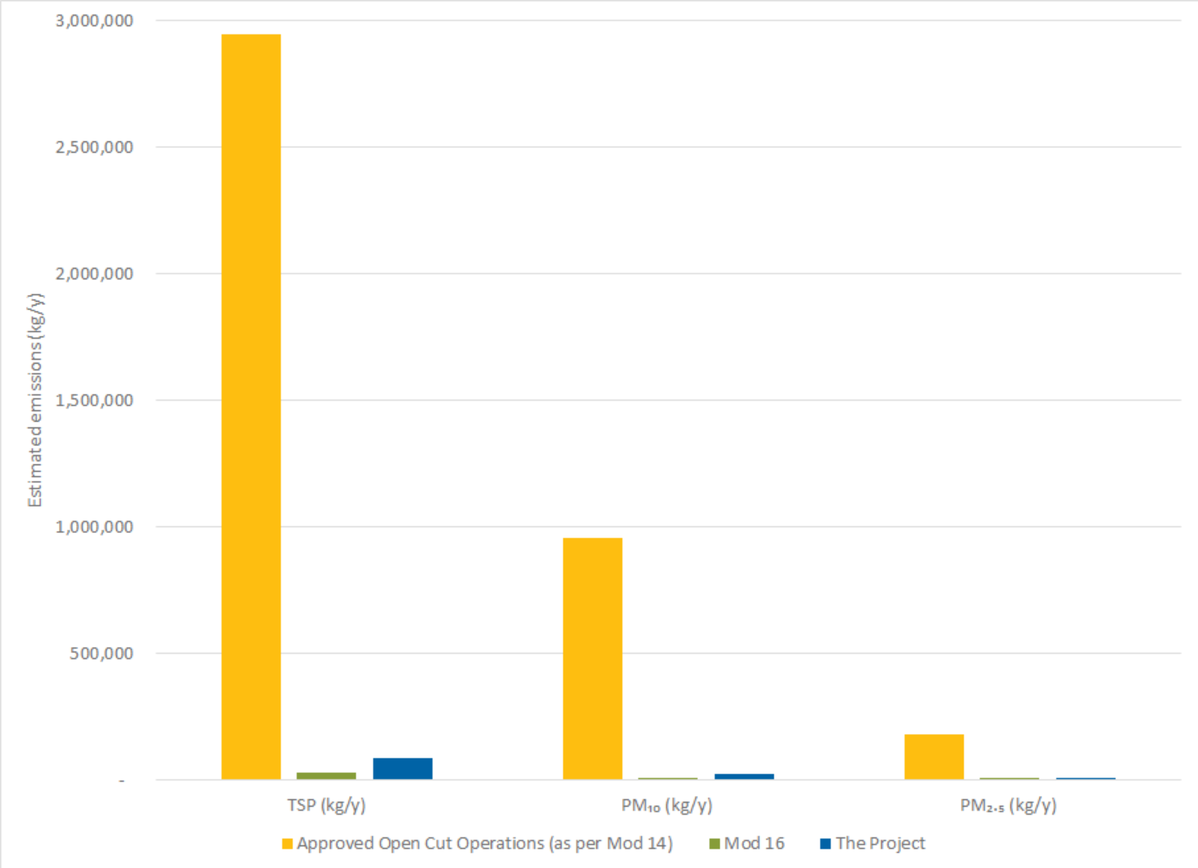

Figure 7.4 Comparison of estimated TSP, PM_{10} and $PM_{2.5}$ emissions for the approved open-cut, Mod 16 surface changes and the Project

7.7 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.

7.8 Modelling results

7.8.1 Project-only modelling results

A summary of the modelling results for each particulate matter include:

- The highest predicted 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.

- 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.

Therefore, the short-term VLAMP criteria are not triggered at any private residences.

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 well below the applicable impact assessment criteria at all assessment locations. For all pollutants and averaging periods, the Project alone represents a marginal change in impacts when compared to the existing open-cut operations.

7.8.2 Cumulative results

This conservative approach in the modelling demonstrates that the overall impact of the Project compared to the open-cut mining will be minimal as 98% of the material movements used in the emission estimate for FY22 will be derived from earthmoving associated with the open-cut (refer Figure 7.2). Additionally, 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, progressive improvement in air quality as mining transitions from open-cut mining only to also include underground mining.

When 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 relevant impact assessment criteria.

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.

7.8.3 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 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 Air Quality Management Plan.

7.9 Management and mitigation measures

The CGP Air Quality Management Plan AQMP has been developed for approved operations at the site. The dust management measures applied to the emission estimates for the Project are consistent with the AQMP and are outlined in Appendix B

Other control measures adopted at the CGO, while not explicitly applied as reduction factors in the emission calculations, are provided in Table 7.4 below.

Table 7.4 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
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

Table 7.4 Air quality management measures listed in the CGO AQMP

Source	Management measure
Tailings Storage Facility	• During non-operational periods, dust suppression measures will eb undertaken to minimise dust emissions from dry exposed areas on the
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

7.9.1 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 $PM_{2.5}$.

With the addition of these continuous monitoring sites, the existing monitoring network is considered suitable for ongoing operations associated with the underground development.

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

7.10 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 Project alone (underground development and associated surface changes), 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.

The maximum number of additional days above 50 µg/m was two. Additional cumulative analysis was presented with an extended background dataset, for the receptors with the highest predictions. This analysis showed that the probability of days above 50 µg/m³ was low, with less than one additional day predicted for each receptor. The maximum predicted 24-hour $PM_{2.5}$ concentrations were below the impact assessment criterion at all assessment locations. There are no private residences where the VLAMP criteria are triggered.

Part C – Impact assessment

Chapter 8 Noise, vibration and blasting

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8 Noise, vibration and blasting

8.1 Introduction

A noise and vibration impact assessment (NVIA) has been prepared by EMM (2020a) for the Project and is included as Appendix D. The NVIA documents the existing acoustic and meteorological environment, outlines the noise, vibration and blasting assessment criteria and study method, and assesses the potential noise and vibration impacts from the proposed 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 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.

8.2 Assessment requirements

The noise and vibration requirements for the Project and where they are addressed in the EIS are listed in Table 8.1.

Table 8.1 Noise and vibration related assessment requirements

Requirement	Location in EIS
DPIE	
Noise and blasting / vibration – including:	
• an assessment of the likely operational noise impacts of the development (including construction noise) under the Noise Policy for Industry (EPA), and the Voluntary Land Acquisition and Mitigation Policy;	Section 8.6
• if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline;	N/A
• an assessment of the likely road traffic noise impacts of the development under the NSW Road Noise Policy; and	Section 8.6.4
• an assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZECC guidelines.	Section 8.6.5

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

- development consent (14/98);
- EPL 11912;
- Industrial Noise Policy (EPA 2000);
- Noise Policy for Industry (NPfI) (EPA 2017a);
- Interim Construction Noise Guideline (ICNG) (DECC 2009);

- NSW Road Noise Policy (RNP) (EPA 2011);
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC 1990);
- Australian Standard AS 2187.2-2006 'Explosives – Storage and use – Part 2: Use of explosives' (Standards Australia 2006);
- Imperial Chemical Industries (ICI) Explosives Blasting Guide (ICT Technical Services 1995);
- CGO's approved Blast Management Plan (BMP) (Evolution 2015a); and
- CGO's approved Noise Management Plan (NMP) (Evolution 2018a).

8.3 Existing environment

8.3.1 Ambient noise environment

The existing ambient acoustic environment was characterised by the ambient noise monitoring completed by Renzo Tonin & Associates (Renzo Tonin) (2016) 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 8.1 and Table 8.4.

8.3.2 Existing CGO noise

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

CGO has been operating since 2005 and has been through several operational modifications. Throughout the life of the operations, an extensive suite of management and mitigation measures have been implemented on-site.

Noise limits that the site 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 Environment Protection Licence 11912. Operational noise limits provided in the development consent are outlined in Table 8.2.

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 8.1) 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.

A review of CGO's quarterly noise monitoring data over the last five years shows that the mine has complied with the noise limits prescribed in the development consent. A review of the complaints history shows that there have been two noise complaints in the last five years. Records show that these complaints were handled swiftly and resolved under the mine's established complaints management process.

Table 8.2 Development consent (DA 14/98) noise limits

Assessment location ID	Land	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).

8.3.3 Existing blasting limits

Blasting at CGO is approved to occur 24 hours a day, seven days a week. One blast a day is allowed. Condition 6.3 of Schedule 2 of the existing development consent provides blasting limits the site must meet in relation to airblast overpressure and ground vibration. Airblast overpressure and ground vibration limits in the development consent (14/98) are summarised in Table 8.3. Blasting is managed in accordance with the BMP (Evolution 2015a), which includes blast monitoring at five monitoring locations consisting of one near field and on-site location and four off-site locations.

Table 8.3 Development consent blasting limits

Location and time	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Residence on privately-owned land – Anytime	120	10	0%
Residence on privately-owned land – Monday to Saturday during day	115	5	5% of the total number of blasts over a period of 12 months.
Residence on privately-owned land – Monday to Saturday during evening	105	2	5% of the total number of blasts over a period of 12 months.
Residence on privately-owned land – Monday to Saturday at night, Sundays and public holidays	95	1	5% of the total number of blasts over a period of 12 months.

8.4 Assessment locations

The area surrounding CGO includes rural properties, with the closest located approximately 2.3 km south-west of the CGO. In order to assess potential noise and vibration impacts across the surrounding area, the closest residences to CGO were selected for assessment. Details are provided in Table 8.4 and their locations are shown in Figure 8.1.

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 8.4 Noise and vibration 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

Table 8.4 Noise and vibration assessment locations

Assessment location ID	Receiver type	Property name	Easting (MGA Zone 55 GDA94)	Northing (MGA Zone 55 GDA94)
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
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 land owner 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 (ie non-residential locations) also included in this assessment are listed in Table 8.5. The locations of these non-residential assessment locations are also shown on Figure 8.1.

Table 8.5 Non-residential assessment locations

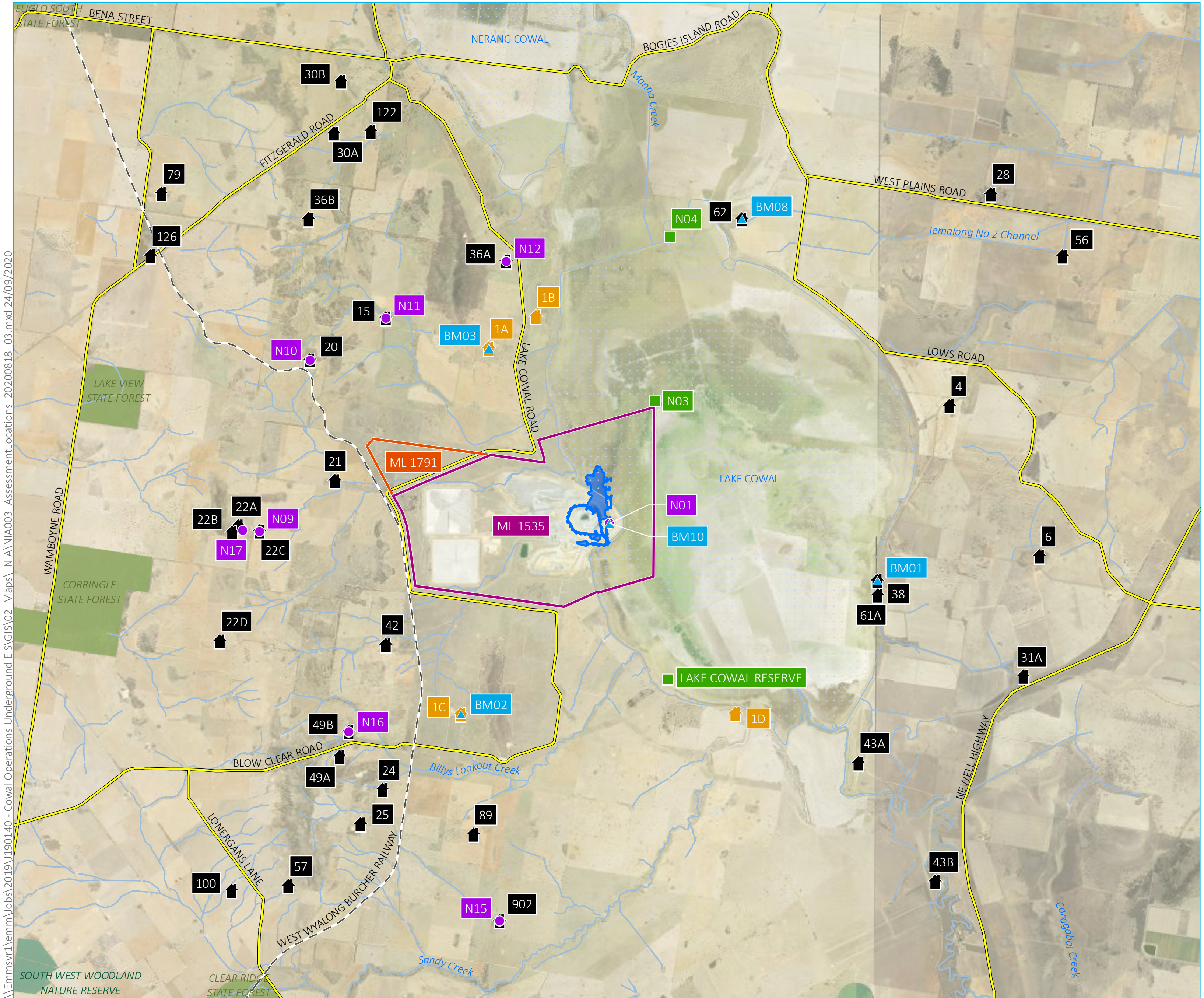
Assessment location	Description	Easting (MGA Zone 55 GDA94)	Northing (MGA Zone 55 GDA94)
N04 - Bird Breeding Area	Bird Breeding Area North	540025	6285561
N03 - Bird Breeding Area	Bird Breeding Area South	539620	6281131
Lake Cowal Reserve	Relocated Crown Reserve	539978	6273640

8.5 Assessment criteria

8.5.1 Operational noise

The NPfI (EPA 2017a) provides guidance in the EPA's preferred methods for the assessment of noise from existing industrial sites. Since the noise and blasting assessment was undertaken for Modification 14 of CGO, the INP (EPA 2000) has been superseded by the NPfI (EPA 2017a). In accordance with SEARs for the Project, and the EPA's *Implementation and transitional arrangements for the Noise Policy for Industry* (2017b), the NVIA for the Project 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 Project intrusive noise levels are 40 dB $L_{Aeq,15min}$ 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 (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.



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

KEY
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

Monitoring locations
- Noise monitoring
- Blast monitoring

Assessment locations
- Residential (Evolution-owned)
- Residential (privately-owned)
- Non-residential

Noise and vibration monitoring and assessment locations

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 8.1

EMM
creating opportunities

For non-residential locations (ie rural areas and passive recreation areas such as Lake Cowal Reserve), Project 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. 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 project 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.

The 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 Modification 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.

8.5.2 Sleep disturbance

Furthermore, 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 for Project 30 dB, and maximum noise level event screening criteria are $L_{Aeq,15min}$ of 40 dB and 52 dB. These values exclude mine-owned properties and privately-owned properties where the application has a noise agreement in place with the landowner.

8.5.3 Construction noise

The SEARs reference the ICNG for the assessment of noise from the Project, where demonstrated to be relevant. However, noise associated with construction activities for mining operations are generally 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 8.5.1 have been adopted as the construction noise criteria for the Project.

8.5.4 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 (i.e. assessment locations), as outlined in the RNP for road categories relevant to the Project is:

- 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.

8.5.5 Blasting

The limits adopted by regulators for blasting are consistent with those provided in the ANZECC guideline 'Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration'. The blasting criteria addresses two main effects of blasting including:

- airblast noise overpressure; and
- ground vibration.

Airblast overpressure and ground vibration limits are specified in the development consent (refer Table 8.3). Blasting at CGO is approved to occur 24 hours a day and and seven days a week. The CGO airblast overpressure and ground vibration limits provided in the development consent are relatively consistent with the ANZECC criteria. However, the development consent includes airblast overpressure and ground vibration limits for the day, evening and night periods. The limits for the evening and night periods, as well as for Sundays and public holidays are more stringent than the ANZECC criteria, as the ANZECC guideline recommends the blasting be limited between 9 am and 5 pm Monday to Saturday.

8.6 Predicted impacts

8.6.1 Operational noise

Operational noise associated with the Project will principally be from underground mining operations including blasting and mining, activities associated with ore haulage and operation of the paste fill plant as described in Chapter 3.

To assess the potential total operational noise impacts from the Project, operational noise levels were predicted 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. 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 8.6.

Table 8.6 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 8.6 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 8.6 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 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 relatively unchanged from existing approved operations and predicted to satisfy the existing noise limits under development consent DA 14/98 at all assessment locations.

The noise assessment has demonstrated that noise emissions from the Project (both from the approved operations and proposed activities under the Project) are predicted to be relatively the same as existing CGO noise emissions at all assessment locations and generate no material additional noise impacts. As feasible and reasonable mitigation measures have already previously been considered as part of the Modification 14 noise assessment (Renzo Tonin 2018), further measures have not been considered as part of this NVIA.

At the waterbird breeding areas (assessment locations N03 and N04), the modelling results show that CGO noise levels during the Project 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 during the Project in accordance with the CGO Flora and Fauna Management Plan. No significant noise impact is anticipated as a result of the Project.

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.

8.6.2 Sleep disturbance

Maximum noise levels from future night-time Project operations, 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 8.6 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, the Project 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.

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.

8.6.3 Construction

Activities associated with the construction of the paste fill plant are unlikely to result in significant noise levels at all assessment locations and therefore have not been assessed further. This, in part, was due to the relatively lower noise emission levels of likely plant and equipment to be used.

The construction of the box-cut entry, however, is likely to generate higher noise emissions compared to other construction activities, and hence has been modelled as a worst-case construction scenario for the Project. The box-cut entry construction has been assumed to occur during approved existing CGO mining operational hours, 24-hours and seven days per week.

Furthermore, proposed construction works will occur concurrently with mining operations at CGO and hence predicted noise levels for the box-cut construction have been combined with the Modification 14 2024 noise predictions before comparison to existing development consent (DA 14/98).

Modelled noise sources and sound power levels for the box-cut construction are summarised in Table 4.2 of the NVIA. The sound power levels are based on data referenced from the Modification 14 noise and blasting assessment.

Predicted noise levels for construction relevant to the Project (ie box-cut entry and paste fill plant) during noise-enhancing meteorological conditions are provided in Table 5.1 of the NVIA (refer Appendix C).

The results show that CGO noise levels during the box-cut construction during noise-enhancing meteorological conditions are predicted to satisfy the existing noise limits (DA 14/98) at all assessment locations.

At the waterbird breeding areas (assessment locations NO3 and NO4), the modelling results show that CGO noise levels during the box-cut 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 during Mod 16 in accordance with the CGO Flora and Fauna Management Plan. No significant noise impact is anticipated during the box-cut construction.

8.6.4 Road traffic noise

Additional daily mine traffic movements will primarily be related to the additional workforce travel. The Project 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 Project workforce (75%) to and from the site each day.

The peak construction workforce for the Project will occur during month 9 of construction, with a total of 335 persons at this time. The proposed construction hours for the Project 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 Project will comprise a total of 83 persons for each 12-hour shift. The shift work hours for the Project will be from 6 am to 6 pm and from 6 pm to 6 am, seven days per week, resulting in peak periods of Project 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.

i Operational traffic

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 Project-related traffic, at the nearest residential facade along these roads, are predicted to increase from existing noise levels by 0.6 dB during the day and 0.7 dB 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.

ii Construction traffic

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 Project construction related traffic, at the nearest residential facade along these roads, is predicted to increase from existing noise levels by 1.1 dB during the day period and 1.3 dB during the night period. Hence, construction road traffic impacts will be negligible and 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.

8.6.5 Blasting

Proposed blast activities during the underground mine operation will be conducted underground. Following the construction of the box-cut entry, blasting will be required during the development of the underground access decline development. Potential impacts associated with air blast overpressure and ground vibration in the early stages of the underground access declined development have been assessed.

The results of the allowable maximum instantaneous charge (MIC) calculations based on the relevant airblast overpressure and ground vibration equations for the early stages of the underground access decline development and underground mine operations are provided in Table 5.6 and Table 5.7 of the NVIA respectively, for the nearest privately-owned residences from the proposed underground mine.

The allowable MIC calculations show that there are no significant restrictions to the MIC for blasts proposed to occur during the early stages of the underground access decline development during the day and evening periods Monday to Saturday. For Sundays and public holidays and the night period Monday to Saturday, the MIC should be limited to 520 kg to achieve the relevant airblast overpressure limits at the nearest assessment location (i.e. assessment location 42) during the early stages of the underground access decline development. The allowable MIC calculations for the early stages of the underground access decline development indicate that the MIC will be limited by airblast overpressure levels.

The assessment shows that during the underground mine operation, no strict control of MIC values is required to achieve the relevant 95% peak particle velocity (PPV) ground vibration limits at the nearest residences.

The allowable MIC calculations indicate that there are no significant restrictions to the MIC of blasts to achieve the existing ground vibration limits for the proposed underground mine operation.

By maintaining the current approach to blast design and blast emission management, it is anticipated that the blasting emission limits will continue to be met throughout the life of the Project.

Potential impacts from blasting at the waterbird bird breeding areas at locations N03 and N04 has been considered. 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 blast emissions. The bird behaviour monitoring is expected to continue during the Project in accordance with the CGO Flora and Fauna Management Plan and hence no significant noise impact is anticipated as a result of blasting for the Project.

8.7 Management measures

Noise and vibration impacts will continue to be managed in accordance with the NMP (Evolution 2018a) and BMP (Evolution 2015a). 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;
  - 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;

- educating staff on the effects of noise and the use of quiet work practices;
- specify maximum noise/sound levels when purchasing equipment; and
- include maximum noise/sound levels in tender documents and contracts.

- 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.

Where relevant, the NMP and the BMP for the site will be updated following determination of the Project.

8.8 Summary

The key findings of the NVIA are as follows:

- Future operational noise levels were assessed against the existing development consent limits in development consent 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 comply with the existing development consent limits at all locations.
- Noise levels during the box-cut construction were assessed against the existing development consent limits for the day, evening and night periods for noise-enhancing meteorological conditions. The modelling results showed that CGO noise levels during the box-cut construction are predicted to comply with 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 comply with the relevant screening criteria at all residential assessment locations.
- The Project 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. Therefore, noise impacts from road traffic noise associated with the Project are shown to be negligible.
- A blasting assessment was completed for the Project. There are no significant restrictions to the MIC for blasts proposed to occur during the early stages of the underground access decline development during the day and evening periods Monday to Saturday. For Sundays and public holidays and the night period Monday to Saturday, the MIC should be limited to 520 kg to achieve the relevant 95% airblast overpressure and ground vibration limits at the nearest residential receiver during the early stages of the underground access decline development. During the underground mine operation, no strict control of MIC values is required to achieve the relevant 95% PPV ground vibration limits at the nearest residential receivers.



Part C – Impact assessment

Chapter 9 Subsidence

9 Subsidence

9.1 Introduction

A subsidence assessment was prepared by Beck (2020) to assess the potential for ground movement associated with the proposed underground mining.

The term 'subsidence' describes the formation of a depression at the surface of land above mine workings as a result of underground mining. The nature of impacts of subsidence are Project-specific and relate to the mining method used, as well as other aspects such as depth of cover to the mine, the geology, faults and geotechnical factors.

The design of the proposed underground development has been revised a number of times during the feasibility phase of the Project, to ensure that the Project will have minimal surface impacts and therefore negligible environmental impacts. As previously noted in section 3.4.1, ore extraction relevant to the Project will take place using SLOS. This mining method was specifically chosen to target the orebody, ensure the safe operation of the mine and to limit the environmental consequences at the surface. The mining method will involve top down SLOS starting from a depth of approximately -80 m AHD and progressively excavating approximately 1,106 stopes to a final depth of -850 m AHD over the life of the mine. Following ore extraction, open stopes will be backfilled using cemented paste. Strict controls will be put into place to minimise the risk of fracturing between the underground development and the surface.

This chapter provides a summary of the subsidence assessment (Beck 2020), which is provided in Appendix E. The subsidence assessment is based on three-dimensional numerical modelling of the SLOS mining method over the life of the mine.

9.2 Secretary's Environmental Assessment Requirements

Specific subsidence requirements for the Project and where they are addressed in the EIS are listed in Table 9.1.

Table 9.1 Subsidence related SEARs

Requirement	Location in EIS
Subsidence – including an assessment of the likely conventional and non-conventional subsidence effects, and the potential consequences of these effects and impacts on the natural and built environment, paying particular attention to features that are considered to have significant economic, social, cultural or environmental value, and taking into consideration:	Chapter 9 Appendix E Section 9.5.4
- recorded regional and historic subsidence levels, impacts and environmental consequences;	Not applicable
- the potential extent of fracturing of the strata above the underground mine;	Section 9.5
- the implementation of a comprehensive subsidence monitoring program which is capable of detecting vertical, horizontal and far-field subsidence movements;	Section 9.6

9.3 Existing environment

9.3.1 Hydrological and geological environment

The proposed underground development is located to the north of the existing open-cut pit and below Lake Cowal, which periodically holds water after seasonal or heavy rainfall.

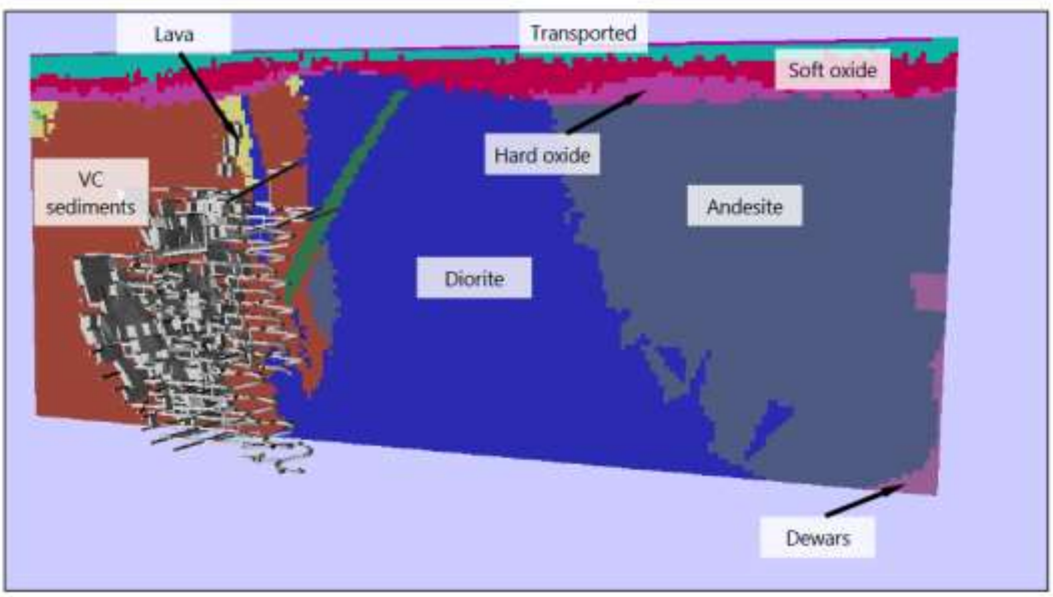
A cross-section through the rock layers in the proposed underground development is shown in Figure 9.1. It shows that the cover above the underground development consists of transported sediments, soft oxidised rock (weathered by oxygen and moisture) and fresh (un-oxidised) rock. The lake floor sediments display low permeability.

There are four distinct geological units where the underground mine is proposed. These are:

- the transported unit –sedimentary and surface layers which form the lake floor, containing clay deposits;
- soft-oxide unit – which has been weathered by oxygen and moisture;
- hard-oxide unit – smaller unit also weathered by oxygen; and
- fresh rock – deeper igneous units containing the orebody.

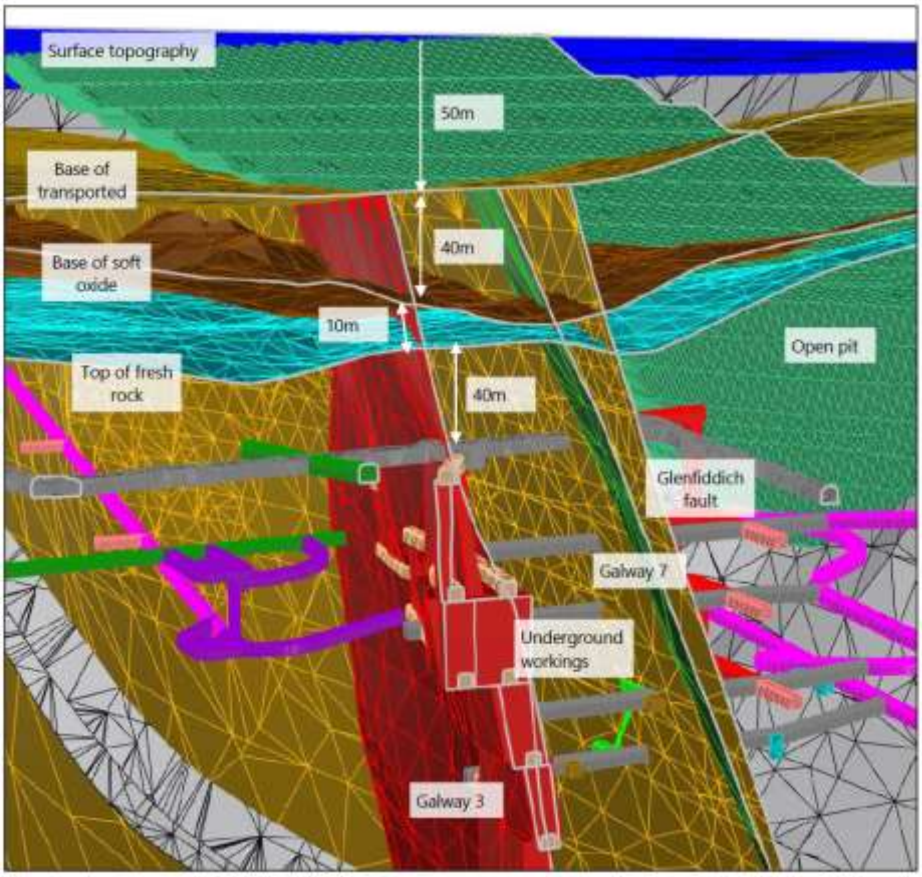
The units have varying thicknesses (refer Figure 9.2) The transported unit has low permeability and is not hydraulically connected with the units beneath it. This is demonstrated by the uniform inflows to the open-cut pit irrespective of whether the lake is full or dry. The groundwater assessment for the Project supports this conclusion, stating that that there is unlikely to be any hydraulic connectivity between the underground development and Lake Cowal due to the largely impermeable rock layers which contain the ore and the less permeable sediments which form the lake floor (Coffey 2020a).

Therefore, Lake Cowal is hydraulically separate from the fractured rock aquifer and its levels are controlled by rainfall and inflows from surface run-off.



Source: Figure 2-2, Beck 2020

Figure 9.1 Cross section showing lithology domains of the Project



Source: Figure 3-1, Beck 2020

Figure 9.2 Cross-section showing indicative thickness of the cover units relative to the underground mine

9.3.2 Fault structures

The geological model for the Project used for the subsidence assessment identifies several fault structures in the area of the underground mine. However, the key fault that is intercepted by the Project is the Glenfiddich Fault. The Glenfiddich Fault is a broader zone up to 1 m wide, comprising discrete clay-filled shear planes. Its estimated strength is moderate to weak and it strikes north-south.

The groundwater assessment (Coffey 2020a) noted that faults around the mine site are all inactive and thus unlikely to provide higher conductive pathways for water, however, the zones surrounding the faults may include more fractured rock and may have a higher conductivity (Coffey 2020a). The assessment concluded that the groundwater drawdown is likely to be higher in the deeper parts of the mine, and drawdown in the near-surface layers would be negligible due to the lack of hydraulic connectivity with the drawdown cone caused by mine dewatering .

9.3.3 Surrounding features

i Environmental Features

Lake Cowal is the most prominent environmental feature surrounding the Project. The type and extent of vegetation within the lake is subject to significant change depending on whether the lake is holding water. Currently the lake is dry and has been since 2019, and thus the vegetation is currently dominated by exotic grasses. When the lake fills with water, the grasslands are submerged and die and aquatic plants dominate.

Historically, when it was dry, the lake bed was used for agriculture including cropping. The lake bed has therefore been considerably altered from its natural state. When the lake is full, significant concentrations of water birds feed in the lake and breed along its shores.

ii Built Features

The only built features near the mine are residences associated with the various farming properties in the area surrounding the mine. However, the closest of these residences are around 3 km from the mine and would not be directly affected in the unlikely event that any subsidence was caused by the Project.

Surrounding land-uses are described in further detail in section 4.1.2.

9.4 Assessment approach

9.4.1 Numerical model

The subsidence assessment method is based on three-dimensional numerical modelling using analysis in a range of commercial software packages such as 3D CAD and Abaqus Explicit. Three-dimensional numerical modelling involves inputting the geological domains, fault structures and the mine design of the underground development. These geological domains were provided by Evolution and show the types of different faults in the underground rock domain and the boundaries between them (refer section 9.3.2). The model was calibrated and used to predict the potential ground movements during the development of the mine and to predict the effect at surface from any potential subsidence.

The subsidence assessment has undergone four iterations, using various underground mine designs which were iteratively refined over a period of one year. The latest iteration was undertaken in May/June 2020 based on the current mine design, and includes the underground mine, box-cut, portal and decline.

9.4.2 Estimated material properties for modelling

The properties of the rock mass that will be affected by the Project were derived from earlier modelling by AMC Consultants Pty Ltd (AMC) and Itasca for the open-cut mine.

The rock mass properties used for modelling are provided in Table 2-1 of Appendix D. The rock mass properties include hard oxide, andesite, diorite, lava, and other types of rocks present within the underground development (refer Figure 9.2). The modelling took into consideration rock density and different types of strength properties (ie uniaxial compressive strength, geological strength index).

The strength properties for faults were grouped into two categories, to encompass the range of fault properties. Fault strengths were assigned based on the strength of the host rock domain. Rock in the weathered oxide domain is known to be weaker in comparison to fresh rock and faults in that domain were categorised as 'weak' faults, while faults in fresh rock were categorised as moderate or strong to moderate and given 'strong' properties.

9.4.3 Other modelling inputs

No in-situ stress testing has been undertaken at the CGO to date, and thus the stress field applied in the numerical model was taken from an underground mine in the region with extensive in-situ stress testing.

The effects of groundwater drawdown on surface subsidence were not been included in the numerical modelling as, at the time of the subsidence assessment, it was understood the host rock subject to underground mining is effectively drained due to drawdown of the water table by dewatering of the open-cut. This was a consideration in the groundwater assessment prepared by Coffey (2020a) undertaken as part of the EIS.

9.4.4 Numerical model limitations

The data entered into the numerical model development had limitations that prevented a forecast of the stability of individual stopes or the stability of individual drives. These forecasts depend largely on stope-scale structures. However, the model allowed for general interpretations of stope and drive stability.

The subsidence assessment report recognises that the modelling will be updated from time to time as actual monitoring data of the behaviour of individual stopes becomes available.

9.4.5 Mine design iterations

Chimneying is a sink-hole type conical collapse structure that propagates to the surface from an underground mining void. If chimneying were to occur in the underground mine it could result in a significant impact to Lake Cowal. The Beck (2020) report recommended that the top layer of stopes should be removed from the proposed underground mine plan due to the proximity of the weak cover layers and accordingly, the latest underground development design has excluded these stopes.

In addition, Beck (2020) recommended a minimum stope width to crown pillar thickness of 1:2 (ie a minimum crown pillar thickness of ~20 m to 30 m for the 10 m to 15 m wide stopes). The crown pillar thickness would be adjusted in accordance with the width of the stopes, in keeping to the 1:2 ratio. Beck also recommended that the crown pillars should be in fresh rock, and not within the oxide layers.

However, these are preliminary requirements and additional geotechnical assessment will be required during the detailed design of the underground development once more geotechnical information is available, such as drilling information, development mapping and experience in the general underground mining conditions.

The mine design also assessed the potential interaction between CGO's existing open-cut pit mine and the proposed underground mine. The underground mine has been designed so that there is no subsidence or ground instability in the open-cut pit resulting from the excavation of the declines or stopes.

9.4.6 Groundwater modelling

The subsidence assessment notes the importance of groundwater modelling, as the interaction of stopes with groundwater has two potential impacts to underground mining. One is an increase in pumping due to drainage of groundwater into the mine, and the other is stope instability due to the presence of water (Beck 2020).

Groundwater modelling was completed as part of the groundwater assessment prepared by Coffey (2020a) and is summarised in Chapter 10.

In general, Coffey has found that:

- the mine is hydraulically separated from the lake, and mining would occur in the hard oxide rock which would not affect the lake;
- the maximum inflows to the mine are expected in deeper parts of the mine and far below the layers within which nearby groundwater users extract their water; and
- groundwater inflows would not trigger the Aquifer Interference Policy's minimal impact limits for water table, water pressure or water quality.

9.5 Predicted impacts

9.5.1 Impacts from sub-level open stoping

The SLOS mining method has been adopted for the Project as it offers the maximum level of protection to both the overlying surface features, as well as the underground workers. The SLOS method leaves significant pillars of undisturbed rock between stopes to maintain ground stability and to protect worker safety.

SLOS is also compatible with backfilling to enhance long-term stability and allow adjacent stopes to be safely developed. Unlike some other mining methods used for underground coal mining, such as longwall mining, surface subsidence is generally minimal and often negligible, for most stoping operations. This is the case, in particular with stoping operations targeting near vertical and relatively thin gold orebodies such as Lake Cowal underground.

However, the subsidence assessment notes that the main potential hazards for the underground development include hanging wall overbreak and stope failure/chimney failure of the upper stopes in the mine. The model does not forecast significant rock mass damage or major instability above these stopes. However, local geological conditions encountered may be different from the current understanding as assumed in the subsidence assessment.

Chimney failure and stope instability is a potential hazard in all stope mines and must be managed appropriately. Chimney failure of a stope to surface at Lake Cowal would likely result in any surface water in the lake draining through to the underground workings. Potential failure of stopes at Lake Cowal will be appropriately addressed to mitigate the potential risk of chimneying. It is noted in the subsidence assessment (pp 53, Beck 2020):

> In our opinion, the most likely cause of (potential) chimney failure of the stopes closest to the surface are the major faults in proximity to planned stopes. These faults include the Glenfiddich fault, Galway splay faults and any other larger to intermediate scale structures that have not been identified to date. Although the likelihood of stope overbreak and chimneying to failure is very low (with appropriate controls), the consequence to the underground mine would be catastrophic.

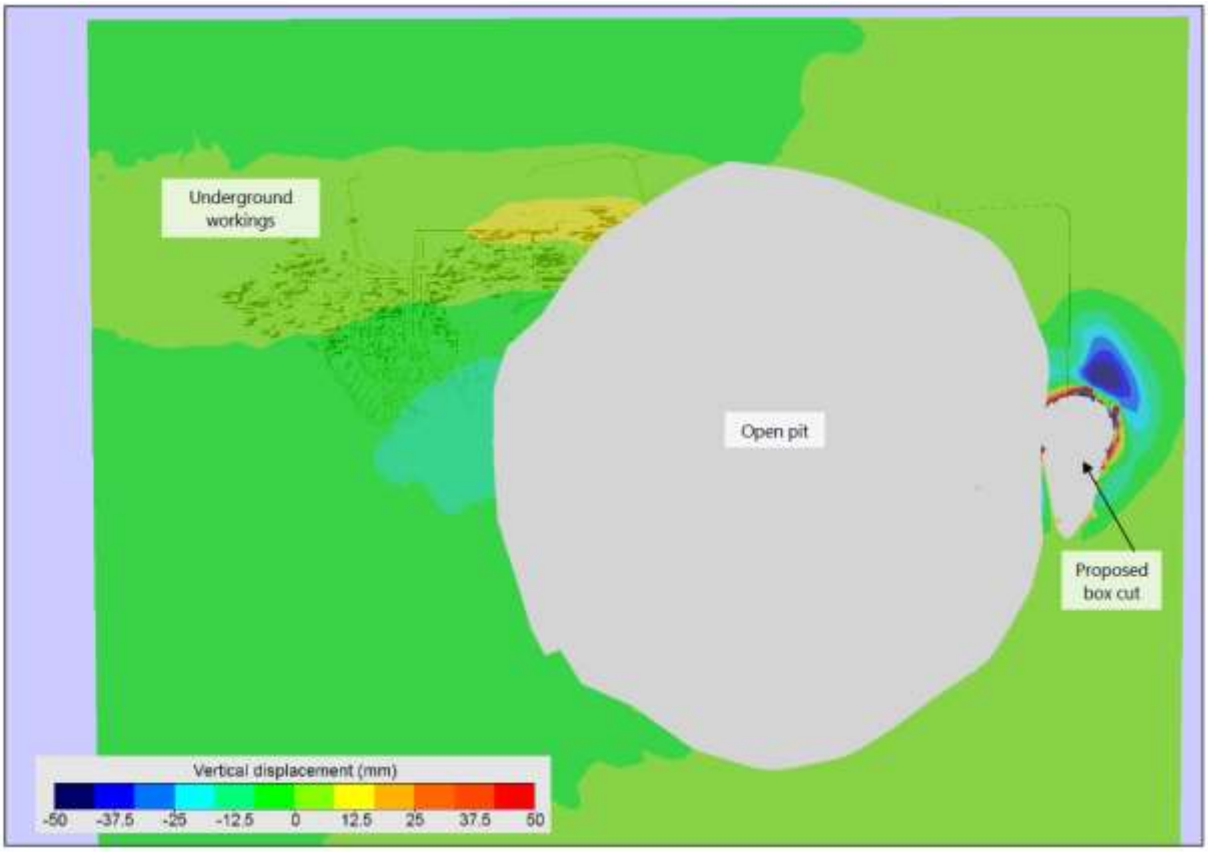
Therefore, CGO will need to carefully manage this hazard through its detailed mine design, mine sequencing, timely paste filling and potential cable bolting stope walls and stope crowns. As noted in section 9.4.5, this can be achieved by retaining a minimum stope width to crown pillar thickness of 1:2, to maintain overhead stability within the stopes. Mitigation measures to manage and control this hazard are outlined in the section 9.6.

9.5.2 Subsidence impacts

In terms of subsidence impacts, the primary conclusion of the subsidence assessment in relation to vertical subsidence is that surface lowering will generally be less than 15 mm (refer Figure 9.3) and the potential for subsidence impacts at the surface is considered negligible. This amount of displacement is well within the limits and precision of current geological understanding, material properties and capabilities of a mine-scale model.

In isolated areas of the mine, upsidence (uplift) of 25 mm is forecast due to displacement along the Glenfiddich fault, which becomes slightly mobilised in the model forecasts due to nearby underground mining. There is a minor level of localised surface subsidence near the box-cut, however this is not expected to result in any noticeable impact at the surface and would occur on land already disturbed at the mine site.

These surface movements are within the same order of magnitude as the effects of water (shrink/swell action) and erosion. These forecast levels of surface movement are well within limits and precision of current geological understanding, material properties and model capabilities at mine-scale.



Source: Figure 3-9, Beck 2020

Figure 9.3 Forecast vertical displacement above the proposed underground mine

9.5.3 Interaction with CGO's open-cut pit

The subsidence assessment examined any potential interaction between CGO's open-cut pit mine and the proposed underground development. Figure 9.4 shows the proximity of the proposed underground development to CGO's open-cut pit mine.

Minor levels of horizontal closure are expected in the underground development, particularly in deeper and thicker sections of proposed stoping. Displacement in proximity to the open-cut pit is inwards (horizontal closure) and slightly upwards due to excavation of rock from the open-cut pit.

The assessment also forecasts some rock mass damage of varying degrees, depending on the position of the underground development and its proximity to the open-cut pit. For this reason, a detailed crown pillar stability assessment has been recommended for each stope on the upper mining levels, to confirm crown pillar stability (refer section 9.6).

Overall, assessment of model forecasts for displacement, rock mass damage and stress demonstrates very low and negligible interaction between the open-cut pit and underground development. Some minor interaction is expected between the proposed underground development and the existing open-cut pit mine, in the weak sediments and soft oxide layers; these effects are mostly due to previous open-cut pit mining.

Source: Figure 3-3, Beck 2020

Figure 9.4 Aerial photo of the open-cut pit mine and Lake Cowal showing the underground mine footprint

9.5.4 Impacts to the natural and built environment

The SEARs require an assessment of potential impacts from subsidence on the natural and built environment, paying particular attention to features that are considered to have significant economic, social, cultural and environmental value.

Lake Cowal is the most notable feature of environmental value surrounding CGO. When full, Lake Cowal is the largest natural inland lake in NSW, having the capacity to hold approximately 150 gigalitres of water. When the lake is full, large flocks of native birds breed there.

As noted in section 4.4.3, Lake Cowal contains water only after significant rainfall events and has previously had prolonged dry periods of up to 30 years. During these prolonged dry periods, Lake Cowal has been used for agricultural purposes. Evolution owns approximately half of the land within Lake Cowal and no agriculture is undertaken on this portion of the land.

As the lake is hydraulically separate from the fractured rock aquifer, its water levels are not influenced by changes in groundwater. Instead, its water levels are controlled by rainfall and surface water run-off. The proposed mining method has a small lateral extent in comparison to other underground mining methods and will occur as discrete pockets rather than the long linear extractions such as longwall mining which can be several hundred metres in length and width before the goaf (void) eventually collapses.

The subsidence assessment has concluded that subsidence impacts will be less than 15 mm and considered are thus considered negligible. Potential impacts to Lake Cowal are considered to be manageable with the implementation of the mitigation measures outlined in the following section.

The mining would therefore be highly unlikely to affect the hydrological processes of the lake and consequently would not affect the integrity of Lake Cowal (ie the vegetation or the surface water).

Finally, there are no built features either at the existing CGO site or in the areas surrounding the mine that would be affected by subsidence from the underground mining activities.

9.6 Management and mitigation measures

The subsidence assessment identified a number of options to manage or mitigate the risk of subsidence associated with underground mining. They include:

- The stopes located in the oxide and transported layers are at higher risk and have been removed from the mine plan.
- Control measures to aid in minimising potential for stope overbreak and chimney failure include:
  - a detailed crown pillar stability assessment for each stope on the upper mining levels;
  - stope sequencing to minimise risk of failure and unravelling along faults, particularly where stopes are bounded by multiple faults;
  - top down drilling of the upper stopes to provide access to the top of the stope (the overcut drive);
  - backfilling stopes in a timely manner and tight filling stopes as far as practical;
  - cable bolting of stope crowns, when appropriate; and
  - employing a continuous mining sequence.
- Subsidence monitoring above the underground mining precinct.
- *In situ* stress measurement.

9.7 Summary and conclusion

The potential subsidence effects, impacts and environmental consequences resulting from the underground stope mining have been modelled.

The results of this modelling show that vertical subsidence will be less than 15 mm and upsidence will be around 25 mm. These subsidence levels are considered negligible and within the natural variation of the ground surface.

This amount of displacement is well within the limits and precision of current geological understanding, material properties and capabilities of a mine-scale model. These subsidence and upsidence levels are unlikely to result in any impacts to Lake Cowal.

The potential hazards of hanging wall overbreak and stope failure/chimneying of the upper stopes in the mine will be closely managed and mitigated through the mine design, which has already been modified to remove a layer of 19 stopes which showed the potential for increased chimneying risk.

A range of operational protocols will be implemented to ensure the risks will be minimised. This includes detailed mine sequencing, backfilling the stopes immediately after they are extracted, and through comprehensive stope surveillance monitoring during operations.

Part C – Impact assessment

Chapter 10 Groundwater

EMM
creating opportunities

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MINING

10 Groundwater

10.1 Introduction

A hydrogeological assessment of the mine site was conducted by Coffey (2020a) and included as Appendix F. Coffey (2020b) prepared an hydrological assessment on the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield for the Project, also provided in Appendix F.

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 E and is outlined below.

10.2 Assessment requirements

The SEARS require an assessment of the Project's potential impact on groundwater. The requirements related to groundwater and the EIS sections where they are addressed are listed in Table 10.1.

Table 10.1 Groundwater related SEARs

Requirement	Location in the EIS
• An assessment of the likely impacts of the development on the quantity and quality of regional surface water and groundwater resources.	Section 10.4.3.
• An assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users.	Section 10.4.3.
• Identification of the proposed water supply for the development.	Section 10.3.5 Chapter 11 and Appendix F.

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).

10.3 Existing environment

10.3.1 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 open-cut 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:

1. **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 2010).
2. **The Saprolite unit:** underlies the Transported unit and is of relatively low hydraulic conductivity. The unit comprises extremely weathered rock, often weathered to clay.
3. **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.
4. **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); and
- groundwater outflow from the Corinella Constriction.

A visual representation of the different hydrological processes occurring at the site and region is provided in Figure 3.3.

10.3.2 Faults and structure

Evolution's geological model of 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-cut 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.

The Glenfiddich Fault was also observed to cross the exploration decline near its southern portal during a field investigation program between January and March 2020. The Glenfiddich fault zone consisted of slightly more fractured rock compared to the surrounding rock over a zone of approximately 8 m width. Some areas of higher inflow were found adjacent to the fault. Appendix E notes, however, that many other areas of higher inflow were found in joints not apparently associated with the Glenfiddich Fault or other faults. It does not appear that the Glenfiddich Fault is providing a significant preferential conduit for groundwater when it is considered amongst the surrounding fractured rock at the scale of the Project. See also Appendix E.

10.3.3 Groundwater levels and flow regimes

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

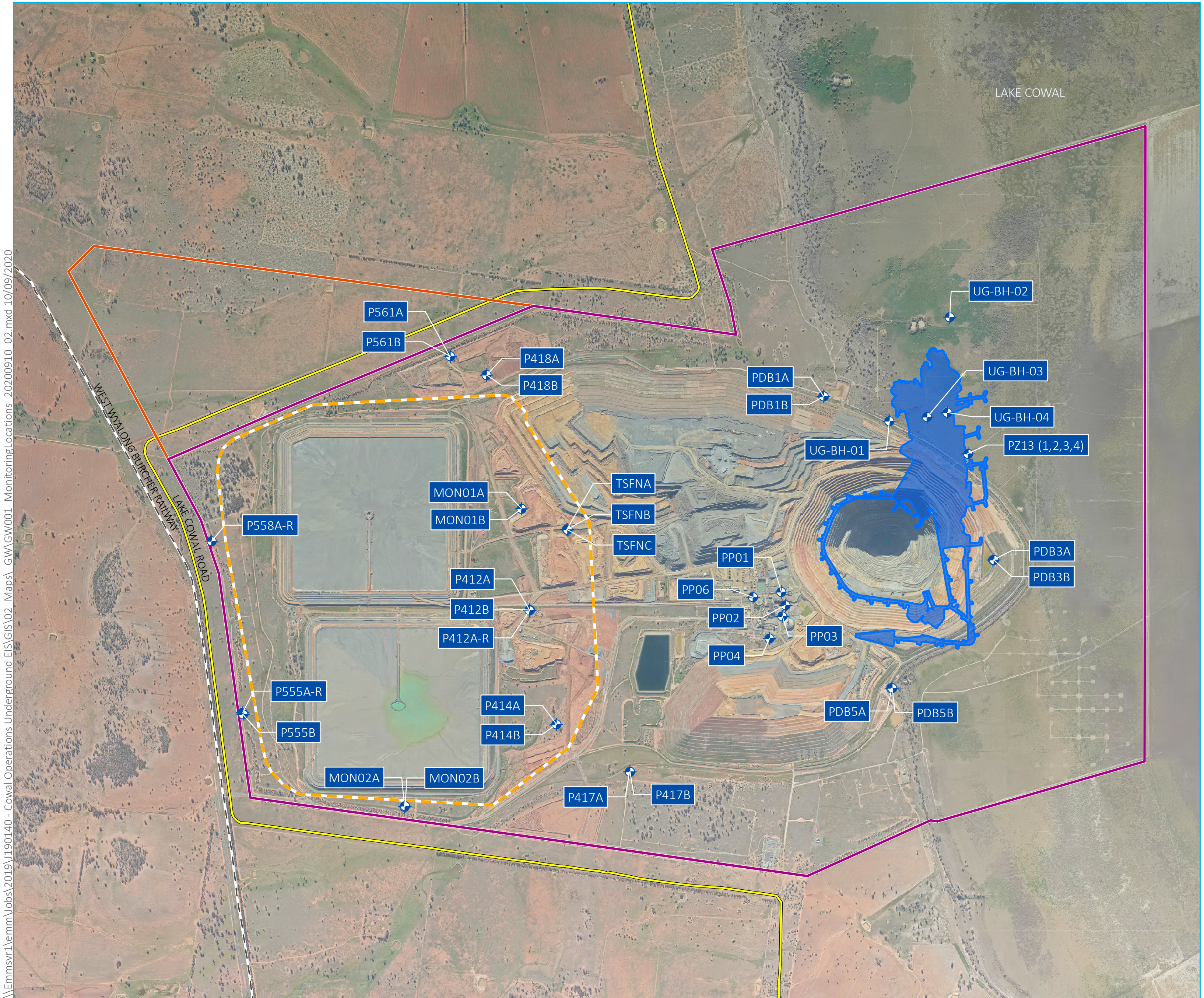
The coordinates and screen elevations for these piezometers are provided in Table 6.1 and Table 6.2 of Appendix E and their locations are shown in Figure 10.1.

i Groundwater levels and flow regimes within ML 1535

Over the life of the CGO, 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-cut pit have been depressurised by discharges into the open-cut pit and active pit dewatering. Despite Lake Cowal becoming inundated, records show that groundwater flow into the open-cut 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 E, supports this understanding. The observed groundwater flows in December 2019 for the Transported and Saprolite units are shown in Figure 10.2.

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

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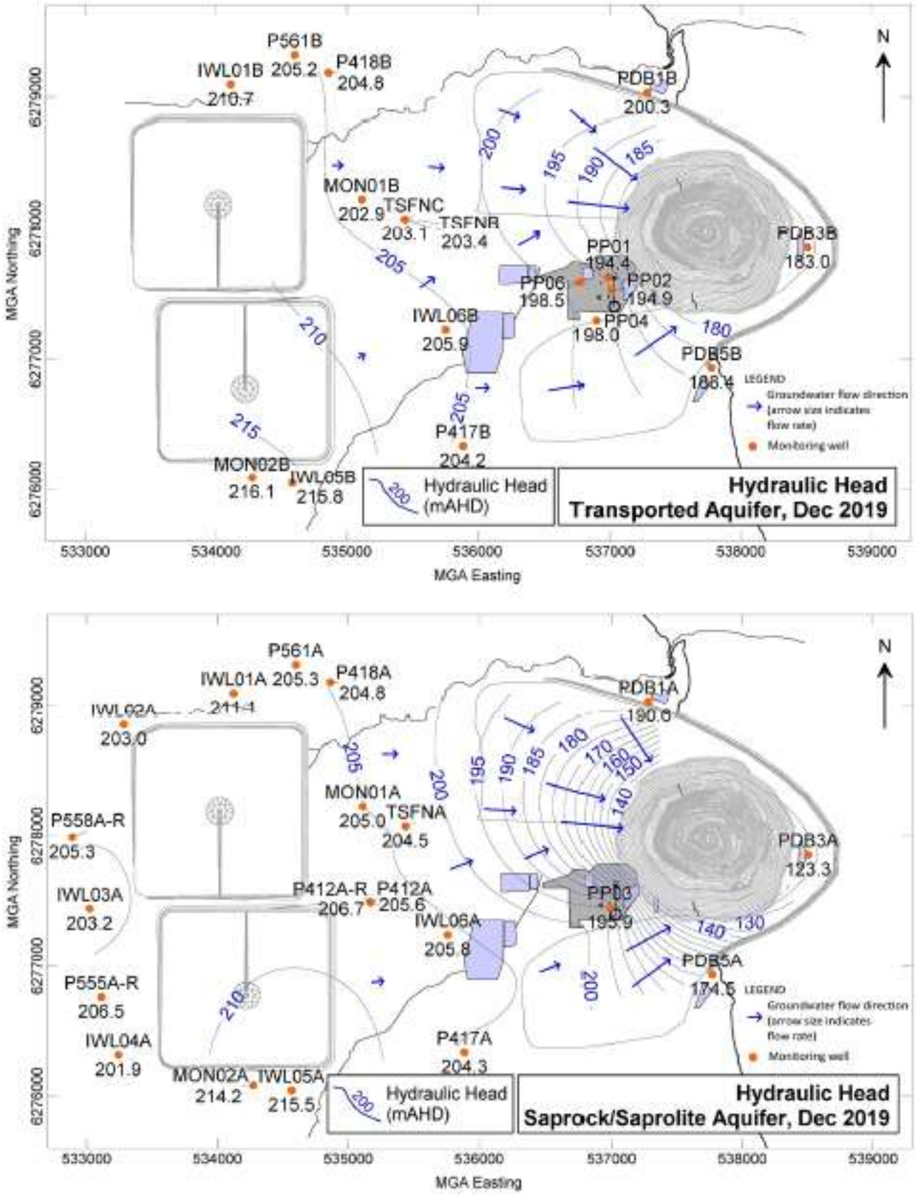
Monitoring well locations

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 10.1

EMM
creating opportunities



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

Figure 10.2 Observed hydraulic head in December 2019 for the Transported and Saprolite units

ii 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 (2009). Rises were assessed to be related to the percolation and the movement of seepage from the TSFs.

It is noted in Appendix F 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 prediction. Well-established measures can be used to control groundwater levels approaching the surface should this prove necessary and are discussed further in section 10.4.3viii.

10.3.4 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-cut 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).

i 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.

10.3.5 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 F), primarily sourced from on-site with make-up from external sources. Of the total process water consumed, approximately 53% comes from catchment runoff and tailings bleed, 22% from the Bland Creek Palaeochannel Borefield and 6% from the Eastern Saline Borefield. A detailed summary of the water balance is provided in Appendix G.

In order of importance, process water sources are:

1. Reclaim from the IWL decant pond.

2. Pumping from the open-cut pit and underground mine sumps.

3. Water from contained water storages.

4. Groundwater from the eastern saline borefield via the mine borefield pipeline.

5. Groundwater from the BCPB via the mine borefield pipeline (consistent with existing licensed limits outlined below).

6. Groundwater from the saline groundwater bores located with ML 1535 when lake conditions allow.

7. Water accessed from the Lachlan River via the Jemalong Irrigation Channel using regulated flow licences purchased by Evolution on the open market.

Details regarding items 1-6 above are provided below. Further details regarding item 7 are in the surface water chapter (refer Chapter 11).

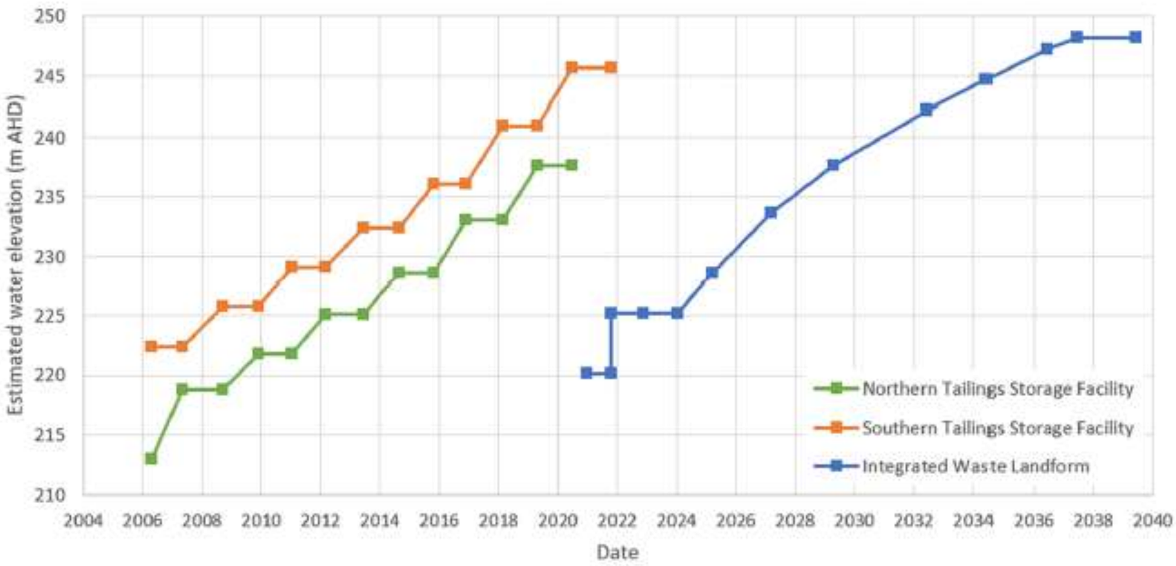
i Tailings storage facilities and Integrated Waste Landform

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 F 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 10.3.



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

Figure 10.3 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 10.6.9.

ii 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 the 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-cut pit began in 2006. Some of these horizontal bores continue to operate and have proven successful in controlling groundwater pressure behind the pit face.

Groundwater seepage into the open-cut pit, groundwater flows from in-pit horizontal drains and rainfall runoff in the 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 pit footprint.

Based on modelling and interpretation of pit dewatering volumes, groundwater inflow to the open-cut 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.

iii 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.

iv Eastern saline borefield

The eastern saline borefield 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.

v 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 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 the palaeochannel. 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 F).

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).

vi Saline groundwater supply bores

Currently, two saline groundwater supply bores are located within ML 1535 to the south-east of the open-cut 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.

10.4 Impact Assessment

10.4.1 Field investigations

To support assessment of groundwater level and hydraulic conductivity parameters adopted for the 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 F.

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 4.8×10^{-4} m/day.

10.4.2 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-cut 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-cut pit inflows and to groundwater monitoring data from 22 locations over a fourteen year period from 2005 to 2020 and four locations above the Project where monitoring commenced in February 2020.

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

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

10.4.3 Predicted impacts

i Groundwater levels

a Groundwater levels during mining

The model predicts that the groundwater head in the Transported, Saprolite, Saprock and Primary Rock units will decrease by approximately 5 m between 2020 and 2038/2039. Despite this development, the modelling also predicts that the underground development will have very little influence on groundwater levels with only a slight shift in the centre of the groundwater drawdown cone around the open-cut pit towards the Project by 2038/2039.

The drawdown of the groundwater table caused by the dewatering around the open-cut pit and Project is predicted to remain entirely within ML 1535 during and until the end of mining in 2038/2039, except for small areas to the north and south where the 1 m drawdown contour is just ML 1535. However, this does not affect any private groundwater users, which are located well beyond the mining lease area.

Additionally, mounding of the groundwater table caused by seepage from the IWL is predicted, but the groundwater head draws that leakage towards the open-cut pit (refer Figure 10.2) and constrains the risk of surface salination. The recharge is not expected to result in any material impacts to local groundwater resources and continues to be closely monitored during the operation of the Project.

Evolution has developed mitigation measures as a contingency. These are outlined in section 10.4.4.

b Groundwater levels after mine closure

Following the end of mining and dewatering of the open-cut pit in 2038/2039, groundwater inflow and surface water run-off will gradually fill the base of the open-cut pit, forming a lake. The pit lake water level will rise to a level where net evaporation from the pit lake is balanced by groundwater inflow and surface water run-off into the pit.

As the water level in the open-cut pit will remain below the surrounding groundwater level (assuming the open-cut pit is not flooded with surface water), groundwater in the vicinity of the open-cut pit will continue to flow towards the open-cut pit indefinitely in the absence of any other external factors.

A slight recovery in groundwater heads around the open-cut pit in the Transported, Saprolite and Saprock units of around 5 m is predicted between 2038 and 2058 with negligible change between 2058 and 2138. The recovery of groundwater heads in the Primary Rock unit is anticipated to be more pronounced between 2036 and 2138. This is related to recovery of drawdown associated with the stopes and also the infilling of the base of the pit with groundwater inflow. Predicted impacts on groundwater levels after mine closure are therefore minor.

Following mine closure, once the tailings emplacement is complete, recharge will tail off and mounding will dissipate over time with the diminishing hydraulic head in the tailings mass while the pull from the pit will remain in perpetuity due to evaporation.

ii Groundwater inflows

a Groundwater inflows during underground mining

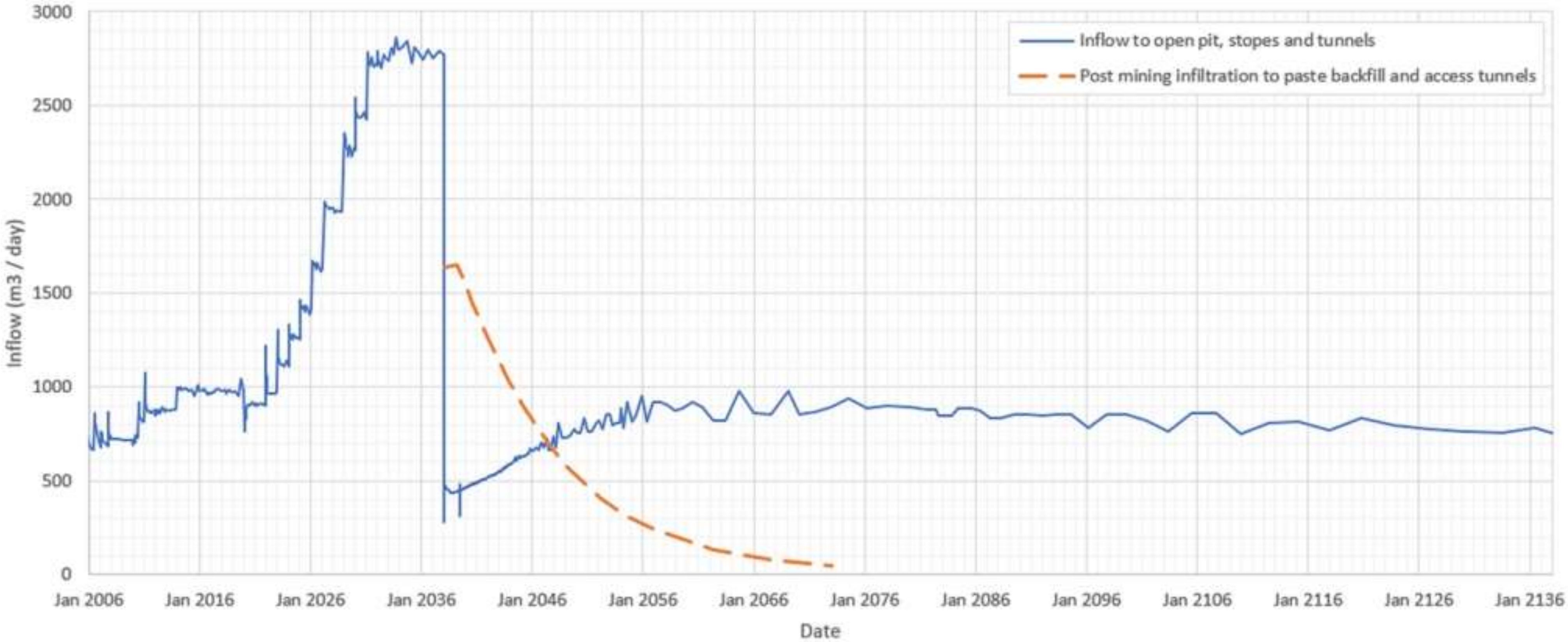
Combined groundwater inflow to the open-cut pit and the stopes is predicted to increase from approximately 1 ML/day in 2020 to a peak of approximately 2.8 ML/day in 2031 and continue at this rate until the end of mining and ore processing.

Around 1 ML/day of this inflow is attributed to the current open-cut pit, leaving around 1.8 ML/day that would enter the stopes and only between the period from 2031-2039. This is not considered to be a significant impact and there are a number of mitigating factors to the significance of the inflows to the underground mine.

Firstly, the highest depressurisation occurs in the lowest levels of the mine (ie in the stopes located 700–850 m underground). The effect on predicted groundwater heads caused by underground development is expected to be confined primarily to the Primary Rock unit (with very small to negligible effects in the overlying Transported, Saprolite and Saprock units) and this is where inflow rates will be expected to highest and well below any beneficial use aquifers.

Further, the inflows will be limited by paste filling the stopes and the drawdown from the alluvial layers is minimal due to the aquitard layer below Lake Cowal will minimise any adverse effect on terrestrial ecology.

The inflows would reduce over time as the underground voids fill and local groundwater levels recover. This is expected to take around 30 years (see Figure 10.4).



Source: Figure 10-5 of the Cowal Underground Development EIS Mine Site Hydrogeological Assessment (August 2020)

Figure 10.4 Predicted groundwater inflow to the open-cut pit, stopes and access tunnels (2006 to 2138)

b Groundwater inflows post mine closure

Following the cessation of mining, groundwater inflow to the open-cut pit is expected to rise from approximately 0.5 ML/day in 2038 to 0.9 ML/day by 2066. During this time, the access tunnel voids and the paste backfill in the stopes will gradually fill with groundwater. From 2066 to 2100 the inflow rate to the open-cut pit is predicted to gradually fall to approximately 0.65 ML/day then remain at around that rate as the inflow to the pit is almost balanced by evaporation from the pit lake surface. The difference in predicted inflow rates between the dry lake case and the flooded lake case is negligible. This is a result of the low vertical permeabilities of the hydrogeological units and the very high pan evaporation rates in the area.

Following mine closure, during the period from 2040 to 2066, groundwater inflow into the access tunnel voids and paste backfill in the stopes is predicted to fall from 1.65 ML/day to less than 0.1 ML/day (refer Figure 10.5).

iii Predicted effects of increased fracturing of rock above stopes

An assessment of the potential effect on inflows if stoping development were to result in increased fracturing in the rock overlying the stopes was carried out. The model was run with the horizontal and vertical hydraulic conductivity of the Primary Rock in the area of the stopes, from the level of the base of highest level of stoping up to the interface with the Saprock unit, increased by a factor of ten.

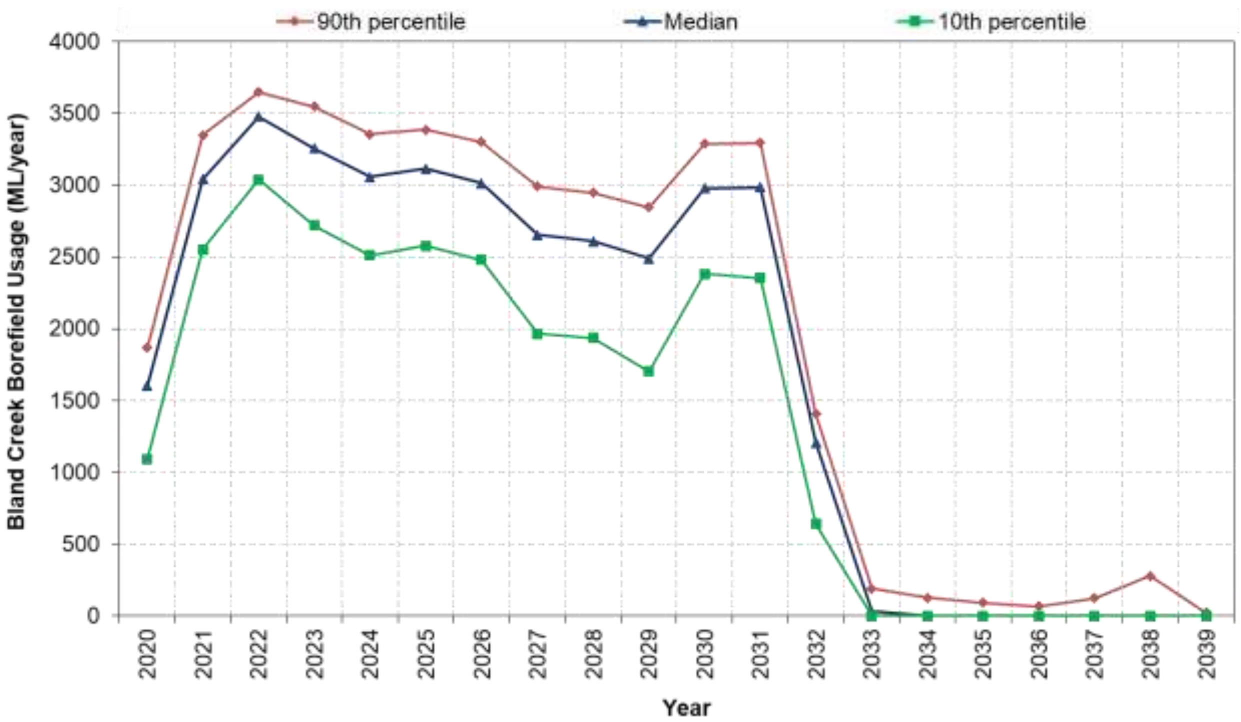
The maximum predicted increase in inflow during the period 2020 to 2056 was less than two per cent. This can be understood by considering the low vertical hydraulic conductivities in the Transported, Saprolite and Saprock units overlying the stopes. These units have a combined thickness of between 50 m and 100 m in the area above the stopes.

Additionally, as stoping progresses to depths reaching up to 900 m below the ground surface, a large proportion of the total inflow is predicted to be from flows into the deepest stopes from the nearby rock, rather than from sources close to the ground surface.

iv Predicted impacts on the Bland Creek Paleochannel Borefield

The water balance model results of average system inflows and outflows for the Project (outlined further in Chapter 11) 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 Project.

Figure 10.5 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 residual ore processing , with zero requirement from the BCPB predicted following the cessation of treatment of the residual open-cut pit ore stockpiles.



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

Figure 10.5 Predicted Annual Bland Creek Palaeochannel Borefield Usage

When ESB and BCPB pumping stops, groundwater levels at reference bore GW036553 are predicted to recover to around 166 m AHD in 10 years (about 30 m below 1998 water levels), and would continue to gradually recover over time, to a level that is dependent on the amount historically pumped, private bore usage following CGO closure, and climate. It may 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) because of the low rate of media recharge and continuing pumping for agricultural purposes.

v Predicted effects of increased hydraulic conductivity of lake bed sediments

An assessment of the effects on inflows to the underground mine resulting from a higher hydraulic conductivity in the Transported Unit was carried out by factoring the horizontal and vertical hydraulic conductivity of the Transported Unit up by a factor of ten.

The predicted increase in inflow to the stopes and tunnels during the period 2020 to 2056 was less than two per cent. This can be understood by considering that between the base of the Transported Unit and the top of the highest stopes at approximately -80 m AHD, there is an approximate combined thickness of 60 m to 100 m of Saprolite, Saprock and Primary Rock. The vertical hydraulic conductivities of these units is low based on the calibration of the numerical model to observed groundwater levels and open-cut pit inflows between 2005 and 2020.

vi Predicted impact on Lake Cowal

Lake Cowal is a surface water fed water body, originating from Bland Creek and occasional flooding of the Lachlan River. It is separated from the proposed underground development by a 120 m combined thickness of lake sediments and extremely weathered to fresh rock, with vertical permeabilities of less than 1 x 10^{-3} m/day.

As a result of the low vertical permeabilities, the majority of groundwater inflow (1.8 ML/day) will be from deep groundwater originating in the rock surrounding the underground development and not from Lake Cowal. When Lake Cowal is full it occupies an area of 13,000 hectares, and would thus lose on average 200,000 ML/day to evaporation (assuming 1.5 m net pan evaporation, refer to Table 4-1). This means that the average rate of evaporation from the surface of Lake Cowal is approximately 100,000 times the predicted maximum rate of groundwater inflow to the whole underground development. As such, the impact of mine groundwater inflow on the water levels of Lake Cowal is considered to be negligible.

vii 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 10.2. Pit dewatering will only have a small and localised (ie within ML 1535) impact on groundwater quality.

Table 10.2 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 E. Contaminants identified as having the potential to be released from the IWL include cyanide, arsenic, zinc and other heavy metals (Coffey 2018). 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 (within 1 km).

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

viii Dry lake and inundated lake scenarios

There is a negligible difference between dry and inundated lake scenarios. This is a result of the low vertical hydraulic conductivities of the hydrogeological units. These were calibrated based on 22 monitoring wells with groundwater level observations between 2005 and 2020 and on observed inflows to the open-cut pit.

10.4.4 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 that would be lost during 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
- develop a groundwater control plan and design control measures to address water level rise at the IWL which could include:
    - augmenting the existing monitoring network;
    - pumping groundwater from bores introduced in the vicinity of MON02 back to the TSFs; and/or
    - installing trench drains and sumps to collect groundwater and suppress further rise in groundwater levels.

Additionally, monitoring activities will include:

- continued groundwater monitoring to validate the predictive modelling, particularly in the vicinity of the open-cut 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.

10.5 Summary and conclusion

A hydrogeological assessment was undertaken by Coffey to assess potential impacts on the groundwater system by the Project. 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.

Modelling results indicate that groundwater table drawdown is expected to remain completely within the CGO mining leases ML1535 and ML1791 over the life of the mine. Combined groundwater inflows into the proposed stopes and access tunnels and the open-cut pit are predicted to increase from 1 ML/day in 2020 to a peak of 2.8 ML/day between 2031 and 2038. Inflow to the open-cut pit on its own is predicted to fall from 1 ML/day in 2020 to 0.5 ML/day between 2031 and 2038.

Groundwater levels in the ESB and BCPB are predicted to recover to around 166 m AHD in 10 years (about 30 m below 1998 water levels), and 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.

Following mine closure, groundwater inflow to the open-cut pit is expected to result in a lake forming in the open-cut pit, with the pit lake level rising to a level where groundwater inflow is balanced by evaporation from the pit lake.

Groundwater impacts to Lake Cowal are predicted to be negligible.

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.

Part C – Impact assessment

Chapter 11 Surface water

11 Surface water

11.1 Introduction

A surface water assessment has been conducted by HEC (2020) for the Project and included as Appendix G. The assessment also draws on the results of groundwater modelling contained in the Coffey reports prepared for the groundwater assessment (Coffey 2020a and 2020b) provided in Appendix F.

Due to the relative complexity of separating the surface water impacts for those facilities being assessed in the EIS and those as part of Mod 16 to the existing development consent, the surface water assessment reproduced at Appendix G is a cumulative assessment of all surface water impacts of the proposed works.

11.2 Secretary's Environmental Assessment requirements

The surface water SEARs and where they are addressed in this document are listed in Table 11.1.

Table 11.1 Surface water SEARS

Requirement	Location in the EIS
An assessment of the likely impacts of the development on the quantity and quality of regional surface water and groundwater resources.	Chapter 11 Groundwater resources are discussed in Chapter 10.
An assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water related infrastructure, and other water users.	Appendix F and Appendix G
Identification of the proposed water supply for the development.	Chapter 11, Appendix G
A detailed site water balance, including a description of site water demands, water disposal methods (including the location, volume, and frequency of any water discharges and management of discharge water quality), water supply arrangements, water supply and transfer infrastructure and water storage structures.	Appendix G
A detailed description of the proposed water management system (including sewage), beneficial water re-use and proposed measures to monitor and mitigate surface water and groundwater impacts.	Section 11.3 Appendix G
EPA – Attachment 2 and 3	
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)	Chapter 2
• 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 11.5.1i
• it is acceptable in terms of the achievement or protection of the River Flow Objectives and Water Quality Objectives	Section 11.5.1ii and Appendix G

Table 11.1 Surface water SEARS

Requirement	Location in the EIS
The assessment should document the measures that will achieve the above goals.	Section 11.6
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.	Appendix G
The assessment should provide details of any water management systems for the site to ensure surface and groundwaters are protected from contaminants.	Chapter 2 Appendix G

The surface water assessment has been prepared with consideration of relevant legislation, policies, guidelines and plans outlined in section 1.3 of Appendix G.

11.3 Existing operations

11.3.1 Surface water management system

All the bulk ground-disturbing works at CGO (ie IWL, TSF, stockpiles, open-cut and ore processing plant) have been constructed within a contained catchment, referred to as the ICDS. The ICDS works in combination with the UCDS and the on-site lake protection bund to protect Lake Cowal from potential impacts should water and sediment be mobilised from the CGO site. Runoff from areas undisturbed by mining is directed via the UCDS around the CGO to Lake Cowal. Appendix G provides a detailed overview of CGO's surface water management system.

11.3.2 Water supply

Water supply for the CGO includes the preferential re-use of mine process water (including tailings water reclaim), capture and re-use of runoff from areas within the ICDS, groundwater seepage to the open-cut pit and groundwater sourced from the saline groundwater supply bores within ML 1535 when Lake Cowal is dry. Three other external sites supply water to CGO via the mine borefield pipeline (in order of priority):

- the Eastern Saline Borefield;
- the Bland Creek Palaeochannel Borefield; and
- the Lachlan River via the Jemalong Irrigation Channel, using the regulated flow licences purchased by Evolution on the open market under the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.

11.3.3 Water use

The main consumers of water at CGO are the process plant, construction and haul road dust suppression.

Since mid-2007, the CGO processing rate (total) has averaged 7.4 Mtpa and the water demand (total) has averaged 17 ML/day, of which up to approximately 7.6 ML/day (around 45%) on average was supplied by on-site recycled and incident rainfall water. Monitoring records show that water consumption for haul road dust suppression averages 0.62 ML/day.

11.3.4 Water quality

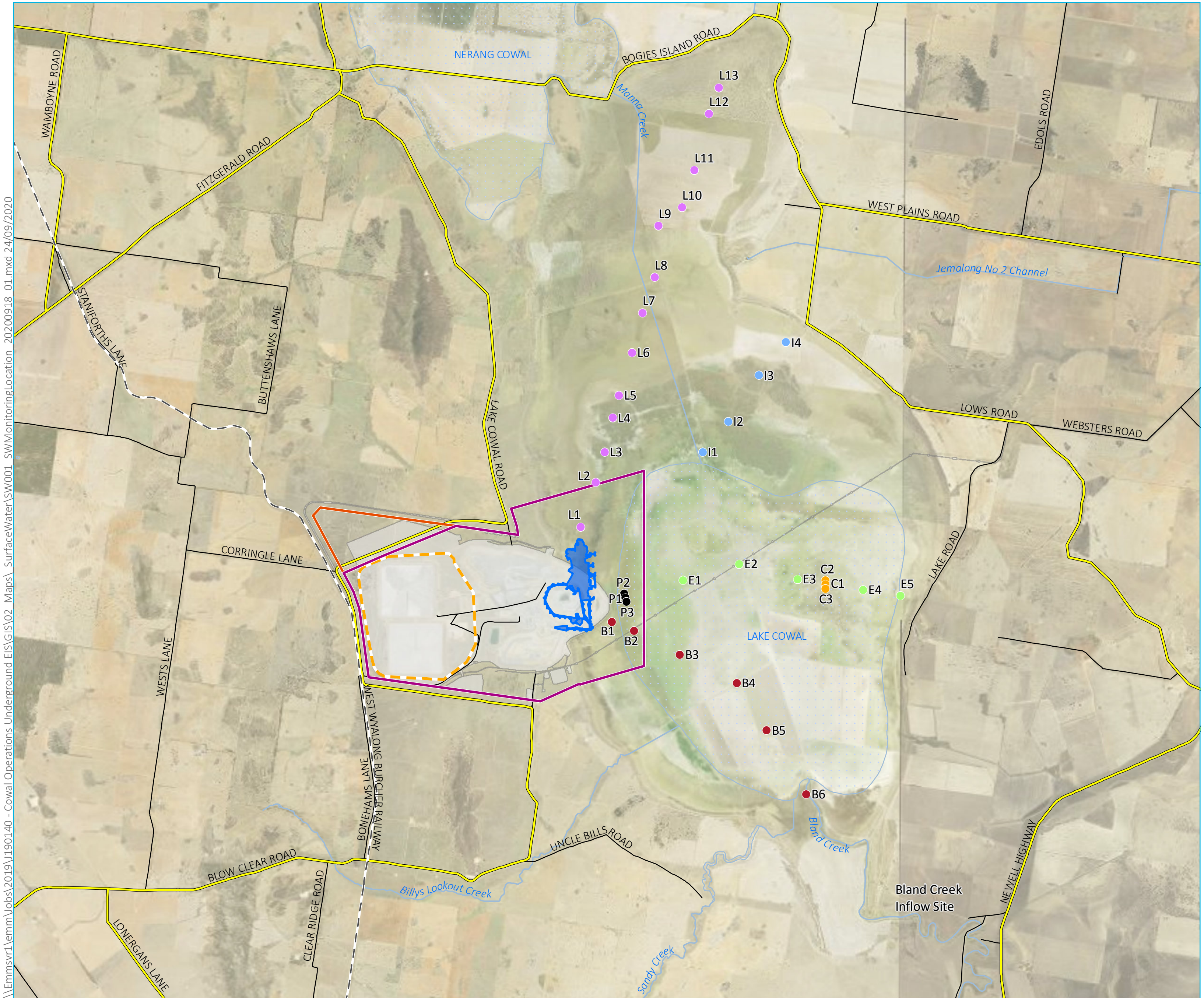
Baseline water quality data for the Project was gathered between 1991 and 1995 from 34 monitoring sites along four transects across Lake Cowal. This is described in more detail in the Cowal Gold Project EIS (North Limited 1998). That data has been supplemented by additional monitoring undertaken when the lake re-filled (between 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 – 2017 when sufficient flow permitted.

The results are provided in Table 5, Table 6 and Table 7 of Appendix G, and compared to relevant default guideline values in ANZECC/ARMCANZ (2000) and ANZG (2018). Notable results include:

- the range of pH was high relative to ANZECC/ARMCANZ (2000) default guideline values and baseline ranges, however, as discussed further below has been similarly elevated at sites near and distant to the CGO;
- average copper, lead and zinc concentrations were high relative to both the ANZG (2018) default guideline values and baseline concentrations however were lower than inflow site concentrations and have been similarly elevated at sites on the opposite side of Lake Cowal;
- average turbidity was significantly higher than the ANZECC/ARMCANZ (2000) default guideline value and higher than baseline levels, however as discussed further below turbidity levels have been relatively uniform at sites close to and distant from the CGO; and
- total phosphorous concentrations were significantly higher than the ANZECC/ARMCANZ (2000) default guideline value for freshwater lakes however as discussed further below 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 surface water runoff within the CGO area is fully contained in the ICDS, and based on assessment of the monitoring data, there is no evidence that the existing CGO has resulted in changes to water quality in Lake Cowal.

Notwithstanding, Evolution continues to regularly monitor water quality in the lake at its monitoring locations as in Figure 11.1.



\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02_Maps_SurfaceWater\SW001_SWMonitoringLocation_20200918_01.mxd 24/09/2020

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

0 2.5 5 km
GDA 1994 MGA Zone 55
N

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

Existing surface water monitoring locations

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 11.1

creating opportunities

11.4 Proposed changes to water management

11.4.1 Overview

The most significant change in surface water management at the site will be the introduction of the paste fill plant as a new consumer of water. The construction of that plant and the box-cut entry will necessitate some additional drainage control structures however, these are situated within the ICDS and will have a negligible impact on surface water management.

The production of paste requires thickening (dewatering) a portion of the tailings slurry and adding cement to produce a tailings paste that is then pumped underground to backfill stopes after the ore has been removed. Water removed in the thickening process will be recycled within the process plant (Outotec 2019) but, as a paste of 70% solids and 30% water, up to 1.22 ML/year will be entrained in the backfill. Paste-fill plant general arrangements, processes and water usage are further described in Chapter 3 and shown in Figure 3.4.

Water will also be required for dust suppression and air cooling in the underground mine. While the majority of the return water will be directed to the underground sumps and returned to the surface for reuse, a portion will be lost as evaporation through the ventilation system or entrainment in the broken ore.

11.4.2 Post-closure water management system

The post-closure water management strategy is further described in Chapter 5 of Appendix G.

In accordance with Condition 2.4(b) of DA 14/98, rehabilitation of final landforms or disturbed areas will continue to be undertaken progressively as soon as reasonably practicable following disturbance. For the Project, the post-closure requirements will be to decommission the paste fill plant and to seal the adits to the mine, including rehabilitating the box-cut so that it integrates with the post-mining landscape.

The stopes 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 (i.e. the final void would be contained). Equilibrium levels would 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.

11.5 Predicted impacts

11.5.1 Operational phase

i Water demand

Most of the water consumed at the CGO site is initially directed to the process plant where it is used as a transport media for the ore passing through the process plant and to the TSF for disposal as tailings. Water used to deliver tailings to the TSF is continuously recycled by decantation from the TSF and pumped back to the process plant for reuse.

Total site water demand, including the Project and the Projected water demand for the combined processing of ore is shown in Table 11.2. The key water inputs attributable to the Project is groundwater seepage into the mine, and key water consumption in the underground mine is as vent loss and paste production. Therefore, in context of the total water used at CGO, the contribution of the Project is unlikely to result in any material effect to the overall site water balance.

Table 11.2 Site water demand

Inflows (ML/year)	10th percentile Rainfall Sequence (Dry)	Median Rainfall Sequence	90th percentile Rainfall Sequence (Wet)
Catchment runoff	1,114	1,380	1,443
Tailings bleed	2,579	2,579	2,579
Open-cut pit and Project groundwater	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

ML/year = megalitres per year
*Modelled volume of water actually reaching CGO – excludes irrigation channel losses

Additional make-up water is required to replace water entrained in the tailings mass, lost to evaporation on the surface of the TSF, for dust suppression and, in future, for paste production. The site's water balance has been upgraded to include water consumed in paste production. Paste production represents around 5% of the total process plant water demand.

The underground mine is expected to consume around 2.5 ML/day for dust suppression and air cooling. This water will also be sourced on-site. While the majority of this water would report to the underground sumps and be returned to the surface for reuse, around 15% would be removed as vent loss and in increased ore moisture.

a Interaction with Lake Cowal

The proposed surface infrastructure changes associated with the Project will be contained within the current approved disturbance area. Therefore, no additional impacts on inflows to Lake Cowal are expected to occur as a result of the Project.

ii Water quality

The HEC study concluded that there has been no apparent link between the mining operations and any variance in the water quality of Lake Cowal. It is concluded that there would be a low risk of anything more than a negligible hydrological impact on Lake Cowal due to the Project.

The quality of groundwater collected by the dewatering system (including groundwater pumped from both the open-cut pit sump and stopes) is expected to be similar to existing groundwater quality and would contribute to water supply for the processing plant (Coffey 2020a).

a Post-closure phase

Post-closure surface water impacts includes the potential for structural instability of final mine landforms that could lead to impacts on Lake Cowal's water quality (as salinity and turbidity/sedimentation).

The environmental geochemistry assessment (GEM 2020) prepared for the Project found that the waste rock from the Project is geochemically similar to the waste rock from the current open-cut pit operations, apart from a small amount of potentially acid-forming material that would need to be managed carefully at the waste rock emplacements. However, this is not likely to affect the surface water management system at the site. This means that the management strategies currently employed for the waste rock emplacements will not need to be changed.

However, the CGO closure and landforming strategy will mean that, after closure, the majority of the CGO site will continue to drain to the open-cut pit. The groundwater assessment makes clear that the final open-cut pit void will act as a groundwater sink and the long-term pit water level will be approximately 60 m below the spill level. The net result of this is that no impacts on the water quality of Lake Cowal are expected.

11.6 Mitigation measures

11.6.1 Operational monitoring and management

The following management and mitigation measures are planned:

- continuation of surface water monitoring;
- inclusion of silver in the suite of analytes in the current water monitoring program as recommended in GEM (2020); and
- the results of the monitoring programs will continue to be maintained in a database for review and assessment and used to assist in the management of the quality and quantity of surface and groundwater within and around the mine site.

11.7 Conclusion

The surface water assessment shows that the effects of the Project, which are related to the inflows pumped to the surface from the underground mine, use of water in the paste fill plant and water use for underground dust suppression and cooling, will be integrated into CGO's current water management systems. Construction of the box-cut and paste fill plant will involve some minor drainage control works that will be integrated into the current ICDS. The production of paste used as backfill for the underground stopes will require some water, but this will not require additional water from external sources and will not materially affect the water balance at CGO.

Due to the established management systems which keep and recycle water on-site, the Project is not expected to result in any interaction with Lake Cowal and will not affect the quality of water in the lake either during operations or after mine closure.

Overall, the Project is not expected to change the way surface water is currently managed at the site in accordance with the ICDS and will continue to be managed in accordance with the site's approved Water Management Plan.

Part C – Impact assessment

Chapter 12 Biodiversity

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12 Biodiversity

12.1 Introduction

A biodiversity assessment report (BDAR) has been prepared by EMM for the Project and included as Appendix H.

The BDAR identifies the potential impacts of the Project on the biodiversity values. Measures taken to date to avoid and minimise impacts are summarised and recommendations to assist in the design of a development that further avoids, minimises and mitigates impacts are provided.

This chapter provides a summary of the key findings of the BDAR.

12.2 Assessment requirements

The SEARS require an assessment of the Project's potential impact on biodiversity. The requirements and EIS sections where they are addressed are listed in Table 12.1.

Table 12.1 Biodiversity assessment related SEARs

Requirement	Location in the EIS
Biodiversity – including: an assessment of the biodiversity values and the likely biodiversity impacts of the development in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless the Planning Secretary determines that the proposed development is not likely to have any significant impacts on biodiversity values; and	Appendix H
the BDAR must document the application of the 'avoid, minimise, offset' framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM;	Section 12.5.

Additionally, the Project has been assessed against the key biodiversity legislation and government policy, including:

- *Environmental Protection and Biodiversity Conservation Act 1999*;
- *Biodiversity Conservation Act 2016;*
- *Fisheries Management Act 1994;*
- *Environmental Planning and Assessment Act 1979;*
- *Biosecurity Act 2015;*
- *National Parks and Wildlife Act 1974* (NPW Act); and
- *State Environment Planning Policy (SEPP 44) Koala Habitat Protection*.

In order to provide context for the Project, information about flora and fauna species, populations, communities and habitats from the locality (generally within 10 km) was obtained from the following databases:

- past ecological reports relating to Cowal Gold Operations and Lake Cowal (see references);
- BioNet Atlas of NSW Wildlife for previous threatened species records; and
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) likely to occur within the Project areas.

12.3 Existing Environment

12.3.1 Bioregions and landscapes

The Project occurs entirely within the NSW South Western Slopes Interim Biogeographic Regionalisation for Australia (IBRA) region, and within the Lower Slopes subregion. The majority of the Project area is located within the Ardlethan Hills, with a smaller area of Manna Hills and Footslopes, and Cowal Lakes, Swamps and Lunettes. The potential indirect impact area consists of the Cowal Lakes, Swamps and Lunettes Mitchell Landscape.

12.3.2 Vegetation

The native vegetation cover and patch size have not been calculated for the Project as there will be no new clearance of native vegetation.

12.3.3 Threatened species

Candidate species for further assessment were identified in accordance with Step 1 to 2 of the BAM and outlined further in Appendix H. For this assessment, there are no direct impacts, and therefore threatened species are not triggered by the Biodiversity Assessment Method Calculator (BAMC), as there is no vegetation clearance.

To assist in the identification of predicted and candidate species credit species in accordance with the biodiversity assessment method (BAM) that could be affected should the Project affect Lake Cowal, the native vegetation communities mapped as occurring within Lake Cowal were entered into the BAMC, and the results used to generate a list of predicted and candidate threatened species. In addition, literature was reviewed to identify a list of threatened aquatic species which may potentially utilise Lake Cowal. Further details on these candidate threatened species are in Chapter 5 of Appendix H.

Figure 12.1 The bed of Lake Cowal above the proposed underground mine – June 2019

12.3.4 Rivers, streams and estuaries

The area being considered in the BDAR is situated within the Lachlan catchment. The Project area is not part of any mapped Strahler 1st order or higher drainage line, or its buffer as specified in Appendix 3 of the BAM (Appendix H). The Project area does include the Lake Cowal wetland, as described in section 12.3.5.

12.3.5 Wetlands

The only wetland of relevance to the assessment of the Project is Lake Cowal. The following description regarding the lake can be found on Lake Cowal Foundation's website[6]:

> Lake Cowal forms part of a large ephemeral inland wetland system in the Lachlan Catchment and is located 43 km northwest of West Wyalong, and approximately 60 km south west of Forbes in Central New South Wales, Australia. Significant concentrations of water birds visit the Lake and the Australian Heritage Commission listed Lake Cowal on the Register of the National Estate in 1992.
>
> Lake Cowal is New South Wales' largest natural inland lake at approximately 21 km long and 9.5 km wide with an average depth of around 2.5m and covering an area of over 13,000 hectares when full.
>
> During the summer of 2000/2001 Lake Cowal dried out completely and remained dry until March 2010 when it commenced refilling mainly via flows from Bland Creek, reaching capacity and flowing into the smaller Nerang Cowal during March 2011. A small amount of water flowed into Lake Cowal during the spring of 2005 covering approximately 1,200 hectares but, being shallow, it dried out within 3 months.

[6] Source: http://www.lakecowalfoundation.org.au/lake-cowal

Due to the warmer summer weather and hot, dry winds, Lake Cowal completely dried out during the third week of December 2014. Large numbers of dead European carp and some unfortunate waterbirds are concentrated in the lake's centre where the last sheets of water lingered. Following over 85 mm of rain during July 2015, approximately 1,800 ha of Lake Cowal was covered with water leaving some opportunity barley crops standing in water. Lake Cowal completely dried again on 13th December 2015, remaining dry until falls totalling over 200 mm for the months of June/July 2016 saw flows from the Bland and other local creeks cover approximately 8,915 ha (66%) of the lake bed. Significant flooding rains in the Lachlan River and Bland Creek Catchments will be required to further lift water levels in Lake Cowal.

The lake is a typical ephemeral inland system with highly variable flooding/drying cycles. It has been known to dry completely for extended periods of up to 30 years in the early part of the 20th Century and since that time for lesser periods typically from 3 to 18 months. Without inflows, Lake Cowal dries from evaporative losses, which usually takes three years from full storage.

12.3.6 Connectivity

Lake Cowal forms part of a matrix of wetlands in the bioregion and, as such, it is considered to be a connectivity feature.

12.3.7 Areas of outstanding biodiversity value

No areas of outstanding biodiversity value (AOBV) are within or surrounding the Project area.

12.4 Predicted impacts

The Project is an underground mine that will have negligible surface impacts and those that will occur will be within the previously approved mine disturbance area. Without any surface disturbance, no impact on habitat needs for threatened species is expected. Accordingly, the Project will not impact on, or interfere with, habitat connectivity. As such, the BDAR focuses on assessing indirect impacts relating to subsidence and hydrogeology. The Project will not alter or affect any aspect of habitat connectivity. The issue is outlined further in section 12.4.2.

12.4.1 Potential direct impacts

The Project is an underground mine and does not have any new direct surface impacts, other than from associated infrastructure in previously disturbed areas within the approved impact footprint of the existing mine.

12.4.2 Potential indirect impacts

Four technical aspects relating to the operation of the underground mine have been identified that, if they occurred, have the potential to cause indirect impacts to the biodiversity values of Lake Cowal. They are:

- surface water (refer Chapter 11);
- groundwater (refer Chapter 10);
- groundwater quality (refer Chapter 10); and
- subsidence (refer Chapter 9).

A summary of potential impacts is provided in Table 12.2 below.

Table 12.2 Summary of potential indirect impacts of the Project on biodiversity values

Technical area	Summary of potential indirect impacts of the Project on biodiversity values
Surface water	CGO is located on the western shore of Lake Cowal and partially overlaps the shoreline of the lake. Lake Cowal is an ephemeral, freshwater lake that forms part of the Wilbertroy-Cowal Wetlands that are located on the Jemalong Plain. Lake Cowal is in the lower reaches of the Bland Creek catchment. It also receives periodic inflows from the Lachlan River during periods of high flow when flood waters enter Lake Cowal from two main breakout channels from the northeast. Under the development consent for the existing open-cut mine, surface water on the mine site is permanently isolated from Lake Cowal (and vice versa) through a combination of the bunds (the LPB and TIB) with the UCDS. The UCDS directs runoff from areas unaffected by mining around the perimeter of the site. The ICDS captures all site runoff and seepage within the mining area for re-use in the processing plant within the mined area and elsewhere on-site. In the longer term, the ICDS would direct site runoff to the final void which would become a permanent sink for groundwater and surface runoff. This sophisticated and established system ensures that the mine and the lake remain hydraulically separated. Mining commenced at CGO in 2005. In the last 15 years, the lake has remained dry for significant periods. Lake Cowal remained dry from 2005 until the middle of 2010, after which rainfall led to the lake beginning to fill. By late 2014, the lake was again dry due to evaporation. During winter 2016, a series of rainfall events led to the peak water level of the lake reaching 207.49 m AHD in October 2016. The lake water dropped rapidly from this peak and the lakebed has been dry since early 2019. During these processes, the open-cut mine has been developed and operating. Throughout mining in the open-cut pit, there has been no hydraulic connection created between the lake and the mine. Therefore, the current CGO open-cut pit is protected from inflow from Lake Cowal by the bunds. Since the commencement of mining operations, the bunds, combined with the UCDS and ICDS have proven effective in preventing impacts from the mine affecting the surrounding surface water catchment. The Project does not propose any changes to the UCDS or ICDS. The underground mining will involve developing a series of stopes to as deep as -850 m AHD or approximately 1,050 m below ground surface. The mining will occur in the hard oxide rock layers and not in the near surface sediments which form the lake floor. Accordingly, there would be no movement of surface water from Lake Cowal (or other surface water sources) to the mine. Given the above EMM is confident that there will be no surface water impacts relating to Project affecting the biodiversity values of Lake Cowal.

Table 12.2 Summary of potential indirect impacts of the Project on biodiversity values

Technical area	Summary of potential indirect impacts of the Project on biodiversity values
Groundwater	Since commencement of the CGO, the underlying aquifers surrounding and intercepting the open-cut pit have been depressurised by seepage into the open-cut pit and active dewatering. Despite Lake Cowal becoming inundated in 2010 and 2016, groundwater inflows to the open-cut pit have remained at, or below, historical records and are relatively stable. This is most likely because the lacustrine sediments that form the lakebed have a very low vertical permeability and act as an aquitard (a low permeability layer) between lake water and underlying aquifers. It is estimated that groundwater inflow to the open-cut pit is around 1 ML/day. About 90% of this inflow is from the Saprolite/Saprock groundwater units and 10% from the Transported unit. No material increase in groundwater inflow to the open-cut pit was observed during or following the 2010 and 2016 lake filling events. This is strong evidence that Lake Cowal is a surface fed system which is hydrogeologically isolated from the underlying aquifers. In 2020, Coffey (2020a) (who have been investigating hydrogeology at the site of the mine since 1995) developed a model to predict the long term (steady state, post mine closure) vertical leakage from Lake Cowal considering the lake was inundated in the presence of the open-cut void. The model predicted vertical leakage over the lake area was 3.0×10^{-6} m^3 per day per square metre. This is in the order of 0.1% of the losses in water level apparent due to evaporation of between 3 and 4 mm/day. The lake bed sediments act as an impeding layer to vertical leakage from the lake. A system of dewatering bores historically operated to control groundwater levels around the pit, commencing January 2005. As inflows reduced, these were progressively decommissioned such that by the end of 2017, no vertical dewatering bores were in use. The Project is to the north of the existing open-cut pit and below Lake Cowal. The underground sits at around 130 m below the surface at its uppermost point. The cover units above the underground mine consist of transported sediments (generally 20-50 metres thick), soft oxide material (Saprolite/Saprock generally 20-60 metres thick) and then fresh rock. Due to the depth of the proposed underground mine, and the thickness of cover rock, it is not anticipated that there would be any hydraulic connectivity between the top of the underground mine and Lake Cowal when it is inundated. Accordingly, there are no anticipated indirect impacts to Lake Cowal and the associated wetlands due to 'leakage' into groundwater. This assumption is supported by the low rate of groundwater inflows (ie 2 L/s) that were experienced during the development of the exploration decline. These assumptions are supported by the groundwater impact assessment that has been prepared by Coffey (2020a) (refer Appendix F) and which will accompany the EIS for the Project. Coffey (2020a) concluded that "Groundwater impacts to Lake Cowal are predicted to be negligible".

Table 12.2 Summary of potential indirect impacts of the Project on biodiversity values

Technical area	Summary of potential indirect impacts of the Project on biodiversity values
Groundwater quality	An assessment of groundwater contaminant migration (cyanide), based on a conservative assessment of contaminant transport parameters, was undertaken as part of Coffey (2020a)'s Hydrogeological assessment. Cyanide is introduced to ore during 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. This process has been ongoing since the start of operations and ore processing rates will not exceed the existing upper limit of 9.8 Mtpa. Cyanide is subject to gradual decay typically characterised by a half-life (the time for concentration to fall to half its initial value). The rate of decay is uncertain in the conditions beneath the IWL, with half-lives of the order of 300 days quoted for anerobic conditions and much shorter half-lives quoted for aerobic conditions which would apply at the surface of the water in the mine void. For a half-life of 300 days, an initial concentration of 20 mg/L would reduce to below 0.001 mg/L after 12 years. The modelling assessment 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 Integrated Waste Landform (IWL) walls. However, the modelling does not take account of decay in cyanide concentration with time discussed above. Taking account of decomposition leads to the conclusion 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 the CGO mine area. There are not predicted to be any impacts on Lake Cowal or its biodiversity. CGO will continue its groundwater and cyanide monitoring regime to monitor developments.
Subsidence	**Subsidence/upsidence** A subsidence impact assessment has been carried out by Beck (2020) (refer to Appendix E) for the Project. This assessment includes a detailed geological assessment and comprehensive mapping of faults. The assessment concluded that the forecast vertical movement above the underground development to end of mine life is negligible and generally less than 15 mm. This movement is upwards (upsidence) due to displacement along the Glenfiddich Fault. Surface displacements are within the same order of magnitude as the effects of water (shrink/swell) and erosion. It should be noted that the effects of groundwater drawdown on surface subsidence have not been included in the numerical simulation to assess surface subsidence as hydrogeological assessment shows that the underground mining sequence is effectively drained due to open-cut pit drawdown of the water table. The Glenfiddich Fault occurs in the hard saprolite layers in the Project area which are well below the transported zone layers. Therefore, any effect on the Glenfiddich fault would not propagate to the surface layers or lake bed. **Chimneying** The rock mass in proximity to the underground mine is generally strong with weak fault conditions. The Glenfiddich and Galway splay faults are located in proximity to underground stopes. The numerical modelling undertaken for the subsidence analysis did not identify significant rock mass damage or instability in the upper level stopes. However, as noted in the report, the resolution of the model is limited to the resolution of the input data, which does not include stope-scale geotechnical data. This is perfectly normal at this stage of a Project as stope-scale information is generally not available until underground development in the area is completed. The recommendations and list of potential controls in the report are provided so that Evolution can implement the required controls based on the conditions encountered. All the other controls rely on additional geotechnical data that will only be available in the future and adopting an observational approach for design, controls and risk management. With the implementation of the control measures outlined in section 12.5.1, the risk of chimneying to the surface is considered highly unlikely.

12.4.3 Prescribed impacts

Part 8.2.1.2 of the BC Regulation (Clause 6.1) identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme, these are detailed in Appendix H and summarised in Table 12.3

Table 12.3 Prescribed biodiversity impacts not related to the Project

Label from 8.2.1.2 of BAM	Prescribed impact	Justification
(a) (i)	**Impacts of development on the habitat of threatened species or ecological communities associated with karst caves, crevices, cliffs and other features of geological significance, rocks, human made structure, or non-native vegetation**	No known karst caves, crevices, cliffs and other features of geological significance, rocks, or human made structure being utilised by threatened species are known to be present. Non-native vegetation is present within Lake Cowal. No direct impacts to Lake Cowal are proposed, and potential indirect impacts associated with water are discussed under the response to item (d) below.
(a) (ii)	**Habitat of threatened species or ecological communities associated with rocks**	No human made structures (buildings) have been identified as been impacted on as part of the Project.
(a) (iii)	**Habitat of threatened species or ecological communities associated with human made structures**	No human made structures (buildings) have been identified as been impacted on as part of the Project.
(a) (iv)	**Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation**	Potential impacts on the habitat of threatened species or ecological communities associated with non-native vegetation are associated with the potential for indirect impacts on water quality, and thus are discussed under the response to item (d) below.
(b)	**impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range**	No species have been identified as part of the Project.
(c)	**impacts of development on movement of threatened species that maintains their life cycle**	Not relevant as the proposal is for a modification to a below ground mine
(d)	**impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)**	This prescribed impact is relevant to the Project and discussed in subsections 7.1.3(i) to (xiii) of Appendix H. It was concluded no impacts to the hydrological processes that sustain and interact with rivers, streams and wetlands are expected as a result of the Project. As there will be no changes to hydrological processes, no impacts to the Lake Cowal waterbody or water quality are expected from the Project. Therefore, the consequences of the development and operation of the Project are not anticipated to have any perceptible impacts for the bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat.
(e)	**Impacts of wind turbine strikes on protected animals**	Not relevant to the Project.
(f)	**impacts of vehicle strikes on threatened species or on animals that are part of a TEC**	The proposal is for a modification to continue underground mining; no new roads are proposed and thus this factor is not relevant to the Project.

12.4.4 Serious and irreversible impacts

The following species credit species (identified through the BDAR assessment) are identified as having potential serious and irreversible impacts (SAII) entities in the BAMC for the predicted biodiversity values identified for Lake Cowal:

- White Box Yellow Box Blakely's Red Gum Woodland (should PCT 250 - Derived tussock grassland of the central western plains and lower slopes of NSW be part of the EEC);
- Austral Pillwort;
- Claypan Daisy;
- Curlew Sandpiper (breeding habitat); and
- Swift Parrot (see text below).

For the Swift Parrot, it is noted that SAII applies only to mapped important habitat areas for the species, which based on the inspection of this mapping, does not apply to Lake Cowal.

Despite being a rare event, stope failure to surface (chimneying) along major faults is a potential hazard for all underground stoping mines. This is the only potential impact that could lead to SAII.

However, this issue has been considered in the conceptual design of the underground mine. The potential risks associated with chimneying are known conceptually and are manageable by adopting an observational approach for design, controls and risk management as the Project transitions from conceptual to detailed design, and detailed geotechnical information, at a stope level becomes available. An underground stope monitoring system will also need to be installed to pick up early signs of any instability, as part of a Trigger Action Response Plan (TARP). Given that proposed mitigation measures are proposed to be carried out and are an integral part of the mine plan further, more detailed assessment of serious or irreversible impacts has not been conducted. For example, should a lake water incursion occur through a stope, there is a high risk of death or injury of mine personnel and damage to equipment. This would necessitate a shutdown of mining until an investigation and any necessary rectification could be completed.

12.4.5 Groundwater dependent ecosystems

Schedule 4 of the Upper Lachlan Alluvial Groundwater Source Water Sharing Plans nominates two high priority GDEs (Bogolong Springs and Old Man Springs). These GDEs are located more than 60 km to the east of the CGO, on the other side of the Bland Creek Palaeochannel. These GDEs are distant from the CGO and could not be affected by mining operations.

Schedule 3 of the NSW Murray-Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan indicated that the closest high priority GDE to the CGO site is Cartwrights Spring, located more than 5 km east-south-east of the site. Coffey (2020a) does not expect this GDE to be affected by the CGO.

A check was carried out on 15 January 2020 on the BoM Atlas of Groundwater Dependent Ecosystems. The key findings are as follows:

- High potential aquatic GDE at Lake Cowal immediately east of the CGO. This will not be affected as groundwater modelling and observations to date indicate that seepage from Lake Cowal into the open-cut pit during periods of inundation is negligible.

- High potential terrestrial GDE approximately 4.5 km north of the CGO comprising Grey Box-White Cypress-pine woodland. Following a review, Coffey (2020a) considers that this vegetation is unlikely to be groundwater dependant, based on knowledge of local groundwater conditions. This area is unlikely to be affected by the mining operation.

- Moderate potential terrestrial GDE surrounding the CGO comprises wetland sedgeland, Mixed Box Eucalypt woodland, and River Red Gum within, or at the fringe of, Lake Cowal during periods of inundation and is also subject to periods where the lake is dry. The movement water in the lake area will not be affected by mining operations as the seepage from the lake into the open-cut pit, stopes and access tunnels is assessed as being negligible. Further, these communities are considered more likely to be influenced by soil moisture increases during full lake conditions than by the regional or local groundwater resources. As a result, they are considered unlikely to be affected by the mining operations.

- Low potential terrestrial GDE surrounding the CGO comprising tussock grasslands. These areas may be affected by changes in soil moisture depending on the root depths. However, the CGO's impacts on the deeper underlying hard rock aquifers are considered to be unlikely to affect any tussock grasslands.

During the life of the CGO, dewatering from the open-cut pit, stopes and access tunnels will only have a small and localised (ie within ML1535) impact on groundwater levels. Over the longer term, groundwater will flow towards the open-cut pit, ultimately terminating there and evaporating. The groundwater quality in the region surrounding the open-cut pit void is not expected to change significantly due to this process, although the quality of the water within the open-cut pit is expected to change (eg salinity will increase due to evaporation). The beneficial use of groundwater is not expected to change due to dewatering or the presence of the open-cut pit.

As the equilibrium surface water level in the open-cut pit (the pit lake) following the end of mining will be well below the ground surface, water from the pit lake will not be released. Thus, it is not classified as a highly connected surface water source and will not interact with Lake Cowal when it is empty or inundated.

12.5 Avoidance and minimisation strategy

The following section describes the key measures implemented through the design to avoid and minimise biodiversity impacts.

Table 12.4 Impact avoidance and minimisation strategy

Impact	Action	Intended outcome	Timing	Responsibility
Potential direct impacts on the surface of Lake Cowal .	Use underground mining methods to eliminate direct impacts on Lake Cowal.	Zero surface disturbance / land-take from Lake Cowal and adjacent areas by designing an underground mine which is accessed from the existing open-cut pit.	This happened at the early strategic stages of the study.	Evolution
Potential Stope failure (chimneying) to the surface of Lake Cowal along major faults.	Model potential subsidence and stability impacts of the initial mine design. This process identified 19 stopes that were located in close proximity to the weathered cover sequence geology, or within the cover sequence layers. These stopes were considered to pose a risk of chimneying. This issue was communicated to CGO in May 2020. Subsequently, 19 stopes in the upper levels were removed from the mine plan.	Minimise the potential for potential stope failure (chimneying) to the surface of Lake Cowal.	This occurred during the conceptual design process.	Beck and Evolution

12.5.1 Adaptive management strategy for prescribed impacts

As noted by Beck (2020), the resolution of the model is limited to the resolution of the input data, which does not include stope-scale geotechnical data. This is perfectly normal at this stage of a Project as stope-scale information is generally not available until underground development in the area is completed. The recommendations and list of potential controls in the report are provided so that Evolution can implement the required controls based on the conditions encountered. All the other controls rely on additional geotechnical data that will only be available in the future and adopting an observational approach for design, controls and risk management.

Whilst Evolution has minimised the risks of stope failure to surface (chimneying) at this conceptual design stage, it is critical that monitoring of underground stope stability occurs during the mine's development, particularly during mining of the upper stopes.

Table 12.5 Adaptive management strategy

Uncertain biodiversity impact	Monitoring strategy	Trigger for management	Response
There is an extremely remote risk of stope failure to surface (chimneying) when the upper stopes are mined. This could lead to water within the lake (assuming it is full) reporting to the underground mine. Depending on the size of the mine at the time and the amount of water in the lake, this could have very significant biodiversity impacts. There are a large range of eventualities that could occur. If the lake was dry, as it currently is, the impacts would be relatively minimal.	It is critical that monitoring of underground stope stability occurs during the mine's development, particularly during mining of the upper stopes. Further details are given below regarding the TARP.	At the first sign of instability an experienced geotechnical engineer will review the seriousness of the instability and implement agreed management measures documented below.	See recommendations in Chapter 23 of this EIS regarding a program of monitoring and management responses that would assist in preventing risk of stope failure to surface (chimneying) and reacting to the early signs to prevent failures occurring with instability is detected. A key response will be ensuring paste lines and other backfill infrastructure is in place prior to firing stopes with potential for instability or in proximity to major faults.

12.5.2 Mitigation measures and recommendations

i Mitigation measures related specifically to chimneying

Stope failure to surface (chimneying) along major faults is a potential hazard for all underground stoping mines. Stope failure (or crown pillar failure) to surface is not common, but it does very occasionally happen. However, the risk of chimneying associated with the proposal would be strictly controlled by Evolution Mining adopting the following controls:

- paste filling stopes immediately following extraction;
- stopes will be 100% tight filled with cemented paste fill; and
- all stopes will have crown development (overhead drives) that will be fully supported and accessible for the life of mine to ensure no failure ensues from ongoing operations; and
- the stopes have been numerically modelled by Evolution and have been comprehensively assessed by Beck, and the sequence of extraction and stope size has been selected for stable excavation (for the duration it is open – before being filled) to further mitigate risks of chimneying.

Additionally, Beck 2020 made the following recommendations arising from their assessment relating to minimising the risk of stope failure to the surface (chimneying):

- Stopes within the oxide and transported layers are not likely to be stable and should not be planned at this stage of the Project. Current geological interpretation demonstrates the depth and thickness of the transported and oxide layers is variable. The mine should continue to update the interpretation of these boundaries with information from ongoing drilling programmes. The location of the top of fresh rock is most important for the underground mine design.

- Geotechnical characterisation and development of a detailed geotechnical domains model and structural model, particularly in the upper mining areas of the underground mine. The geotechnical and structural models will require on-going refinement over the mine life which is the normal practice in any mine.

- The mine should review the planned mining sequence and consider delaying the mining of the upper most row of stopes in the upper most stoping blocks. Mining these stopes first, or very early in the mine life is when the mine has the least geological knowledge and understanding of stope performance (relative to other stages of underground mining). This includes the understanding of the hydraulic properties of the faults and (potential) water inflows to the underground mine.

- Other recommendations and control measures to minimise the potential for stope overbreak or chimney failure that may impact the surface are provided in Appendix E. Depending on local geological conditions encountered, the mine should review the list provided and select the controls appropriate to the conditions encountered.

12.5.3 Summary

The consequences of the development and operation of the Project are not anticipated to have any perceptible impacts for the bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat. As discussed in this chapter:

- there are no new direct land-take impacts;

- there is minimal surface disturbance within the existing CGO;

- there is not predicted to be any noticeable subsidence;

- the new underground mine is not connected hydrogeologically with Lake Cowal and therefore there are no ecological impacts related to hydrogeology; and

- the is no surface water connectivity between CGO and Lake Cowal and the surface water system will not be changed as part of this Project.

Stope failure to surface (chimneying) along major faults is a potential hazard for all underground stoping mines. This issue has been considered in the conceptual design of the underground mine. The potential risks associated with chimneying are known conceptually, and are manageable by adopting an observational approach for design, controls and risk management as the Project transitions from conceptual to detailed design, and detailed geotechnical information, at a micro level becomes available.

Based on the above information, there are no impacts of any significance predicted from the Project to the terrestrial or aquatic habitats within or surrounding Lake Cowal.



Part C – Impact assessment

Chapter 13 Aboriginal heritage

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13 Aboriginal heritage

13.1 Introduction

This chapter provides a summary of the Aboriginal heritage due diligence assessment completed by EMM (2020d) for the underground development, which is provided in full in Appendix I. The assessment was prepared in consideration of *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010a) and the relevant SEARs (refer Table 13.1).

It considers the proposed underground development, including the paste fill plant and box-cut within the CGO site, in the context of local Aboriginal cultural heritage, consultation undertaken to date with relevant registered Aboriginal parties (RAPs) and assesses the likely impact of the Project on Aboriginal cultural heritage values based on a desktop study and a site inspection informed by a predictive model of the likely occurrence of cultural heritage sites in the area. The study area focused on the land within ML 1535 and ML 1791.

The Project will not cause surface disturbance or discernible changes in ground level and the site of CGO is already highly disturbed. Nonetheless, an Aboriginal heritage due diligence assessment was undertaken to demonstrate that the Project will not result in any new impacts outside of the existing disturbance footprint of CGO. The assessment is consistent with the SEARs issued for the Project.

The Project will operate under Aboriginal Heritage Information Permit (AHIP) Consent 1467/Permit 1468. CGO also operates under the Indigenous Archaeology and Cultural Heritage Management Plan (IACHMP) (Barrick 2003a). That assessment (for permits and consent to harm Aboriginal objects) has been used to develop a management framework for the CGO.

13.1.1 SEARs requirements

Ground-disturbing works associated with the Project are located entirely within ground disturbance previously approved under the existing AHIP consent. Nevertheless, an assessment is required by the SEARs to demonstrate that Aboriginal cultural values are not at risk from Project activities and that appropriate stakeholder consultation has been undertaken. The SEARs requirements and sections where they are addressed in this document are provided in Table 13.1.

Table 13.1 Aboriginal heritage related SEARs for the underground development

Requirement	Location in EIS
Heritage – including an assessment of the likely Aboriginal cultural heritage and historic heritage (cultural and archaeological) impacts of the development.	Chapter 13 addresses Aboriginal heritage.

13.1.2 Research method

The research method used in this Aboriginal heritage due diligence assessment for the Project is summarised below. It included a desktop study, consultation with relevant RAPs and a site inspection.

i Desktop study

The desktop study consisted of a:

- 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 (1994) Camp sites at Lake Cowal: an archaeological survey in central New South Wales;
- North Limited (1998) The Cowal Gold Project EIS;
- 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) CGO processing rate modification (Modification 14) Aboriginal Cultural Heritage Assessment; and
- due diligence style investigations and salvage activities (various, 2005 to present).

The desktop study was used to establish the context of the Project within the known Aboriginal cultural heritage of the study area and to develop a predictive model in relation to the Project's 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 the Project.

ii Consultation with registered Aboriginal parties

Consultation has been undertaken with the following RAPs who have previously registered an interest in CGO:

Table 13.2 Registered Aboriginal Parties

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	Isabelle Collins

Given the absence of impact on Aboriginal cultural values arising from the Project, detailed discussion of impacts or management measures with the RAPs was not undertaken in this instance. Nevertheless, Evolution provided a draft version of the Aboriginal Due Diligence Assessment Report to the RAP on 25 August 2020 for review.

iii Site inspection

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 development and the site of CGO.

The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010a), states that an archaeological survey is not required where no impact to Aboriginal cultural heritage objects or values is anticipated outside of the previously approved disturbance area, in this case, of the CGO. The inspection of the lakebed was completed to further verify the predictive model. The Project will not result in additional surface disturbance and therefore, no additional impact on Aboriginal cultural heritage is expected.

13.1.3 Results

i Desktop study

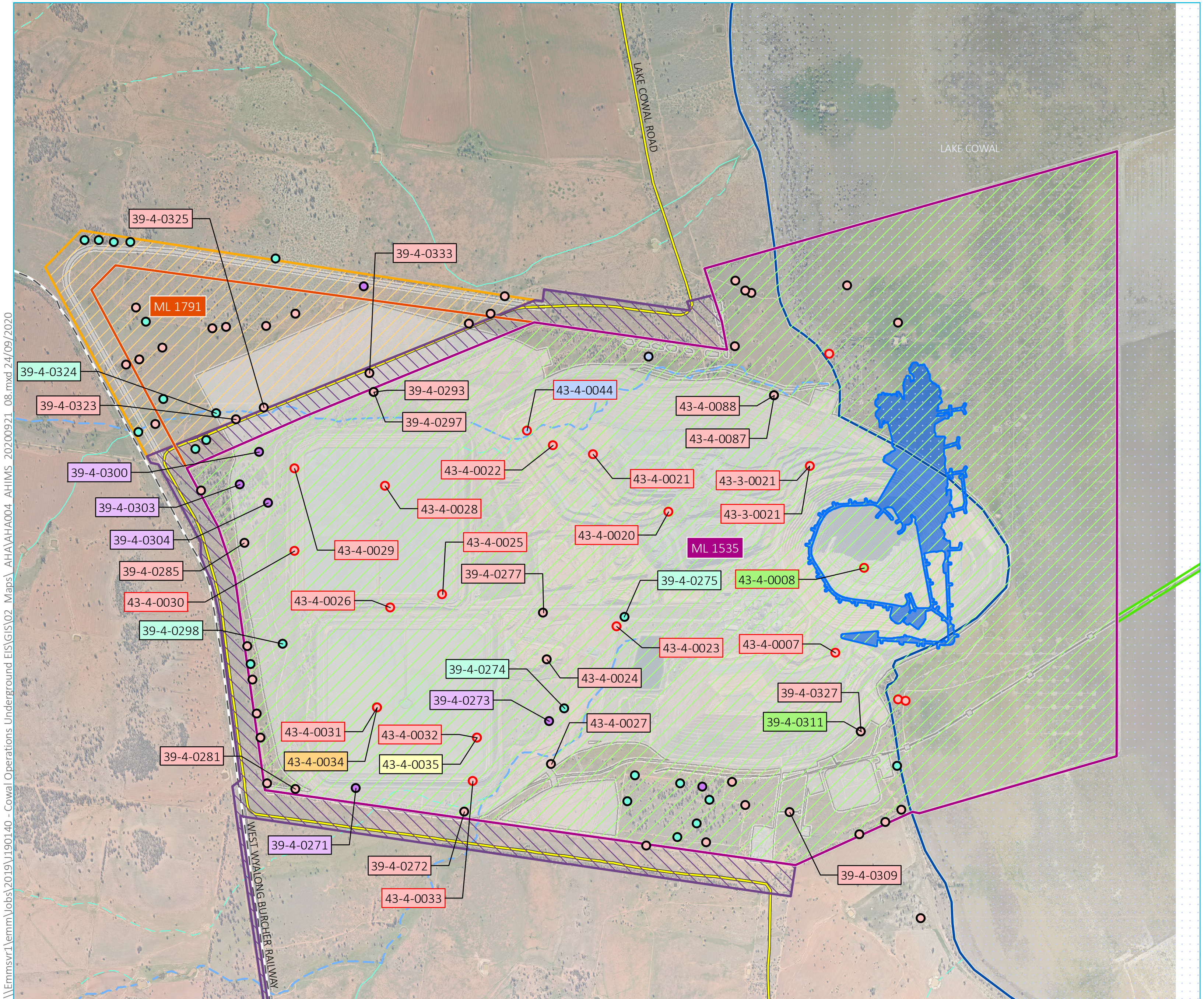
a Aboriginal Heritage Information Management System

A search of the AHIMS database was carried out on 27 August 2019. In total, 104 Aboriginal objects were identified within an 84 km^2 area centred on CGO (refer Table 13.3). Aboriginal objects located within the mining lease are shown on Figure 13.1. 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 13.3 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%), 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 1 modified tree, are listed as destroyed in AHIMS in accordance with an approved AHIPs.



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

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 CONCEPTUAL 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.

Archaeological context

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 13.1

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b National Native Title Tribunal

A search of the NNTT Register of Native Title Applications, Registration Decisions and Determinations was carried out on 27 August 2019. There are no determined native title or land claims over the study area. Additionally, a search of the NNTT Register of ILUAs on 27 August 2019 confirmed that no ILUAs exist over the study area.

ii Site inspection results

The results of the visual inspection was consistent with the predictive model and findings of previous archaeological assessments of the area (refer section 1.1.1). The lakebed is considered to be of low archaeological potential, as no new Aboriginal objects were discovered during the visual inspection. All trees located within the footprint of the underground development where inspected and no signs of Aboriginal scarring or carving were observed.

The inspection confirmed that the area is of low archaeological potential.

13.2 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.

13.2.1 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.

13.2.2 Landform

The study area is within the Lower Slopes subregion of the 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.

13.2.3 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 artefacts have 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.

13.2.4 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.

13.3 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 Parode (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 13.4.

The Project is located in the lakebed management zone, which considered by Pardoe (2002) to have low archaeological potential. The predictive model considers the lake bed to be of negligible archaeological potential and any artefacts identified within this landscape are predicted to have been imported from the slope and lake edge ridge landforms during periods of inundation by floodwaters. The lake bed zone above the proposed underground development is not predicted to feature Aboriginal objects and will not be disturbed through the proposed development activities.

The site of CGO 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 gilgai 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 13.4 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.

13.4 Predicted impacts

This is based upon the desktop study and site inspection completed as part of the Aboriginal heritage due diligence assessment for the Project and subsequently the predictive model prepared for the Project (refer section 13.2).

The mining aspect of the Project is wholly underground. The surface changes of the Project will not result in change to ground disturbance or disturbance to Aboriginal cultural heritage sites associated with CGO identified to date. The area overlying the underground development does not contain any known Aboriginal objects and is unlikely to host currently unknown Aboriginal objects or sites based on the findings of numerous previous archaeological investigations. The overlying area is also situated within the bed of Lake Cowal that has been extensively cropped for many years and is periodically inundated by floodwater. It is predicted that any extant cultural material within the lake's bed will slowly be buried by accumulating sediment and occasionally reworked by cropping and fluvial processes.

As a result, any currently unknown Aboriginal objects present in the lakebed overlying the underground development area are not expected to be affected by the Project and no change to the previously approved disturbance area of CGO, the boundary or conditions of AHIP Consent 1467/Permit 1468 is required.

The site of CGO, which will contain the paste fill plant and box-cut 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 2003a). 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.

13.5 Mitigation measures

As the Project will not cause any change to Aboriginal cultural heritage values, no additional management measures are proposed for AHIP Consent 1467/Permit 1468 and the CGO IACHMP.

An unexpected finds protocol for Aboriginal heritage objects will be in place during construction and operation of the Project. In the event new Aboriginal heritage objects are discovered during construction or operation of the 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 discoveries of human remains).

13.6 Summary and conclusion

In accordance with the SEARs and the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010a), an Aboriginal heritage due diligence assessment has been completed for the Project to assess the impact of the underground development 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, consultation with relevant RAPs and a site inspection. This information was used to inform a predictive model for the Project, which formed the view that the Project is unlikely to impact any Aboriginal cultural heritage values or objects that are outside the previously approved disturbance area of CGO and the boundary of AHIP Consent 1467/Permit 1468.

No AHIMS sites are registered within the disturbance footprint of the underground development. No native title or land claims or ILUAs are over the study area. The results of the site inspection were consistent with the predictive model and findings of previous archaeological assessments of the area, as no new Aboriginal objects were discovered. No scarring or carving were observed on trees within the footprint of the Project.

The Project is wholly underground and will not result in additional surface disturbance or discernible changes in ground level. Additionally, the site of CGO is highly disturbed due to bulk earthworks and has been the subject of past extensive archaeological investigations prior to disturbance associated with CGO. The footprint of the Project and site of CGO does not contain any known Aboriginal objects and is unlikely to feature unknown Aboriginal objects as based up on extensive previous archaeological investigations. Therefore, the Project is unlikely to impact any Aboriginal cultural heritage values or objects.

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 the Project.

Part C – Impact assessment

Chapter 14 Historic heritage

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14 Historic heritage

14.1 Introduction

This chapter provides a summary of the desktop and site inspection completed by EMM as part of the historical heritage assessment for the Project.

It describes the historical heritage context of the Project area, identifies relevant items listed on all applicable statutory and non-statutory heritage databases and inventories and assesses the impact of the Project 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.

The study area for this historical heritage assessment includes the landscape above the footprint of the Project and the existing disturbance of CGO, which will contain the paste fill plant and box-cut.

It should be noted that the construction of the box-cut and paste fill plant will take place within the footprint of CGO, which has previously been assessed for historical heritage values and approved for disturbance. The CGO site is highly disturbed by bulk earthworks necessary to establish the surface facilities and excavation of the open-cut.

14.1.1 SEARs requirements

The SEARs require an assessment of the Project's potential impact on historical heritage. The requirements and sections where they are addressed are listed in Table 14.1.

Table 14.1 Historical heritage related SEARs for the Project

Requirement	Location in the EIS
Heritage – including an assessment of the likely Aboriginal cultural heritage and historic heritage (cultural and archaeological) impacts of the development.	This chapter addresses historic heritage.

14.1.2 Research method

The research method used in the historical heritage assessment for the Project is summarised below. This included a desktop study and a site inspection.

i Desktop study

A search of all relevant statutory and non-statutory heritage databases and inventories was completed on 13 September 2019 for Lake Cowal in the LGA of NSW. These are listed below.

- National Heritage List (NHL). This register is made under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Commonwealth Heritage List (CHL). This register is made under the EPBC Act.
-

- State Heritage Register (SHR). This register is made 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 authorised 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 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 Significance 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.

ii Site inspection

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. This included an inspection of the (dry) natural lakebed of Lake Cowal above the proposed underground mine area and the site at CGO.

Although no historical heritage items are anticipated to occur within the proposed footprint of the underground development or the site at CGO due to extensive disturbance, a visual inspection of both areas was carried out to further verify this prediction.

14.1.3 Results

i Desktop study

A summary of the findings of the search of the databases and inventories is provided in Table 14.2.

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). 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.

Lake Cowal itself is listed on the RNE (non-statutory archive), 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.

Table 14.2 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

ii Site inspection

No historical heritage items were found during the site inspection of the Project footprint or at the site of CGO.

14.2 Existing environment

CGO is highly disturbed due to 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.

The footprint of the Project is located within the shoreline of Lake Cowal. The topography above the Project footprint is relatively flat and part of the broad alluvial plain of Lake Cowal. 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.

No other items exist in or near CGO or the footprint of the Project which are listed on the remaining relevant statutory and non-statutory heritage databases and inventories. No evidence of potential relics was identified during the site inspection.

Photograph 14.1 Former location of heritage item I11 as shown in the Bland LEP (NB: This item no longer exists)

14.3 Predicted impacts

No known items of heritage significance were found during the register searches or the site inspection within the proposed disturbance footprint of the Project or the site of CGO.

The Project will not result in discernible changes in ground level and surface disturbance associated with the Project will be contained within the existing, approved disturbance footprint of CGO. Similarly, any currently unknown historical heritage objects present in the lakebed above the Project footprint will not be affected by the Project.

The overlying area is also situated in the bed of Lake Cowal that has been extensively cropped for many years and periodically inundated with floodwaters. It is predicted that any historical heritage items located within the lake's bed will slowly be buried by accumulating sediment and occasionally reworked by cropping and fluvial processes.

As noted in section 14.1.3, Lake Cowal itself is listed on the RNE. The RNE is a non-statutory archive for which Lake Cowal's listing does not include any cultural heritage values. As noted previously the Project is wholly underground and will not result in discernible changes in ground level, therefore the Project will not impact Lake Cowal or any historical heritage values it may hold.

The site of CGO is 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.

As a result, the Project will have no impact on known historical heritage items or cultural values and is unlikely to have any impact on currently unknown sites.

14.4 Mitigation measures

Considering no items of heritage significance were found during the register searches and the site inspection (or are predicted to occur in the footprint of Project or the site of CGO), no specific mitigation measures need 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 Project. 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.

14.5 Summary and conclusion

In accordance with the SEARs and as documented in this chapter, an historical heritage assessment has been completed for the Project to assess the impact of the Project on historical heritage items, cultural value and archaeological resources.

The study was based on a desktop study, consisting of searches of all applicable statutory and non-statutory heritage databases and inventories, and a site inspection of the footprint of the Project and the site of CGO.

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). However, it no longer exists. Lake Cowal is also listed on the RNE, albeit the listing does not include cultural heritage values. The Project will not affect either listing.

No historical heritage items were discovered during the site inspection.

Considering the results of the desktop study and the site inspection, it can be concluded that the Project will have negligible effect on historical heritage items, cultural values and archaeological resources.

Part C – Impact assessment

Chapter 15 Traffic and transport

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15 Traffic and transport

15.1 Introduction

This chapter provides a summary of the traffic impact assessment (TIA) completed by EMM (2020e) for the underground development. It is provided in full in Appendix J.

This includes traffic associated with the construction of the proposed new facilities and the personnel needed to operate it in the longer term. This 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 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 Project will have during both the construction and operational phases. These routes are listed below and shown on Figure 15.1:

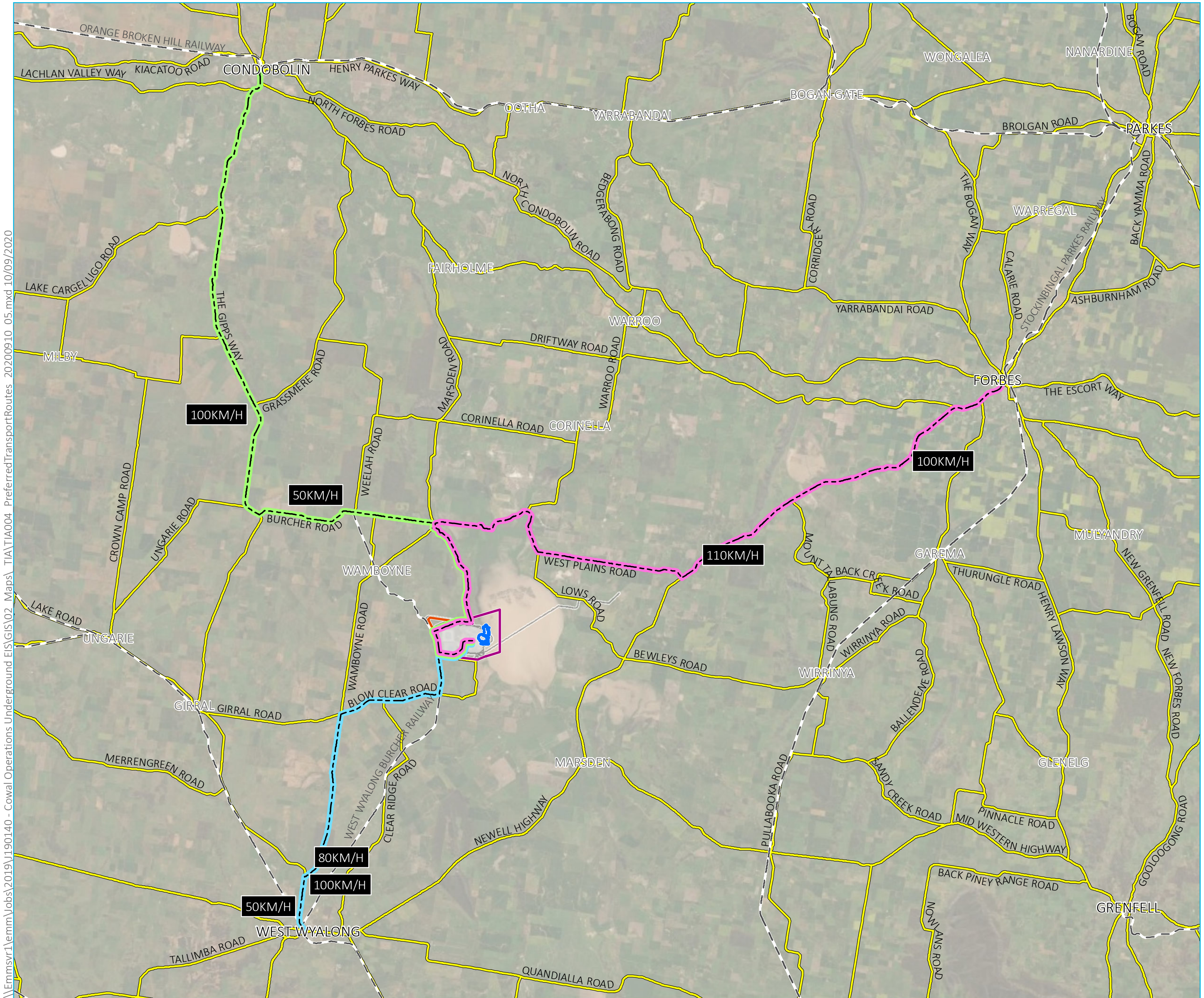
- CGO - West Wyalong: Mine Access Road, Bonehams Lane, Blow Clear Road, Wamboyne Road, Ungarie Road and Newell Highway;
- CGO - Condobolin: Mine Access Road, Lake Cowal Road, Fitzgerald Road, Lake Cowal Road, Bena Street, Burcher Road and The Gipps Way; and
- CGO - Forbes: Mine Access Road, Lake Cowal Road, Fitzgerald Road, Lake Cowal Road, Bogies Island Road, West Plains Road and Newell Highway.

The alternative transport routes that are used during adverse weather are shown on Figure 15.2.

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 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 Project. This includes light vehicle (car) movements and heavy vehicle movements such as expanding the existing shuttle bus service between CGO and local towns and additional heavy vehicle movements delivering construction materials, mobile equipment and eventually, new mining equipment to the site. The TIA has been based upon a workforce increase of 200 FTE employees during construction and 160 FTE employees during operation. Since the preparation of the TIA and through the progressive design of the Project, the Project now requires a workforce increase of 160 FTE additional employees during construction and 230 FTE additional employees during operation.



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

0 5 10 km
GDA 1994 MGA Zone 55
N

KEY

- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Approved surface disturbance
- Rail line
- Main road

Preferred transport routes

- Condoblin route
- Forbes route
- West Wyalong route

Existing transport routes

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 15.1

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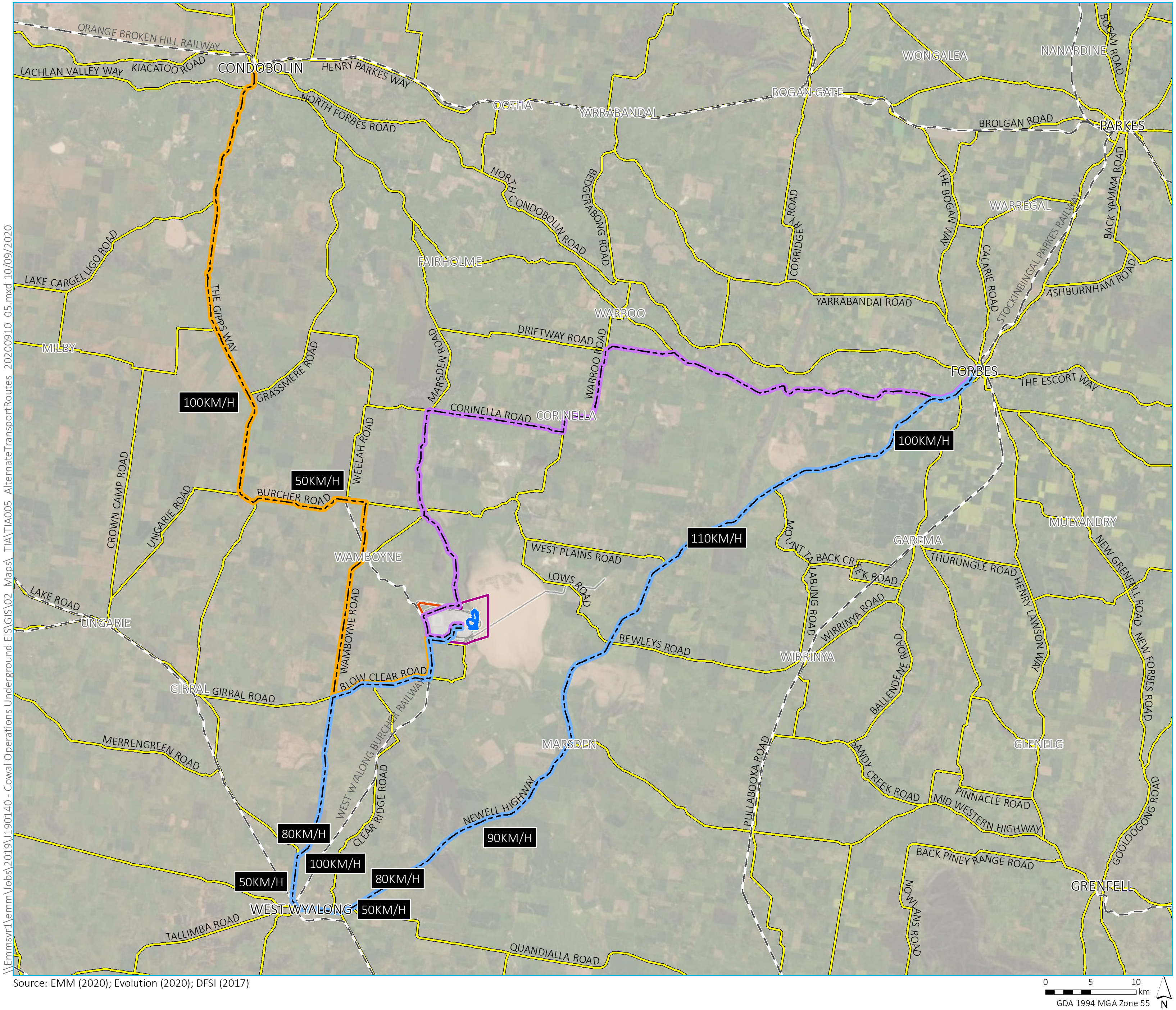

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KEY
- Proposed underground development
- Mining lease (ML1535)
- Mining lease (ML1791)
- Approved surface disturbance
- Rail line
- Main road

Alternate transport routes
- Condoblin alternate route due to weather condition
- Forbes alternate route due to weather condition
- Forbes alternate route due to high water level

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

Alternative transport routes

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 15.2

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15.1.1 Secretary's Environmental Assessment Requirements

The SEARs received for the Project require Evolution to assess the Project's potential impact on the local and regional traffic network. The requirements and sections in which they are addressed are shown in Table 15.1.

Table 15.1 Traffic related SEARs for the underground development

Requirement	Location in the EIS
Transport – including an assessment of the likely impacts of the development on the capacity, condition, safety and efficiency of the local and State road network.	This chapter addresses the underground development's impact on the local and regional traffic network based upon the TIA completed by EMM (2020e).

15.1.2 Research methods

The research methods for the TIA included a site inspection, desktop research, intersection traffic surveys and intersection modelling.

i Site inspection

The site inspection was completed on 6 June 2019 by Associate Transport Planner Tim Brooker and Planner Alice Meng from EMM. It included an inspection of CGO, the existing transport routes and key intersections along the existing transport routes. The inspection also included traffic counts at the key intersections.

Photographs taken during the site inspection are provided in Appendix A of the TIA (refer to Appendix J of this EIS).

ii Desktop research

Desktop research was undertaken to provide an understanding of the existing traffic environment, including the local and regional road networks. It identified the roads network potentially affected by the Project; road accident records, public transport services and known future improvement Projects to upgrade the local or regional road network.

To inform the impact assessment as part of the TIA, the baseline traffic volumes for the routes (as listed above) were established from data obtained by Transport for NSW (TfNSW), Bland Shire Council, Forbes Shire Council and Lachlan Shire Council, including the average daily or hourly traffic volumes and percentage of heavy vehicles.

iii Intersection traffic surveys

Existing tube traffic count data taken from Bland Shire Council, Forbes Shire Council and Lachlan Shire Council and observations during the site inspection were compiled to form intersection traffic surveys for the key intersections listed above. This was completed to form an understanding of the existing capacity of these key intersections, which informed the predicted impact of the Project on these intersections.

iv Intersection modelling

Intersection modelling was completed using the SIDRA-8 Model to predict the impact of the Project on the key intersections listed above and during the following peak morning and afternoon 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 during construction and operation of the Project considering the associated additional traffic volumes is determined through the following parameters in accordance with the *Austroads Guide to Road Design Part 4: Intersections and Crossings: General* (Austroads 2017):

- level of service (LOS);
- degree of saturation (DOS);
- average delay per second (DEL); and
- 95th percentile back of queue length (95th percentile BQL).

The LOS standards which have been applied to the assessment of intersection performance are provided in Table 15.2.

Table 15.2 Intersection level of service standards

Level of service	Average delay (seconds per vehicle)	Traffic signals, roundabout	Priority intersection ('Stop' or 'Give Way' signage)
A	<14	Good operation	Good operation
B	15-28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29-42	Satisfactory	Satisfactory, but accident study required
D	43-56	Operating near capacity	Near capacity and accident study required
E	57-70	At capacity. At traffic signals, incidents will cause extensive delays. Roundabouts require other control mode.	At capacity; required other control mode
F	>71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; required other control mode

v Austroads turning lane warrant assessment

This assessment identifies whether an additional right-hand turning lane is required to accommodate vehicles associated with the Project at the key intersections and have been completed in accordance with *Part 4 Intersection Design Standards* (Austroads 2017).

This assessment is completed by plotting the peak hourly major road through traffic movements (Qm) against the right turning traffic volume (Qr) for each key intersection during the peak time periods, and is dependent on whether the speed limit is above or below 100 km/hr.

15.2 Existing environment

As noted in section 15.1, the existing capacity of the local and regional road network, including key intersections, was assessed by means of a site inspection, desktop research and intersection traffic surveys. The potential impact of the additional light and heavy vehicles associated with the Project will have on the existing transport routes and key intersections is regarded as one of the more direct impacts on members of the local community.

15.2.1 Baseline traffic volumes

To inform the impact assessment of the Project, baseline daily traffic volumes were obtained from data collected by TfNSW, Bland Shire Council, Forbes Shire Council and Lachlan Shire Council for the existing transport routes. As shown in Table 15.3, this included the total traffic volumes for 2017, 2018 and 2019 and the approximate peak hourly volumes and average proportion of heavy vehicles.

Table 15.3 Baseline traffic volumes from TfNSW

Station ID	Road	Location	2017	2018	2019	Approximate peak hourly volume	Average proportion of heavy vehicle
6144	Newell Highway	150 m west of Greens Road, Forbes	2,607	2,681	2,588	260	37%
MRDSTC	Newell Highway	160 m south of Mid Western Highway, Caragabal	1,958	1,990	1,975	200	44%
6142	Newell Highway	460 m east of Nicholson Lane, Wyalong	2,243	-	2,254	230	38%

The baseline traffic volumes for parts of the existing transport routes within the Bland, Lachlan and Forbes Shire local government areas are provided in Table 15.4, Table 15.5 and Table 15.6. The daily traffic volume for 2019 was estimated from past traffic volumes for relevant roads within the Lachlan Shire and Forbes Shire local government areas. The traffic volumes and percentage of heavy vehicles for these roads are significantly less than the Newell Highway.

Table 15.4 Baseline traffic volumes from Bland Shire Council

Roads	Average daily traffic volume for 2019	Daily heavy vehicle traffic	Daily heavy vehicle percentage
Blow Clear Road (south of Bonehams Lane)	254	66	26%
Bonehams Lane (north of Blow Clear Road)	254	52	20%
Lake Cowal Road (north of mine entrance)	55	17	31%
Ungarie Road (south of Hateleys Lane)	1,221	154	21%
Wamboyne Road (near Hiawatha Forest)	303	76	25%

Table 15.5 Baseline traffic volumes from Lachlan Shire Council

Roads	2014	2018	Estimated average daily traffic volume for 2019	Percentage of heavy vehicle
The Gipps Way (south of Wallaroi Creek Bridge)	-	473	478	35%
Burcher Road (3 km west of Burcher)	41	-	43	24%

Table 15.6 Baseline traffic volumes from Forbes Shire Council

Road	2011	2015	Estimated average daily traffic volume for 2019	Percentage of heavy vehicles
West Plains Road	41	40	42	25%

15.2.2 Intersection traffic surveys

Intersection traffic surveys were compiled from existing tube traffic count data taken from Bland Shire Council, Forbes Shire Council and Lachlan Shire Council and observations made during the site inspection. This was completed to form an understanding of the existing capacity of these key intersections, which informed the predicted impact of the Project on these intersections through intersection modelling. As summarised in Table 15.7, this was completed for peak inbound and outbound time periods.

Table 15.7 Intersection traffic surveys

Road	Direction	AM peak hour inbound 5-6 am		AM peak hour outbound 6-7 am		PM peak hour inbound 5-6 pm		PM peak hour outbound 6-7 pm	
		Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
West Wyalong Condobolin Road/Ungarie Road/Wamboyne Road intersection									
West Wyalong Condobolin Road (north of Wamboyne Road)	Northbound	0	1	30	6	35	1	21	6
	Southbound	8	2	15	2	24	0	22	0
MR 57 Ungarie Road (south of Wamboyne Road)	Northbound	42	8	61	9	46	5	22	4
	Southbound	8	2	20	6	64	7	53	8
Wamboyne Road (east of West Wyalong Condobolin Road and Ungarie Road)	Eastbound	43	7	31	3	11	4	1	0
	Westbound	1	0	5	4	40	7	31	10
Wamboyne Road/Girral Road/Blow Clear Road intersection									
Wamboyne Road (north of Girral Road and Blow Clear Road)	Northbound	7	0	3	0	4	1	0	0
	Southbound	0	3	6	1	1	2	2	2
	Northbound	43	7	31	3	11	4	1	0

Table 15.7 Intersection traffic surveys

Road	Direction	AM peak hour inbound 5-6 am		AM peak hour outbound 6-7 am		PM peak hour inbound 5-6 pm		PM peak hour outbound 6-7 pm	
		Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Wamboyne Road (south of Girral Road and Blow Clear Road)	Southbound	1	0	5	4	40	7	31	10
Blow Clear Road (east of Wamboyne Road)	Eastbound	38	10	37	4	12	6	1	0
	Westbound	3	0	8	4	44	8	29	8
Mine Access Road/Bonehams Lane/Lake Cowal Road intersection									
Bonehams Lane (west of Lake Cowal Road)	Eastbound	38	9	41	3	15	4	1	0
	Westbound	3	0	11	3	49	6	25	5
Lake Cowal Road (north of Bonehams Lane and Mine Access Road)	Northbound	0	1	0	0	5	4	2	1
	Southbound	5	2	8	2	1	1	0	0
Mine Access Road (east of Bonehams Lane and Lake Cowal Road)	Eastbound	43	11	49	5	16	5	1	0
	Westbound	3	1	11	3	54	10	27	6

15.2.3 Baseline intersection performance

The existing performance of the key intersections during peak time periods is provided in Table 15.8. This is represented by the intersection LOS standards noted in Table 15.2 and the DOS, DEL and 95% BQL.

Each of the key intersections are operating at a LOS rating of A, meaning there is minimal delay and good operation, and a low DOS (0.02 to 0.04).

Table 15.8 Existing performance of key intersections

Intersection	Peak hourly period	LOS	DOS	DEL (secs)	95% BQL (m)
West Wyalong Condobolin Road/Ungarie Road/Wamboyne Road	5 – 6 am inbound	A	0.031	7.9	1.1
	6 – 7 am outbound	A	0.032	9.1	1.1
	5 – 6 pm inbound	A	0.034	8.3	1.1
	6 – 7 pm outbound	A	0.031	9.4	1.1
Wamboyne Road/Girral Road/Blow Clear Road	5 – 6 am inbound	A	0.032	9.1	1.2
	6 – 7 am outbound	A	0.022	9.0	0.8
	5 – 6 pm inbound	A	0.039	9.6	1.2
	6 – 7 pm outbound	A	0.028	8.8	0.9
Mine Access Road/Bonehams Lane/Lake Cowal Road	5 – 6 am inbound	A	0.030	9.1	0.2
	6 – 7 am outbound	A	0.026	7.9	0.3
	5 – 6 pm inbound	A	0.040	8.7	0.6

Table 15.8 Existing performance of key intersections

Intersection	Peak hourly period	LOS	DOS	DEL (secs)	95% BQL (m)
	6 – 7 pm outbound	A	0.021	8.3	0.2

15.2.4 Austroads turning lane warrant assessment

An Austroads turning lane warrant assessment was completed for the key intersections to determine whether there was an existing need for a right-hand turning lane during the peak time periods. This was determined by assessing the Qm and Qr of each key intersection. This is provided in Table 15.9 along with the resulting requirement for a right-hand turning lane.

It was found that traffic volumes at each intersection only need the minimum right-hand lane turning requirement known as a basic right (BAR) turn treatment. Additionally, the current design of the intersection between West Wyalong Condobolin Road/Ungarie Road/Wamboyne Road is an auxiliary right-turn (AUR) treatment which can accommodate higher Qm and Qr volumes.

Table 15.9 Austroads turning lane warrant assessment of key intersections

Intersection major road	Intersection minor road	Peak hourly traffic period	(Qm) Major Road through traffic volume	(Qr) Major Road right turn traffic volume	Turning lane warrant requirement
West Wyalong Condobolin Road/Ungarie Road	Wamboyne Road	5 – 6 am inbound	11	49	BAR
		6 – 7 am outbound	53	34	BAR
		5 – 6 pm inbound	60	15	BAR
		6 – 7 pm outbound	47	1	BAR
Wamboyne Road	Girral Road/Blow Clear Road	5 – 6 am inbound	8	45	BAR
		6 – 7 am outbound	7	34	BAR
		5 – 6 pm inbound	3	15	BAR
		6 – 7 pm outbound	4	1	BAR
Mine Access Road/Bonehams Lane	Lake Cowal Road	5 – 6 am inbound	50	1	BAR
		6 – 7 am outbound	58	0	BAR
		5 – 6 pm inbound	74	9	BAR
		6 – 7 pm outbound	31	3	BAR

15.3 Predicted impacts

15.3.1 Traffic volumes

The Project will result in an increase in heavy vehicle volumes along the routes between CGO and the townships of Forbes, Condobolin and West Wyalong. Table 15.10 provides a summary of the proposed additional construction and operational traffic and compares it to the existing traffic associated with CGO.

Mine Access Road and Lake Cowal Road will experience the largest increase in traffic during both the construction and operational stages of the Project. These roads are currently primarily used by vehicles associated with CGO and therefore, this increase is not likely to affect other road users.

Construction-related traffic will include 168 light vehicles and 42 heavy vehicles, however, it will be temporary in nature. Operational traffic will include 84 light vehicles and 26 heavy vehicles. These numbers represent one-way vehicle movements.

Road traffic noise has been assessed in the NIA (EMM 2020a) completed for the Project and summarised in Chapter 8. It was concluded that road traffic noise levels during construction and operation for Bonehams Lane and Blow Clear Road will not exceed the day and night noise criteria and therefore unlikely to cause an impact to residential receptors.

The shuttle bus service for the existing workforce between CGO and West Wyalong and Forbes will be expanded commensurate with the additional workforce. When travelling between CGO and West Wyalong, the shuttle bus service uses the following route: Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane. When travelling between CGO and Forbes, the shuttle bus service uses the following route: Newell Highway, West Plains Road, Bogies Island Road, Lake Cowal Road, Fitzgerald Road and Lake Cowal Road.

It is expected that up to 75% of the additional construction and operational workforce would use the shuttle bus service.

Table 15.10 Daily traffic volume increases during construction and operation of the Project

Road	Existing daily traffic (daily heavy vehicle trips)	Additional construction stage daily traffic (heavy vehicles)	Future total construction stage daily traffic (percentage increase)	Additional operation stage daily traffic (heavy vehicles)	Future total operation stage daily traffic (percentage increase)
Ungarie Road	1,221 (154)	168 (32)	1,389 (14%)	76 (16)	1,297 (6%)
Wamboyne Road	303 (76)	168 (32)	471 (55%)	76 (16)	379 (25%)
Blow Clear Road	254 (66)	168 (32)	422 (66%)	76 (16)	330 (30%)
Bonehams Lane	254 (52)	168 (32)	422 (66%)	76 (16)	330 (30%)
Mine Access Road	280 (64)	210 (42)	490 (75%)	110 (26)	390 (39%)
Lake Cowal Road	55 (17)	42 (10)	97 (76%)	34 (10)	89 (62%)

Table 15.10 Daily traffic volume increases during construction and operation of the Project

Road	Existing daily traffic (daily heavy vehicle trips)	Additional construction stage daily traffic (heavy vehicles)	Future total construction stage daily traffic (percentage increase)	Additional operation stage daily traffic (heavy vehicles)	Future total operation stage daily traffic (percentage increase)
West Plains Road	42 (10)	21 (5)	63 (50%)	17 (5)	59 (40%)
Burcher Road	43 (10)	21 (5)	64 (49%)	17 (5)	60 (40%)
The Gipps Way	478 (167)	11 (3)	489 (2%)	9 (3)	487 (2%)

Note: The Mine Access Road existing daily traffic volume is estimated as 90% of the combined daily traffic volume using both Bonehams Lane and Lake Cowal Road

15.3.2 Key intersection performance

The effects of the Project on key intersections during peak time periods has been predicted using the SIDRA-8 Model, which considered the results of the intersection traffic surveys and forecasted traffic volume associated with the Project.

As noted in Section 15.1.2v), the performance of key intersections during construction and operation of the Project is defined via the LOS, DOS, DEL and BQL. The existing LOS standard for the key intersections are rated A, meaning there is minimal delay and good operation.

As summarised in Table 15.11, the LOS standard for the key intersections will not be affected during construction and operation. During construction, the DOS will be increased for each key intersection. For the 5 to 6 am inbound and 6 to 7 pm outbound periods, the DEL will remain the same or increase by less than one second.

During construction, the DEL for the 6 to 7 pm outbound period for the intersection of Mine Access Road/ Bonehams Lane/Lake Cowal Road will also remain the same or increase by less than one second.

This marginal increase is also predicted to occur during operation for the 6 to 7 am outbound period for the intersections of West Wyalong Condobolin Road/Ungarie Road/Wamboyne Road and Wamboyne Road/ Girral Road/Blow Clear Road and the 6 to 7 pm outbound period for the intersection of Mine Access Road/Bonehams Lane/Lake Cowal Road.

It is expected that there will be no noticeable change to each of the assessed intersection performance measures due to traffic associated with the construction or operational phases of the Project.

Table 15.11 Key intersection performance indicators during construction and operation of the Project

Intersection	Peak hourly period	LOS	DOS	DEL (secs)	95% BQL (m)
Construction					
West Wyalong Condobolin Road/Ungarie Road/Wamboyne Road	5-6 am inbound	A	0.082	8.2	3.1
	6-7 pm outbound	A	0.088	9.4	3.0
Wamboyne Road/Girral Road/Blow Clear Road	5-6 am inbound	A	0.083	9.1	3.1
	6-7 pm outbound	A	0.084	8.8	2.8
Mine Access Road/Bonehams Lane/Lake Cowal Road	5-6 am inbound	A	0.077	9.7	0.8
	6-7 pm outbound	A	0.077	8.2	1.3
Operation					
West Wyalong Condobolin Road/Ungarie Road/Wamboyne Road	5-6 am inbound	A	0.042	7.9	1.5
	6-7 am outbound	A	0.032	7.9	1.1
	5-6 pm inbound	A	0.034	8.3	1.1
	6-7 pm outbound	A	0.043	9.4	1.4
Wamboyne Road/Girral Road/Blow Clear Road	5-6 am inbound	A	0.043	9.1	1.6
	6-7 am outbound	A	0.022	8.2	0.8
	5-6 pm inbound	A	0.039	9.6	1.2
	6-7 pm outbound	A	0.040	8.8	1.3
Mine Access Road/Bonehams Lane/Lake Cowal Road	5-6 am inbound	A	0.040	9.2	0.4
	6-7 am outbound	A	0.026	8.0	0.5
	5-6 pm inbound	A	0.040	8.8	0.6
	6-7 pm outbound	A	0.036	8.0	0.6

15.3.3 Austroads turning lane warrant assessment

An Austroads intersection warrant assessment for right turning traffic for the key intersections during peak periods was completed. The turning lane warrant requirement will not change as a result of light and heavy vehicle associated with the construction and operation phases of the Project and will remain as a minimum right-hand lane turning requirement known as 'BAR' right hand turn treatment.

Therefore, an additional right turning lane is not required to be constructed to accommodate additional light and heavy vehicles resulting from the Project.

15.3.4 Road safety

Within the last five years, only a single vehicle collision has occurred at the intersection of Blow Clear Road, Wamboyne Road and Girral Road while one collision occurred at the intersection of the Mine Access Road with Bonehams Lane and Lake Cowal Road.

Lake Cowal Road and Blow Clear Road will be frequently used by light and heavy vehicles during the construction and operation phases of the Project. As shown in Table 15.4, these roads do not experience high traffic volumes, as the daily traffic count currently is 66 vehicles for Blow Clear Road and 17 vehicles for Lake Cowal Road. As shown in Table 15.10 one-way vehicle movements will increase by 168 construction vehicles and 76 operational vehicles on Blow Clear Road and 42 construction vehicles and 34 operational vehicles on Lake Cowal Road.

Notwithstanding these increases, the Project will not significantly affect road safety for current mine vehicle movements and local traffic. This is because all roads that are being used and would continue to be used by mine traffic from either West Wyalong, Forbes or Condobolin include State roads and local roads which are sealed and are designed to handle a larger amount of traffic than is currently experienced, with intersections which are clearly marked and signposted.

Further, the mine's shifts are scheduled so that periods of the day where there could be more local traffic on the roads and, in particular, the mine traffic, avoids the times when the school bus operates (ie 7:30 to 8:30 am and 3:30 to 4:30 pm on weekdays) on Wamboyne Road, Blow Clear Road, Burcher Road and Bena Street. Light and heavy vehicles associated with the construction and operational phases of the Project are not expected to cause any increase the road safety risk along these routes.

15.3.5 Public transport

The additional construction and operational workforce will utilise the existing shuttle bus service between CGO and West Wyalong, Forbes and Condobolin rather than public transport. This shuttle bus service will be extended to accommodate this forecast demand.

There will be no change in demand for public transport services associated with the additional construction and operation workforce of the Project.

15.4 Mitigation measures

The Project will contribute to a significant localised increase in traffic during the construction phase. However, traffic numbers will reduce as the underground development is developed and becomes operational, although it is expected that the long-term traffic volume will remain around 2 to 62% higher than exists currently (refer to Table 15.10) depending on the affected road.

It is expected that up to 75% of the additional construction and operational workforce will use the shuttle bus service. This will significantly reduce light vehicle traffic associated with the Project during both phases. Roads which form the existing and approved traffic routes will remain safe despite the increase of heavy vehicles associated with the temporary construction phase and operation phase, as these roads are not subjected to existing high traffic volumes, are fully sealed and constructed to a standard suitable for use as State trucking routes.

To mitigate traffic impacts to residential receptors, additional Project-related traffic will only use the existing transport routes between CGO, West Wyalong, Forbes and Condobolin. Dilapidation surveys and local road repairs will continue to be completed and managed under the existing TMP and the local community will be notified of construction activity.

These increases will not affect the performance of key intersections, as there will be no change to each of the assessed intersection performance measures as a result of the Project. Similarly, the Project is not expected to affect road safety or public transport. Therefore, no 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):

- 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 its existing monitoring programs in the TMP to take into account the increase of light and heavy vehicles using the route between CGO and West Wyalong to ensure the continued safety of all road users on CGO transport routes.

15.5 Summary and conclusion

A TIA has been completed in accordance with the *Guide to Traffic Generating Developments* (RTA 2002) and the relevant guidelines by Austroads to assess the impact of the Project on the existing local and regional traffic network.

The TIA considers light and heavy vehicle movements associated with the increased workforce during the construction and operational phases of the Project and also heavy vehicle movement resulting from deliveries during the construction and operational phase.

The research method included a site inspection, desktop research including establishment of the baseline traffic volumes, intersection traffic surveys, intersection modelling using the SIDRA-8 Model and a turning lane warrant assessment in accordance with the *Part 4 Intersection Design Standards* (Austroads 2017).

The Project will result in an increase to heavy and light vehicle volumes along the existing routes between CGO and Forbes, Condobolin and West Wyalong during the construction phase of the Project. Mine Access Road will experience the largest increase in vehicle usage, including 168 light and 42 heavy vehicles during the construction phase and 84 light and 26 heavy vehicles during the operational phase. Mine Access Road is used by traffic associated with CGO and is not used by the public. Ungarie Road, Blow Clear Road, Bonehams Lane and Wamboyne Road will experience an increase in Project-related traffic, ranging from 168 to 76 additional daily movements during the construction and operational phases of the Project respectively.

The proposed daily increases of light and heavy vehicles will not affect the performance of the key intersections, as the LOS will remain at a standard of A for the key intersections during peak hourly periods. The DOS, DEL and BQL will remain as is or experience a negligible increase because of the Project. Additionally, the turning lane warrant requirement at these key intersections remains unchanged, meaning an additional right turning lane is not required to be constructed to accommodate the anticipated traffic increases.

The proposed traffic increases is not expected to affect road safety on the existing routes or exacerbate risk relating to road accidents, school buses or public transport as the additional workforce will largely be transported using an expansion of the existing shuttle bus service.

Considering the minimal impacts to the local and regional road network associated with the underground development, no specific traffic impact mitigation measures have been recommended in the TIA. However, it is recommended that the existing TMP is applied to proposed traffic increases associated with the underground development, which includes requirements relating to the monitoring of road quality and maintenance works.

Part C – Impact assessment

Chapter 16 Rehabilitation and closure strategy

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16 Rehabilitation and closure strategy

16.1 Introduction

This chapter provides a summary of the mine closure and rehabilitation actions for the Project, which for completeness considers the rehabilitation and closure actions for the whole CGO site.

A Rehabilitation and Closure Strategy was prepared by EMM (2020f) for the Project and is presented in full in Appendix K. The overarching objective of the rehabilitation strategy is to create safe, stable and non-polluting landforms that are consistent with agreed post-mining land uses.

The rehabilitation concepts presented in Appendix K will be reviewed and refined over time to allow for the consideration of several factors, including the outcomes of future rehabilitation trials and current research. Final rehabilitation and Project closure requirements will ultimately be formulated in consultation with key government agencies and other relevant stakeholders.

16.2 Assessment requirements

The mine closure and rehabilitation strategy has been prepared in accordance with requirements of DPIE's SEARS outlined in Table 16.1. The Resources Regulator also provided assessment comments which were attached to the SEARs. These comments are replicated in Table 16.2.

Table 16.1 Rehabilitation related SEARs

Requirement	Location in the EIS
General Requirements:	Appendix K
In particular, the EIS must include:	
• a full description of the development including:	
– a mine closure and rehabilitation strategy	
Key Issues	
The EIS must address the following specific issues:	
• Land – including:	
– an assessment of the likely impact of the development on landforms (topography), including the long-term geotechnical stability of any new landforms on site; and	Section 16.6 of this document and section 4.3 of Appendix K.
– an assessment of the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 12 of *State Environmental Policy (Mining, Petroleum Production and Extractive Industries) 2007*, paying particular attention to the agricultural land use in the region;	Section 16.10
• Rehabilitation and Final Landform – including:	
– a conceptual final landform design, including justification of the final landform design, long-term geotechnical stability, and nominated final land uses, having regard to relevant strategic land use planning, resource management plans or policies;	Section 16.10 and section 4.3 of Appendix K.
– progressive rehabilitation measures that would be implemented for the development;	Section 16.7 and section 4.4 of Appendix K.

Table 16.1 Rehabilitation related SEARs

Requirement	Location in the EIS
– rehabilitation objectives, performance standards and completion criteria; and	Section 16.4 and section 6 of Appendix K.
– decommissioning of surface infrastructure.	Section 16.10.

Table 16.2 Resources Regulator assessment requirements for the Project

Requirement	Location in the EIS
Post-mining land use	
a) Identification and assessment of post-mining land use options;	Section 16.10.2. Chapter 4 of Appendix K
b) 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 16.10.2. Chapter 4 of Appendix K.
c) 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	
d) 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 16.4.2. Section 4.1 and Chapter 6 of Appendix K.
Rehabilitation method	
e) Details regarding the rehabilitation methods for disturbed areas and expected time frames for each stage of the rehabilitation process.	Section 16.7. Chapter 4 and Chapter 5 of Appendix K.
f) 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;	Section 16.8. Chapter 4 and Chapter 5 of Appendix K.
Conceptual final landform design	
g) 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 16.2. Figure 4.1 of Appendix K.
Monitoring and research	
h) Outlining the monitoring programs that will be implemented to assess how rehabilitation is trending towards the nominated land use objectives and completion criteria	Sections 5.5.1 and section 6 of Appendix K.
i) 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 K.

Table 16.2 Resources Regulator assessment requirements for the Project

Requirement		Location in the EIS
j)	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 6.2.2 of Appendix K.
Post-closure maintenance		Section 16.8.
k)	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 5.5 of Appendix K.
Barriers or limitations to effective rehabilitation		
l)	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 16.4.
i)	evaluation of the likely effectiveness of the proposed rehabilitation techniques against the rehabilitation objectives and completion criteria	Section 4.1.3 of Appendix K.
ii)	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 K. Note given that this is not a coal mining proposal, spontaneous combustion is not a risk for this Project.
iii)	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;	Section 3.1.2 of Appendix K.
iv)	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 K.
v)	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 K.
m)	Where a void is proposed to remain as part of the final landform include:	Summary provided in Table 16.4.
vi)	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 K.
vii)	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 K.
viii)	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 K.

Table 16.2 Resources Regulator assessment requirements for the Project

Requirement	Location in the EIS
n) Where the mine includes underground workings:	
ix) 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 K.
x) 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 K.
o) 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 K.
p) 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 16.7.2. Section 4, 5.2, 5.5 and 6 of Appendix K.
q) 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 16.7.2. Section 4, 5.2, 5.5 and 6 of Appendix K.
r) Consider any relevant government policies	Section 16.3. Section 1.4 of Appendix K.

16.3 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) (DRE 2016);
- 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, 2006a) (MR Handbook);
- *The Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry* (NSW Department of Industry, Tourism and Resources, 2006b) (MCC Handbook);
- *NSW Wetlands Policy* (DECCW 2010b);
- 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).

16.4 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 2018b).

The above philosophy has led to the rehabilitation principles and objectives described below.

16.4.1 Rehabilitation Principles

Evolution's rehabilitation program includes the following general principles (Evolution 2018b):

- 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.

16.4.2 Rehabilitation objectives

Evolution's rehabilitation objectives for the rehabilitation program include (Evolution 2018b):

- 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 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 2010b).
- 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.

16.5 Existing environment

16.5.1 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.

16.5.2 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 Project are:

- highly erodible dispersible subsoils and topsoils;
- low annual average rainfall to establish and sustain vegetation cover; and
- long and steep slopes.

16.6 Rehabilitation domains

16.6.1 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 K.

16.6.2 Primary and secondary domains

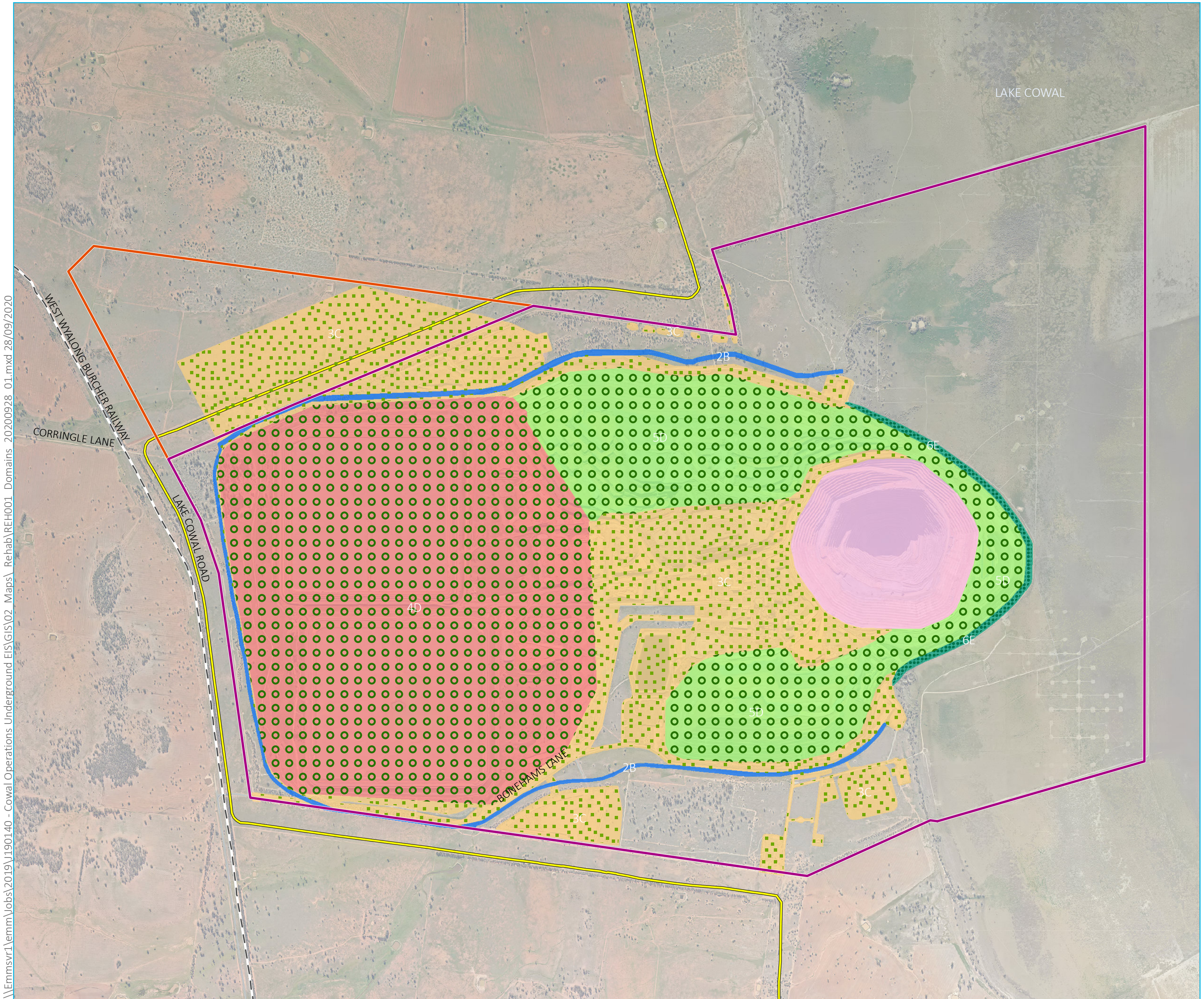
Primary domains are based on land management units within the Project area, usually with a unique operational and functional purpose during operation and therefore, have similar physical and geochemical characteristics that require management. The primary domains form the basis of conceptual closure 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 16.3 below and are shown in Figure 16.1.

Table 16.3 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



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

0 1 2 km
GDA 1994 MGA Zone 55
N

KEY
Mining lease (ML1535)
Mining lease (ML1791)
Rail line
Main road
Primary domain
1A 1 - Final void
2B 2 - Permanent water management infrastucture
3C 3 - Infrastructure area
4D 4 - Integrated waste landform
5D 5 - Waste rock emplacement
6E 6 - New lake foreshore
Relevant secondary domain
C - Grassland/scattered woodland
D - Eucalypt woodland
E - Riverine woodland/freshwater communities

Primary and secondary domains

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 16.1

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\\Emmsvr1\emm\Jobs\2019\J190140 - Cowal Operations Underground EIS\GIS\02_Maps_Rehab\REH001_Domains_20200928_01.mxd 28/09/2020

16.6.3 Summary of potential impacts and rehabilitation in each domain

A summary of potential impacts and the rehabilitation in the domains is provided in Table 16.4. Further details of the other domains are included in Appendix K.

Table 16.4 Summary of rehabilitation domains

Domain	Description
1A – Final void	The surface area of the final void will be approximately 131 ha and, at the end of mining, the void has an approved maximum depth of approximately -331 m AHD (ie approximately 540 m below the natural surface level). The berm widths and slope angles will continue to be reviewed and monitored through ongoing geotechnical studies and data collection during mine development. Modelling indicates that the approved final void would reach an estimated equilibrium water level below 130 m AHD (approximately 80 m below spill level). The rehabilitation objectives for the final void are to (Barrick 2013): • create habitat opportunities for waterbirds at the approximate level at which void water will reach equilibrium, where feasible; and • leave the void surrounds safe (for humans and stray stock). At the completion of mining, the portals will be sealed, box-cut backfilled and final void will be surrounded on three sides by the revegetated mine waste rock emplacements (WREs).
2B – Permanent water management infrastructure	The permanent water management structures comprise: • UCDS; and • ICDS (including the existing low mounds associated with the permanent catchment divide). The UCDS has been constructed to simulate natural drainage features in the region and includes a low flow drainage path within a wider floodplain (approximately 65 m wide). The channel includes constructed features such as low flow and overbank zones, meanders and pool/riffle sequences. The UCDS will remain to facilitate permanent drainage of adjacent areas upslope of the site to Lake Cowal and the low mounds associated with the ICDS will remain to contain runoff generated within the site catchment. The Lake Isolation System (including the TIB, Lake Protection Bund and Perimeter Waste Rock Emplacement) has also been constructed to hydrologically isolate the open-cut pit from Lake Cowal (and vice versa) during mining and post-mining. The rehabilitation objective for the permanent water management structures is to create stable systems (ie with acceptably low risk of environmental harm to Lake Cowal).

Table 16.4 Summary of rehabilitation domains

Domain	Description
3C – Infrastructure areas	Domain 3C includes: • mine fleet workshop; • reagent and fuel storage areas; • process plant and administration area; • internal access roads and other roads; • transmission line and substation; • water supply infrastructure; • contained water storages; and • exploration areas. The key additional infrastructure for the underground operation will be the paste fill plant which will be located adjacent to the open-cut pit and the mine portals, vent fans, fuel storage and office facilities that will be located in the pit. Post-operations, the rehabilitation objectives for the infrastructure areas are to: • remove all infrastructure to ensure the site is safe and free of hazardous materials (unless an alternative arrangement is agreed by Evolution, the ultimate landholder and relevant regulatory authorities); and • establish vegetative communities (including scattered Eucalypt woodland species and native pasture species) that are endemic to the region and suitable for managed grazing.
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.

Table 16.4 Summary of rehabilitation domains

Domain	Description
5D – Waste rock emplacements	Domain 5D includes the Northern, Southern and Perimeter WREs. The proposed underground Project will produce an additional 5.74Mt of waste rock but this can be accommodated within the existing height limits of 308 m AHD, 283 m AHD and 233 m AHD, respectively. The underground development will generate an additional 5.74Mt of waste rock but will not change the proposed landform design of the WREs with batter slopes of approximately 11° with top of emplacement drainage away from the batters to minimise the potential for erosion as described in the MOP and approved Rehabilitation Strategy (Evolution 2018b). The underground development will not change the proposed revegetation design of the WREs which includes a biodiversity post-mine land-use with the establishment of native Eucalypt woodland, shrub and grassland communities and the exclusion of stock. The approved rehabilitation objectives for the WREs are to (Evolution 2018b): • stabilise batter slopes with rock armour (primary waste rock/soil matrix) to control surface water runoff downslope and reduce erosion potential in the long term; • provide a stable plant growth medium able to support long-term vegetation growth including native and/or endemic Eucalypt woodland, shrubland and grassland species suited to slope and elevated positions similar to those remnants in the surrounding landscape; and • exclude grazing and agricultural production.
6D – Woodland corridor	During the mine closure phase, a woodland corridor will be established between the rehabilitated Northern Waste Rock Emplacement and the rehabilitated NTSF to provide connectivity between the rehabilitated landforms and facilitate fauna movement between the rehabilitated landforms, with grazing and agricultural production excluded. The rehabilitation objectives for the woodland corridor (post-operations) are to: • establish native and/or endemic woodland species characteristic of remnant woodland communities in the surrounding landscape to provide connectivity between the rehabilitated landforms and facilitate fauna movement between the rehabilitated landforms; and • exclude grazing and agricultural production.
7E – New lake foreshore	The New Lake Foreshore includes the TIB, Lake Protection Bund and the first batter of the Perimeter Waste Rock Emplacement. There will be no changes to New Lake Foreshore from the underground development. Construction of the lake isolation embankments has been completed and the TIB and the Lake Protection Bund have been topsoiled and revegetated with native and exotic grass species and scattered aquatic species such as Lignum, Rush sp., River Cooba and River Red Gums. The outer batter slopes of the Lake Protection Bund have been rock armoured to further protect against wave action from lake level rises. The TIB is a short term feature and at the completion of operations is proposed to be reworked (breached) by light machinery (ie small excavator and bob cat) when the level of the lake is lower than the bund, to create a series of low mounds (Evolution 2018b). The mounds would comprise a mixture of inert bund rock and lakebed sediments (Evolution 2018b). Once the TIB has been reworked during the post-closure phase, the New Lake Foreshore would then comprise the Lake Protection Bund and the first batter of the Perimeter Waste Rock Emplacement. This domain will have a biodiversity post mine land-use with the establishment of riverine woodland and freshwater communities as detailed in the approved Rehabilitation Strategy, Compensatory Wetland Management Plan and MOP.

16.7 Rehabilitation methods

16.7.1 Soil management

i 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 (eg 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.

ii 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.

16.7.2 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 programme (including revegetation species lists for each rehabilitation domain) will be refined in consultation with relevant regulatory agencies.

i Seed Collection

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 programme.

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 programmes 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 the CGO's rehabilitation programme within ML 1535 and for implementation of CGO's offset strategy. The strategy will include an assessment of the potential risks associated with the seed supply and planting implementation programme.

Revegetation at the CGO uses a combination of direct seeding and tubestock planting.

16.7.3 Subsidence

A subsidence assessment by Beck (2020) indicate that future soil surface displacement is predicted to be less than 10-15 mm and considered negligible. Forecast surface movement is slightly upwards (due to upsidence, not subsidence). Upsidence is where the land surface rises slightly due to elastic deformation effects from removing large volumes of material from the pit. The movement is inwards toward the pit and upwards. These movements are consistent with natural ranges of shrink and swell during wetting and drying cycles and are unlikely to result in any change to soils at the surface.

The assessment also identified the stoping on the upper levels of the underground mine near major faults could result in unravelling and chimney type failure to the surface. CGO has removed the uppermost stopes from the mine plan to limit this risk, and will further manage risks by filling all stopes during underground mining operations with cemented pastes made from CGO tailings, using fully supported overhead drives and the use of large crown pillars (Mining One 2020).

Therefore, as the proposed mining will have negligible impacts on current soil erosion profiles in Lake Cowal and will not necessitate any rehabilitation to be undertaken at the lake. Subsidence monitoring will be undertaken in the underground mining precinct to ensure unforeseen impacts can be identified and appropriately managed in accordance with the site rehabilitation management plan.

Further details regarding subsidence can be found in Appendix I.

16.7.4 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 programme (or for use within the CGO's offset enhancement areas or remnant vegetation enhancement programme areas).

Vegetative material unsuitable for the rehabilitation programme 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) (eg 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.

16.7.5 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 Project 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% 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.

16.7.6 Weed management

The CGO's existing weed management programme 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.

16.8 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 section 16.9) 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 TARP provided in the CGO Rehabilitation Management Plan.

16.9 Completion criteria

Rehabilitation completion criteria are used as the basis for assessing when rehabilitation of the Project 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 Project 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 K.

16.10 Final landform and land use

16.10.1 Final landform

Key features of the final landform will include (refer Figure 16.2):

- a final void;
- backfilled and rehabilitated box-cut;
- rehabilitated WRE surrounding the final void to the north, east and south;
- rehabilitated IWL;
- a woodland corridor between the rehabilitated Northern Waste Rock Emplacement and rehabilitated IWL;
- 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);
- permanent water management features including the UCDS and low mounds associated with the ICDS; and
- permanent lake isolation embankments to hydrologically separate the open-cut pit development area and Lake Cowal during mining and post-mining.

16.10.2 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 I. This section provides a summary of this discussion.

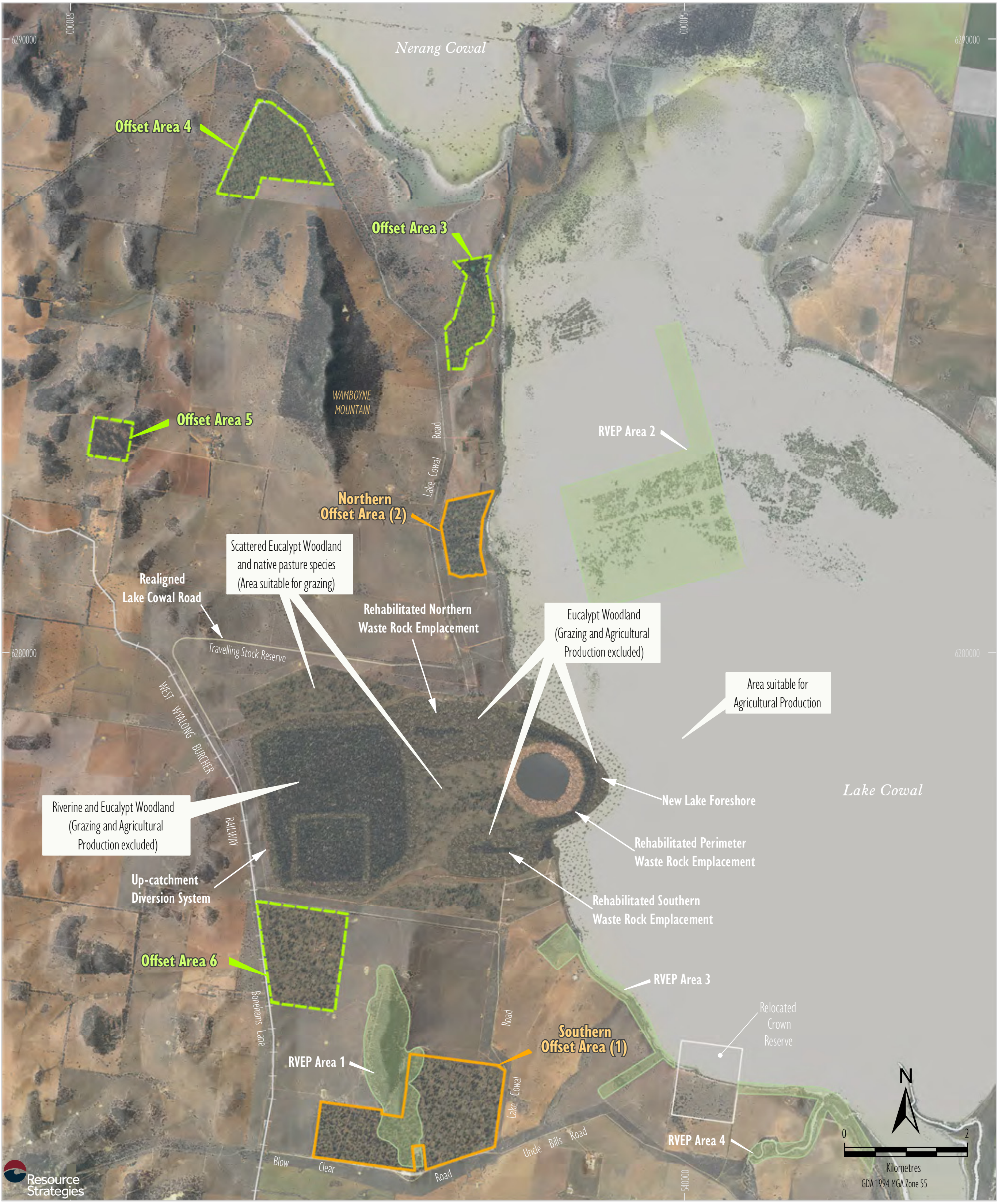
Rehabilitation of ML 1535 disturbance areas will aim to enhance and expand wildlife habitat values within ML 1535 and around Lake Cowal. CGO also recognises that the former land use within ML 1535 included grazing of cleared and semi-cleared areas of predominantly native pastures by livestock.

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 Programme (RVEP) Areas (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 Bland Creek Palaeochannel Borefield, Eastern Saline Borefield and the saline groundwater bores within ML 1535 be retained for local use, the pipelines would remain in place (Evolution 2016).



LEGEND

Offset Areas 1 and 2 (Voluntary Planning Agreement to be registered on the title of the lands)

Offset Areas 3 to 6 (Biodiversity Stewardship Agreement to be established)

Remnant Vegetation Enhancement Program Area (Management of these areas would be maintained for the term of Evolution's tenure of the land)

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

Proposed final landforms and post mine land uses

Evolution Mining
Environmental Impact Statement
Figure 16.2

Part C – Impact assessment

Chapter 17 Visual amenity

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17 Visual amenity

17.1 Introduction

A visual impact assessment (VIA) of the Project was completed by EMM (2020g) 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 construction and operation of a paste fill plant, including additional lighting, on the visual amenity of the local area and is provided in Appendix L.

The box-cut was considered but not assessed further as its proposed shielded location within the site would not result in any visual impact. The visual impact of the following aspects is considered in Mod 16:

- increasing the final height of the IWL by 1 m;
- augmentation of dam D5A and other on-site water storages;
- ancillary surface infrastructure; and
- placement of additional waste rock on existing emplacements.

The impact assessment includes an assessment of the visual magnitude of the proposed change and the visual sensitivity the proposed change will have on receptors within the primary view catchment (PVC) surrounding the site. The PVC represents the area within which views of the Project are located and is constrained to a radius of 13 km surrounding the site.

This includes residential dwellings, tourist sites (mostly recreational areas) and local roads from which the site can be seen.

17.2 Environmental Assessment Requirements

The SEARs were issued for the Project on 26 August 2020. The SEARs did not specifically reference the requirement to undertake an assessment of the visual impacts of the Project.

Given that elements of the paste fill plant could be visible from nearby locations and to ensure the visual impacts at the site continue to be effectively managed, Evolution has undertaken this visual impact assessment.

17.3 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 Project, such variables as the visual magnitude and visual sensitivity of the proposed changes were considered.

17.3.1 Visual magnitude

The visual magnitude relates to the visual effect of the Project. 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, as shown in Table 17.1. The assessment of visual magnitude was made for the proposed new paste fill plant, including additional lighting associated with the paste fill plant.

Table 17.1 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.

17.3.2 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 17.2 and considers the distance between the view point and the Project, value of the view that is proposed to be changed and the visual compatibility of the Project to confirm within the surrounding environment.

Table 17.2 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.

17.3.3 Impact assessment

The visual impact assessment of the Project has been based on the rating schedule provided in Table 17.3. This impact has been determined based upon the magnitude of the visual effect of the Project and the visual sensitivity of locations and receptors.

Table 17.3 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

17.4 Results

17.4.1 Visual magnitude

The paste fill plant includes several features that would contribute to the visual magnitude, including a concrete batching plant, industrial sheds, mix tanks and storage areas to a maximum height of 10 m. The paste fill plant will be located in an area close to the Lake Cowal perimeter bund and will site slightly lower than the surrounding landscaping ridge of the bund. Therefore in and of itself, the visual magnitude of the plant will be able to be minimised.

However there will be the requirement for safety and operational lighting at the paste fill plant, in addition to existing lighting at CGO. 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.

17.4.2 Visual sensitivity

i Residential receptors

The PVC captures residential receptors up to 13 km from CGO, which will be able to see the Project from close proximity for an extended period (refer

Figure 17.1).

The paste fill plant will be mostly visually absorbed, due to the location of features behind the surrounding landscaping ridge of CGO, including the northern waste rock emplacement. However some elements of the paste fill plant will be visible for up to 3 km north of the site. Therefore within the PVC, there are six residential receptors which are considered to have negligible or low sensitivity to the paste fill plant, due to a combination of distance and intervening topography (refer Table 17.4). This includes P3, P20, P29, P31, E1 and E2 (refer Figure 17.1).

Table 17.4 Sensitivity of residential receptors to the paste fill plant

No.	Nearest road	Sensitivity	Reason / Notes
P1	Lake Road	Nil	Distance is ~10 km
P2	Lows Road	Nil	Distance is ~12 km
P3	Buttenshaws Lane	Low	Distance is 4.5 km
P4	Buttenshaws Lane	Nil	Distance is ~8 km; Topography obscuring
P5	Corringle Lane	Nil	Distance is ~6.5 km; Topography obscuring
P6	Wests Lane	Nil	Distance is ~9 km; Topography obscuring
P7	Wests Lane	Nil	Distance is~9 km; Topography obscuring
P8	Wests Lane	Nil	Distance is ~9 km; Topography obscuring
P9	Wests Lane	Nil	Distance is~10 km; Topography obscuring
P10	Clear Ridge Road	Nil	Distance is~9.5 km; Topography obscuring
P11	Clear Ridge Road	Nil	Distance is~10 km; Topography obscuring
P12	West Plains Road	Nil	Distance is ~13 km
P13	Fitzgerald Road	Nil	Distance is ~10 km
P14	Fitzgerald Road	Nil	Distance is ~14 km
P15	Newell Highway	Nil	Distance is ~13 km
P16	Blow Clear Road	Nil	Distance is ~9.5 km; Topography obscuring
P17	Blow Clear Road	Nil	Distance is ~9 km; Topography obscuring
P18	West Plains Road	Nil	Distance is ~14 km
P19	Lonergans Lane	Nil	Distance is ~11 km; Topography obscuring
P20	Lake Road	Negligible	Distance is ~8 km
P21	Lows Road	Nil	Distance is ~8.5 km
P22	Livingstone Road	Nil	Distance is ~13 km; Topography obscuring
P23	Wilsons Lane	Nil	Distance is ~9 km; Topography obscuring
P24	Wilsons Lane	Nil	Distance is ~11 km; Topography obscuring
P25	Lonergans Lane	Nil	Distance is ~11 km; Topography obscuring
P26	Fitzgerald Road	Nil	Distance is ~10 km
P27	Wamboyne Road	Nil	Distance is~12 km; Topography obscuring

Table 17.4 Sensitivity of residential receptors to the paste fill plant

No.	Nearest road	Sensitivity	Reason / Notes
P28	Newell Highway	Nil	Distance is ~12 km
P29	Lake Cowal Road	Negligible	Distance is ~6 km; Topography partially obscuring
P30	Buttenshaws Lane	Nil	Distance is ~10 km
P31	Lake Road	Negligible	Distance is ~8 km
P32	Bonehams Lane	Nil	Distance is ~6.5 km; Topography obscuring
P33	Newell Highway	Nil	Distance is ~10 km
E1	Lake Cowal Road	Low	Distance is ~3.5 km; discounted due to Evolution occupants
E2	Lake Cowal Road	Low	Distance is ~4.2 km; discounted due to Evolution occupants
E3	Blow Clear Road	Nil	Distance is ~6.8 km; Topography obscuring
E4	Uncle Bills Road	Nil	Distance is ~7.8 km; Topography obscuring

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 location 5 km south-west of CGO and currently have views of the southern and northern waste rock emplacements and IWL (refer Photograph 17.1 to Photograph 17.5). The paste fill plant will not be visible from these residential receptors.

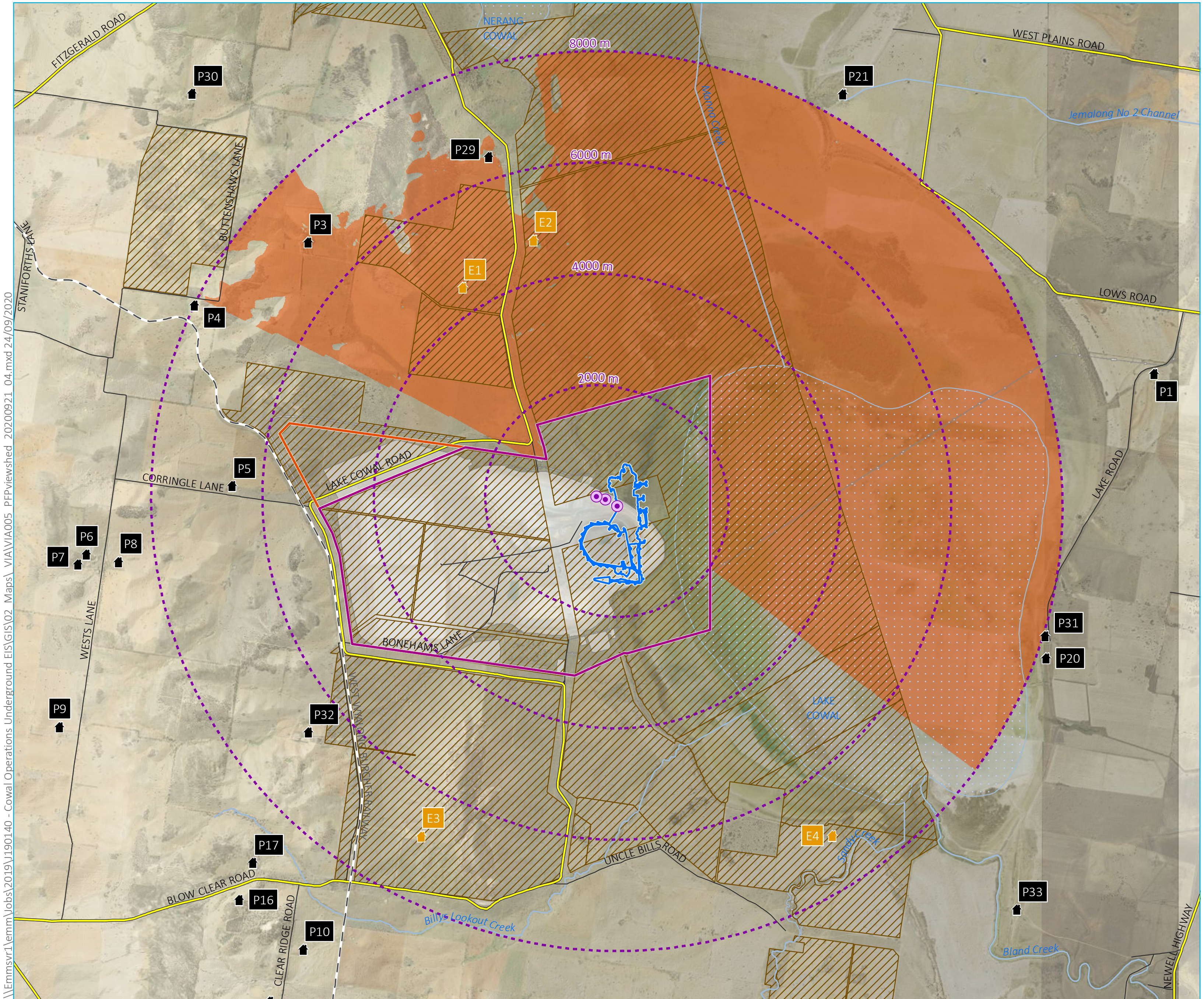
Photograph 17.1 View from Lakeview, at gate (Source: EMM 2020g)

Photograph 17.2 View from Lakeview, at gate, zoomed in with 400 mm lens (Source: EMM 2020g)

Photograph 17.3 View from Lakeview, at office (Source: EMM 2020g)

Photograph 17.4 View from Lakeview, at house (Source: EMM 2020g)

Photograph 17.5 View from Lakeview, at tennis court (Source: EMM 2020g)



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

KEY

- Viewpoint location
- Viewpoint buffer (2000 m increments)
- Visible project infrastucture (assumed 10 m height) - 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
- Evolution-owned land

Rural residences

- Evolution-owned
- Privately-owned

Viewshed for paste fill plant

Evolution Mining
Cowal Gold Operations
Environmental impact statement
Figure 17.1

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ii Roads

The visual sensitivity of roads surrounding CGO has been considered and summarised in Table 17.5. The visual sensitivity of these roads to the Project is mostly ameliorated due to intervening vegetation and topography which obscures views. There are clear views of the site from Lake Cowal Road, Bonehams Lane and Corringle Lane. Visual sensitivity of the Project will be improved by the integration of the Project into the existing site.

Table 17.5 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 paste fill plant and additional lighting will be integrated into the existing site. This will ameliorate the sensitivity of the road to the 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 paste fill plant and additional lighting will be integrated into the existing site. This will ameliorate the sensitivity of the road to the 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 paste fill plant and additional lighting will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Project.
Lows Road	East	There is no visibility of the Project from Lows Road due to the lake protection buttress.
Lake Road	East	There is no visibility of the 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 paste fill plant and additional lighting will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Project.

Table 17.5 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 paste fill plant, height increase to the IWL and additional lighting will be integrated into the existing site. This will ameliorate the sensitivity of the road to the Project.

iii Tourist sites

The visual sensitivity of tourist sites has been considered for Billys Lookout, Lake Cowal Public Reserve and surrounding state forests.

Billys Lookout is located approximately 7 km south-west of CGO, and therefore will have a low visual sensitivity to the 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 Project. State forests surrounding the site include Corringle State Forest and Lake View State Forest. Both state forests are over 8 km away and contain dense vegetation which obscures views of CGO. Therefore, the visual sensitivity of tourist sites is limited.

17.5 Existing environment

The area surrounding the site is generally flat to undulating, with occasional ridges. Land uses near CGO are predominantly agricultural, however there are also State forests, vegetated ridges and surface water features such as Lake Cowal. Wamboyne Mountain and Billy's Lookout are the most elevated points closest to the site. Wamboyne Mountain is 5 km north of the site and is 470 m AHD and Billy's Lookout is 7 km south-west of the site and sits at 368 m AHD.

The site operates 24 hours a day. Therefore there is the need to light the site at night for safety. Despite 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.

17.6 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 Project was assessed as negligible to low.

In accordance with the rating schedule in Table 17.2, the overall visual impact of the Project in consideration of the visual magnitude and visual sensitivity rating is assessed to range in significance from negligible to minor.

17.7 Mitigation measures

The visual effect of the paste fill plant will result from the bulk and height of the proposed elements. These elements can be distinguished from the surrounding environment, which consists of the rock emplacement areas or an earth buttress. Mitigation measures to promote visual integration of the paste fill plant include:

- the finish on external cladding is a muted and neutral colour which matches the palette of the surrounding landscape;
- the finish of external cladding should have low reflectivity; and
- screening plants should be planted to obscure the visual effect of the paste fill plant.

The visual effect of the additional lighting associated with the paste fill plant will integrate with the glow of existing lighting. Evolution is required to take all reasonable and feasible measures to mitigate visual and off-site lighting impacts of CGO under DA 14/98. Mitigation measures in accordance with Australian Standard AS 4282-1997 *Control of the obtrusive effects of outdoor lighting* are already undertaken at CGO and will also be applied to any additional lighting associated with the Project:

- scheduling of mining operations, where practicable, so that evening and night-time operations on the northern and southern waste rock emplacements would be located to reduce the potential for direct lighting impacts to locations outside of the site;
- restriction of night-lighting to the minimum required for operations and safety requirements, where appropriate;
- use of unidirectional lighting techniques; and
- use of light shields to limit the spill of lighting.

17.8 Summary and conclusion

A VIA (EMM 2020g) has been completed for the Project to assess the visual effect of the paste fill plant, and associated lighting.

The visual impact assessment of the Project has considered the visual magnitude of these elements 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 views of the site.

For most residences, roads and tourist areas, the Project will be indistinguishable from the surrounding landscape or obscured by vegetation and topography resulting in a negligible visual impacts.

The Project will be visible to some residential receptors, resulting in a minor impact , however this will be mitigated by ensuring the design of the paste plant integrates it into the existing site, use of vegetation screening and the shielding of light.

The visual sensitivity of roads close to the Project is mostly ameliorated by obscuring vegetation and topography. Where roads are located within 600 m of the site and the CGO is clearly visible, the Project will be integrated into the existing site which will also reduce visual impacts.

Overall, the visual impact of the Project was assessed as having a negligible to minor significance on receptors within the PVC.



Part C – Impact assessment

Chapter 18 Greenhouse gas

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18 Greenhouse gas

18.1 Introduction

For clarity and simplicity, this section summarises the greenhouse gas (GHG) assessment completed by EMM as part of the AQIA, which considers GHG emissions associated with all aspects of the Project - ie underground aspects and the changes to surface infrastructure.

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 Project in accordance with 'Method 1' of the National Greenhouse and Energy Reporting Measurement (Technical Guidelines) (DoE 2014).

18.1.1 Secretary's Environmental Assessment Requirements

The SEARs for the Project require Evolution to assess the Project's potential emissions of GHG. The requirements and sections in which they are addressed are shown in Table 18.1.

Table 18.1 GHG related SEARs

Requirement	Location in EIS
Air Quality – including: i. an assessment of the likely greenhouse gas impacts of the development;	This chapter addresses the proposed modification and underground development's potential GHG contribution. The AQIA is attached as Appendix B.

18.2 Summary of Greenhouse Gas Assessment

A more detailed summary of the GHG assessment is provided in section 6.13 for Mod 16. This is because the majority of additional GHG emissions will result from the surface facilities proposed under Mod 16. The GHG assessment cumulatively considers impacts from both the Project and Mod 16. A brief summary of the GHG assessment has been provided below in Table 18.2, including the research method, predicted impacts and mitigation measures described in the GHG assessment.

Table 18.2 Summary of the GHG assessment

Aspect	Summary
Research method	The research method included definition of the emission sources to result from the Project, including Scope 1, 2 and 3 emissions, followed by estimation of the annual energy consumption for the Project. Scope 1 emissions are direct emissions which occur within the boundary of an organisation because of that organisation's activities and include direct emissions from fuel combustion and explosive usage (DoEE 2019). Scope 2 and 3 emissions are indirect emissions which are generated from that organisation's activities but are physically produced by the activities of another organisation (DoEE 2019). Scope 2 emissions include the consumption of purchased electricity and Scope 3 emissions include indirect upstream emissions from diesel production and lost electricity. The Project's estimated energy consumption, including electricity, diesel consumption and explosive usage and were provided by Evolution. From this, Scope 1, 2 and 3 emissions were predicted by applying the methodology outlined in the NGAF workbook (DoEE 2019). Scope 1 emission factors were applied to diesel and explosive consumption and Scope 2 emission factors were applied to electricity consumption.
Predicted impact	The GHG impact assessment of the Project is based upon the predicted GHG emissions from diesel, electricity and explosive consumption during the construction and operational (from 2021 to 2039) phases of the Project. A summary of the estimated annual diesel, electricity and explosive consumption from 2021 to 2039 is provided in Table 9.2 of the AQIA. The Project 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. A summary of the estimated annual GHG emissions from 2021 to 2039 is provided in Table 9.3 of the AQIA. 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. 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.
Mitigation measure	The existing Air Quality Management Plan for CGO will be applied to the Project, which includes the following GHG related mitigation measures: • regular maintenance of plant and equipment to minimise fuel consumption; • efficient mine planning (eg minimising rehandling and haulage of materials) to minimise fuel consumption; • consideration of energy efficiency in the plant equipment selection phase; and • implementation of a biodiversity offset program. Opportunities to improve energy efficiency will be investigated on an ongoing basis throughout the life of the Project. Additionally, Evolution will continue to measure energy consumption and calculate and report Scope 1 and 2 GHG emissions in accordance with the requirements of the NGER Act.

Part C – Impact assessment

Chapter 19 Hazards, public safety and health

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19 Hazards, public safety and health

19.1 Introduction

This chapter provides an assessment of the hazards, public safety and health aspects of the Project in accordance with the assessment requirements.

It includes 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 Project and proposed mitigation measures required to address them.

19.1.1 Secretary's Environmental Assessment Requirements

The SEARS require an assessment of the Project's potential impact on hazards, public safety, and health. The requirements and EIS sections where they are addressed are listed in Table 19.1.

Table 19.1 Hazard, public safety and health related SEARs

Requirement	Location in the EIS
Hazards - including an assessment of the likely risks to public safety, bushfire risks, and the handling and use of any dangerous goods;	This chapter

19.2 Overview of current operations and existing hazards to public safety and health

A Preliminary Hazards Analysis (PHA) (Barrick 1999) was prepared as part of CGO's original EIS 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;
  - 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.

19.2.1 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% 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 section 19.7) 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.

19.2.2 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); and

- 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.

19.2.3 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.

19.2.4 Risks to public property

During the transport of personnel and materiel to site, there is the risk of damage to public property arising from a vehicle impact with a property (be it a house or car) or from an explosion.

19.2.5 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.

19.3 The risk assessment process for the proposed Project

The steps for identifying new risks associated with the proposed Project are outlined below:

1. Identification of potential receptors in relation to the proposed modification.
2. Review the proposed Project's 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 (Table 19.2) and the consequence (Table 19.3) of that occurrence. The outcome of this, a risk rating, is then used to prioritise the prevention or mitigation of those risks. Table 19.4 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 19.2 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 19.3 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 19.4 Risk assessment matrix

	Consequences				
Likelihood	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

19.4 Identification of potential receptors

The site is remote and surrounded by agricultural land used for cattle grazing or cropping to the north, south and west of the site. Lake Cowal is situated to the east.

Potential receptors include the eight private landowners within a 5 km radius of the Project.

19.5 Identification of new hazards, public health and safety risks related to the proposed Project

The main new Project activity with the potential to affect public health and safety is blasting. This is largely due to potential impacts of ground vibration from underground blasting.

Blasting activities will result in an increased consumption of blasting consumables, including ammonium nitrate and ammonium nitrate emulsion. Associated risks for the increase of these blasting consumables form part of the scope for the surface changes and are therefore addressed in Mod 16 to the existing development consent. Additionally, key hazard risks are associated with the transport of materials/hazardous substances are addressed in Mod 16.

19.6 Risk assessment and management of new risks

As outlined in section 19.3, step three of the risk assessment process assigns the likelihood and consequence criteria outlined in Table 19.2 and Table 19.3 respectively to determine a risk rating outlined in Table 19.4.

An assessment of all risks associated with the new activities related to the Project is provided in Table 19.5. 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.

In the presence of control measures, all scenarios evaluated were low or medium risk. These risks are currently being managed by CGO's management plans, which will be updated to include these new activities.

Table 19.5 Risk assessment and management

Activity	Associated risk	Risk rating	Risk mitigation measure/identification of existing management controls in place	Residual risk after controls
Blasting activities - potential impacts of ground vibration from underground blasting on the environment	Potential impacts of ground vibration unsettles birds resulting in reduced breeding/disrupted feeding and potential population decline.	4 Medium	Existing management controls include: • 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 blast emissions. • The bird behaviour monitoring is expected to continue during the Project in accordance with the CGO Flora and Fauna Management Plan and hence no significant impact is anticipated as a result of underground blasting. Therefore, this risk is currently being managed and will continue to be managed with existing management plans detailed further in section 19.7.	3 Low

19.7 Mitigation measures

The original PHA included several recommended risk reduction measures to reduce the likelihood or 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).

The summary of identified risks discussed in section 19.6 and the relevant current management plans and studies available to address them is provided in Table 19.6. In the presence of control measures, all scenarios evaluated were low or medium risk. These risks are currently being managed by CGO's management plans, which will be updated to include these new activities.

Table 19.6 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 • Hazardous Waste and Chemical Management Plan (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 propose Project's determination.

19.7.1 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 the Department of Infrastructure, Planning and Natural Resources (DIPNR). The HAZOP Study addresses the monitoring, control, alarm and shutdown systems associated with the cyanide process.

19.7.2 Final Hazard Analysis

A Final 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 Project 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 Project does not pose any unacceptable levels of risk.

19.7.3 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.

19.7.4 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.

19.7.5 Emergency Response Plan/Pollution Incident Response Plan

In accordance with Development Consent Condition 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.

19.7.6 Blast Management Plan

The BMP (Evolution 2015a) 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.

19.7.7 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.

19.7.8 Hazardous Waste and Chemical Management Plan

A Hazardous Waste and Chemical Management Plan (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.

19.7.9 Transport of Hazardous Materials Study

Multiple transport of hazardous materials studies has been completed in accordance with Development Consent Condition 5.4(b)(i). Each study 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 CGO site.

Issues associated with spills, clean-up procedures, training of clean-up teams, communication, and liaison with organisations are also addressed in the studies.

19.7.10 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.

19.7.11 Implementation plan to protect fauna from interactions with the tailings storage facilities

This 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.

19.8 Summary and conclusion

The hazards, public safety and health aspects of the Project have been considered in accordance with the SEARs.

Predicted impacts relating to hazards, public safety and health for the Project primarily includes risks associated with blasting activities. These risks will be addressed in the development (where applicable) and updating of existing site management plans for the construction and operation phases of the Project.

Part C – Impact assessment

Chapter 20 Waste management

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20 Waste management

20.1 Introduction

This chapter outlines the current waste management measures for the site and outlines any additional waste streams likely to be generated for the Project.

Waste will be managed in accordance with the requirements of the POEO Act, *Waste Avoidance and Resource Recovery Act* 2001 (WARR Act), Protection of the Environment Operations (Waste) Regulation 2014*, Waste Classification Guidelines* (EPA 2014a) and the *Waste avoidance and resource recovery strategy 2014-21* (EPA 2014b). Evolution already uses the general hierarchy of waste minimisation principles such as reduce, reuse and recycle to minimise the quantity of waste that must be disposed off-site. No on-site rubbish disposal or landfill is proposed.

20.1.1 Secretary's Environmental Assessment Requirements

The SEARS require an assessment of the Project's potential impact on waste. The requirements and EIS sections where they are addressed are listed in Table 20.1.

Table 20.1 Waste related SEARs

Requirement	Location in the EIS
Waste – including identification, quantification and classification of the likely waste streams likely to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste;	Chapter 20.

20.2 Applicable legislation, policies, and strategy

20.2.1 Waste and Resource Recovery Strategy 2014-21

The *Waste and Resource Recovery Strategy* 2014-21 (EPA 2014b) 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 Project will be managed in accordance with the *Waste and Resource Recovery Strategy* 2014-21 (EPA 2014b), including incorporating management measures to ensure waste is appropriately reused, recycled or disposed of. The primary aims of waste management during the Project will be the prevention and avoidance of waste generation, recycling and the use of renewable and recycled materials. Waste management is further discussed in section 20.3.4.

20.2.2 Protection of the Environment Operations Act 1997

The POEO Act is the key piece of environmental legislation administered by the Environment Protection Authority (EPA).

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 that will be generated by the Project have been classified as per the POEO Act (and the Waste Classification Guidelines (EPA 2014a)) and are further discussed in section 20.3.1.

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-cut 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.

20.2.3 Protection of the Environment Operations (Waste) Regulation 2014

The POEO Regulation provides for enforcement penalties in support of the POEO Act.

Under Part 2 of the POEO Regulation, unlicensed waste (waste that is not controlled by an EPL) can be disposed of at a licenced waste facility, however a levy liability will be placed on the disposer for all waste received at the licenced waste facility. A levy payment will be triggered if waste is stored for more than 12 months or stockpiled illegally at the licenced waste facility or disposed of to landfill. The levy payment is then required to be paid by the disposer, licenced waste facility and landfill facility. The levy liability is extinguished if the waste is transported off-site of the licenced waste facility to be lawfully recovered, recycled or processed.

This would apply to any construction and demolition waste resulting from the Project that is taken to licensed waste facility.

20.2.4 Waste Classification Guidelines

The *Waste Classification Guidelines* (EPA 2014a) 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 Project will be classified in accordance with Waste Classification Guidelines: Part 1 Classifying Waste (EPA 2014a) 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).

20.2.5 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.

20.3 Existing environment

20.3.1 Identified waste streams

The type and quantity of waste produced is likely to include:

- domestic waste;
- sewage effluent;
- waste hydrocarbons including lubricating oils, hydraulic oils, degreasing fluids, diesel and petroleum fuels;
- vehicle batteries and tyres;
- general construction waste; and
- spent spill recovery/clean-up materials.

Table 20.2 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 20.2 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.

Table 20.2 Existing waste classification, transport, handling and disposal

Waste type	Waste classification	Major source	Handling	Transport/disposal
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.
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.

Table 20.2 Existing waste classification, transport, handling and disposal

Waste type	Waste classification	Major source	Handling	Transport/disposal
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 hydrocarbon s	General solid waste (putrescible)	Minor spills.	Treated in Bioremediation Facility	Disposal on-site in waste emplacements

20.3.2 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 Chapter 19.

20.3.3 Tailings and waste rock emplacements

Waste rock disposal is in three waste rock emplacement sites within the mine site: 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 % solids and deposited into the NTSF and STSF. 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.

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 2015b), Monitoring Programme for Detection of Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls (Barrick 2003b) and Cyanide Management Plan (Evolution 2006).

20.3.4 CGO's waste management plan and strategy

Section 7 of CGO's approved HWCMP outlines the sites waste management and the current Waste Management Strategy is implemented on site, 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.

20.4 Predicted impacts

The Project will not introduce any new waste streams during the construction and operation and, as a result, no changes are required in the existing management measures for waste as outlined in Table 20.2.

20.4.1 Tailings waste management

i Opportunity to reuse tailings waste

The construction and operation of the paste fill plant will be in accordance with the waste management hierarchy outlined in the CGO's current waste management strategy. Specifically, the paste production process will utilise the hierarchy and reuse the tailings waste to make paste for backfilling. The paste material will be delivered to the underground workings via a borehole near the paste fill plant.

ii Tailings management

Although the ore testing results from the geochemical assessment (Appendix O) completed for the Project are generally considered to be geochemically similar to that from the previous investigations, results have identified the possible occurrence of a small quantity of potentially acid forming (PAF) and/or potentially acid forming low capacity (PAF-LC) material within the ore. Because of this, there will be an increased risk of some of the tailings being PAF or PAF-LC and additional recommendations have been included in section 20.5.

20.4.2 Waste rock for the underground development

The results from the geochemical assessment (Appendix O) for the Project 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 will not need to be modified to accommodate the development waste.

20.4.3 Mine rock for the underground development

The results from the geochemical assessment (Appendix O) for the Project confirm that the mine rock is expected to be geochemically similar to the general (not oxide) waste rock assessed within the current and previous investigations, and therefore no special management requirements will be required for within the underground workings.

20.5 Mitigation measures

Evolution's HWCMP will be reviewed and updated in accordance with consent conditions for the Project and 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 2014a);
- 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.

Additionally, the following recommendations have been included for the tailings management:

- Due to the potential risk that some of the tailings from the proposed underground operations would be PAF or PAF-LC a program will be undertaken to geochemically characterise tailings to ensure appropriate management. This characterisation program for the process tailings is expected to involve the routine collection of the discharge tailings over a period of time.

- Previous investigations have identified the risk of the tailings from the open-pit operations as being saline and likely to cause the development of saline conditions within the TSF. As a result, the TSF closure design will include a cover of oxidised rock in order to avoid development of a salt pan and enable revegetation to avoid dust lift-off in the longer term.

- The water quality monitoring program is to be updated.

20.6 Summary and conclusion

Any additional waste will be managed in accordance with all relevant legislation, guidelines and the relevant conditions of EPL 11912. The general hierarchy of of waste minimisation principles will also be applied, such as reduce, reuse and recycle to minimise the quantity of waste that must be disposed of off-site. Any additional hazardous and dangerous goods and liquid wastes will be managed in accordance with CGO's approved HWCMP. Additional waste rock and tailings will be stored at the existing waste rock emplacement areas and the IWL respectively. Existing monitoring at both of these elements will continue through the Project.

No new waste streams will be generated as part of the Project and therefore no changes to the existing waste management measures are required. Evolution's HWCMP will be reviewed and updated in accordance with consent conditions for the Project. Additional tailings from the underground development will be appropriately managed to prevent any geochemical impacts to groundwater and surface water quality.

Part C – Impact assessment

Chapter 21 Social

EMM
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21 Social

21.1 Introduction

A social impact assessment (SIA) was prepared by Elton for the Project 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 of the Project, as well as appropriate measures for managing adverse social impacts and enhancing potential benefits.

The SIA considers the social impacts associated with all aspects of the Project, including both the underground development and the changes to surface infrastructure which are being considered separately under Mod 16 to DA14/98. It is provided in full in Appendix M.

21.1.1 Secretary's Environmental Assessment Requirements

The relevant SEARs and sections in which they are addressed are summarised in Table 21.1.

Table 21.1 Social impact related SEARs

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.	Chapter 21. Appendix M
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).	Chapter 5.

21.2 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.

21.2.1 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 important issues for the region. Lake Cowal is valued by community and environmental groups due to its environmental, social and cultural values.

21.2.2 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 Project and had several options on how to provide feedback on the Project 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 Project due to several potential social and economic benefits that would result from the Project and continued operations at CGO.

21.3 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 21.2, 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 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 160 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 high proportion of the incoming workforce would be single males). As summarised in Table 21.2, 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, the environmental impacts of the Project 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 21.2 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 21.2 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

21.4 Mitigation measures

The mitigation measures summarised in Table 21.3 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 Project's Community and Stakeholder Engagement Plan (CSEP). The objectives of the SIMP will include:

- to ensure community and stakeholder engagement is maintained through all phases of the Project; and
- to align the 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 21.3 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, eg 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)

Table 21.3 Summary of mitigation measures

Impact category	Significance and nature of impact before mitigation	Mitigation measures	Residual significance and nature of impact
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 relations in West Wyalong. • Provide relocation support or incentives for workers to relocate with their dependents or families.	Low (negative)
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)

Table 21.3 Summary of mitigation measures

Impact category	Significance and nature of impact before mitigation	Mitigation measures	Residual significance and nature of impact
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)
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)

Table 21.3 Summary of mitigation measures

Impact category	Significance and nature of impact before mitigation	Mitigation measures	Residual significance and nature of impact
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)
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)

21.5 Cumulative impacts

Major projects with current or future proposals with DPIE and in proximity to CGO which may contribute to cumulative impacts are summarised in Table 21.4.

Table 21.4 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 21.3 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 Project and other developments summarised above are provided in Table 21.5. This includes the likelihood of occurrence of each impact and the subsequent consequence and significance rating.

Table 21.5 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)

21.6 Summary and conclusion

A SIA was completed for the Project 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 of the Project, 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 of the Project. Several communication methods were used to ensure community members that could be directly or indirectly affected by the Project, and other relevant stakeholders, were kept informed about the Project and provided feedback on the Project as it progressed.

In general, community and stakeholder engagement efforts have shown that there is widespread support for the Project in the local and regional community due to the many potential social and economic benefits that will result from the Project and continued operations at CGO.

The Project is expected to have a positive impact on surrounding communities. The Project 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 potential negative social impacts which also relate to the Project. These mainly relate to the potential impacts to the housing market in the region due to the influx of a new workforce. The preferred option is to construct 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.

There is the possibility that the economic benefits to local towns may not be fully realised due to the incoming workforce being mainly FIFO or DIDO workers, particularly in the early stages of the Project. However, Evolution's intention is to follow its existing practices and localise the workforce as soon as is practicable, to maximise local benefits.

Other potential negative impacts relate to the environmental impacts to nearby landowners, 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. This will help to ensure that the overall mining operation continues to be a respected member of the local community.

Other mitigation for potentially 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.

The Project will generally result in positive impacts 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 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 benefits in the region.

Part C – Impact assessment

Chapter 22 Economic

EMM
creating opportunities

Evolution
MINING

22 Economic

22.1 Introduction

This chapter provides a summary of the economic impact assessment completed by AEC for the underground development, which is provided in full in Appendix N. The assessment holistically takes into consideration the economic effects of establishing the Project and, mining and processing the ore from the underground mine. While ore processing is not part of this EIS it is intrinsically linked to the Project and is being assessed as part of Mod 16 to the existing development consent at the site. The assessment was prepared in accordance with the *Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals* (DPE 2015).

22.1.1 Secretary's Environmental Assessment Requirements

The SEARs and sections where they are addressed in this document are provided in Table 22.1.

Table 22.1 Economics-related SEARs for the underground development

Requirement	Location in the EIS
• an assessment of the likely economic impacts of the development, paying particular attention to the:	
– significance of the resource	Chapter 22
– economic benefits of the development for the State and region; and	Chapter 3
– demand for the provision of local infrastructure services.	Appendix N

22.1.2 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 Project in the locality, specifically impacts on local employment and non-labour Project expenditure. It also considers social impacts on the local community in relation to the source of labour and accommodating the workforce for the Project.

It uses computable general equilibrium (CGE) modelling techniques to model the impact of the Project in the State and regional economy. The assessment identifies the economic impacts specific to the Project compared to what would be anticipated if the Project did not proceed.

The LEA considers the 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 of the Project to the State economy, by considering the relevant economic, social and environmental costs and benefits of the Project.

The method used in the CBA is outlined in Appendix N. 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 Project. Consideration has also been given to potential impacts that may extend beyond this timeframe, however, given the nature of this 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).

22.2 Existing environment

The population of the Bland, Lachlan and Forbes LGAs (or the 'Catchment') 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[7]. 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.

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.

[7] 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

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.

22.2.1 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 Asia Pacific (Core Logic) (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.

22.3 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 Project. These estimates represent the net change in the respective indicators compared to Projected growth in the Catchment (and state) economy without the Project proceeding. Assumptions used in developing baseline estimates of growth are outlined in Appendix N.

The direct activity associated with each stage (construction and operations) is outlined in section 22.3.2. 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 Project in aggregate across all relevant stages of activity each year.

22.3.1 Potential beneficial impacts

Key beneficial impacts arising from the Project are outlined in Table 22.2. Beneficial impacts are examined in the context of what would otherwise occur if the Project did not proceed.

Table 22.2 Beneficial impacts

Impact	Description
Economic Growth	The 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 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 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 Project (2024-25 to 2031-32).
Employment and Incomes	The Project will increase employment during construction and operations, compared to what would occur without the Project, flowing from both direct and flow-on impacts. Including both direct and flow-on (supply chain) impacts, the 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 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 Project will create opportunities to secure new contracts and increase sales of goods and services to the Project with associated flow-on impacts in the supply chain during all phases of the 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 Project include business services, trade, public services, health and education. The Project will also support local suppliers and contractors, providing additional security and longevity of business incomes (and employment) in the region.

Table 22.2 Beneficial impacts

Impact	Description
Government Revenue	The Project will provide a lift in State and Australian government taxation revenues through a variety of taxes and duties. Overall, the 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 Project; and • $174.8 million in additional revenue to the NSW Government compared to what would occur without the 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.

22.3.2 Potential adverse impacts

Table 22.3 summarises the predicted impacts in consideration of what would otherwise occur if the 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 22.3 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 Project), the impacts of the 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 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

Table 22.3 Adverse impacts

Impact	Description
	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-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.

22.3.3 Contribution to the economy

The Project will generate considerable output and gross product, both:

- **directly**, through construction activity and the extraction and export of saleable gold; and
- **indirectly**, through additional demand for goods and services to support the Project, household consumption effects as a result of additional wages and salaries paid, and government expenditure through additional taxation revenues.

i 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 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.

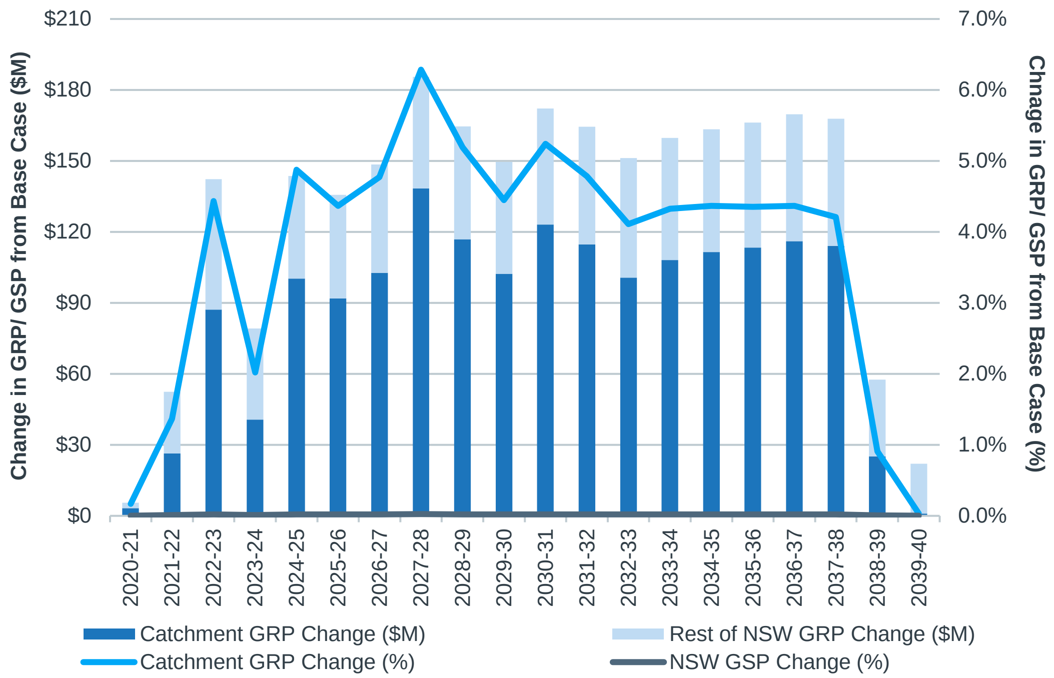


Figure 22.1 Annual impact of the Project's GRP and GSP

ii Industry output

The industry output considers the 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 Project, as the economic output of the 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 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 22.4.

Table 22.4 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).

22.3.4 Contribution to employment and wages

i Employment

Jobs supported by the 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 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 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 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 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 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 Project will extend the life of mining operations in the Catchment. The operations phase of the 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 Project and the boost it provides to both the Catchment and to NSW.

The modelled change in employment is shown in Table 22.5.

Table 22.5 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 (%)
Agriculture, forestry & fishing	-7	-0.2%	-15	0.0%	-2	0.0%	-16	0.0%
Mining	22	4.8%	12	0.0%	214	42.9%	205	0.5%
Manufacturing	-6	-1.2%	-46	0.0%	-10	-2.2%	-83	0.0%
Electricity and water	-2	-3.3%	-10	0.0%	-2	-3.0%	-9	0.0%
Construction	111	20.4%	86	0.0%	9	1.6%	-18	0.0%
Trade	16	1.0%	47	0.0%	10	0.6%	37	0.0%

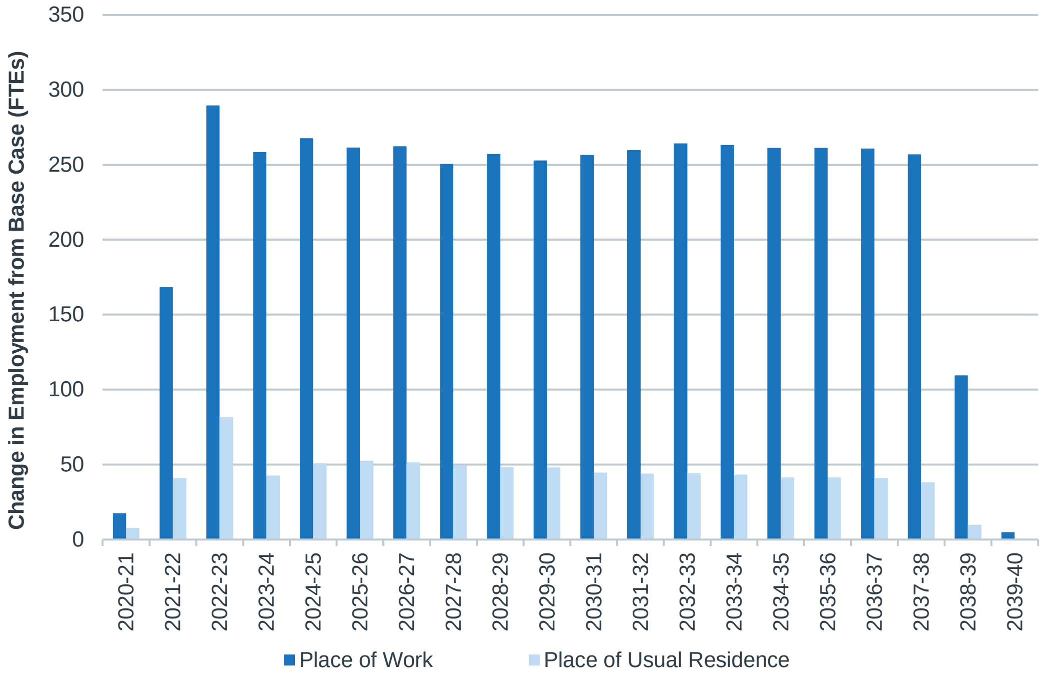
Table 22.5 Change in employment

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 (%)
Transport and storage	1	0.5%	-4	0.0%	2	0.8%	-25	0.0%
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).

ii 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 22.2 Annual Impact on Employment in the Catchment, Deviation from the Base Case, Place of Work versus Place of Usual Residence

22.4 Contribution to Government Revenues

22.4.1 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[8]. In estimating the royalty rate, all processing costs have been deducted on the assumption that these represent allowable deductions.

22.4.2 Tax Revenues

The NSW Government is expected to receive around $175 million in additional revenue, primarily through royalty payments, over the life of the 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 22.6.

Table 22.6 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.

[8] 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).

22.5 Cost benefit analysis

The CBA identifies that the Project is economically desirable for NSW with the benefits outweighing the costs across all discount rates examined (4%, 7% and 10%) (refer Table 22.7). Assuming a discount rate of 7%, the 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.
- a benefit-cost ratio (BCR) of 1.18, highlighting that the Project is estimated to return $1.18 for every dollar cost.

Table 22.7 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				
NPV	-	**$514.2**	**$314.4**	**$177.2**
BCR	-	**1.23**	**1.18**	**1.12**

22.6 Sensitivity Analysis

The sensitivity analysis has been undertaken using a Monte Carlo analysis (refer Appendix N) across the key assumptions used in the CBA modelling (the base assumptions used are outlined in section 22.5).

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 22.8. 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 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 22.8 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.

22.7 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 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 Project.

22.7.1 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 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.

22.7.2 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 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.

22.7.3 Mitigation Strategy 3: Minimise Impacts on the Local Property Market

The Project is likely to yield some inward migration to Bland, in particular West Wyalong, to take up jobs generated by the 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.

22.8 Summary and conclusion

The CBA and local effects analysis both show that the Project is expected to yield a range of economic benefits to the region, the State and to Australia. In particular:

- A NPV of $314.4M 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 Project is estimated to return $1.18 for every dollar cost.
- Royalties to the State of $174M and taxation revenue of $556M.

The 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 Project. A large proportion of the construction and initial operational workforce will be FIFO or DIDO for the 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.

Part C – Impact assessment

Chapter 23 Summary of commitments

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23 Summary of commitments

23.1 Introduction

This chapter provides a consolidated summary of the commitments made to manage, mitigate and/or monitor impacts during the construction and operation of the Project.

23.2 Environmental management system

Environmental aspects of the Project will be managed under Evolution's existing environmental management system (EMS) for CGO. Evolution is certified under the EMS standard ISO 14001 for 'mining and ore processing operations and support services for gold and silver production' (certification number EMS 717917).

The EMS will be updated to contain details of the new construction environmental management plan (CEMP) and operational environmental management plan (OEMP). The CEMP and OEMP will be prepared by suitably qualified persons and in consultation with relevant government agencies where deemed necessary. The CEMP and OEMP will be prepared to be consistent with the relevant conditions of development consent and statutory obligations. Further detail on the content of these plans is provided below.

23.2.1 Construction Environmental Management Plan

The CEMP will provide a framework for the management of potential material construction impacts identified in this EIS. It will describe the processes and procedures for the management of these specific environmental aspects and mitigation of impacts, as well as any specific monitoring and construction rehabilitation measures to be undertaken.

The CEMP will also contain provisions for site-specific training and induction of construction personnel so that they are made aware of the requirements in the CEMP that are relevant to their respective work activities.

23.2.2 Operational Environmental Management Plan

The OEMP will contain the impact-specific management measures to be implemented during operations, including timeframes and responsibilities. The OEMP will contain a number of sub-plans, which are anticipated to include:

- water management plan, comprising:
  - a surface water management plan, including an erosion and sediment control plan; and
  - a groundwater management plan;
- noise, vibration and blasting management plan;
- air quality management plan;
- traffic management plan;
- rehabilitation management plan;
- hazardous materials management plan;
- a social impact management plan including a stakeholder engagement plan;

- Aboriginal cultural heritage management plan;
- historic heritage management plan; and
- waste management plan.

These individual management plans that support the overarching OEMP will describe the processes and procedures for the management of specific environmental aspects and mitigation of impacts, as well as any specific monitoring and construction rehabilitation measures to be undertaken.

Where possible, the above management plans will be integrated with the existing approved management plans for CGO.

The OEMP will also contain provisions for site-specific training and induction of employees and relevant contractors so that they are made aware of the applicable requirements to their respective work activities.

23.3 Environmental management strategy

Environmental aspects of the Project will be managed under the existing environmental management strategy as described in *Cowal Gold Operations Environmental Management Strategy* (Evolution 2018). The environmental management strategy was prepared in accordance with Condition 9.1(a) of DA 14/98 and provides a strategic framework for environmental management at CGO including the implementation of relevant approvals, licenses, monitoring and rehabilitation principles.

The EMS will be updated in consideration of any new approvals, licences and additional monitoring or rehabilitation principles that are associated with the Project.

23.4 Summary of commitments

A summary of the proposed mitigation, management and monitoring measures for the Project is presented in Table 23.1.

Table 23.1 Summary of commitments

Subsidence
Minimisation of stope overbreak and the probability of chimney failure To mininise the risk of stope overbreak and limit the probability of chimney failure, the following measures will be undertaken as is necessary in consideration of the conditions and safety of implementing the measures: • any stopes that are not wholly in fresh rock will be removed from the mining schedule; • a detailed crown pillar stability assessment has been conducted based on the mine design and stoping sequence on the upper sub levels of the mine; • stope sequencing will be implemented to minimise the risk of failure and unravelling along faults, particularly where stopes are bounded by multiple faults; • undertaking top down drilling of the upper stopes to provide access to the top of the stope (ie the overcut drive); • stopes will be backfilled in a timely manner and will be tight filled as far as practicable; • stope crowns will be cable bolted when appropriate; • a continuous mining sequence will be employed; • regular inspection of the uppermost developed level; and • undertaking in situ stress measurements in each stope. *Stope Stability* An initial stope stability assessment has been completed. As a result of this assessment appropriate modifications to the overall mine design and stoping sequence has been made. Control measures to minimise the potential for stope overbreak or probability of chimney failure are listed below. However, depending on local geological conditions encountered, CGO will review the list below and select the controls appropriate to the conditions encountered: • All design work will adhere to the detailed crown pillar stability assessment that was conducted for each stope on the upper mining levels. We recommend the use of empirical methods as a minimum, or a combination of empirical and numerical methods. The mine must ensure the risk of crown pillar failure is suitably controlled. • Stope sequencing to minimise risk of failure and unravelling along faults, particularly where stopes are bounded by multiple faults. Multiple stopes in close proximity should not be mined at the same time. • Top down drilling of the upper stopes, to provide access to the top of the stope (the overcut drive) which enables cablebolting of the stope crown and hangingwall and access for rapid tight filling with paste. • Tight filling stopes, as far as practicable. • Backfilling stopes in a timely manner. • Developing the overcut drive with a downwards grade from the access, to enable the stopes to be tight filled to the backs with paste. • Ensuring paste lines and other backfill infrastructure is in place prior to firing stopes with potential for instability or in proximity to major faults. • Reducing the strike length and width of stopes to reduce potential instability. A review of the stope dimensions should be conducted following stope development and structural mapping of the area. • Cablebolting of stope crowns, when appropriate. • Reviewing the stand-off distance between stope walls and major faults, such as the Glenfiddich fault and Galway Splays. • Employing a continuous mining sequence, as secondary stopes have a higher risk of instability (generally). • Avoiding mining stopes where major faults confluence in proximity to the stope, particularly near sub-vertical faults such as the Glenfiddich fault and Galway splays. • Undertaking detailed stope stability assessments using geotechnical information from future drilling programmes, laboratory testing and rock mass characterisation from underground exposures. • Stability monitoring of stopes and implementing a Trigger Action Response Plan to backfill stopes that show early signs of large scale instability.
Air quality
Continued implementation of Air Quality Management Plan (AQMP)

Table 23.1 Summary of commitments

Subsidence
Particulate emissions
Air quality impacts will continue to be managed in accordance with the AQMP (Evolution 2018), including the following measures for the Project: • transport routes to be clearly marked; • prevention of truck overloading to reduce spillage during ore loading/unloading and hauling; • increased watering of exposed surfaces via water trucks or other methods as required; • freefall height during ore/waste stockpiling will be limited; • soil stripping will be limited to areas required for mining operations; • limiting disturbance to only the minimum area necessary for mining operations; • dust aprons will be lowered during drilling for collection of fine dust; • fine material collected during drilling will not be used for last stemming; • adequate stemming will be used at all times; and • during non-operational periods, dust suppression measures will be undertaken to minimise dust emissions from dry exposed areas.
Diesel emissions
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.
Noise and vibration
Continued implementation of Noise Management Plan
Noise and vibration impacts will continue to be managed in accordance with the NMP (Evolution 2018) and BMP (Evolution 2015), including the following measures: • 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. Best management practice will continue to be implemented where necessary to reduce CGO noise emissions, and will include the following measures: • scheduling the use of any noisy equipment during daytime where practicable; • siting noisy plant and equipment behind structures that act as barriers where practicable, or at the greatest distance from the noise-sensitive area where practicable, or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve maximum attenuation; • where there are several noisy pieces of equipment operating at a given time, scheduling operations so that where possible they are used separately rather than concurrently; • keeping equipment well maintained; • employing 'quiet' practices when operating equipment (eg positioning idling trucks in appropriate areas); • reducing the speed limit where practicable, 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

Table 23.1 Summary of commitments

Subsidence
specify maximum noise/sound levels when purchasing equipment; and
• include maximum noise/sound levels in tender documents and contracts. 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 to lodge complaints. The NMP and the BMP for the site will be updated where relevant following determination of the Project.
Groundwater
Continued monitoring
Continued groundwater monitoring to validate the predictive modelling, particularly in the vicinity of the open-cut pit, TSFs, stopes and access tunnels and ML1535 saline groundwater supply borefield.
Surface water
Surface water monitoring will continue to be undertaken in Lake Cowal (when lake water levels permit) at monitoring sites along the six transects used during the baseline monitoring programme to enable evaluation of water quality data against records of baseline monitoring. The monitoring program and associated annual site water management system performance reviews continue to be undertaken over the life of the Project.
Aboriginal heritage
Unexpected finds protocol
An unexpected finds protocol for Aboriginal heritage objects and skeletal remains will be in place during construction and operation of the Project. In the event new Aboriginal heritage objects are discovered during construction or operation of the Project, it will be managed in accordance with the conditions of AHIP Consent 1467/Permit 1468 and IACHMP.
Historic heritage
Unexpected finds protocol
An unexpected finds protocol will be added to the existing Heritage Management Plan (HMP) for CGO and will provide guidance to the construction and operational workforce should works uncover historic heritage items that may indicate relics.
Traffic
Road quality monitoring and maintenance
The following mitigation measures will be carried out: • Evolution will monitor the road quality of Wamboyne Road, Blow Clear Road, Bonehams Lane and Lake Cowal Road as part of the existing transport routes. • Responsibility for road maintenance of Wamboyne road and Blow Clear Road is proposed to 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. • Evolution will review the existing monitoring measures noted in the Traffic Management Plan to consider the increase of light and heavy vehicles using the route between CGO and West Wyalong during the construction and operational stages of the Project to ensure the continual effectiveness of these measures.
Rehabilitation and closure strategy
Rehabilitation monitoring
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

Table 23.1 Summary of commitments

Subsidence
Management Plan and MOP. An annual rehabilitation report will be prepared, and a summary of this report will be included in the Annual Review.
Visual
Visual integration of the pastefill plant
The visual impact of the paste fill plant will be mitigated through: • a muted and neutral colour finish which matches the palette of the surrounding landscape; • the finish having low reflectivity; and • screen planting to soften the visual effect of the paste fill plant from outside the site.
Lighting
Mitigation measures in accordance with Australian Standard AS 4282-1997 *Control of the obtrusive effects of outdoor lighting* are already undertaken at CGO and will also be applied to any additional lighting associated with the Project: • restriction of night-lighting to the minimum required for operations and safety requirements, where appropriate; • use of unidirectional lighting techniques; and • use of light shields to limit the spill of lighting.
Greenhouse gas
Continued implementation of Air Quality Management Plan (AQMP)
The existing AQMP for CGO will be updated as relevant to the Project, which includes the following GHG related mitigation measures: • regular maintenance of plant and equipment to minimise fuel consumption; • efficient mine planning (e.g. minimising rehandling and haulage of materials) to minimise fuel consumption; and • consideration of energy efficiency in the plant equipment selection phase.
Energy efficiency
Opportunities to improve energy efficiency will be investigated on an ongoing basis throughout the life of the Project. Evolution will continue to measure energy consumption and calculate and report Scope 1 and 2 GHG emissions in accordance with the requirements of the NGER Act.
Hazards & Risk
Continued implementation of management plans which incorporate risk reduction measures of the original PHA:
The following management plans will be updated as is relevant to provide appropriate management of the operations of the Project and to minimise risk: • Hazard and Operability Study. • Final Hazard Analysis. • Fire Safety Study. • Safety Management System. • Emergency Response Plan/Pollution Incident Response Plan. • Blast Management Plan. • Cyanide Management Plan. • Hazardous Waste and Chemical Management Plan. • Transport of Hazardous Materials Study.
Waste
Continued implementation of Hazardous Waste and Chemical Management Plan

Table 23.1 Summary of commitments

Subsidence
Evolution's HWCMP will be reviewed and updated as relevant for the Project and 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 and areas will be appropriately sign posted and frequently inspected. • 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. • Where practicable, fresh tailings will be diverted to paste used to backfill voids underground.

Part D – Justification and conclusion

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Part D – Justification and conclusion

Chapter 24 Justification

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24 Justification

24.1 Introduction

At its most fundamental level, the development of the Project is proposed as a beneficial economic opportunity that, if approved, may have adverse impacts environmentally, socially, economically or culturally. The opportunity is based on the extraction and sale of gold. This EIS and related documentation, has been prepared with the intention of allowing stakeholders of the Project to make an informed assessment on the question of whether it is justifiable and that the NSW Government can approve the Project.

This EIS has described the potential impacts of the Project in all their forms, including their location, duration, severity and significance, to arrive at, in the following chapter, Evolution's reasoned conclusion in respect of that question.

This chapter addresses the environmental assessment requirements relating to the reasons why the Project should be approved, having regard to:

- relevant matters for consideration under the EP&A Act, including how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the Project;
- the biophysical, economic and social costs and benefits of the Project; and
- the suitability of the site.

A detailed review on how the Project accords with the objects of the EP&A Act is provided in section 5.2 of this EIS.

In addition to the alternatives considered in the development of the Project design, Chapter 3 also discusses why the Project configuration proposed for approval is regarded as the most appropriate and feasible option.

24.2 Significance of the resource

24.2.1 Demand for gold

The only product of mining at CGO is metallic gold, in the form of unrefined gold bars. Gold has an economic significance almost worldwide that has existed for millennia aided by its colour, rarity and unusual physical properties (corrosion resistance, malleability, ductility and heat conduction). As a result, the demand for gold is shared across virtually all nations and sustains the value of most major currencies and it is the prospect of profitable sales of gold that is the main economic motivator for the Project.

Globally, gold is used for:

- jewellery - 48% of annual usage[9];
- coins and gold bars - 20% of annual usage [10];
- as an investment instrument for central banks - 15% of annual usage[11];
- global backed exchange traded funds - 9% of annual usage[12]; and
- in the electronics industry, medical and dentistry applications, accounting for around 8% of its global annual usage[13].

9 Office of the Chief Economist, Resources and Energy Quarterly Review, June 2020

10 Office of the Chief Economist, Resources and Energy Quarterly Review, June 2020

11 Office of the Chief Economist, Resources and Energy Quarterly Review, June 2020

12 Office of the Chief Economist, Resources and Energy Quarterly Review, June 2020

13 Office of the Chief Economist, Resources and Energy Quarterly Review, June 2020

Australia is the second largest producer of gold in the world, and therefore plays an essential part in meeting the global demand for gold. The June 2020 *Resources and Energy Quarterly Report* from the Australian Government's Office of the Chief Economist reported that 'The London Bullion Market Association (LBMA) gold price has risen by 14 per cent so far in 2020, to US$1,727 an ounce on 17 June 2020 — well above the average of US$1,479 an ounce in the second half of 2019.' The price increase is thought to be linked to a reduction in production during the COVID-19 Pandemic, less recycling of gold (-4.4%) and a flight to gold by investors during a turbulent economic period.

The June 2020 *Resources and Energy Quarterly Report* a drop in gold process in 2021 and 2022. It states, 'As the global economy recovers, gold prices are forecast to fall by around 3.7 per cent between 2021 and 2022, to average US$1,510 an ounce in 2022. The global economic recovery is expected to undermine some of gold's appeal to institutional investors: funds are expected to move out of safe haven assets like gold and into riskier assets. The pace of central bank gold buying is expected to decrease at an annual rate of 4.0 per cent over the outlook period, amidst a modestly diminished appetite for gold for reserves.' The *Quarterly Report* also predicts that a stronger Australian dollar will lower the price of gold in this period to an average of A$2099 an ounce in 2022.

With regards to consumption, the June 2020 *Resources and Energy Quarterly Report* detailed a significant increase in gold consumption. It states 'World gold demand increased by 1.2 per cent year-on-year in the March quarter 2020, to 1,084 tonnes, driven by inflows into gold-backed exchange traded funds (ETFs), which added 298 tonnes (or net inflows of US$23 billion) — the largest quarterly value ever — driven by large inflows into ETFs in Asia and Europe. The global COVID-19 pandemic, which raised the level of volatility in financial markets, has driven demand for gold backed ETFs.

24.2.2 Gold production

The June 2020 *Resources and Energy Quarterly Report* also details current and future predicted gold production:

> World gold supply fell by 3.8 per cent year-on-year in the March quarter 2020, to 1,066 tonnes, due to a 2.6 per cent decline in gold mine production. A decline in net producer hedging in the March quarter — to minus 10 tonnes — contributed to the fall in gold supply.
>
> Around 36 tonnes (or 1.1 per cent) of world gold mine production has been affected by the COVID-19 related lockdowns. Production losses have been recorded in many gold producing countries, including Mexico (nearly 11 tonnes), Canada (over 10 tonnes), South Africa (5.4 tonnes), Peru (5.0 tonnes) and Argentina (2.4 tonnes).
>
> Production in China — the world's largest gold producing country — was largely unaffected by the COVID-19 pandemic, with only one mine reporting a 60-day shutdown, resulting in an estimated production loss of 0.4 tonnes of gold.
>
> Production in Australia — the world's second largest gold producing country — was unaffected by COVID-19 measures. However, output from several large Australian gold mines was reduced, due to planned maintenance.

A summary of additional points raised in June 2020 Quarterly Review on production included:

- Movement restrictions during the COVID-19 pandemic have discouraged gold recycling activities, decreasing by 4.4 % year-on-year to 280 tonnes.
- In 2020, world gold supply is estimated to fall by 1.3 per cent to 4,751 tonnes reflecting the impacts of the COVID-19 pandemic especially in Russian and Brazilian gold mine output.
- Chinese gold mines have returned to normal operations following suspensions in January and February 2020.
- Following planned maintenance in the March quarter, Newcrest's Cadia and Telfer gold mines in Australia, are expected to resume normal operations in the June quarter.

- Propelled by higher mine production, world gold supply is forecast to rise at an average annual rate of 3.5 per cent between 2021 and 2022, reaching 5,087 tonnes by the end of the outlook period (to 2022).

- Gold scrap supply is forecast to rise by 2.0 per cent in 2021, to 1,345 tonnes, due to an expected rise in gold selling activity due to COVID-19 related hardship.

24.2.3 Significance at a local level

The CGO sits within Bland Shire Council which is situated in the *Riverina Murray Regional Plan* area. However, CGO is also close to the border with the *Central West and Orana Regional Plan* area, which includes Lachlan and Forbes Shire Councils, so both plans are considered in this appraisal of the local importance of mining and CGO in the region.

i Riverina Murray Regional Plan 2036 (DPE 2017) (includes Lachlan Shire Council)

The Plan provides a regional planning framework, sets priorities and provides guidance for regional and local planning decisions. The NSW Government uses this Plan to:

- advise infrastructure agencies about the timing of new developments; and

- to inform ongoing planning and delivery of infrastructure, asset management and services.

In March 2018, amendments to the EP&A Act introduced new requirements for councils to prepare Local Strategic Planning Statements (LSPS). The statements provide a clear 'line-of-sight' between the key strategic priorities identified at regional or district spatial scales and the finer-grained planning at local, centre and neighbourhood scales. This Plan outlines strategic ('line-of-sight') land use planning for the region, district and local government areas. This will allow issues to be identified and resolved early, rather than at the development application stage.

From a mineral resource perspective *Direction 12: Sustainably manage mineral resources* sets out the industry's importance to the area. The plans notes that 'The mineral resources sector delivers economic and employment benefits in the region' and identifies that 'Significant mining activity is occurring at Lake Cowal Gold Mine near West Wyalong'. It recognises that 'Communities can benefit from the development of mineral resources, with the degree of benefit and impact varying across the life cycle of a development'. However, it also notes that the industry needs to 'manage the impacts of mining to produce long-term sustainable economic, social and environmental outcomes'.

Other key points relating to mining include:

- Areas with mineral and energy resources must be protected and managed recognising other land uses, where feasible, in the life of a mining development, and so that valuable resources are not sterilised.

- Mining activities have specific operational needs that can compete with other land uses; however, they are also temporary and dependent on the productive life of the facility or resource. Once extractive resource lands have been identified, there may be opportunities to identify interim activities that will enable lands to be used productively, without sterilising the future potential of the underlying resource.

- Developing local land use strategies that respond to the life cycle of the extractive resource area will provide all stakeholders, including investors, with certainty around the long-term productive value of the land.

- Population and economic fluctuations can occur with the development of mineral and energy resources. Some regional communities will need support to diversify and transition their economy out of the sector as mineral extraction diminishes.

The Plan identifies the following actions relating to the resource sector:

- 12.1 Consult with the NSW Department of Industry (Division of Resources and Energy) when assessing applications for land use changes (strategic land use planning, rezoning and planning proposals) and new development or expansions.
- 12.2 Protect areas of mineral and energy resources potential in the region through local land use strategies and local plans.
- 12.3 Protect infrastructure that facilitates mining industries from development that could affect current or future extraction.
- 12.4 Support communities that are transitioning out of mining operations to manage changes in population and demand for service delivery, and explore new economic opportunities

ii Central West and Orana Region Regional Plan (DPE 2017) (includes Forbes and Lachlan Shire Councils)

The *Central West and Orana Regional Plan 2036* (DPE 2017) (the Regional Plan) was released by the DPE in 2017 to guide land use planning priorities and decision making in the region for the next two decades. The region covered by the plan comprises the Cabonne, Orange, Blayney, Bathurst Regional, Lithgow, Oberon, Lachlan, Parkes, Forbes, Weddin and Cowra LGAs (Central West), and the Bogan, Warren, Coonamble, Gilgandra, Narromine, Warrumbungle and Dubbo Regional Mid-Western Regional LGA's (Orana). The Regional Plan provides an overarching framework to guide local land use plans, development proposals and infrastructure funding decisions. The implementation component of the Regional Plan includes priority actions and medium-long term actions.

At a local level, the Regional Plan highlights the important role the mineral resources sector plays in underpinning many local economics in the region, noting that mining represented the largest contributor to gross regional product at $2,508 million in 2011. Priorities of the regional plan include continuing to grow and support the mining sector in the Blayney and Cabonne local government areas.

Direction 8 of the Plan, *Sustainably manage mineral resources*, notes that 'The mineral resources sector underpins many local economies and will continue to drive growth. Mineral resource extraction can benefit and affect communities in different ways during the mining lifecycle. The sustainable management of mineral resources must consider and balance varying impacts to produce long-term economic, social and environmental outcomes. The other policies relating to mining in this region are all very consistent with the Riverina Murray Regional Plan looking for the mining industry to minimise impacts on, and work with other land uses, whilst ensuring resources do not become sterilised.

The plan identifies five actions (listed above) relating to the resource sector: the first four are identical to those found in the Riverina Murray Regional Plan, the last (Action 8.5) states "Work with councils to scope the application and implementation of a scenario planning or impact modelling tool to be applied at a regional level to help communities plan for the impacts of mining".

iii Summary of Regional Planning Support

Both of the relevant regional plans acknowledge the importance of the resource sector to the socio-economic stability of their regions whilst seeking 'sustainably managed resources'. Both plans state "The sustainable management of mineral resources must consider and balance varying impacts to produce long-term economic, social and environmental outcomes". CGO's Project has focused on finding the right balance between protecting the environmental values of the local area, whilst giving social and economic stability to the communities.

One of the most significant aspects of this Project in this continuing the economic diversity it provides to LGAs which are strongly dependent on agriculture. Since the mine commenced in 2005, the area has been beset by drought and CGO represents a significant viable alternative for local jobs, investment, purchase of goods and services and taxes. Compared to its physical impact, it is also has a disproportionately large enriching influence in the area.

24.3 Economic justification

The Project has strong justifications economically due to the net economic benefits and the economic stimulus it will provide locally and to NSW, as set out below. Importantly, the Project involves a mining operation that will, consistent with the objects of the Mining Act, extract a State-owned resource for the benefit of the State of NSW. Key beneficial impacts arising from the Cowal Gold Operations Underground Development are outlined below. Beneficial impacts are examined in consideration of what would otherwise occur if the Project does not proceed.

24.3.1 Economic Growth

Successive governments of all political persuasions at State and Federal levels are strongly focussed on encouraging economic development for its own sake (jobs, wealth creation etc.) but also as a means of indirectly funding other societal needs such as health services, education, police and government administration) through the payment and redistribution of taxes. The Project is entirely consistent with both aspects.

The Project will contribute to economic growth through increased industry output and GRP during construction and operation (ie production), flowing from both direct and indirect impacts. The Project is estimated to support an additional:

- $38.9 million in GRP per year in the Catchment during construction.
- $106.3 million GRP per year in the Catchment during operations.

At peak, the 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 Project (2024-25 to 2031-32).

24.3.2 Employment and Incomes

The Project will increase employment during construction and operations, compared to what would occur without the Project, flowing from both direct and indirect impacts. Including both direct and flow-on (supply chain) impacts, the Project is estimated to support an additional:

- 159 FTE jobs per annum in the Catchment during construction.
- 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 created as well as through a small lift in real wages generated by increased competition for labour. Overall, the 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.

24.3.3 Support for Local Businesses

The Project will create opportunities to secure new contracts and increase sales to supply goods and services to meet the needs of the Project through flow-on impacts in the supply chain during all phases of the 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 Project include business services, trade, and public services, health and education. The Project will also support local suppliers and contractors, providing additional security and longevity of business incomes (and employment) in the region.

24.3.4 Government Revenue

The Project will provide a lift in State and Australian government taxation revenues through a variety of taxes and duties. Overall, the 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 Project.

- $174.8 million in additional revenue to the NSW Government compared to what would occur without the Project, primarily through royalty payments.

These additional revenues can be used by government to provide additional infrastructure and services to support business and households across the State and Australia.

24.3.5 Cost Benefit Analysis

The NPV of the Project has been estimated as the difference between the PV of future benefits and PV of future costs. A CBA for the Project shows that, assuming a discount rate of 7%, the NPV of the Project to the NSW economy is estimated at $314.4 million. Even at a discount rate of 10%, the Project is estimated to result in a net benefit to NSW of $177.2 million. The benefit cost ratio (BCR) is estimated at 1.18, highlighting that the Project is estimated to return $1.18 for every dollar cost. From an economic perspective, the Project is therefore clearly justified on economic grounds. The NPV (discount rate of 7%) includes the following costs totalling $1793.5M:

- Construction costs $281.6M
- Operating and closure costs $1,409.3M
- Greenhouse gas emissions $10.0M
- Traffic / transport $12.7M

And the following benefits totalling $2,107.9M:

- The value of gold (including royalties and company tax) $1,939.5M
- Benefits to labour $168.4M

The net producer surplus of the Project (value of gold less operating and closure costs) totals $449.3M.

24.4 Social justification

The Project will directly benefit the catchment (Bland, Lachlan and Forbes LGAs), as outlined in the SIA (Elton 2020b), and summarised in Chapter 21 of this EIS. While the Project has some potential negative impacts which are discussed in Chapter 21, it is considered that these can all be managed to acceptably low levels. CGO has very positive relationships with its key stakeholders in the community and has earned its existing 'social licence to operate' from those communities. The following key social benefits are expected to arise from this Project:

- The extended life of mine will increase certainty for the future of the local communities allowing its residents to make long term decisions to live and work in the region.
- Longer term stability for the existing workforce at CGO through to approximately 2040.
- New construction and new operational (underground) mine workers as detailed in section 24.3.2 above, through to approximately 2040.
- A modest increase in population for the local shires, particularly Bland Shire which will assist in slowing the current slow decline in the region's population.
- Increased spending on local private services and businesses and increase in demand will stimulate local economic activity and services expansion, in turn generating improved social and commercial benefit.
- Regional workers are likely to motivate increased commercial flight services and commercial activity at airports, increasing connectivity and mobility of existing communities.
- CGO will continue to invest in and support local communities. These shared value schemes and community programs will increase levels of community wellbeing, cohesion and social capital, particularly for vulnerable community groups.

As part of its commitment to the local community, Evolution will enter into discussions with Bland Shire Council in relation to a Voluntary Planning Agreement. Recognising its important role in the community, CGO acts as a member of that community to prevent or manage all potentially negative impacts arising from its operations. This will continue as it embarks on the next stage of its development, whilst at the same time it maximises the benefits and opportunities it creates for the people of the region.

24.5 Environmental justification

A summary of the key findings of the environmental assessment are detailed in Chapters 7 to 22 and the mitigation and management measures committed to is provided in Chapter 23. As shown, the Project has been designed such that impacts are either avoided, or appropriate mitigation measures identified so that the residual impacts of the Project, on balance, will be acceptable.

24.6 Suitability of the site

The suitability of this site for mining gold was first established over 20 years ago when the orebody was first discovered and examined to determine if it could support an economically viable mine. The viability of the mine is due to a range of attributes (grade, tonnage, proximity to surface, mining method, equipment selection etc.) and has operated successfully within a sensitive environment without causing undue harm to the local environment.

Its economic ‘suitability’ is tested with variances in the state of the economy (price of gold) and in the control of costs (Australian dollar - United States dollar exchange rate) and the rate of inflation. More severe tests occur periodically when there is a significant disruption to the global economy such as the Global Financial Crisis in 2008 and now, in 2020, with the COVID-10 pandemic.

The new resource is within CGOs’ existing mining lease and allows the use of existing infrastructure that has the effect of reducing unit costs of production. That said, underground mining represents a new test, not only for the cost of construction but, as an underground mine, the equipment used is of necessity smaller in scale resulting in higher unit costs for things like ore transport and other costs that have not been encountered before eg. providing light and fresh air in the mine. Hence, the orebody to be mined underground typically needs to be higher grade and/or larger to allow economically viable mining. Use of the existing investment is an important consideration as CGO plans its future in the region.

The site’s suitability also stems from the fact that CGO has gained acceptance amongst the local community. That acceptance and recognition of CGO as part of their community is an important part in ongoing investment decisions. The region has provided a loyal, locally-based workforce and investing in the future of CGO has taken into this into account.

24.7 Ecologically sustainable development

The Commonwealth Government’s *National Strategy for Ecologically Sustainable Development* (ESD) 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 NSW EP&A Act adds to this by providing a set of ESD principles. The Project’s compatibility with each of the above principles is considered below.

24.7.1 The precautionary principle

The precautionary principle holds that where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent such damage.

The proposed mine plan and overall Project design were progressively devised over two years and based on detailed investigations of geological, environmental, engineering and financial considerations. The baseline environmental investigations began in June 2019 and have included groundwater, surface water, ecology, noise, Aboriginal and historic heritage, visual amenity, social and economic conditions.

The engineering and geological assessments were used to optimise the most economic method of extracting the gold resource while the social, cultural and biophysical studies are aimed at reducing areas of scientific uncertainty where there was the potential for serious or irreversible damage to environmental, social or cultural heritage values within the Project area. Significantly, the majority of those studies originated independent of Evolution through the SEARs and will be vetted by government agencies and members of the public through the exhibition period for the EIS.

These studies have helped to minimise risks to both the investment decision and the surrounding environmental, social or cultural values if they had not been identified (where they exist) and specifically addressed in the design and operational plans. Within the constraint of the fixed location of the orebody and the economic and environmental drivers to use existing mining infrastructure, a lesser range of options were viable compared to perhaps, a ‘greenfield’ site in a similar setting.

Nevertheless, as explained in Chapter 3, Project planning included multiple rounds of design, assessment and refinement to avoid or minimise impacts. Importantly, the principle of minimising direct and indirect impacts on the surrounding environment include:

- the use of underground mining rather than open-cut methods (refer Chapter 3);
- removing the upper stopes from the original design to minimise the risk of chimneying to surface. Nineteen (19) stopes were removed and the stability and subsidence model was re-run to show the reduced risks were at an acceptable level (refer Chapter 9);
- undertaking a groundwater study to confirm whether hydrogeological connectivity existed between Lake Cowal and the gold resource intended for mining;
- heavy reliance on recycling water;
- consumption of low quality (saline) bore water in its process water supply;
- use of cemented tailings paste to provide ground support; and,
- the location of new facilities within the footprint of previous ground disturbance.

The result is that for all potential impacts no serious or irreversible harm will occur on Lake Cowal. Minor, localised Therefore, the Project addresses the precautionary principle because there will be no serious or irreversible environmental damage.

Further, in relation to uncertainty, the technical assessments prepared in support of this EIS have been prepared by technical experts in each relevant field. The engagement of suitably qualified and experienced consultants has ensured that the planning, design and environmental assessment phases of the Project have been transparent. The contents of this EIS and accompanying appendices has enabled the potential implications of the Project to be understood, and the management strategies, mitigation measures and monitoring activities required to ensure potential impacts are appropriately minimised, to be identified.

24.7.2 Inter-generational equity

Inter-generational equity is the concept that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. In considering this concept, it is important to realise that most human activities, have some impact on the natural environment whether it is the construction of a new housing estate, food production or taking an international plane flight, all entail either consumption of a natural resource or an emission to the environment. This then means that intergenerational equity does not infer no impact to the environment but rather, acceptable impacts (even the concept of 'acceptable change' has shifted and will continue to move with each passing generation).

The CGO Project will have:

- no impacts on current land uses as it is an underground mine;
- no impacts on natural resources as it is an underground mine that has and will continue to be designed and operated to avoid impacts on Lake Cowal; and
- no change to surface water management as the mine will continue to operate as a nil discharge site with a clean water diversion in place.

The Project will cause some localised drawdown of the groundwater table in close proximity (mainly within the existing ML) but this will not affect Lake Cowal of other water users. The use of the Bland Paleo-channel will continue at regulated, sustainable levels proven by ongoing monitoring and part of a diversified groundwater resource management group.

A natural resource that will be consumed is the gold orebody. About 1.8 M ounces of gold will be removed over the life of the mine. 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 mine workforce and provide more community facilities and other social infrastructure, partly through a VPA. This will allow natural capital (gold) to be transformed into economic capital (greater personal and public income), social capital (better public facilities) and human capital (a more skilled and wealthier workforce).

24.7.3 Conservation of biological diversity and maintenance of ecological integrity

This principle holds that the conservation of biological diversity and the maintenance of ecological integrity should be a fundamental consideration for development proposals. The potential impacts of the Project have been described in this EIS, including the negligible impact of the Project on biodiversity, in particular Lake Cowal.

24.7.4 Improved valuation and pricing of environmental resources

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.

The EIS (refer Chapter 22) provides estimates of the monetary value of all material costs and benefits associated with the 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 Project's economic value that provides useful guidance to decision-makers and other interested parties about the Project's overall merit.



Part D – Justification and conclusion

Chapter 25 Conclusion

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25 Conclusion

Evolution owns and operates an open-cut gold mine known as CGO near West Wyalong, in the central west region of NSW. Evolution now seeks approval to construct and operate an underground mine at CGO, the Project, to gain access to a deeper orebody containing approximately 1.8 Moz of gold. The Project will allow Evolution to invest $281M during construction, over $1 Billion in operating and closure costs, creating 160 FTE jobs per annum during construction and 230 FTE jobs per annum during operations, during an expected life of 19 years.

The Project is being developed beneath and adjacent to the existing CGO open-cut and will utilise the existing processing facility, IWL for tailings and waste rock dumps. The underground mine lies partly underneath Lake Cowal, a nationally-important ephemeral wetland.

The Project will extend the life of mine to mid 2039, providing a range of direct and indirect socio-economic benefits to the region and State over its life. The Project is expected to bring significant economic benefits to NSW of $314.4M (net present value at 7% discount rate). The Project is estimated to support an additional $38.9M in GRP per annum in the Catchment during construction and $106.3M GRP per annum in the Catchment during operations. At its peak, the 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 Project (2024-25 to 2031-32).

Evolution is a publicly listed gold, silver and copper production mining company trading on the ASX. Evolution wholly owns the following additional assets: Mount Carlton Open Pit and Underground Gold Operation (QLD); Mount Rawdon Open Pit Gold Operation (QLD); Mungari Open Pit and Underground Gold Operation (WA); and Red Lake Underground Gold Operation in Western Ontario, Canada. Evolution also partly owns the Ernest Henry Copper-Gold Operation in QLD, operated by Glencore. For the last five years, Evolution has been committed to making a positive contribution to the local community, and has earned a respected position as part of the local community. This Project will allow another 19 years of positively contributing to the local community.

The proposed mine plan and overall Project design were progressively optimised over two years based on detailed investigations of geological, environmental, engineering and financial considerations. The baseline environmental investigations began in June 2019 and have included groundwater, surface water, ecology, noise, heritage, visual, social and economic conditions. Potential risks have been assessed and taken into account. The Project planning process included multiple rounds of design, assessment and review to avoid or minimise impacts. Importantly, the principle of minimising direct and indirect impacts on Lake Cowal have been addressed by reducing the scope of the mine plan and reducing excavation in the upper levels of the orebody closest to the bed of the lake.

These assessments identified all potential impacts of the Project and have set out appropriate mitigation measures to address them. The Project is considered a 'brownfield development', being within the mine's existing area of surface disturbance. As such, few additional impacts will occur as a result of the Project. Surrounding residents will see negligible changes relating to noise and air quality impacts, which will remain within strict guidelines. Visually, there will be minor changes due to the paste plant, which will be designed to fit within the mine's existing landscape. The Project will have a range of social benefits for the region, whilst negative impacts can all be managed, mainly through existing community plans and processes. A key focus of the EIS has been on those environmental aspects that could potentially affect Lake Cowal: groundwater, surface water, water quality and subsidence. These assessments show that with appropriate management, Lake Cowal will be unaffected by the Project.

The Project has been studied from many perspectives and its final design is considered the most sustainable response to economic, social, environmental and cultural values that exist in the area. It is considered that the predicted economic and social benefits will strongly outweigh, primarily minor and manageable adverse impacts in the region.

Part E – References, abbreviations and acronyms

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Part E – References, abbreviations and acronyms

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Part E – References, abbreviations and acronyms

Abbreviations and acronyms

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Abbreviations and acronyms

95th percentile BQL	95th percentile back of queue length
(µS/cm	Microsiemens per centimetre
ABN	Australian Business Number
ABS	Australian Bureau of Statistics
ACN	Australian Company Number
AEC	AEC Group Pty Ltd
AHD	Australians Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Information Permit
AIP	Aquifer Interference Policy
AOBV	Areas of outstanding biodiversity value
AQIA	Air quality impact assessment
ASX	Australian Securities Exchange
AUR	Auxiliary right-turn
BAM	Biodiversity Assessment Method
BAR	Basic right
BCD	Biodiversity Conservation Division of the Department of Planning, Industry and Environment
BC Act	NSW *Biodiversity Conservation Act 2016*
BCR	Benefit-cost ratio
Beck Engineering	Beck Engineering Pty Ltd
BDAR	Biodiversity Development Assessment Report
Bland LEP	Bland Local Environmental Plan 2011
BMP	Blast Management Plan
BoM	Bureau of Meteorology
BSC	Bland Shire Council
CBA	Cost benefit analysis
CEMCC	Community Environment Management Consultative Committee
CEMP	Construction environmental management plan
CGE	Computable General Equilibrium
CGO	Cowal Gold Operations
CHL	Commonwealth Heritage List
CIL	Carbon-in-leach
CN_{WAD}	Weak acid dissociable cyanide
Coffey	Coffey Services Australia Pty Ltd

DA	Development application
DAWE	Commonwealth Department of Agriculture, Water and the Environment
dB	Decibels
DDG	Dust deposition gauges
DEL	Average delay per second
DIDO	Drive-in drive-out
DIPNR	Department of Infrastructure, Planning and Natural Resources
DOS	Degree of saturation
DPE	NSW Department of Planning and Environment (now the NSW Department of Planning, Industry and Environment)
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered ecological community
EC	Electrical conductivity
EIS	Environmental Impact Statement
Elton	Elton Consulting Pty Ltd
EMM	EMM Consulting Pty Ltd
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPL	Environmental Protection Licence
EPIs	Environmental planning instruments
ESCMP	Erosion and Sediment Control Management Plan
ESD	Ecologically sustainable development
ETL	Electricity transmission line
ETFs	Exchange traded funds
Evolution	Evolution Mining (Cowal) Pty Limited
FFMP	Flora and Fauna Management Plan
FIFO	Fly-in fly-out
FHA	Final Hazard Analysis
FTE	Full time equivalents
FM Act	NSW *Fisheries Management Act 1994*
g/t	Grams per tonne
GDA	Geocentric datum of Australia
GEM	Geo-Environmental Management Pty Ltd
GHG	Greenhouse gas
GRP	gross regional product
GSP	gross state product

GST	Goods and Services Tax
GVA	gross value added
Ha	Hectares
HAZOP study	Cyanide Management Plan and Hazards and Operability Study
HEC	Hydro-Engineering & Consulting Pty Ltd
Heritage Act	*Heritage Act 1977*
HMP	Heritage Management Plan
HVAS	High volume air sampler
HWCMP	Hazardous Waste and Chemical Management Plan
JORC	Joint Ore Reserves Committee
Kg	Kilograms
kL	Kilolitres
Koala Habitat SEPP	*State Environmental Planning Policy (Koala Habitat Protection) 2019*
kV	Kilovolt
IACHMP	Indigenous Archaeology and Cultural Heritage Management Plan
ICDS	Internal Catchment Drainage System
ICNG	*Interim Construction Noise Guideline* (DECC 2009)
ICI	Imperial Chemical Industries
ILUAs	Indigenous Land Use Agreements
INP	*NSW Industrial Noise Policy* (EPA 2000)
IPC	NSW Independent Planning Commission
IWL	Integrated waste landform
Km	Kilometre
LBMA	The London Bullion Market Association
LEA	Local effects analysis
LEP	Local environmental plan
LGA	Local government area
LHD	Load-haul-dump
LMP	Land Management Plan
LOS	Level of service
LPB	Lake protection bund
LSPS	Local Strategic Planning Statements
m^3	Cubic metres
m	Metres
m/s	Metres per second
Mg/L	Milligrams per litre
MGA	Map grid of Australia
µm	Micrometres

MIC	Maximum instantaneous charge
Mining SEPP	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
Mining Act	NSW *Mining Act 1992*
ML	Mining lease
ML	Mega litres
MCC Handbook	*The Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry* (NSW Department of Industry, Tourism and Resources, 2006)
MNES	Matters of national environmental significance
Mod 16	Modification 16
MOP	Mining Operations Plans
MOP Guidelines	*ESG3 – Mining Operations Plan (MOP) Guidelines*
Moz	Million ounces
MR Handbook	*The Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (NSW Department of Industry, Tourism and Resources, 2006)
Mt	Million tonnes
Mtpa	Million tonnes per annum
NAF	Non-acid forming
NGAF	National Greenhouse Accounts Factors
NGER Act	*National Greenhouse Energy Reporting Act 2007*
NHL	National Heritage List
NMP	Noise Management Plan
NT	National Trust of Australia, NSW
NTSF	Northern Tailings Storage Facility
NNTT	National Native Title Tribunal
NPfI	*Noise Policy for Industry* (EPA 2017)
NPW Act	*National Parks and Wildlife Act 1974*
NPV	Net present value
NSS	NSW South Western Slopes
NSW	New South Wales
NVIA	Noise and vibration impact assessment
OEMP	Operational environmental management plan
Oz	Ounces
PAF	Potentially acid forming
PAF-LC	Potentially acid forming low capacity
PAX	Potassium amyl xanthate
PCT	Plant community type
PHA	Preliminary hazards assessment

PM_{10}	Particulate matter less than 10 µm in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5 µm in aerodynamic diameter
PNTL	Project noise trigger levels
POEO Act	*Protection of the Environment Operations 1997*
POEO Regulation	Protection of the Environment Operations (Clean Air) Regulation 2010
PPV	Peak particle velocity
PRP	Pollution reduction programmes
PV	Present value
PVC	Primary view catchment
QLD	Queensland
Qm	Peak hourly major road through traffic movements
PFS	Pre-feasibility study
Right turning traffic volume	Qr
RAPS	Registered Aboriginal parties
RBL	Rating background level
RF Act	*Rural Fires Act 1997*
RFS	NSW Rural Fire Service
RMR Plan	Riverina Murray Regional Plan 2036
RNE	Register of the National Estate
RNP	*NSW Road Noise Policy* (EPA 2011)
RTS	Response to submissions
ROM	Run-of-mine
RVEP	Remnant Vegetation Enhancement Programme
UCDS	Up-catchment diversion system
s170 register	Heritage and Conservation Register
SAII	Serious and irreversible impacts
SEARs	Secretary's Environmental Assessment Requirements
SEPPS	State Environmental Planning Policies
SEPP 33	*State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*
SEPP 55	*State Environmental Planning Policy No 55 – Remediation of Land*
SF	State forests
SFMC	*The Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia, 2000)
SHI	State Heritage Inventory
SHR	State Heritage Register
SIA	Social impact assessment
SLOS	Sub level open stoping

SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SRLUP	Strategic Regional Land Use Policy
SSD	State Significant Development
STSF	Southern Tailings Storage Facility
State and Regional Development SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SWGMBMP	Surface Water, Groundwater, Meteorological and Biological Monitoring Programme
TDS	Total dissolved solids
TfNSW	Transport for NSW
The Project	CGO Underground Development Project
TIA	Traffic impact assessment
TIB	Temporary isolation bund
TMP	Transport Management Plan
Tpd	Tonnes per day
Tph	Tonnes per hour
TSF	Tailings storage facility
TSP	Total suspended particles
UCDS	Up-catchment diversion system
VLAMP	*Voluntary Land Acquisition and Mitigation Policy*
VIA	Visual impact assessment
WA	Western Australia
WAD	Weak acid dissociable
WAL	Water access licence
WARR Act	*Waste Avoidance and Resource Recovery Act* 2001
WM Act	*Water Management Act 2000*
WRE	Waste rock emplacements

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