Cowal Gold Mine

Underground Subsidence Monitoring Program

Revision Status Register

Section /Page/ Annexure	Revision Number	Amendment/ Application	Distribution	DPE Approval Date
New Document	USMP	Development of New Document as required by SSD 10367	Resources Regulator, DPE	TBE

September 2022

Table of Contents

1. Introduction

The Cowal Gold Operations (CGO) is located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure 1). Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the CGO. All mining activity occurs within Mining Lease (ML) 1535 and ML 1791.

Development Consent no. 14/98 (DA 14/98) for the CGO (including the Bland Creek Palaeochannel Borefield water supply pipeline) was granted by the Minister for Urban Affairs and Planning under Part 4 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) on 26 February 1999. Development Consent (DA 2011/64) for the operation of the Eastern Saline Borefield was granted by the Forbes Shire Council on 20 December 2010.

The Minister for Planning granted approval for the *Cowal Gold Operations Underground Development Project as* State-significant Development No. 10367 (SSD 10367) under Section 4.38(2) of the EP&A Act on 30 September 2021 and to modify DA 14/98 through *Modification No.16* (herein referred to as Mod 16) under Section 4.55(2) of the EP&A Act.

DA 14/98 generally allows:

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

SSD 10367 generally allows:

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

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

This USMP has been prepared to reflect the conditions of SSD 10367 specifically B14 – B17 outlining the requirements for a subsidence monitoring program. Copies of the approved development consents for DA 14/98 and SSD 10367 are available on Evolution's website (www.evolutionmining.com.au) along with all relevant management plans.

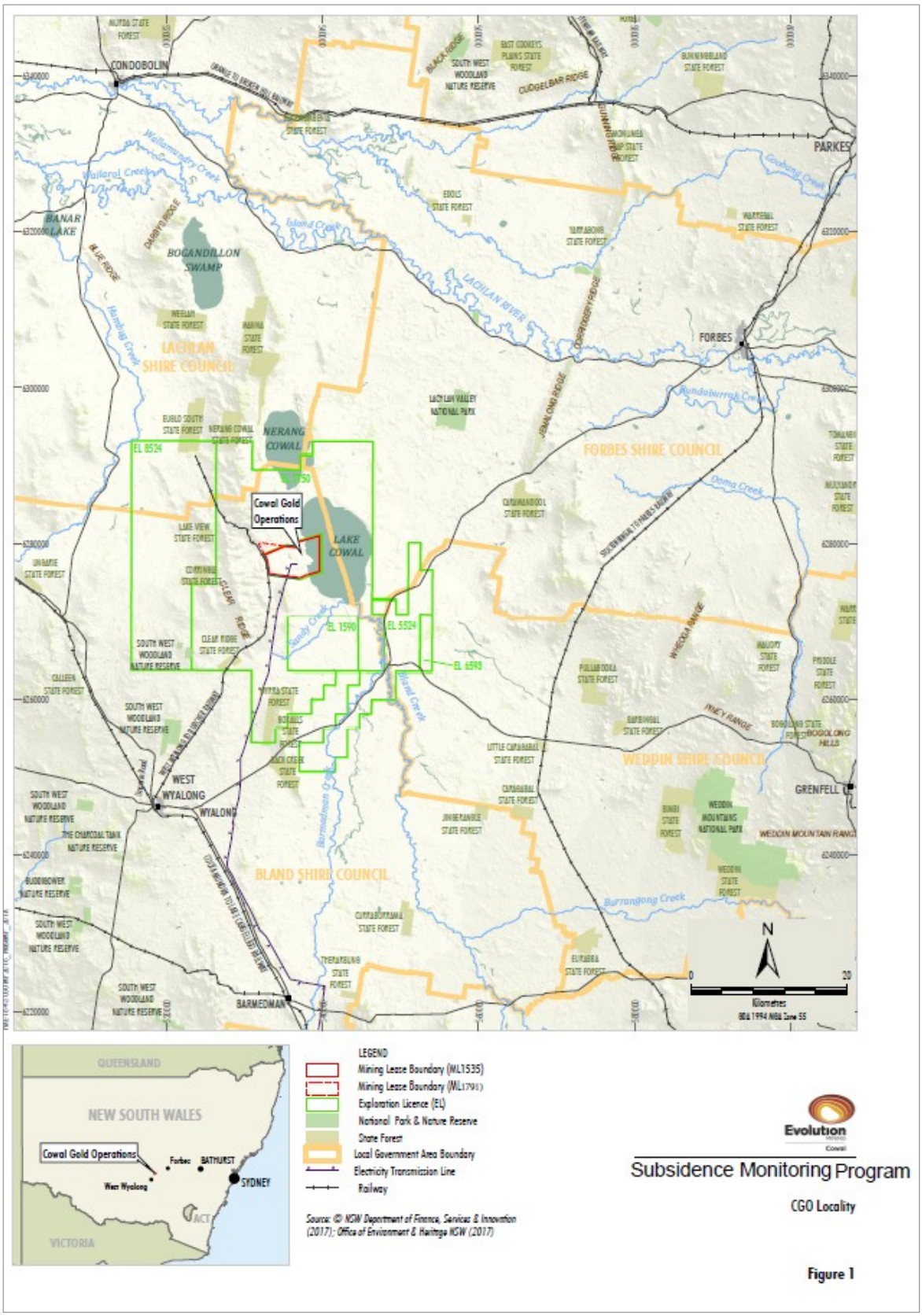

Figure 1: Site Overview

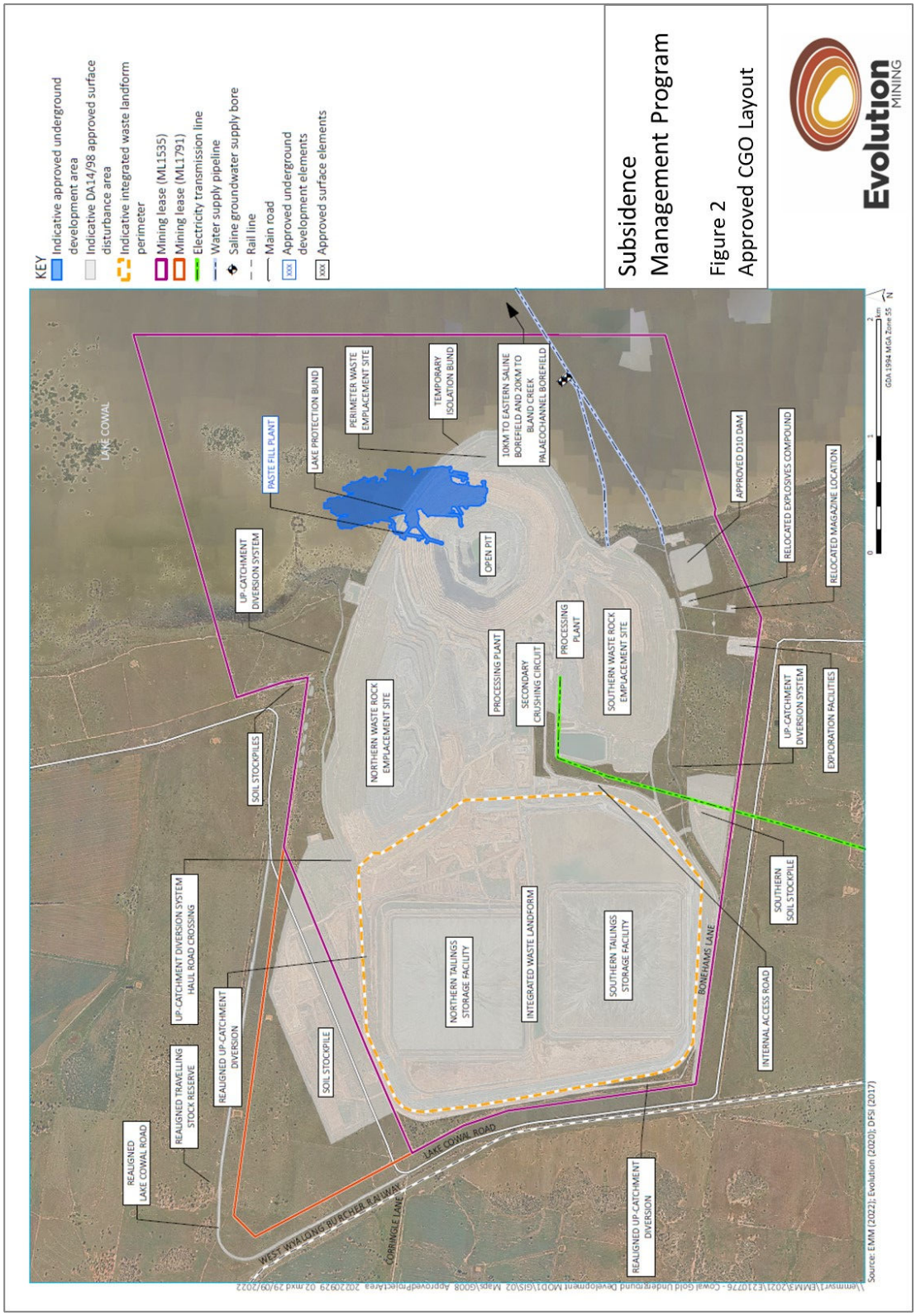

Figure 2: CGO site layout

1.1 Purpose

The purpose of the proposed subsidence monitoring program is to implement a system that will reduce the likelihood and consequence of any potential subsidence event through proactive management of the stable crown pillar to as low as reasonably practicable.

The subsidence monitoring program forms a part of CGOs Subsidence Principal Hazard Management Plan (PHMP) and will be applied in conjunction with our Ground Control Management Plan (Underground) and Backfill Management Plan. An outline of how this plan is integrated with other geotechnical documentation is provided in Figure 3.

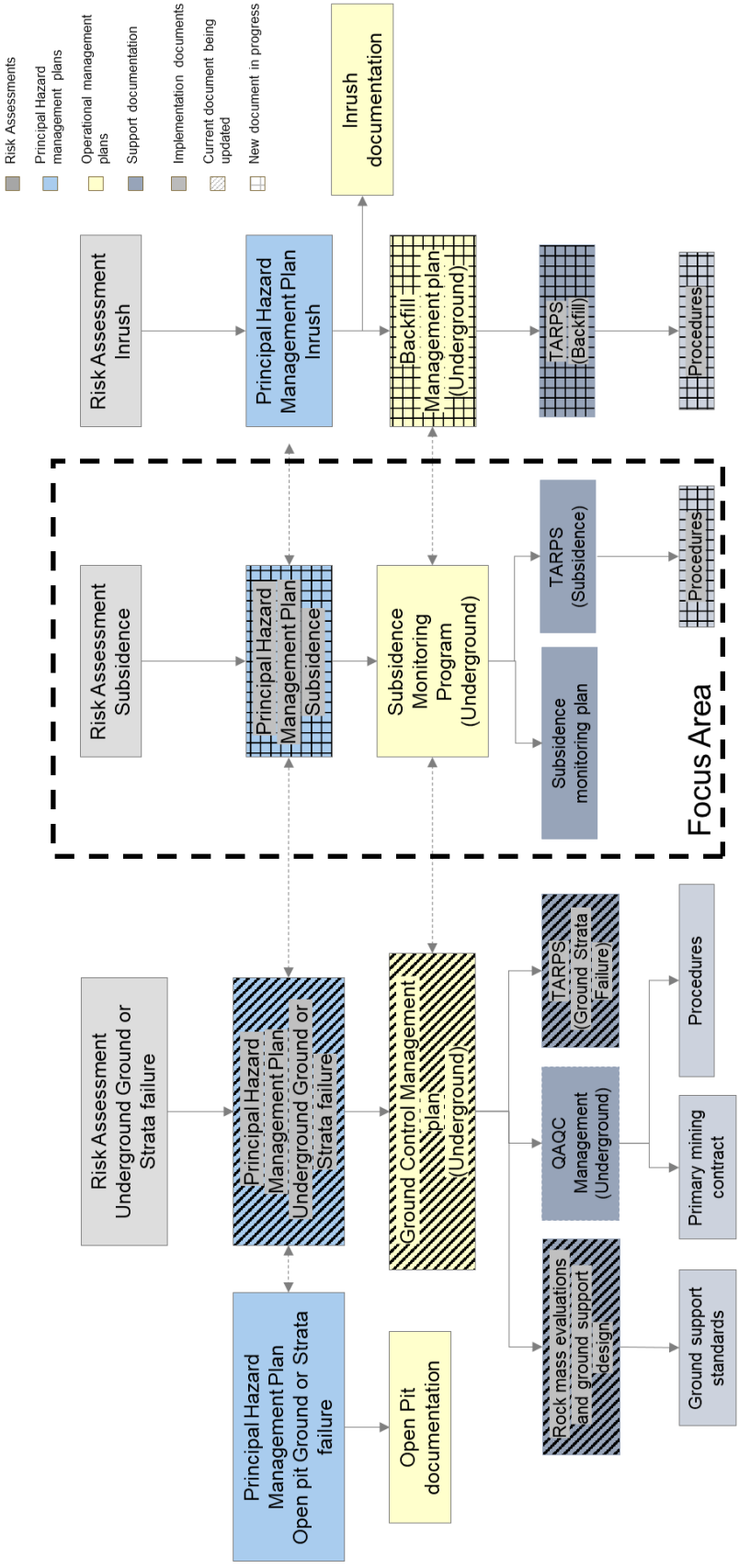

Figure 3: Documentation system implemented for CGO UG Operations

2. Statutory Requirements

2.1 Development Consent Conditions

SSD 10367 has a specific section in Part B of the consent addressing subsidence management. These specific criteria and other relevant conditions to subsidence management are summarised in Table 1 below.

Table 1: Conditions in SSD10367 relevant to this management plan

State Significant Development Condition	Section
A1. In addition to meeting the specific performance measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the construction and operation of the development, and any rehabilitation required under this consent.	Section 1
A11. The Applicant must operate of the Community Environmental Monitoring and Consultative Committee (CEMCC) established under DA 14/98 for the Cowal Gold Operations. The CEMCC must be operated in accordance with the Department's Community Consultative Committee Guidelines: State Significant Projects (2019) during the life of the development, or other timeframe agreed by the Planning Secretary. *Notes:* • *The CEMCC is an advisory committee only.* • *In accordance with the Guidelines, the Committee should comprise an independent chair and appropriate representation from the Applicant, BSC and the local community.*	Section 16
A12. Where conditions of this consent require consultation with an identified party, the Applicant must: consult with the relevant party prior to submitting the subject document for approval; and provide details of the consultation undertaken to the Planning Secretary, including: (i) the outcome of that consultation, matters resolved and unresolved; and (ii) details of any disagreement remaining between the party consulted and the Applicant and how the Applicant has addressed the matters not resolved.	Section 1 and Section 0
B11. The Applicant may only use consolidated paste fill material to backfill stopes.	Section 9
B12. The Applicant must ensure material used to backfill stopes maintains long term stope stability and results in negligible environmental harm.	Section 9
B13. The Applicant must prepare a report to confirm that the paste fill material meets the performance measures in Condition B12. The report must: be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary; set technical specifications for the paste fill material production and clarify its physical and leaching characteristics; include a program for the ongoing testing of the paste fill material to ensure it meets the set technical specifications and performance measures; and be submitted to the Planning Secretary for approval prior to backfilling stopes with consolidated paste fill material.	Section 9
B14. The Applicant must not mine stopes above 80 m AHD, unless otherwise agreed by the Planning Secretary.	Section 3.2 and Figure 5

State Significant Development Condition	Section
B15. The Applicant must prepare a Subsidence Monitoring Program, which has been prepared in consultation with the Resources Regulator, that includes: a detailed description of ongoing subsidence monitoring; detailed baseline data for subsidence monitoring above the Underground Mine Development and data to assist with the management of risks associated with stope overbreak or failure; in-situ stress measurement; detailed measures and controls that would be implemented to avoid and/or minimise subsidence, through management of risk associated with stope overbreak and/or stope failure; a risk assessment and trigger action response plan (TARP) to identify and manage stope instability; a contingency plan and adaptive management process; and validation of subsidence predictions to assess and analyse the subsidence effects and resulting impacts under the program and any ensuing environmental consequences.	This Document
B16. Within two years of commencement of the development and every three years thereafter, unless otherwise agreed by the Planning Secretary, the Applicant must prepare a report detailing the results of the monitoring program.	Section 0
B17. The Applicant must implement the Subsidence Monitoring Program as approved by the Planning Secretary.	This document

3. Subsidence Hazard Definitions and Risk Assessment

3.1 Subsidence definition

Subsidence is defined as movements within the ground strata caused by mining that may cause deformation changes to the natural surface level. This may include subsidence (lower levels that natural) or upsidence (higher levels than natural).

At CGO the primary potential risk relating to surface subsidence has been identified as chimneying from UG excavations because of excessive overbreak of stopes or through uncontrolled failure of faults. A potential risk relating to upsidence may be caused due to fault movements causing ground displacements that are reflected on surface.

The underground development with respect to the surface is provided in Figure 4.

The system described in this document focuses on management of a stable, hard-rock crown pillar between the underground operation and surface areas such that there cannot be any affect at surface attributable to underground mining.

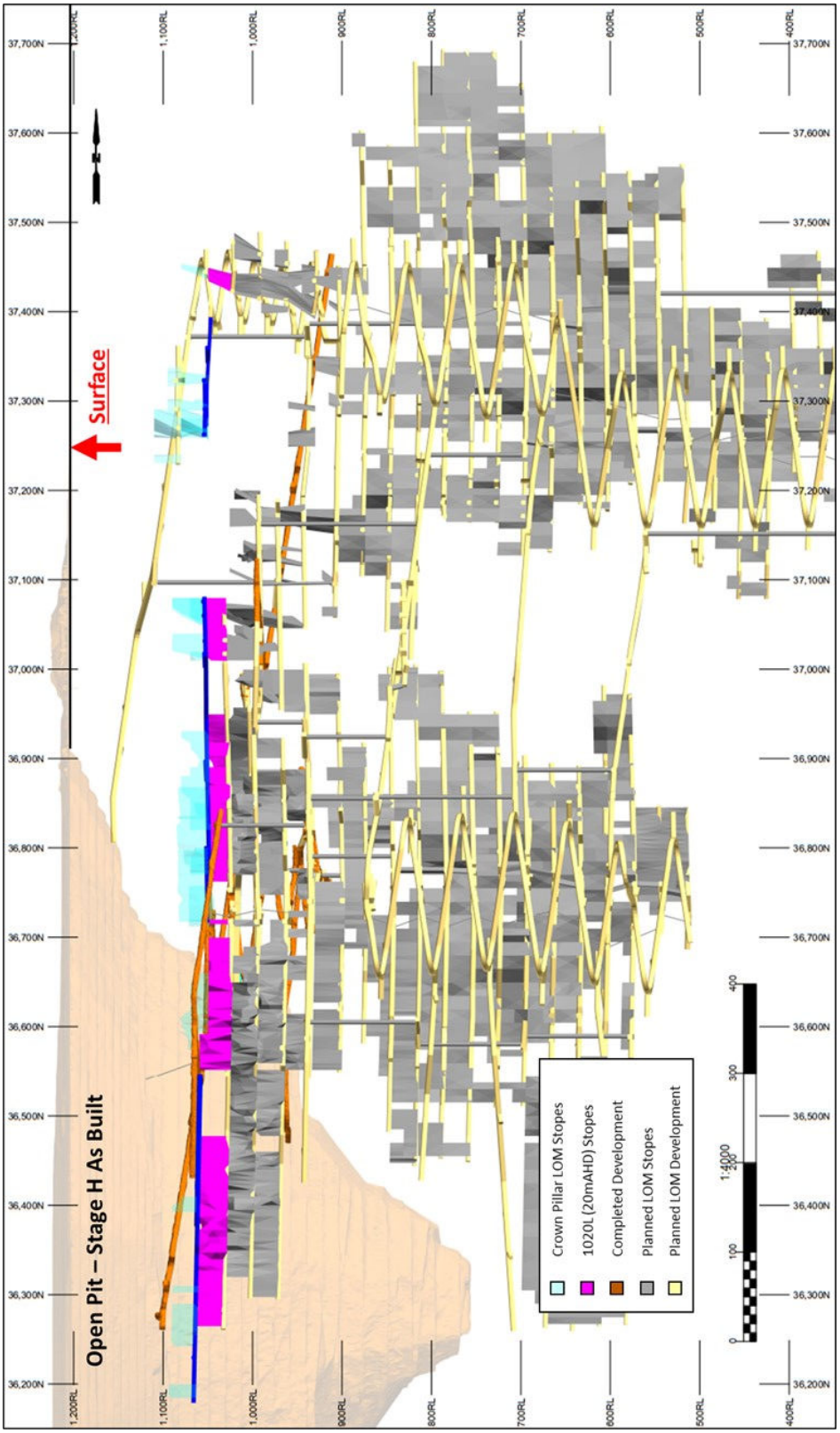

Figure 4: Layout of CGO UG with respect to the surface.

3.2 Crown pillar definition

The crown pillar (Figure 5) is defined as the area between the 1050mRL (50AHD) and the top of fresh rock (TOF). The TOF corresponds to the base of the transitional zone (hard oxide – HOX) between the weathered oxides (soft oxides – SOX) and the fresh rock.

HOX is competent rock that requires blasting (separate from SOX which is free dig). The HOX is distinguished from fresh rock when there are no signs of oxidation within the rock mass. Major structures may still have some signs of oxidization below the TOF boundary.

The depth of the top of fresh rock ranges from 1085mRL to 1140mRL (85 AHD to 140AHD).

Stopes within the crown pillar (blue in Figure 5) will not be mined until subsidence hazard can be demonstrated to be negligible and, where required, in agreement with the Planning Secretary (above 80mAHD).

3.3 Subsidence control zone

Areas deemed to be at higher potential risk of chimneying through the crown pillar will be subject to monitoring and prevention controls. These areas are defined as the **Subsidence Control Zone**. Subsidence controls that are the subject of this document are considered to apply to all areas of the Subsidence control zone.

The Subsidence Control Zone is immediately below the crown pillar between the 1020mRL and the 1050mRL (Figure 6). Stopes below 1020mRL are not considered likely to cause a subsidence event and will not be subject to the subsidence prevention controls illustrated in this document. However, they will be subject to normal strata control measures as defined by the Ground Control Management Plan and Underground Ground or Strata failure Principal Hazard Management Plan.

Monitoring will be installed above the Subsidence Control Zone on the 1050 Level (50mAHD) at the base of the crown pillar.

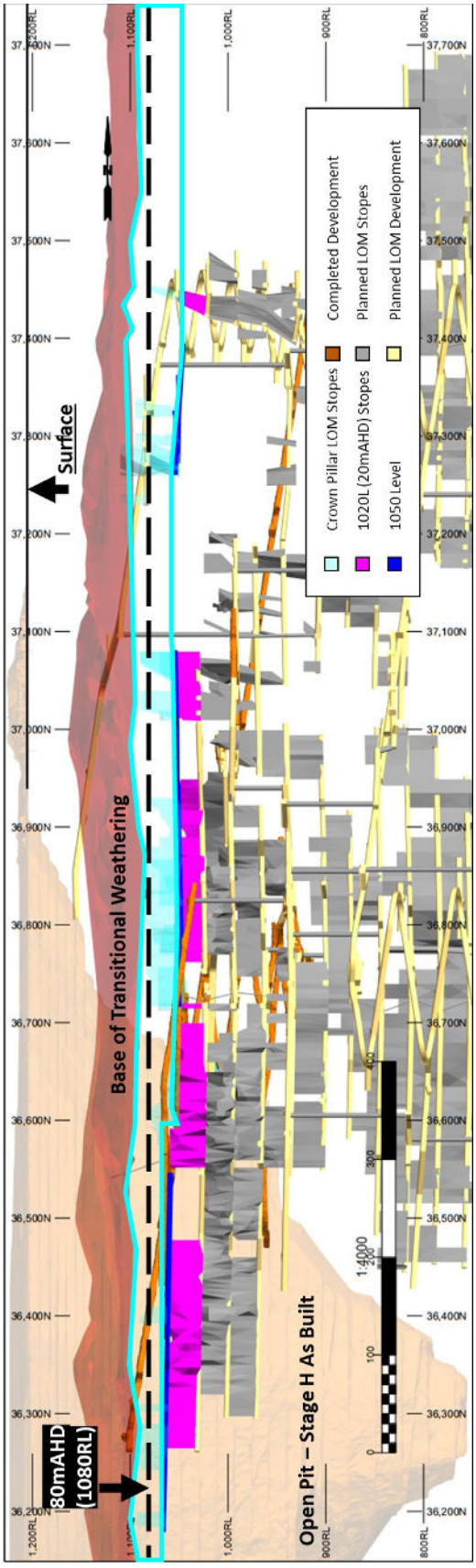

Figure 5: Crown pillar as defined by CGO.

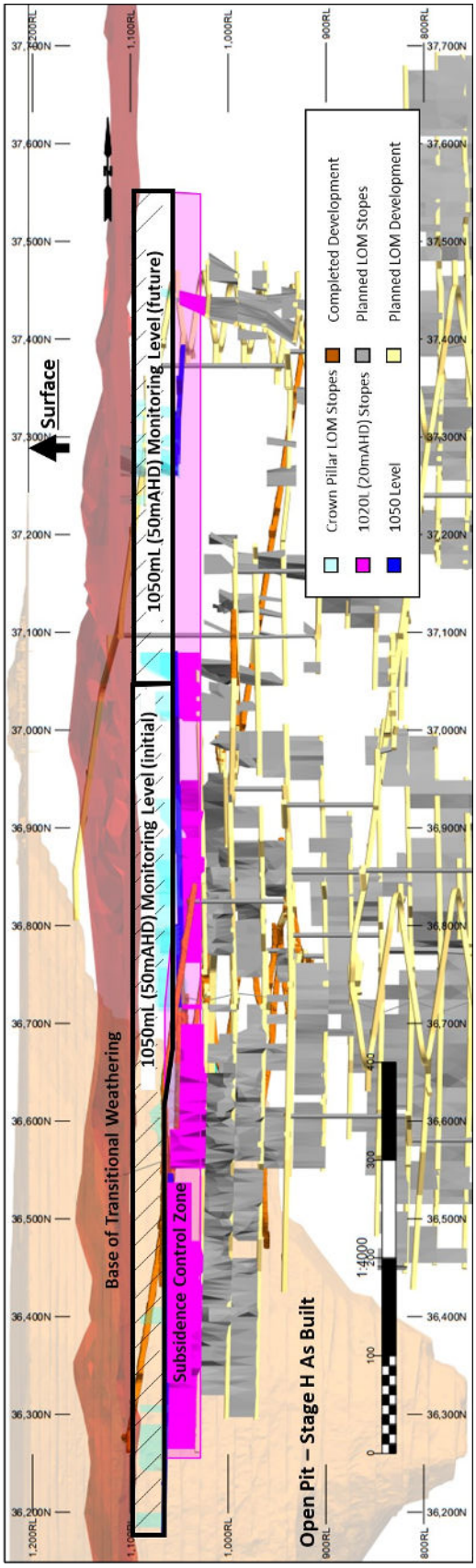

Figure 6: Subsidence Control Zone.

3.4 Subsidence risk assessment

3.4.1 Hazards identified

A risk assessment for subsidence has been conducted with the hazards identified being:

- Failure of development resulting in unravelling to surface
- Failure in stope resulting in unravelling to surface
- Stress induced failure of crown pillar (both due to natural stresses and mining induced stresses)
- Underground causing impact to Open Pit stability
- Open Pit causing impact to Underground stability

3.4.2 Hazard controls

The controls broadly fit into the following categories:

- Data collection and evaluation
- Mine Planning
- Mine Design
- Implementation
- Monitoring
- Procedures and training

3.4.2.1 Data collection and evaluation

Data collection and evaluation includes collecting both geological and geotechnical data from drill core and underground mapping to ensure that the input information for mine design is kept up to date and that the geotechnical conditions are consistent with current understanding. This information allows for appropriate mine planning and mine design for the specific conditions.

The data to be routinely updated includes:

- Lithology model
- Structural model
- Rock mass data

3.4.2.2 Mine Planning

Many of the controls for the prevention of crown pillar failure occur during mine planning. These controls include:

- Having a defined crown pillar that is not extracted early in the mine life
- Crown pillar in fresh rock reducing the consequence of unravelling
- Mine sequence has been selected based on modelling to manage stress impacts
- Underground interactions with Open Pit designs considered
- Having a documented underground mine planning system (from long term to short term) that incorporate reviews from all UG departments
- Ensuring the mine sequence is suitable for stress management

3.4.2.3 Mine Design

To minimise the risk of crown pillar failure the mine design includes considerations of:

- Minimum pillar distances between adjacent excavations (stopes and / or development drives)
- Ground support designs that account for the rock mass conditions and expected changes in stress
- Individual stope design process that includes signoff from all underground departments and which identifies geotechnical risks which are communicated to the mining team for mitigation
- Drill and blast designs that consider major structures and geotechnical conditions of the stope
- Backfill design that considers the support required for the stope

3.4.2.4 *Implementation*

Implementation is critical to ensuring failure of the crown pillar is prevented through good work practices.

Controls include:

- Additional ground support (e.g. cables) at the base of the crown pillar installed prior to stoping
- Scheduled backfilling of all stopes
- Quality Assurance and Quality Control (QAQC) of ground support that ensures the installation and performance of ground support is as designed
- QAQC management of the drill and blast process to ensure that the designs are implemented according to the design
- QAQC of backfill to ensure that fill masses are implemented and perform as designed

3.4.2.5 *Monitoring*

Monitoring of the crown pillar will allow identification of areas of concern that have the potential to result in a subsidence event should mitigation not occur.

Monitoring controls include:

- Instrumented monitoring of the crown pillar to identify of areas of concern that have the potential to result in a subsidence event for mitigation
- Surveying of all voids at the completion of development and stoping that ensures that overbreak is identified and adequate additional controls are put in place where required
- Inspections of the stopes as they are extracted to ensure performance is as expected
- Periodic inspections of accessible areas in the 1050 and 1057 monitoring level to confirm the integrity of the crown pillar

3.4.2.6 *Procedures and training*

It is important that all underground operators understand the risk of subsidence and are trained to identify hazards that may lead to a subsidence event. All operators will be trained to undertake the task that has been given to them to the level of quality expected at CGO.

4. Geotechnical Rockmass Characterisation

Geotechnical rock mass characterisation is an on-going process at CGO. Geological and Geotechnical Data collection occurs through routine diamond drill hole logging and mapping.

Lithological and structural models are provided and updated periodically to ensure that they reflect localized observations.

4.1 Lithology

GRE46 occurs within the Cowal Igneous Complex, a volcano-plutonic complex of Ordovician age within the Macquarie Arc of the Eastern Lachlan Orogen. The sequence has been overturned to be subvertical and runs west to east. The oldest rocks form the centre of the deposit, comprise of a thick sequence of volcaniclastic sedimentary sandstones, conglomerates, and mudstones with trachydacitic lava flows. These have been sub-classified into coarse-grained and fine-grained sediments however, the classification is gradational rather than distinct. The sequence is bounded by Glenfiddich Fault to the west. Thick laminated to massive mudstone units form the eastern extents of the GRE46 Deposit.

A holocrystalline intrusive package of medium to high Potassic calc-alkaline gabbros grading through to mafic diorites and monzodiorites forms the Muddy Lake diorite sill. The sill is present on both hanging wall and foot wall sides of bounding Glenfiddich Fault, however the multi-element geochemical data indicates that the fault delineates separate intrusive phases (Augenstein, Reid, Milojkovic, & Dobe, GRE46 Relog, 2018).

Although the low sulphidation, epithermal, Au-Ag GRE46 deposit is largely structurally controlled through the Galway, Regal, Manna and Ardbeg faults, the correlation between faulting and mineralisation is not uniform. There are many intervals within GRE46 with bonanza mineralisation and no evidence for tectonic faulting within or nearby. Where mineralisation coincides with faulting, faulting occurs contemporaneously with hydrothermal alteration.

The stratigraphic column for GRE46 can be seen in Figure 7.

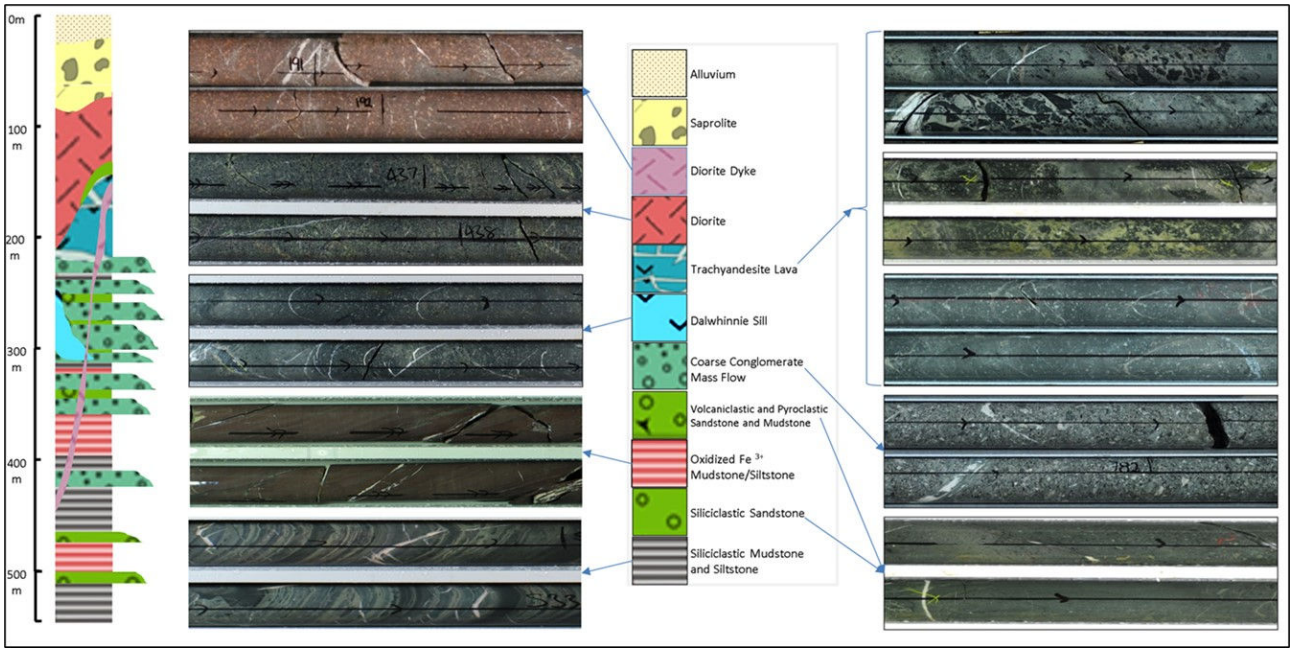

Figure 7: Stratigraphic column of for the lithology in CGO Underground

4.2 Structures

The Cowal mine is located in the Ordovician Lake Cowal Volcanic Complex, east of the Gilmore Fault Zone within the eastern portion of the Lachlan Fold Belt. The faults within the mining area have been modelled from drill core and mapping. These have been categorized from Major to Minor based on their width and observed impact on localized ground conditions. A diagram of these faults and their proximity to the mining area is provided in Figure 8 and a description of each is provided in Table 2.

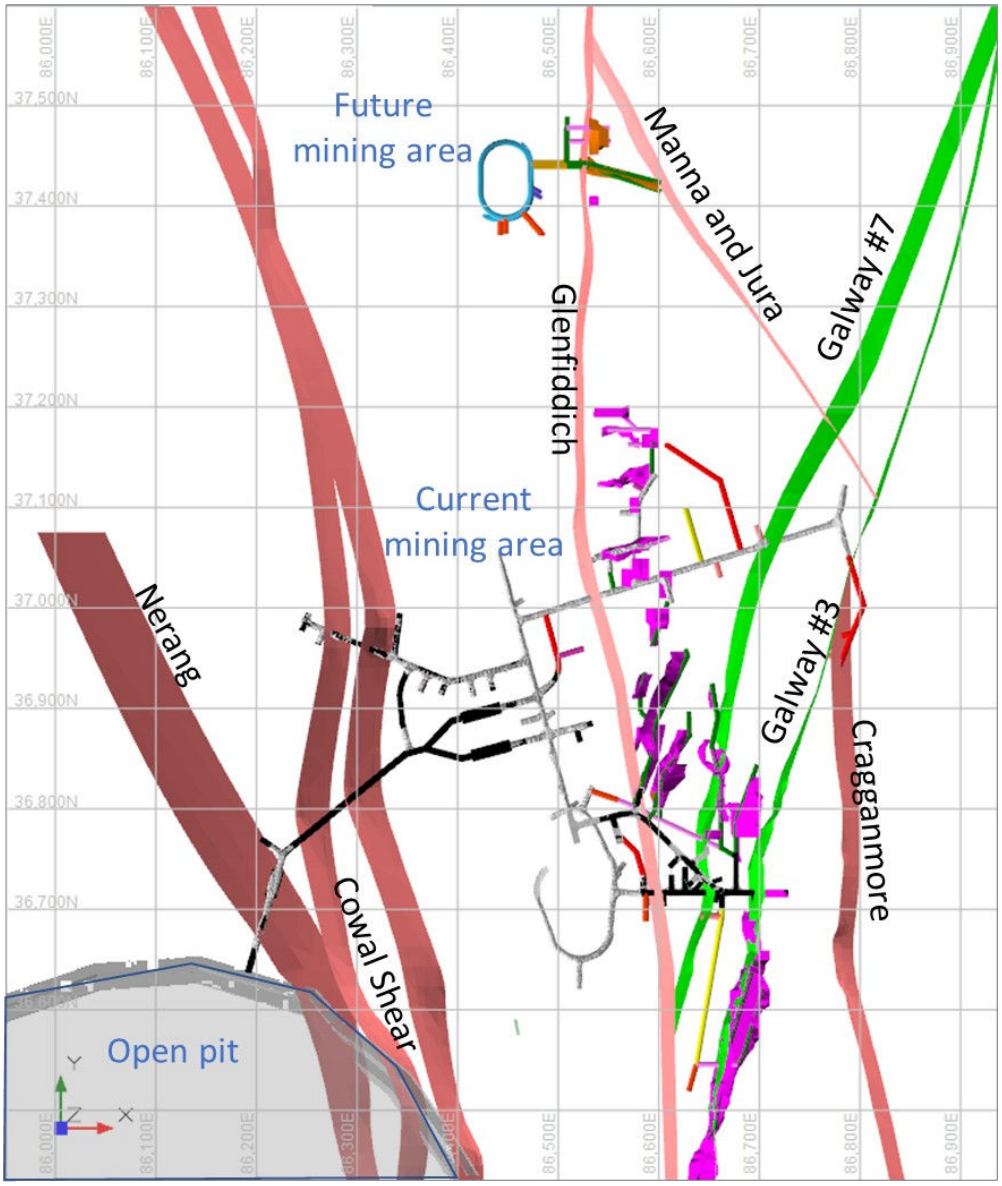

Figure 8: Significant faults intersecting CGO UG

Table 2: Fault descriptions and influence on GCO UG

Structure Name	Estimated thickness	Comments	Consequence
Major Wider zones that influence ground conditions but have not caused major instability. Additional support (such as fibrecrete) is typically required. Models regularly updated and accounted for in design.			
Nerang – Shear Zone	2m	1cm pug within wider zone of brecciation/shearing. Associated with strong phyllic alteration (silica-sericite-pyrite)	To the west in the wall of the open pit. Only intersected in one ventilation drive that is complete. Stable without additional support
Cowal – Shear Zone	20m	Strong sheared zone with associated competent dyke. Sericite altered. Gouge clay on shear and fracture planes with minor brecciated clasts. Occasional slickensides, Moderate clay gouge abundant towards base of zone noted in some holes	To the west in the wall of the open pit Only affects ventilation drives to pit. Stable with additional support (fibrecrete)
Glenfiddich – type	Broader Zone up to 5m wide, containing discrete clay filled planes	Pug usually 10cm wide but can be up to 1m within wider damage-zone up to 5 metres wide. Late fault with large offset.	Cross cuts main mining area and encountered in accesses. Stable without additional support however additional support also added for future planning
Lava Dyke – type (renamed Cragganmore fault)	Up to 2m	Clay pug 1-5cm in width within wider damage zone of 1-2m. Late fault with offset <10m. This fault is still being interpreted by the geology teams as previous to recent grade control drilling, data points were too sparse for accurate modelling	To the east of the majority of development and at this stage only intersected in 3 or 4 drives. Stable with additional support
Lower Mana and Upper	Up to 2m	Upper and lower Manna are one single fault/shear zone. They are separated as appears to be offset by Jura. Upper Manna is the section above Jura. Lower Manna is the section below Jura	Known to affect the north of the ore body. Associated with mineralization. Similar to Cragganmore No current experiences however, it is expected to be similar to Cragganmore . Based on drill hole information it is likely that additional support will be required.
Jura	Up to 1m	Clay pug 1-5cm in width within wider damage zone of 1-2m. Late fault with offset <10m.	Located to the far north Not well defined. Potentially similar ground conditions to the Galway structures

Moderate Generally thin and do not significantly influence ground conditions Models regularly updated.			
Galway Splay 3 – type	Up to 2m	Phyllic altered zone of shearing. Strong sericite alteration. Some 5mm pug filled faults within zone	Associated with mineralization in some areas. Stable without additional support
Galway Splay 7 – Shear Zone	Up to 2m	Phyllic altered zone shear zone with some fractured rock. Gouge filled planes to 10mm noted in some holes at top and bottom of unit	Associated with mineralization in some areas. Stable without additional support
Minor Do not influence ground conditions. Models inaccurate and not regularly updated			
Ardberg – type	Up to 1m	Clay sericite filled, typically sericite altered. Contained within broader sericite alteration zone.	
Galway Splay 4 – type	Up to 2m	Phyllic altered zone of shearing. Strong sericite alteration. Some 5mm pug filled faults within zone. One of many splays within main Galway corridor. Not regularly updated in the GRE46 model	
Galway Splay 5 – type	Up to 2m	Phyllic altered zone of shearing. Strong sericite alteration. Some 5mm pug filled faults within zone. One of many splays within main Galway corridor. Not regularly updated in the GRE46 model	
Galway Splay 6 – type	Up to 2m	Phyllic altered zone of shearing. Strong sericite alteration. Some 5mm pug filled faults within zone. One of many splays within main Galway corridor. Not regularly updated in the GRE46 model	
Galway Splay 8 – type	Up to 2m	Phyllic altered zone of shearing. Strong sericite alteration. Some 5mm pug filled faults within zone. One of many splays within main Galway corridor. Not regularly updated in the GRE46 model	

4.3 Rockmass characteristics

Rockmass data available for CGO comes in the form of Q data collected from selected drill holes, RQD data collected on all drill holes and mapping data collected routinely underground.

The rock mass evaluation has recently been updated and has defined geotechnical domains based on northing (Figure 9). The line along 37,000N defines the line between the northern and southern zones. To the south the lithology comprises of diorites and sediments categorised depending on grain size (fine sediments and coarse sediments). The fine sediments are lowest quality of the lithologies with a median Q' of 3.5. The coarse sediments and diorite are highly competent with median Q' values of 15 and 30 respectively.

To the north the diorite is replaced by Lava (trachyandesite). The prevalence of mudstones within the fine sediments reduces whereas conglomerates become more dominant. The median Q value for the lava is 30 whilst the fine sediments and coarse sediments are comparable with the south domain.

Intrusive andesitic dykes exist in both zones and have a Q' value of 30.

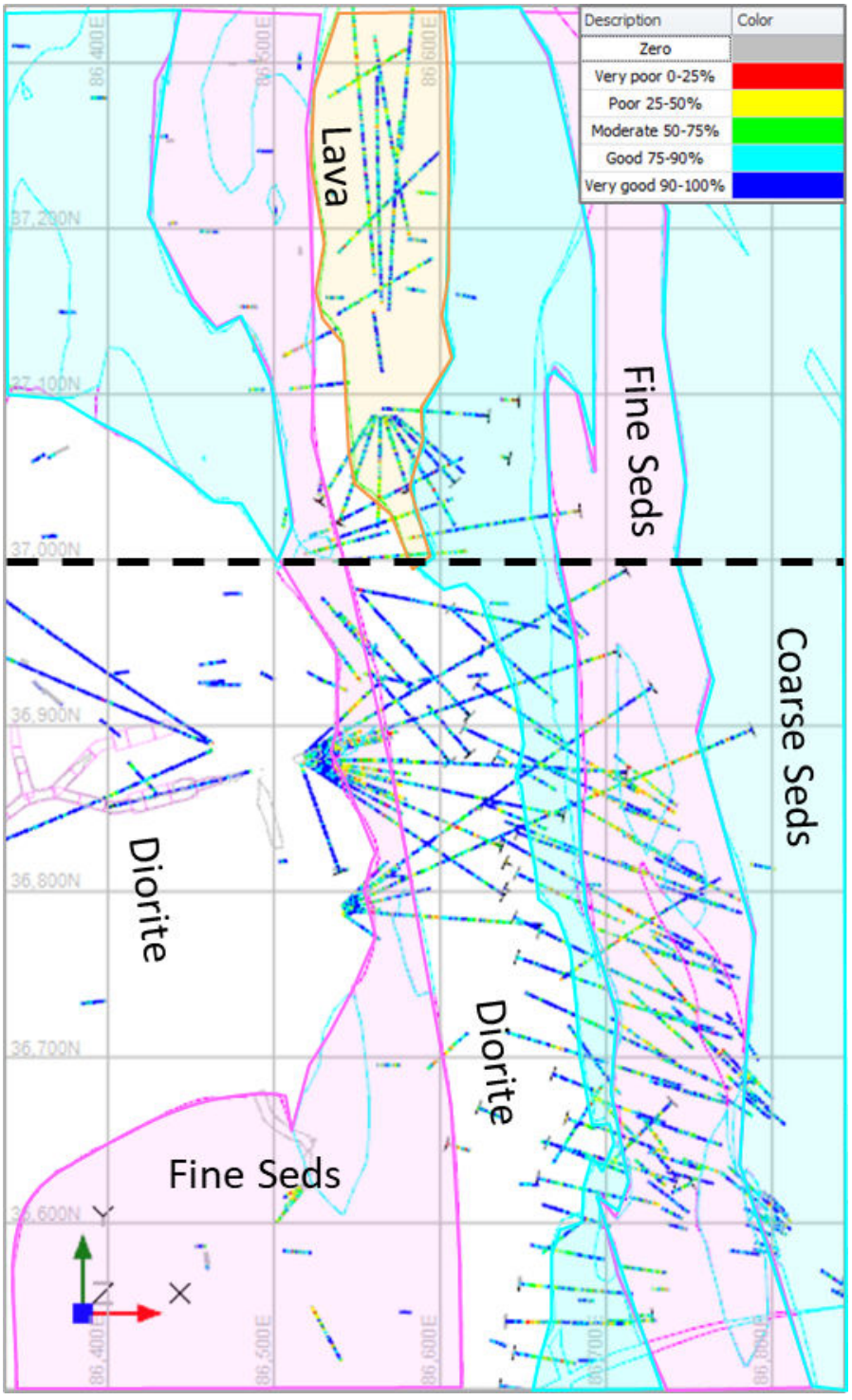

Figure 9: Geotechnical Domains in plan view for CGO UG clipped at 1005mRL.

5. Stress measurements

Stress measurements for underground were collected using a variety of test methods including acoustic emissions and hollow inclusion cell testing.

The recommended orientations from Mining One are provided in Figure 10 with the stress gradient provided in Figure 11.

The stress orientation is perpendicular to the regional stress field however, this may be due to localised variations and cannot be discounted. The stress gradient is similar to the regional stress field and magnitude is aligned with other mines in the region.

Modelling conducted by Beck Engineering (Campbell, 2021) indicates that high stresses will not have a significant impact on the operation.

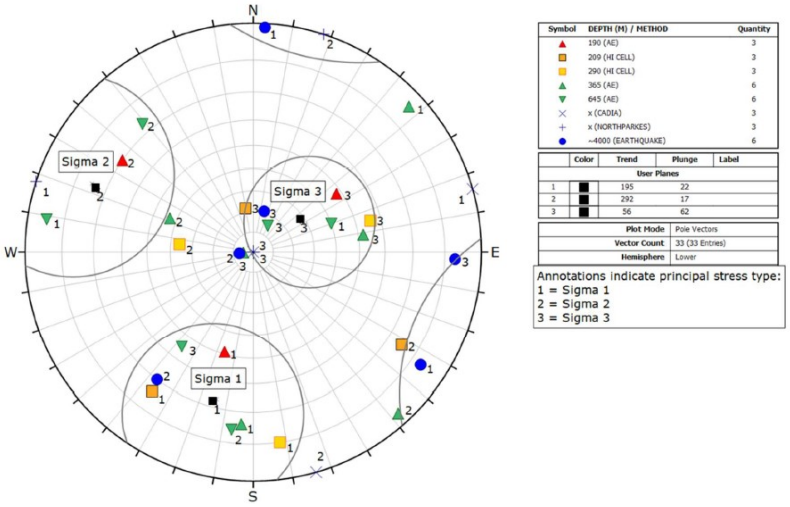

Figure 10: Stress orientations provided by Mining One (Hulls 2020)

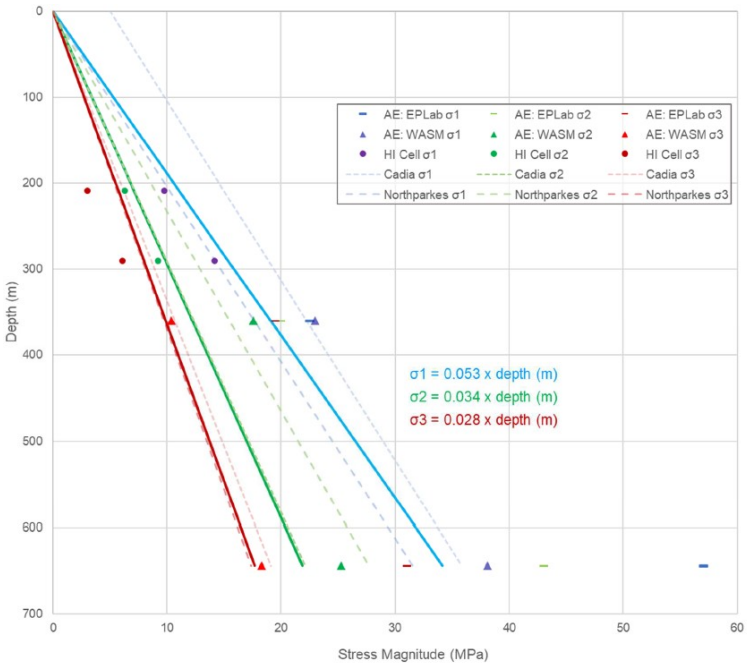

Figure 11: Stress Gradient provided by Mining One (Hulls 2020)

6. Numerical Modelling

6.1 Current modelling

Numerical stress modelling of the underground mining sequence and open pit interactions has been completed periodically throughout the development of the CGO Underground. The most recent sequence modelling was completed by Beck Engineering Pty Ltd using non-linear 3D finite element modelling methods.

Modelling specific to the risk of subsidence was undertaken as part of the approval process. The upper levels have not changed significantly since approval to necessitate a re-evaluation.

6.1.1 Subsidence Model inputs

The model uses a qualitative calibration to simulate the impacts of open pit and underground mining on surface subsidence throughout mining and at the end of mine life.

The inputs included:

- Lithological boundaries including transitions between the transported material, soft oxides and hard oxides
- Major structures
- In situ stress regime
- Rock mass strength
- Rock mass characteristics
- Mining geometry
- Extraction sequence

6.1.2 Modelling conclusions

The main outcomes listed below are direct extracts from the report completed in July 2020 (Campbell, 2020);

- Vertical displacement forecasts on the surface above the proposed underground mine are generally less than 15mm and considered negligible (Figure 12). This amount of displacement is well within the limits and precision of current geological understanding, material properties and capabilities of a mine-scale model.
- Forecast surface movement is slightly upwards (i.e. upsidence). This is due to displacement along the Glenfiddich fault, which becomes slightly mobilised due to nearby underground mining. There is also minor uplift in proximity to the pit due to continued mining of the pit and removal of 'dead-weight' (or overburden pressure).
- The surface of the excavations adjacent to the crown pillar do not exceed 0.1% strain (Figure 13)

6.2 Future modelling

The current models are relevant to the current approved mine plan. Any significant changes to the mine plan will require a review of the modelling and where necessary updates to the model.

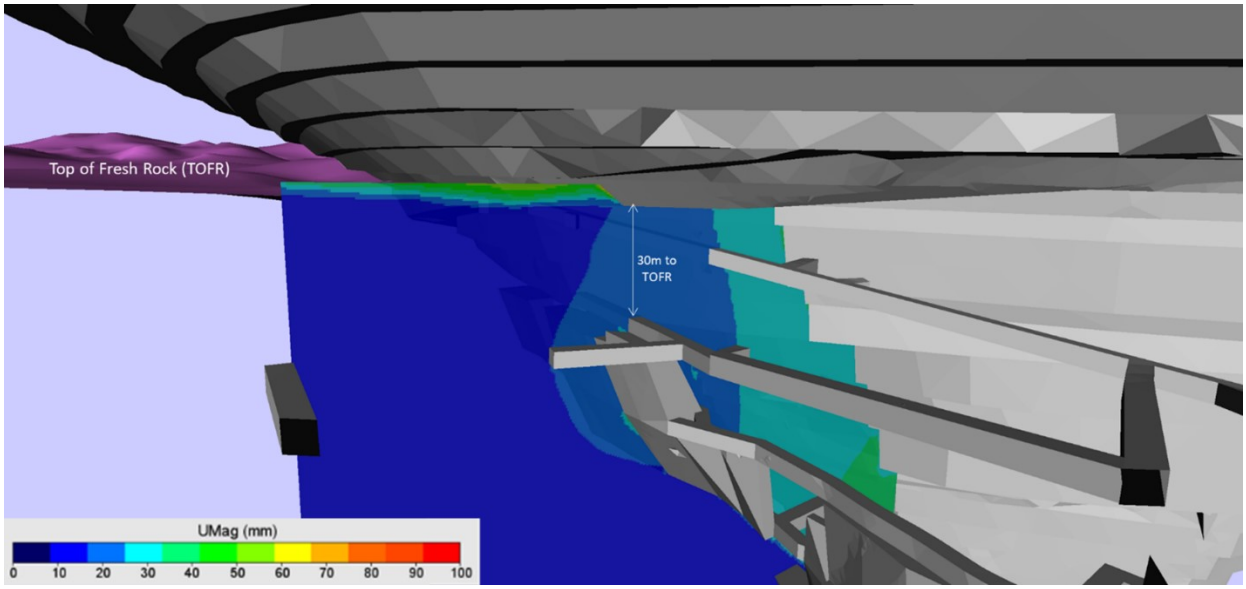

Figure 12: Total predicted displacement between 2022 and 2030 (diagram provided by Beck Engineering 2022)

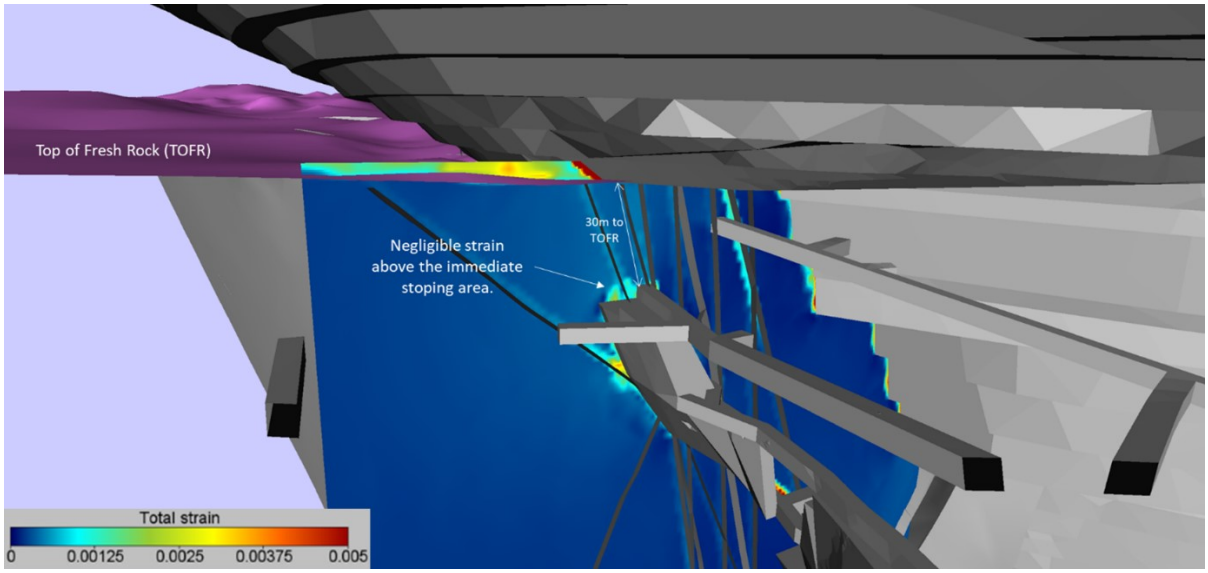

Figure 13: Total predicted strain between 2022 and 2030 (diagram provided by Beck Engineering 2022)

7. Underground Mine Planning Controls

7.1 Long term planning considerations

During the planning of the mine (Feasibility and Optimization studies), subsidence has been a key consideration in the long term mine planning process. The following controls have been adopted:

- All stopes above the top of fresh contact have been removed from the Underground Ore Reserve and Life of Mine plan
- The Life of Mine plan maintains a 15m minimum separation of stoping to the top of fresh rock contact
- Stopes within the crown pillar (blue in diagram) will not be mined until subsidence hazard can be demonstrated to be negligible and, where required, in agreement with the Planning Secretary (above 80mAHD) (Condition B14)
- The stopes within the crown pillar are planned for end of mine life extraction after demonstrated successful production experience

7.2 Extraction sequence

Stress modelling of the extraction sequence has been undertaken by Beck Engineering to provide guidelines on the best sequence to reduce rock mass damage and prevent pillar loading. These recommendations have been considered in the Mine Planning process. Stress modelling will be repeated when material changes to the sequence occur.

7.3 Planned stope dimensions

The stope dimensions were determined in the Feasibility Study (Table 3). Whilst these are specified for the Endeavor – Galway section of the mine, the recommendation does not vary between the mining districts.

The first stopes and those within the subsidence control zone will be mined at a strike length of between 15m and 25m based on width of the stope. Wider stopes will have a shorter length and narrow stopes will have a longer length. The target hydraulic radius will be the recommended 6.8.

As knowledge of stope behaviour is gained, stoping dimensions will be reviewed and potentially expanded based on observed performance and rock mass evaluations.

Table 3: Stope dimension guidance provided by Mining One in the Feasibility Study 2021.

			Geotech Guidance		Max. Stoping Dimensions			
		Domain	Max HR UnSupported	Max HR Supported	Supported	Calc HR	Sub Level Spacing	Length/ Width
Endeavour-Galway	Single Lift	EG-North	6.6	8.5	No	6.8	30	25
		EG-South	6.6	8.5	No	6.8	30	25
		EG-FW	4.8	6.5	No	6.8	30	25
		EG-HW	4.7	6.4	Yes	6.8	30	25
		EG-Crown	6	7.8	No	6.0	30	20
		EG-Crown	6	7.8	Yes	7.5	30	30
Endeavour-Galway	Double Lift	EG-North	6.6	8.5	No	6.0	60	15
		EG-South	6.6	8.5	No	6.0	60	15
		EG-FW	4.8	6.5	No	6.0	60	15
		EG-HW	4.7	6.4	Yes	6.0	60	15
		EG-Crown	6	7.8	No	5.0	30	15
		EG-Crown	6	7.8	Yes	6.8	30	25

7.4 Stope design process

Each stope will be designed using a stope note process. The stope note will comprise of analysis and reviews from each of the technical and operational departments that considers the local rock mass conditions. The planned document will include sign off from representatives of each department.

8. Stoping Operational Controls

8.1 Stoping operational controls

The following operational controls have been put in place to ensure stope overbreak does not lead to a subsidence event:

- The first stope extracted will be extracted away from the crown pillar (below the 1020 level) to ensure that stope performance is understood prior to any potential interaction with the crown pillar zone (1050 level and above).
- Stopes between the 1020 and 1050 will have a top access drive to enable
    - Stopes to be drilled as down holes
    - Additional ground support to stabilize the crown pillar
    - Instrumentation of the crown pillar
    - Adequate backfilling of the stope to the level of the 1050 drive (or higher should it be required).
- TARPs have been devised to respond to triggers that may lead to a subsidence event

9. Backfill

All stopes will be filled. The intended fill method is cemented paste fill.

Pastefill controls will be governed by the inrush risk assessment and principal hazard management plan. The operational management will be through the paste fill management plan.

Evolution has commissioned a paste fill report that address condition B13 of SSD 10367. This report was authored by Quattro Project Engineering in conjunction with SRK. The authors of the paste fill report were endorsed by the Planning Secretary.

10. Underground Monitoring

10.1 Crown pillar monitoring

An underground subsidence monitoring system has been designed to provide verification data for the subsidence modelling outcomes (Beck Engineering, 2020) and to record potential movements within rock strata.

Monitoring is intended to be conducted over the life of mine to detect changes in the rock mass due to global extraction. Cable protection, access restrictions and longevity have all been considered as part of the design process. The monitoring system will be active prior to the start of stoping.

The system is designed to collect data at the base of the crown pillar (1050L, 50mAHD) in the following areas (Figure 14):

- Base line-non-stoping areas
    - provide verification that global stability is not being affected
- Zone 1 - Stope crowns
    - confirm the long-term crown stability after stoping is completed
- Zone 2 - Fault monitoring
    - verify the fault movements identified in the numerical modelling and inform additional controls should movement occur

The area to be monitored is provided in Figure 14. Not all mining areas on the Monitoring Level (1050mRL) will be developed immediately. Designs will be refined with increasing orebody and geotechnical information. The monitoring strategy will be consistent across the mine, where:

- A combination of extensometers and instrumented cables are installed.
- Instruments in stoping areas will be spaced at a minimum every second stope (currently 30m).
- Baseline instrumentation will be placed away from the stoping area with consideration of the local ground conditions.
- Faults that materially change the ground conditions will be instrumented.

Figure 14: Current and future(shaded) monitoring areas

The stress modelling predicts that the approximate depth of the strain and displacement induced by stoping is less than 5m. The monitoring system will include a network of extensometers installed at depths between 6 and 15m into the rock mass prior to the initiation of stoping.

In addition to the extensometers, several instrumented cables between 6m and 9m long will be installed. The primary purpose of these is to monitor fault movement.

The intended locations is provided in Figure 15. The instrumentation placement is based on the current mine designs and implemented development. Within capital areas that have been developed, the instrumentation plan in these areas is unlikely to change. However, in the ore drives associated with stoping, the mine designs are being updated as more drilling is being conducted and detailed designs are being finalized. Some modifications may be required in the ore drives, based on changes to the mine design.

The full extent of the monitoring plan including all the sensors considered (and excluded) is provided in Subsidence Monitoring design referenced at the end of this document.

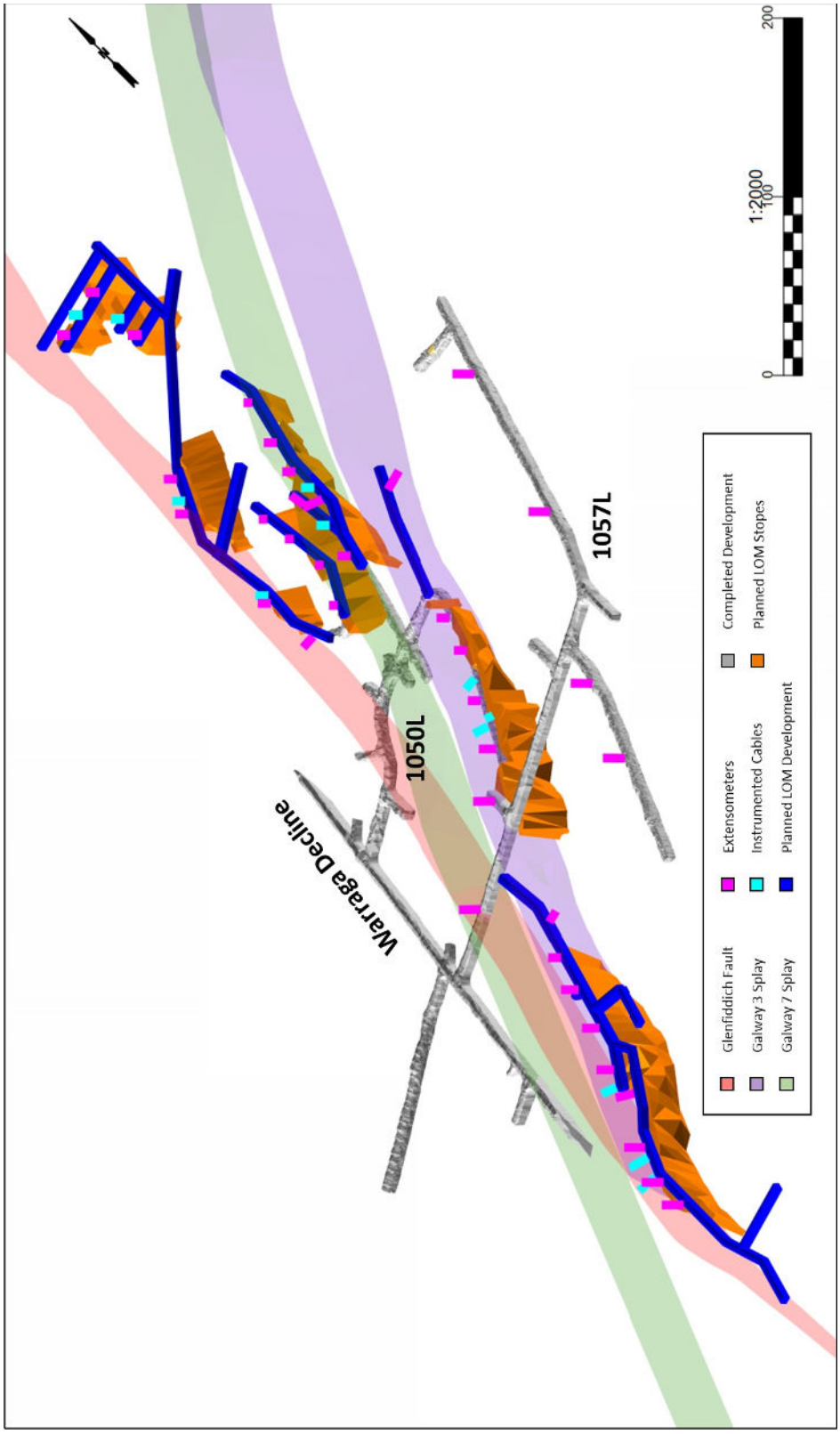

Figure 15: Concept Instrumentation locations for the initial subsidence monitoring.

10.2 Survey scans

Cavity monitoring scans (lidar or similar) of each stope will be taken routinely throughout the extraction of each stope with the final void added to the site void model (survey files).

10.3 Additional monitoring

Additional to survey, routine inspections of each stope (within the safety guidelines of the site) will be undertaken during extraction to visually confirm the performance of the stope.

Periodic inspections of accessible areas in the 1050 and 1057 level will also be conducted to confirm the integrity of the crown pillar.

11. Open pit controls

Additional to controls in the Underground mine, the Open pit mine also has controls for Subsidence.

11.1 Long term plans

The long-term mining department is integrated between the Open Pit and Underground to ensure that the impacts on each of the operating areas is considered.

The current approved mine plan has no impact on the underground operations.

Any future design modifications will include an assessment of the impact to underground operations

11.2 Monitoring

To account for open pit stability a range of monitoring is already undertaken on surface. This monitoring includes:

- Radar monitoring of the Open pit slopes
- Prism monitoring that compliments the radar monitoring of slopes
- Piezometer monitoring adjacent to the pit slopes
- Routine inspections of the Open Pit, Lake Protection Bund and waste emplacements
- INSAR satellite monitoring of the surface surrounding the Open pit inclusive of the Lake Protection Bund

The results of this monitoring are provided in a range of monthly and quarterly reports published by the Open Pit Geotechnical team.

12. Trigger Action Response Plan (TARP)

A TARP has been developed identify triggers and actions to reduce the risk of a subsidence event occurring. The monitoring trigger levels and stope overbreak metrics are based on experience from other sites and the expectations of rock mass behaviour during stoping. Trigger levels will be refined as baseline of production rock mass response is established. The initial TARPs are provided in the additional documentation listed at the end of this document.

13. Contingency planning

In the event that the stope crown pillar fails, contingency measures have been established to provide guidance to the actions required. Each situation may be different and require different levels of action however, the contingency strategy is:

1. Conduct regular cavity surveys to determine progression of failure
    - Cavity monitoring system (CMS) when void is open
    - Drone survey monitoring when void is open
    - Cavity Auto-scanning Laser System (CALS) for borehole scanning
2. Fill to provide confinement
    - Filling process will be dependent on failure location, options include:
        - At the void brow
        - Underground drill holes – can be targeted to any area of the crown pillar
        - Surface drill holes – limited to areas below the active mining area
    - Initial filling with rock
    - Filling with paste
    - Rapid filling can be achieved through a cavity filling phenolic resin product
3. Install TDR monitoring instruments to confirm the stabilisation of the pillar.
4. Should the monitoring indicate that failure is continuing the process would be repeated

To support this contingency plan an evaluation of the accessibility of drilling locations from surface has been undertaken. This has identified that all stopes within the Subsidence Control Zone and crown pillar can be accessed through drilling from either the underground workings or surface. It has also been confirmed that the paste plant can achieve the necessary pressures to reticulate to the contingency filling locations.

14. Roles and Responsibilities

Specific accountabilities and competencies for internal personnel are included in the role descriptions for all roles identified by this document. Any external person required to work underground at CGO must meet the requirements of this plan.

14.1 Statutory Positions

Schedule 10 of the NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 identifies statutory functions. Only people meeting specified requirements are eligible to be nominated by the mine operator to exercise a statutory function. Certain functions have been identified as key statutory functions that predominantly relate to the context of ground control and include:

- General Manager (Mine Operator Representative)
- Mine Manager
- Underground Supervisor
- Mine Surveyor

Personnel who have been appointed to statutory positions shall hold a current practising certificate that authorises the exercise of the statutory function.

14.2 Responsibilities

Roles	Responsibility
Environment Superintendent	• Maintains project approvals, ensuring approval obligations are suitable for the continued operation of the CGO. • Ensures all CGO approval documents are submitted as required by licences, development consent and mining lease conditions and other permits. • Works with relevant government agencies and consultants to ensure necessary project approvals are achieved. • Maintains the implementation of the environment management system and governance programs to ensure the CGO maintains compliance with applicable environmental obligations and minimises environmental harm and risk. • Oversees the environmental monitoring and reporting program. • Coordinates external environmental audits and site visits, acting as primary contact on environmental matters. • Responsible for site environmental monitoring, including external consultant monitoring and reporting. • Implementation and compliance with EMPs, environmental approvals, licensing and permits. • Responsible for annual internal auditing and reporting (e.g. CGO Annual Review).
General Manager	• Provides adequate resourcing to support site environmental management and provided to allow for geotechnical assessments and on-going evaluations. • Provide strategic direction. • Responsible for management of Evolution staff and all contractors.
Mine Manager	• Responsible for ensuring all mining works are carried out in accordance with the mining lease and operational areas and other relevant approvals and legislation. • Provide strategic direction.

Mining Engineering (Long Term and Short Term Planning)	• Responsible for developing and issuing the mine design accounting for geotechnical considerations. The mine designs must respect crown pillar specifications, standoff distances to the open pit and wherever possible minimum separation distances between excavations as per geotechnical guidance. • All designs should be provided to the geotechnical department in timely manner to ensure adequate time for revision and where necessary, design modifications. • Responsible for ensuring that the ground support requirements are specified on all plans issued to the contractor are as per the geotechnical specifications.
Geology	• Responsible for assisting in data collection (such as RQD data) and updating and maintaining the structural and lithological models that are used as input into the geotechnical evaluations
Geotechnical Engineering	• Undertaking the rock mass evaluations and ground support designs to ensure the ongoing stability of the mine. • Ongoing geotechnical data collection that provides verification of the assumptions within assessments. • Undertaking reviews of the mine plan (LOM to short term) to ensure that wherever possible, geotechnical hazards are removed at the design stage rather than depending on limited ground support capacities. • Responsible for specifying the QAQC requirements and reviewing the data to verify that the installed values meet the design requirements. • Recommend appropriate actions if there are non-conformances to the Mine Manager for approval.. • Ensuring the subsidence management plan is routinely updated and reporting requirements are adhered to. • Managing the subsidence monitoring system to ensure continuity of monitoring. • Ensure the requirements of the TARPs are fulfilled and trigger levels are managed based on the appropriate rock mass response.
Survey	• Responsible for ensuring that the survey memos include the ground support requirements. • Responsible for providing notification when the as-built mine does not conform to the design.
General Staff and Contractors	• Every person entering the CGO underground operation are responsible for their own safety. They are responsible for inspecting workplaces and identifying geotechnical hazards and then reporting these to the shift boss for review. • All general staff members trained in environmental procedures and protocols as part of the induction process and regular site meetings. • All general staff members responsible for immediately reporting environmental incidents. • All general staff members responsible for undertaking works in an environmentally sound manner and in accordance with EMPs and site commitments.

15. Environmental Management, Reporting and Auditing

An internal report will be prepared every quarter to report on stopes extracted and to provide a review of the rockmass response to extraction. This will include a review of the instrumentation data along with verification of the additional controls proposed.

As per the requirement B16, a summary report will be provided to the Regulator within two years of commencing stoping and every three years thereafter.

15.1 Revision of strategies, plans and programs

In Accordance with condition C5 and C6 of SSD 10367 this subsidence management plan will be reviewed within three months of:

- the submission of an incident report under condition C7;
- the submission of an Annual Review under condition C9;
- the submission of an Independent Environmental Audit under condition C11;

- or the approval of any modification of the conditions of this consent (unless the conditions require otherwise);
- notification of a change in development phase under condition A5; or
- a direction of the Secretary under condition A3 of Schedule 2

Additionally, to either improve the environmental performance of the development or cater for a modification or comply with a direction, the strategies, plans and programs required under this consent must be revised, to the satisfaction of the Planning Secretary. Where revisions are required, the revised document must be submitted to the Planning Secretary for approval within six weeks of the review.

15.2 Incident Notification

Incidents are defined in SSD 10367 as: A set of circumstances that causes or threatens to cause material harm to the environment.

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

Evolution will maintain a record of and report on any incidents. The Evolution Incident Report Form will be completed when recording incidents at the site.

15.3 Non-Compliance Notification

A non-compliance is defined within SSD 10367 as : *An occurrence, set of circumstances, or development, that is a breach of this consent but is not an incident.*

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

15.4 Annual Review

An Annual Review will be prepared in accordance with the relevant requirements of DPE in accordance of condition C9 and submitted to the Planning Secretary. Consent Condition C9 is reproduced below:

Annual Review

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

a) Describe the development that was carried out in the previous calendar year, and the development

that is proposed to be carried out over the next year;

b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against the:

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

c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;

d) Identify any trends in the monitoring data over the life of the development, including the ongoing interaction between the Cowal Gold Mine and Lake Cowal;

e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and

f) Describe what measures will be implemented over the next year to improve the environmental performance of the development.

Additionally, the annual review document will be submitted to Bland Shire Council and made available to the CEMCC and any other interested person upon request.

15.5 Independent Environmental audit

An Independent Environmental Audit will be conducted in accordance SSD 10367 condition C11. Condition C11 is reproduced below:

C11. Within one year of the date of commencement of development under this consent, and every three years after, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. The audit must:

a) be led by a suitably qualified, experienced and independent auditor whose appointment has been endorsed by the Planning Secretary;

b) be conducted by a suitably qualified, experienced and independent team of experts (including any expert in field/s specified by the Planning Secretary) whose appointment has been endorsed by the Planning Secretary;

c) be carried out in consultation with the relevant agencies and the CEMCC;

d) assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent, water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals);

e) review the adequacy of any approved strategy, plan or program required under the abovementioned approvals and this consent;

f) recommend appropriate measures or actions to improve the environmental performance of the development and any assessment, strategy, plan or program required under the abovementioned approvals and this consent; and

g) be conducted and reported to the satisfaction of the Planning Secretary.

This process provides a mechanism by which environmental management and monitoring at the CGO can be assessed against relevant Development Consent, mining lease and licence conditions

CGO will submit the findings of the independent environmental audit Within three months of commencing the audit, or another timeframe agreed to by the Planning Secretary. Evolution will submit a copy of the audit report to the Planning Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of the recommendations. The recommendations will be implemented to the satisfaction of the Planning Secretary.

15.6 Access to information

In accordance to condition C14 of SSD 10367, Evolution will make information accessible to the public and will keep all relevant information up to date to the satisfaction of the Planning Secretary. C14 has been reproduced below:

Within three months of the date of commencement of development under this consent, until the completion of all rehabilitation required under this consent, the Applicant must:

a) make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this consent) publicly available on its website:

i. the document/s listed in condition A2(c);

ii. all current statutory approvals for the development;

iii. all approved strategies, plans and programs required under the conditions of this consent;

iv. minutes of CEMCC meetings;

v. regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent;

vi. a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;

vii. a summary of the current phase and progress of the development;

viii. contact details to enquire about the development or to make a complaint;

ix. a complaints register, updated monthly;

x. the Annual Reviews of the development;

xi. audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report; and

xii. any other matter required by the Planning Secretary; and

b) keep such information up to date, to the satisfaction of the Planning Secretary.

16. Community Consultative Committee

CGO will continue to operate the Community Environmental Monitoring and Consultative Committee (CEMCC) in accordance with condition A11 of SSD 10367. This condition specifically refers to DA 14/98 requirement to establish and maintain the meeting in accordance to the relevant guidelines.

The CEMCC will provide opportunities for members of the community to attend CEMCC meetings to discuss specific issues relevant to them, including any issues/ concerns related to subsidence. This will be achieved by landholders making a request to the CEMCC regarding a particular issue, or by the landowner registering a complaint in the complaints register. Landowners who register complaints will be invited to join in discussion of the issue at the next CEMCC meeting.

Items of discussion at these meetings will include mine progress, reporting on environmental monitoring, complaints, rehabilitation activities and any environmental assessments undertaken.

17. Associated documents

Attachment 1 - GMS monitoring system design

Attachment 2 - Subsidence Trigger Action Response Plan

ATTACHMENT 1 - GMS monitoring system design

ATTACHMENT 2 - Trigger Action Response Plan