Macraes Phase Four Project

Golden Point Underground Extension - Mine Subsidence Assessment

PSM71-373R 20 August 2026

www.psm.com.au

Executive Summary

PSM was engaged by OceanaGold (New Zealand) Limited (OGNZL) to assess mine subsidence effects associated with the proposed extension of the Golden Point Underground Mine (GPUG) as part of the Macraes Phase Four Project (MP4), a Fast-Track Approvals Act project seeking to extend mining at Macraes for at least 10 years. The assessment focuses on potential impacts to Deepdell Creek, the backfilled Round Hill Open Pit, and the SP11 tailings embankment.

The geotechnical model was updated using OGNZL's fault data, supplemented by lineament analysis, core photo-logging, and mapping data.

Observed underground performance shows squeezing ground (locally up to 50% span convergence), caved stopes, but no chimneying to surface.

InSAR monitoring over the past two years recorded subsidence exceeding 1,000 mm, with angles of draw (20 mm threshold) generally 24 to 33°.

2D and 3D numerical modelling (RS2 and FLAC3D) was calibrated against observed subsidence. The 3D base-case (full mine plan) predicts subsidence up to 5 m and tensile strain up to 1.5% at Deepdell Creek—an order of magnitude greater than measured subsidence—attributed to conservative DDFZ characterisation requiring refinement.

Key risks include potential water-table connectivity via dilating fractures beneath Deepdell Creek, and inrush hazards where stoping approaches saturated backfill beneath the Round Hill Open Pit and SP11 embankment (up to ~2 m subsidence predicted at the embankment toe).

PSM recommends revising the Deepdell Creek Standoff Line to a 24° angle of influence plus a 25 m offset, establishing "Green" (unrestricted, monitored) and "Orange" (restricted) zones, and expanding subsidence and groundwater monitoring (prisms, GNSS, VWPs, extensometers).

Stoping within the Orange Zone should be deferred pending refinement of the geotechnical model with supporting numerical simulations indicating ground surface deformation at Deepdell Creek is less than 400 mm subsidence, and less than 0.5% tensile strain.

OGNZL were presented a draft version of this assessment, particularly the simulated ground deformation at Deepdell Creek due to mining of Panels 144 and 164 which exceeded the recommended limits. OGNZL paused mining of the panels concerned and requested refinement of the geometry and geotechnical model with new data. Following the model refinement, three-dimensional stability analyses were updated (refer Addendum 1). The simulated ground deformation at Deepdell Creek due to mining within the Orange Zone is now below the recommended limits – PSM understands mining Panels 144 and 164 has recommenced based on these results.

Table of Contents

List of Tables

List of Insets

List of Figures

List of Addenda

List of Appendices

Abbreviations

Appendix A presents a list of abbreviations used within this report as defined in Reference 1).

Table 1 – Abbreviations

Abbreviation	Description
DoC	Department of Conservation
FF	Footwall Fault
FRUG	Frasers Underground mine
FTAA	Fast Track Approvals Act 2024
GPUG	Golden Point Underground mine
GCR	Ground Condition Rating is a geotechnical rock mass rating scale (1-5) developed specifically for Macraes underground operations
GSI	Geological Strength Index
HMSZ	Hyde-Macraes Shear Zone
HWS	Hanging Wall Shear
LOM	Life of Mine
MEEA	Murphys Ecological Enhancement Area
MFZ	Macraes Fault Zone
MGPG	Macraes Gold Project Grid
MWMS	Macraes Mine Water Management System
MP4	Macraes Phase Four Project
NZTM	New Zealand Transverse Mercator 2000
OGNZL	OceanaGold (New Zealand) Limited
ORC	Otago Regional Council
RHOP	Round Hill Open Pit
RL	Relative Measure
SI	Site Investigation
SPBF	Southern Pit Backfill
SP10	Southern Pit Option 10 Tailings Storage Facility
SP11	Southern Pit Option 11A Tailings Storage Facility
TARP	Trigger Action Response Plan
TSF	Tailings Storage Facility
VWP	Vibrating Wire Piezometer
WRS	Waste Rock Stack
ZOI	Zone of Influence

1. Introduction

OceanaGold (New Zealand) Limited (OGNZL) currently undertakes open pit and underground gold mining operations at the Macraes Operation located at Golden Point Road, Macraes Flat, East Otago. As part of their ongoing operations, OGNZL continually review the remaining life of the Macraes Operation in light of updated knowledge of the gold resource and the economics of mining.

Reflecting recent exploration success and optimisation work, together with higher gold prices, the Macraes Phase Four Project (MP4 or "the Project") seeks to extend the life of mining at the Macraes Operation until at least 2039. The Project, which will enable ongoing gold production at a rate of approximately 130,000 ounces per annum, is identified as a Listed Project in Schedule 2 of the Fast-track Approvals Act 2024 (FTAA) as a project providing significant national or regional benefits.

To support the development of the substantive application for the Project, OGNZL has engaged PSM to provide an assessment of the Project's effects on mine subsidence associated with expansion of the Golden Point Underground mine (GPUG), to the extent required, identify any necessary management and operation measures to address any such effects.

Following the initial draft of this report, OGNZL paused mining of Panels 144 and 164 due to the simulated deformation at Deepdell Creek reported herein. PSM was commissioned to refine the faults within Deepdell Creek Fault Zone with new data and the three-dimensional stability analyses to refine the simulated ground surface deformation at Deepdell Creek. The refined analyses found forecast ground deformation was below the limits recommended by PSM in this report. The refined model and analyses is presented in Addendum 1.

1.1 Scope

This report documents a mine subsidence assessment associated with the planned extension of GPUG and considers potential sensitive receivers, including nearby mine infrastructure as well as Deepdell Creek.

The scope of this report is to:

1. Prepare an updated geotechnical model, including description of our understanding of the main geotechnical units and selected cross sections alongside the existing fault model. The Deepdell Fault Zone is a dominant feature in the present study.
2. Undertake detailed analysis of measured surface deformation in plan and cross section, focusing on review of:
   a. InSAR data
   b. Previously measured deformation data.
3. 2D finite element analyses have been conducted using the existing geotechnical boundaries and deformation data to understand and calibrate the geotechnical parameters for the units and to establish the nature of the deformation mechanisms.
4. 3D finite element analyses.
5. Assessment of the effects of deformation on surface receptors.

As part of a broader FTAA study, PSM has completed geotechnical assessments for associated site elements which are captured in the following documents:

- Ex-pit Waste Rock Stacks – PSM071-375R
- Open Pit Extensions – PSM071-363R
- Open Pit Stability for Fraser Tailing Storage Facility – Stage 3 (FTSF) – PSM71-376R.

1.2 Site Location and Description

OGNZL owns and operates the Macraes Operation at Macraes Flat, approximately 30 km northwest of Palmerston in the Otago Region. The Macraes Operation is the largest gold mine in New Zealand and, since commissioning in 1990, has produced more than 6 million ounces of gold.

Macraes Flat is situated on an elevated plateau at approximately 500 m above sea level. The plateau is flanked by the Taieri Ridge to the northwest, Shag Valley and Horse Range to the east, and the coastal hills and extinct volcanic cones of Palmerston and Waikouaiti to the southeast. Macraes Road provides access to Macraes Flat and the Macraes Operation, connecting to State Highway 85 to the east and State Highway 87 (SH87, the Middlemarch–Hyde Road) to the west.

The environment within and surrounding the Macraes Operation has been shaped by historic and current mining activities. Inset 1 shows the arrangement of the major mine features at the Macraes Operation. In summary, the current components of the Macraes Operation include:

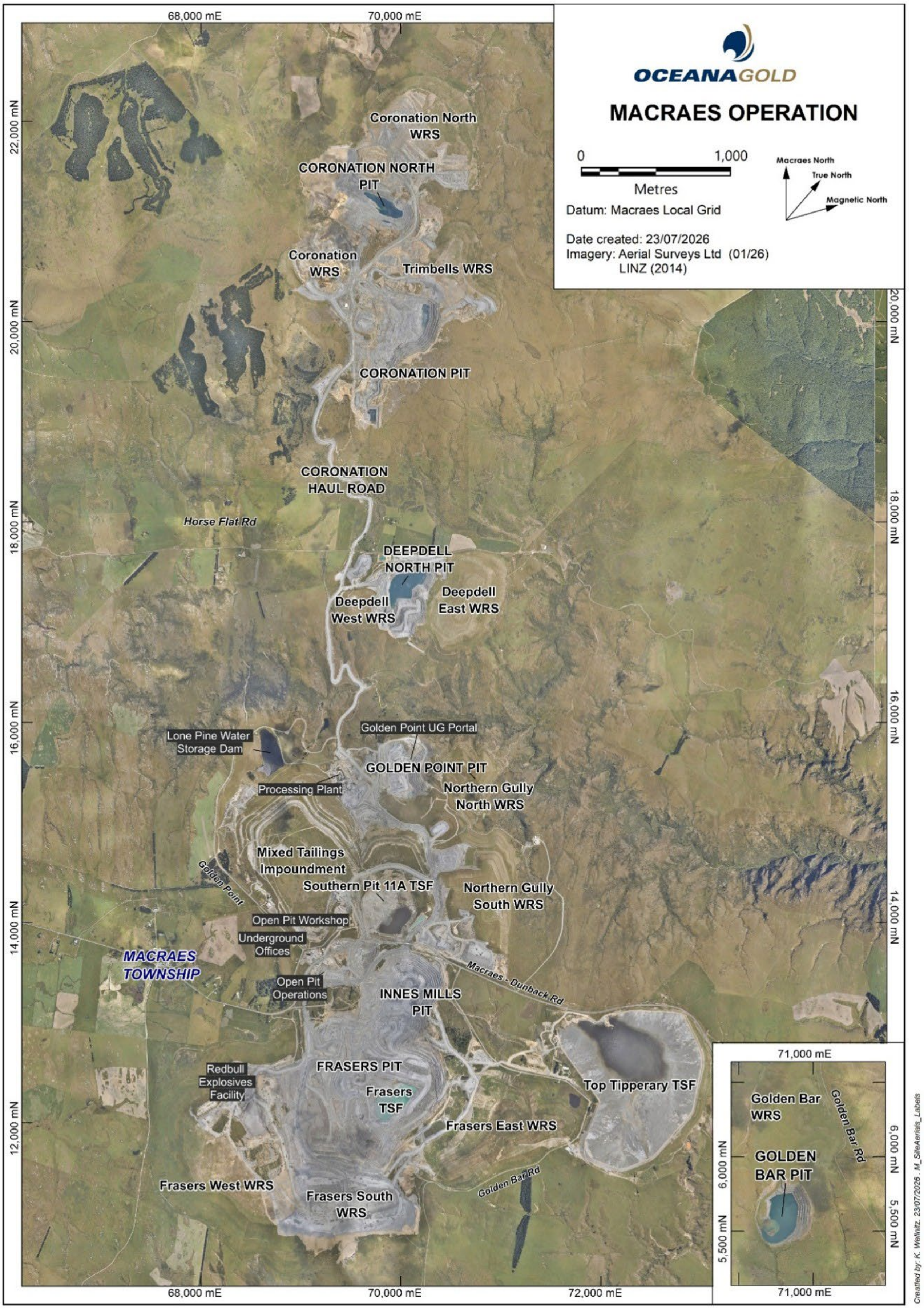
- Numerous open pits (both operational and non-operational)
- Two underground mines (Frasers, now closed, and Golden Point, which is actively mined)
- Waste rock stacks at various stages of operation and rehabilitation
- A network of haul roads and general mine service tracks
- A Processing Plant
- Five tailings storage facilities (three inactive, one active but nearing capacity, and one under construction and currently receiving tailings)
- An extensive network of water management infrastructure, including diversion drains, silt ponds, sumps, pit lakes, and freshwater storage reservoirs
- Two consented but not yet constructed water storage reservoirs (Camp Creek Dam and Coal Creek Dam)
- Associated infrastructure supporting ongoing operations, including district roads, powerlines, workshops, offices, and associated water and amenity facilities.

1.3 Project Overview

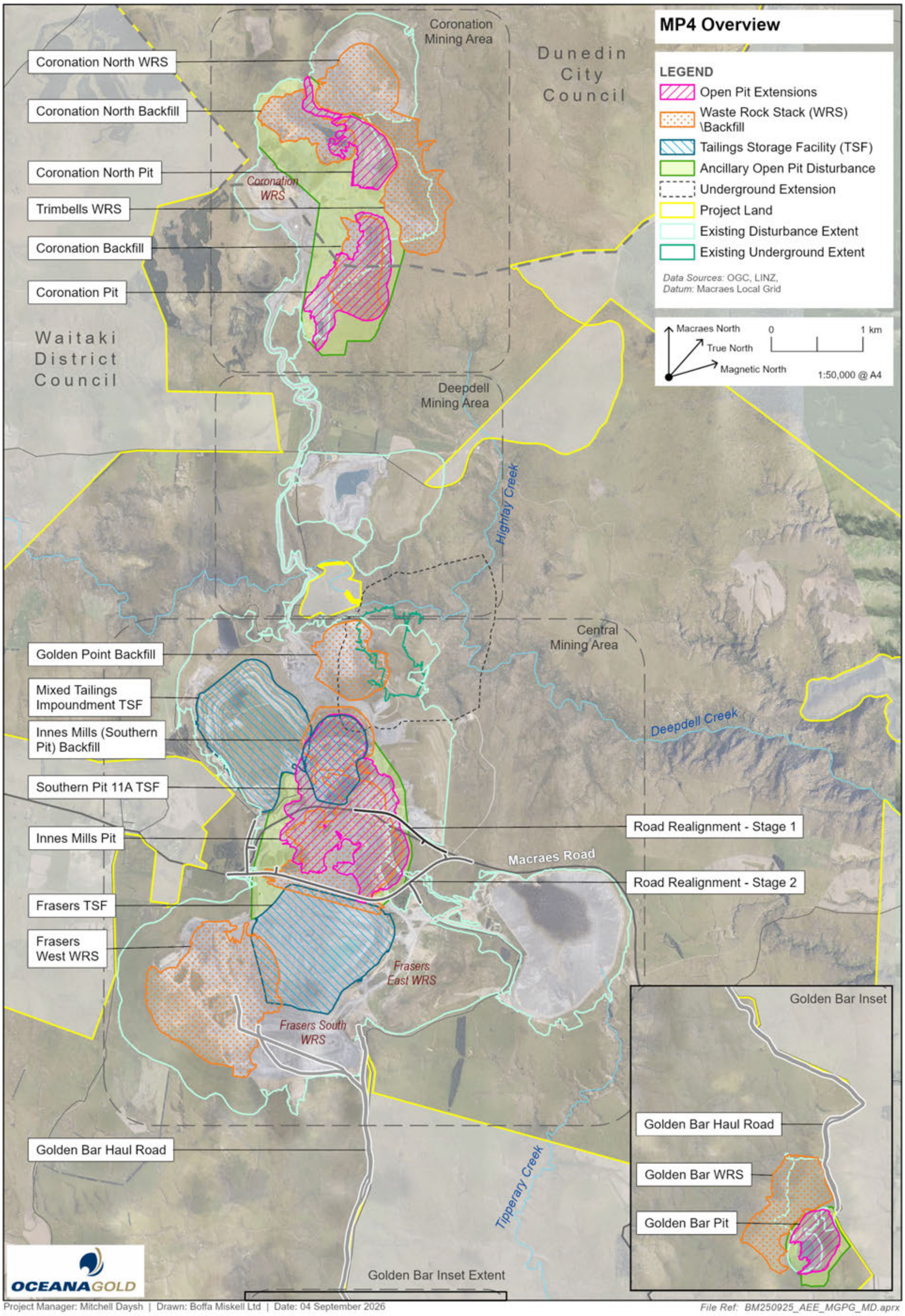
The Project is made up of the following proposed key activities:

- Open pit extensions at Coronation, Coronation North, Innes Mills and Golden Bar
- Underground mine expansion through further development of the Golden Point Underground mine (GPUG)
- Tailings management, including:
  - Construction of the Frasers Tailings Storage Facility Stage 3 to a total tailings storage of up to 153 Mt
  - Hydraulic mining and relocation of tailings from the Mixed Tailings Impoundment (MTI), Southern Pit Option 10 TSF (SP10), and Southern Pit Option 11A TSF (SP11A) to FTSF.
- Waste rock disposal, including increased storage capacity within open pits and at existing waste rock stacks at Coronation, Coronation North, Innes Mills, Golden Bar, Golden Point, and Frasers
- Water management infrastructure and operations, including:
  - Construction of Camp Creek and Coal Creek water storage dams for flow and water quality management
  - Construction, operation and maintenance of a Water Treatment Plant
  - Ongoing operation and management of the Mine Water Management System (MWMS).
- Infrastructure and roading works, including:
  - Realignment of Macraes Road in two stages
  - Relocation of the Open Pit Mining Workshop.
- Ecological enhancements, including establishment of:
  - Murphys Ecological Enhancement Area (MEEA) near Murphys Creek, including predator-proof fencing, access tracks, and site facilities
  - Mt Highlay restoration area
  - Cranky Jims Link shrubland enhancement area
  - Murphys Link tussock protection area
  - Additional compensation measures for residual ecological impacts.
- Mine closure and rehabilitation activities, including rehabilitation of mining landforms, creation of pit lakes, dry capping of tailings storage facilities, and revegetation in accordance with closure objectives.

An overview of the proposed activities which make up the Project is shown in Inset 1 below.



Inset 1: Existing site layout of the Macraes operation (July 2026).



Inset 2: MP4 project area.

1.4 Project Datum

The following datums are used for all work undertaken as part of this assessment:

- Horizontal datum: Macraes Gold Project Grid (MGPG) which is rotated approximately 45° west of true north
- The magnetic declination at Macraes (45.38°S, 170.43°E) is approximately +25° east of True North
- Elevation is shown as metres RL per NZ vertical datum (NZVD 2016).

1.5 Data

Data provided data by OGNZL to inform this assessment includes the following, a detailed breakdown is provided in Appendix A:

- Topographic surfaces
- Underground design surfaces
- Mine development and performance records
- Geology and geotechnical mapping and borehole data
- OGNZL developed fault models
- Geotechnical monitoring and instrumentation including:
  - InSAR
  - GNSS Survey
  - Piezometers
  - Extensometers and SMART Cables.

2. Background

2.1 Historic Mining

The timeline below presents a summary of the history of underground mining in the Macraes area and at Golden Point (OGNZL, 2020):

- 1860's — Commencement of lode quartz mining
- 1889 — Discovery and development of the Golden Point/Round Hill lode system
- 1890 – 1933 — Mining of the Golden Point lode system
- 1939 – 1945 — Scaled down operations during the Second World War
- 1954 — Mining ceased and Macraes area abandoned.

Underground mining between 1889 to 1954 comprised:

- Predominantly within the weathered oxide profile or just below
- Excavation in the form of small span drives
- Mined from three stamper battery locations
- Accessible drives have been mapped, although there remains some uncertainty with the exact location of all underground voids.

In October 1990, mining recommenced with the excavation of Round Hill, the first of many open pits mined at Macraes. In parallel with the open pits, Frasers Underground mine (FRUG) commenced in 2006 through to closure in approximately 2024.

Historic underground workings mined at Golden Point from 1889 to 1954 have been mapped by Homestake and OGNZL, and mine plans sourced from Mines Department Records (OGNZL, 2020). The interpreted and mapped locations of the underground workings are unlikely to be exhaustive due to available data. Several historic underground working locations were excavated by the Golden Point open pit.

2.2 Existing GPUG

Figure 1 presents the layout of the existing GPUG. The following points summarise the underground development:

- Below the weathering profile, targeting ore lodes below the Hanging Wall Shear (HWS)
- Excavation primarily in the form of drives and stopes in a series of levels that progress down dip at about 15 to 20° towards east
- Most stopes remain as open voids and have not been backfilled, some have partially collapsed
- Operates with a Subsidence management plan to limit subsidence at Deepdell Creek as part of the consent condition.

2.3 Proposed Extension

The proposed MP4 underground development layout is presented in Figure 2. The following points summarise the proposed underground development at GPUG:

- Transverse sub-level open stoping, mined in retreat
- Mining is proposed along a strike length of approximately 1,850 m
- Underground development:
  - Accessed by approximately eight 'figure-eight' spiral declines from existing portals
  - Development dimensions:
    - Decline and access drives are 5.5 m wide and 6.0 m high
    - Ore drives are 5.5 m wide and 5.5 m high.
  - Development is located between the Footwall Fault and the HWS.
- Stoping:
  - Proposed stope dimensions are 11 to 15 m wide by 10 to 15 m long with heights of 4 to 20 m
  - Stoping to commence at approx. 400 m RL (approx. 100 mbgl) and continue down dip (following the ore body) to terminate at approx. -120 m RL (approx. 510 mbgl)
  - Typical pillar thickness between stopes is approximately 5 m wide.

3. Geotechnical Model

The following section describes the geotechnical model developed for this assessment. The model is based on existing site investigations, site visit observations, and PSM's experience at Macraes since 1993. The section is sub-divided into:

- A broad overview of the regional geology
- Summary of the local structural geology model
- Local rock mass models and parameters for GPUG
- Groundwater conditions.

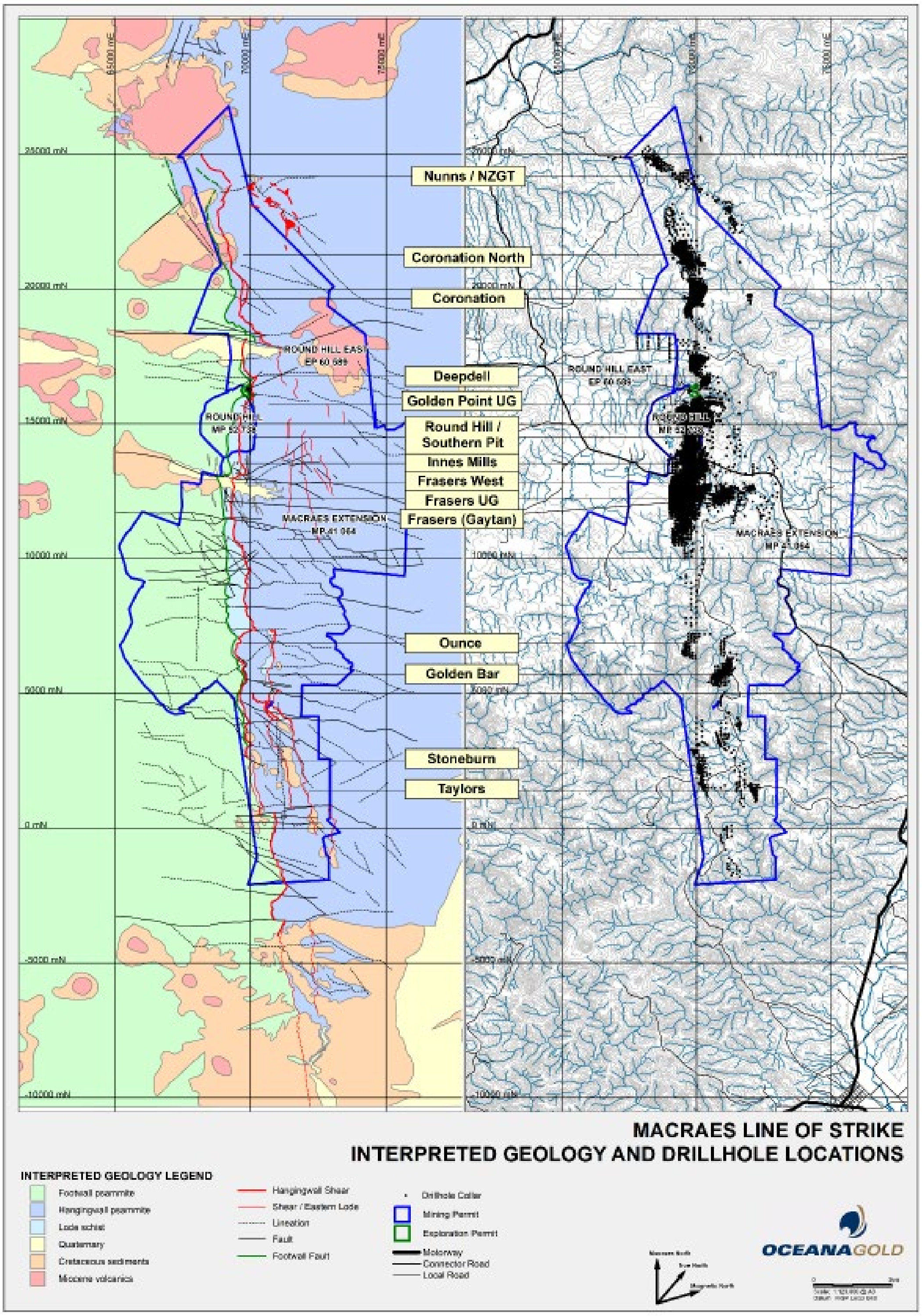
3.1 Geology

3.1.1 Regional

The Macraes Flat area is within the extensively deformed and moderately metamorphosed Otago-Haast Schist Belt. The schist comprises a sequence of gradational psammitic and pelitic lithologies derived by metamorphism of Mesozoic aged sandstone and mudstone. The rocks are strongly foliated and depending on the origins are either light grey, quartz rich and laminated (psammite) or dark grey to green, micaceous, and finely laminated (< 5 mm thick) (pelite).

Mineralisation occurs within the north-south trending Hyde-Macraes Shear Zone (HMSZ) which has a lateral strike length of over 40 km. Mineralisation within the HMSZ is hosted within lower greenschist facies metamorphosed, pelitic to psammitic sediments that are variably altered, deformed, and mineralized. This package of schist, known as the Intra-shear Schist, is bounded above by the Hanging Wall Shear (HWS), and below by the FF, and can be up to 150 m thick. Its tectonic displacement has been inferred to be hundreds of metres. The strain associated with tectonic displacement was probably concentrated within the intra-shear pelite due to its finer grained composition compared to the coarse-grained psammite above and below the HMSZ. The structural geology of the area is dominated by two main orthogonal fault sets, striking to the north and east.

The Shear Zone dips gently to the east from Stoneburn in the south to Coronation in the north but displays a broad bend at Nunns, turning to dip to the northeast, Inset 3.



Inset 3: Plan of Macraes operation showing various pits and deposits and the HMSZ (OGNZL, 2025a).

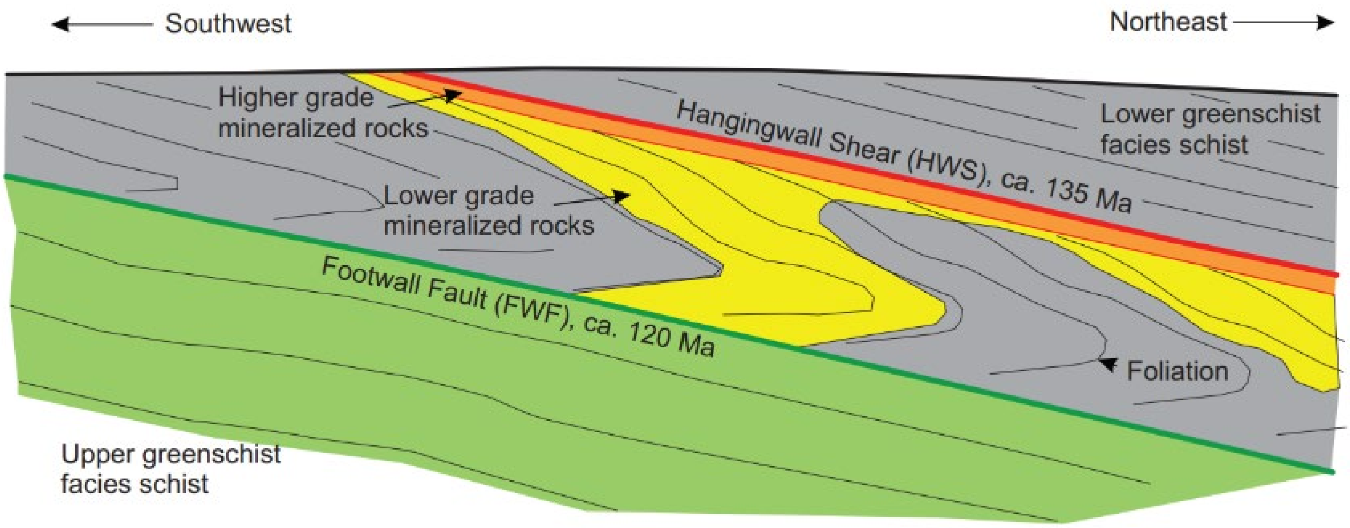
3.1.2 Local

The HMSZ at GPUG is approximately 100 m thick and dips about 15 to 20° to the east. Mineralisation at GPUG is hosted in the lower greenschist facies (chlorite zone) above the Footwall Fault (FF). A schematic cross section of the HMSZ is shown below in Inset 4.

The geological structure is complex and comprises numerous faults, ramp thrusts, recumbent folds, and a penetrative shallow east dipping cleavage. This cleavage is parallel to the HMSZ and largely overprints bedding and earlier deformation fabrics.

Based on Allibone et al (2018), the HWS is a shear zone marking the upper mineralisation strand and comprises the following segments:

- Frontal ramps:
  - Steeply dipping segments of the HWS dipping 30 to 50° northeast. Two end-member ramp geometries observed:
    - All four surfaces dip northeast, forming a single continuous northeast-dipping shear that dip more gently than the overall ramp, likely linked by short southwest-dipping back-thrusts
    - a single steeply dipping surface, high-grade mineralisation (>1.0 g/t Au) is largely confined to a narrow (<5–10 m wide) discontinuous zone
    - Where the ramp splits into multiple stacked, gently dipping strands (i.e. Innes Mills), thick zones of more intensely mineralised rock are developed beneath each strand — stacking of shear surfaces identified as the key factor promoting wide mineralised zones. These are commonly referred to as 'stacked lodes'.
- Gently dipping jogs:
  - Near-flat-lying segments of the HWS developed immediately up dip and downdip of the frontal ramp.
- Lateral ramps:
  - Oblique segments of the HWS striking north-northeast to northeast.
- Strike bends:
  - Sharp changes in the strike of the HWS occurring over 300 to 600 m, generally as right-hand (clockwise) bends
  - Bends in strike occur in the vicinity of major regional faults, i.e. Macraes Fault Zone, and near Deepdell Creek, where the HWS swings sharply to the west before returning to its general northwest strike.
- Splay faults:
  - Second- and third-order shears that splay off the lower (footwall) side of the HWS into the underlying schist
  - Spatially associated with lateral ramps and frontal ramps in the HWS.



Inset 4: Schematic cross-section through the deposit showing the positions of high- and low-grade mineralisation relative to the FF and HWS. Reproduced from Allibone et al (2018).

Brittle northeast striking faults dissect the HMSZ and are described as younger brittle faults that were active during the Cenozoic deformation. Two known faults are:

- Macraes Fault Zone (MFZ):
  - Strikes east-west, dips steeply toward the north northeast
  - Coincides with the sharp change in strike of the HWS between Innes Mills and Frasers open pits
  - The Macraes Fault offsets both the HWS and the FF — indicating it was active after development of the Footwall Fault.
- Innes Mills Fault:
  - Strikes north-northeast, dips steeply toward the east-southeast
  - Also coincides with the sharp bend in the HWS between Innes Mills and Frasers
  - Unlike the Macraes Fault, the Innes Mills Fault offsets the HWS but does not appear to offset the Footwall Fault — implying it was active in the Cretaceous before development of the Footwall Fault at ca. 120 Ma.

Ground conditions in these northeast striking zones are generally poor, as evidenced by poor slope performance in the Frasers north wall where the MFZ was intersected.

3.2 Rock Mass Model

PSM reviewed the available geotechnical data from GPUG with the geotechnical models developed by PSM for Round Hill Open Pit (RHOP) and Innes Mill 7/8 (IM7/8). The rock mass conditions at the three deposits are largely similar. Table 2 summarises the anticipated rock mass classes.

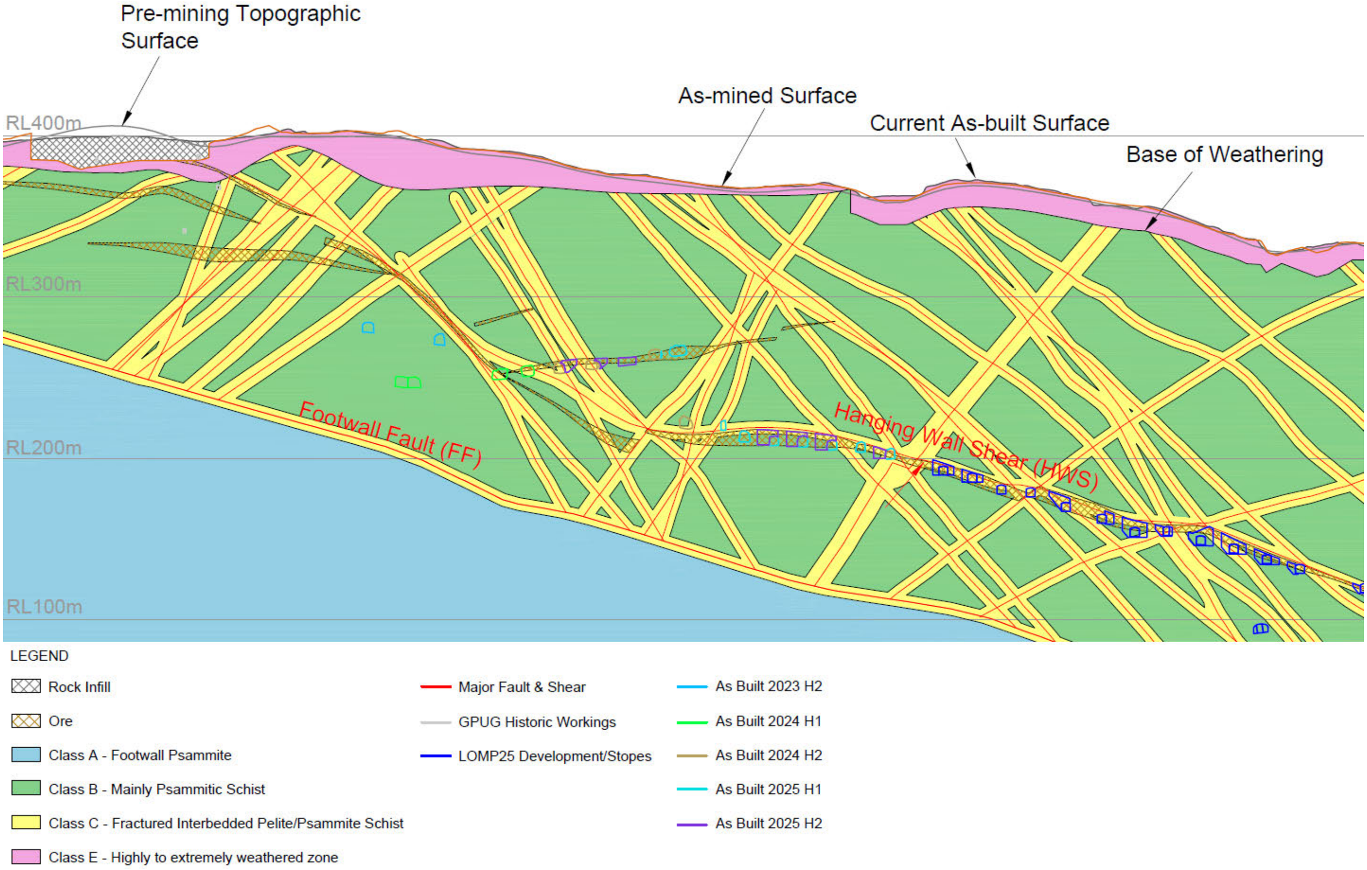
Table 2 – Summary of Typical Rock Mass Classes at Macraes

Class	Rock Mass	Description	Estimated Rock Strength	RQD (1)	Typical Occurrence
A	Footwall Psammite	Lithified rock with frequent defects and rare shearing	High	Good 75 to 90%	Below FF
B	Hanging Wall – mainly psammitic schist	Fractured rock with frequent defects and some shearing	Medium to High	Fair 60 to 80%	Above FF
C	Fractured Interbedded pelite/psammite schist	Fractured to fragmented rock with frequent shearing	Low to medium	Poor to fair: 40 to 60% with zones of very poor	Up to 10 m wide halo around major and secondary faults
D	Fault Zones	High deformation due to major structures	Firm to hard soil, <20% very low rock strength	Very poor 0 to 10%	Very poor quality within faults and shears
E	Weathered schist	High to extremely weathered zone	Extremely low to soil	Very poor: 10 to 30%	Upper 30 m below original topography

Note:
(1) Rock Quality Designation.

The distribution of rock mass classes is presented in Inset 5 and summarised as follows:

- The surficial portion of the in-situ schist rock displays a weathering profile (Class E) up to 30 m deep and could be expected to be locally shallower around gully drainage lines due to incising and downcutting
- The highly foliated schist rock mass is dominated by semi-psammite with small amounts of psammite and semi-pelite schist. A relative class system is adopted for the in-situ schist:
  - Class A: the psammitic schist below the FF. Good to very good quality with medium to high intact strength
  - Class B: The mainly psammitic schist above the FF. Fair to good quality with medium to high intact strength
  - Class C: the schist surrounding faults and shears is fractured to fragmented with frequent shearing. Generally, very poor to poor quality with low to medium intact strength.



Inset 5: Cross-section showing typical rock mass distribution at GPUG.

3.2.1 Stacked Ore Lodes

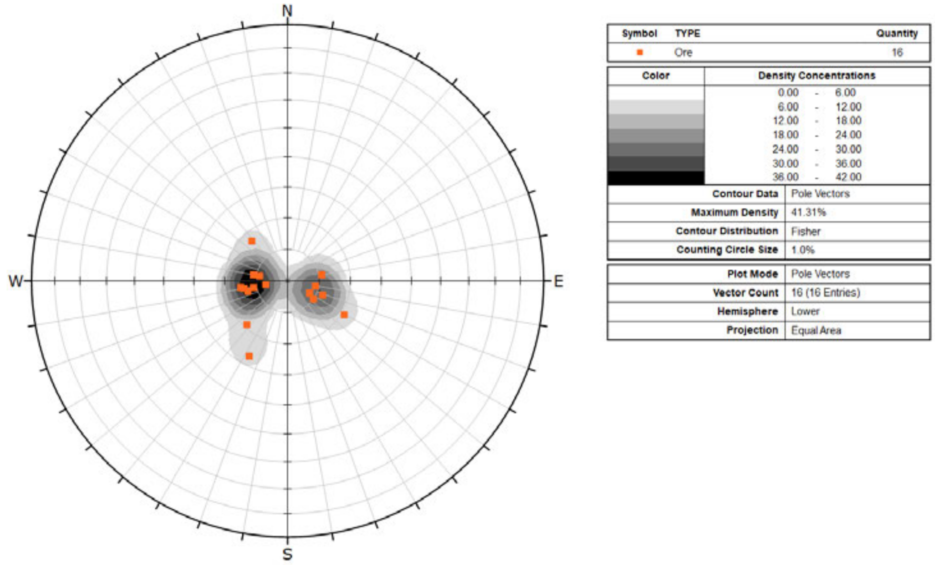
Sixteen modelled ore lode solids were provided to PSM by OGNZL as part of this study. These modelled lodes dip in two directions, orthogonal to each other, summarised below and shown in Inset 6.

- Sub-horizontally towards the east
- Sub-horizontally towards the west.

Where multiple ore lodes exist vertically, they are colloquially referenced on site as “stacked lodes”. Anecdotally within GPUG, rock mass conditions within the stacked lodes are generally poorer quality, similar to that of conditions around faults (possibly Class C). Mining through these zones is typically more challenging, requiring additional support during drive development while stopes experience greater deformation. From a subsidence perspective, both the reduced rock mass quality and the multiple mining levels present conditions more susceptible to propagating impacts to the surface.

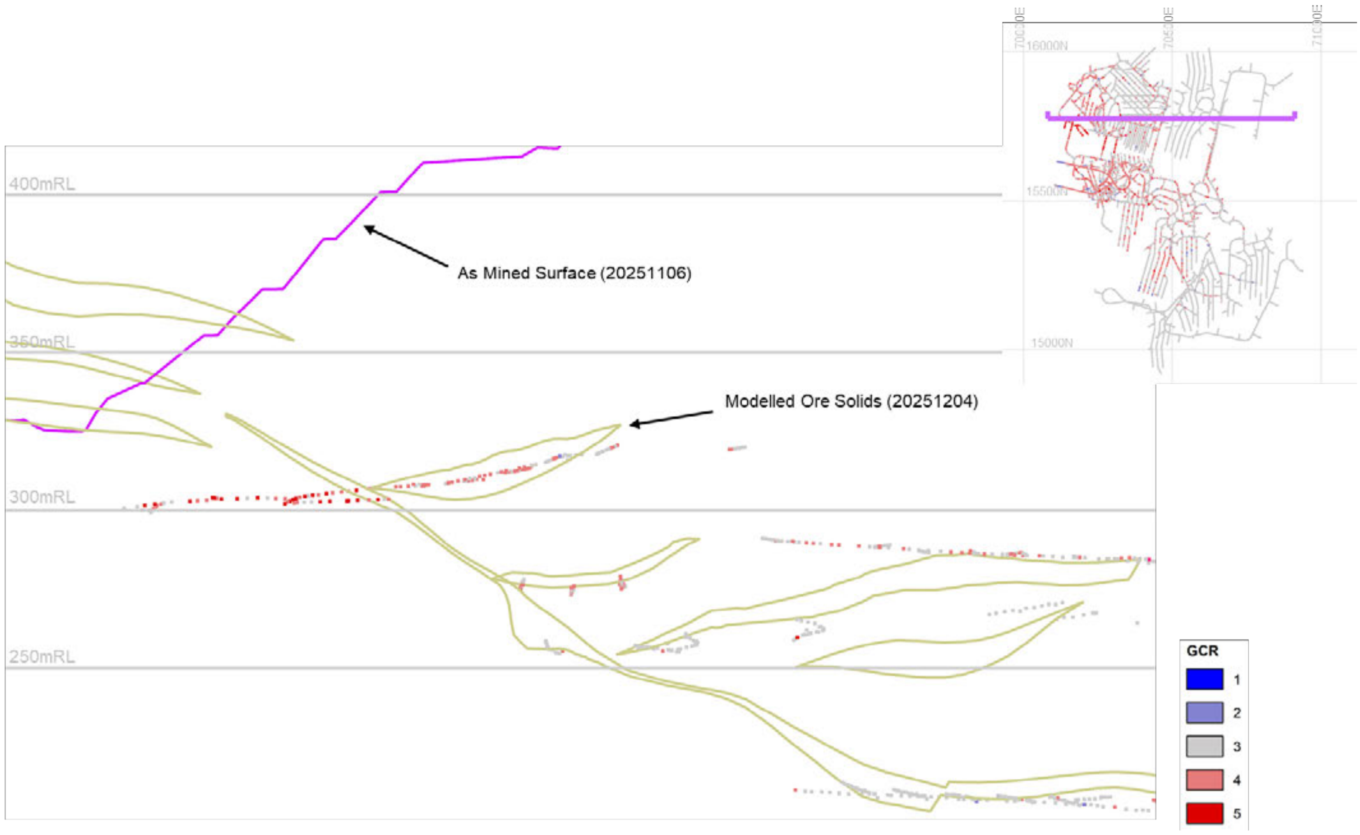
To characterise the geotechnical condition of the stacked lodes, PSM reviewed core photos from six geotechnical boreholes available from the 2021 RHOP drilling that intersected the lodes, with an example of the rock mass conditions shown in Inset 7, as well as the Ground Condition Rating (GCR) mapping data for areas proximal to these stacked modelled ore lodes, Inset 8.

Based on our review, we found that while the discrete rock mass conditions specifically associated with ore lodes was not markedly degraded, the ore lodes often occur in close proximity to faults and shears, refer Inset 5.



Inset 6: Stereoplot of the orientations of OGNZL Modelled Ore Lodes for GPUG.

Inset 7: Core photo example from ddh7837 of rock mass conditions within a modelled stacked ore lode.



Inset 8: **Cross-section showing GCR for mapped drives in GPUG between stacked ore lodes. GCR of 1 is very strong, 5 is extremely weak. Note that quality of drives is variable with some showing a rating of 3 whilst others show a rating of 4. The lower quality GCR can be accounted for by modelled faults.**

3.3 Geological Structure

3.3.1 GPUG Fault Model

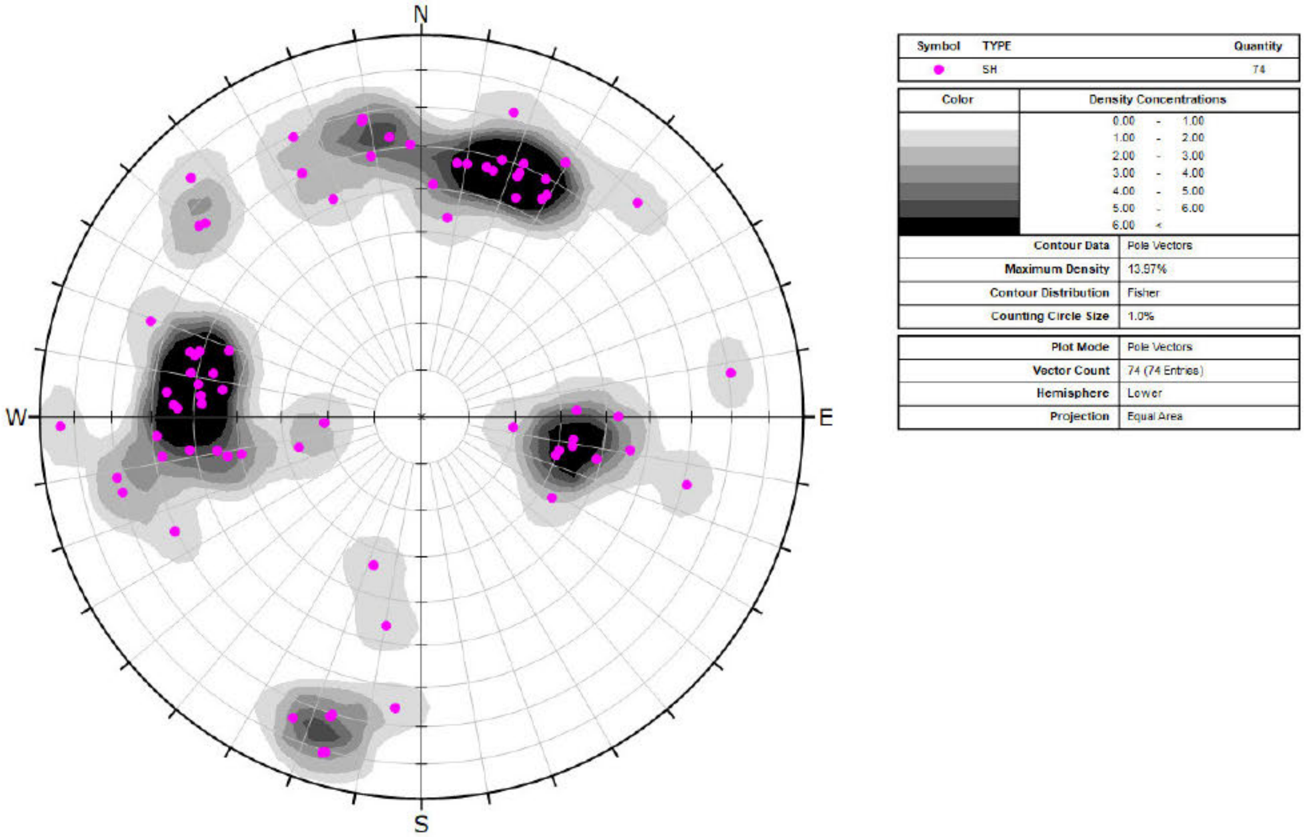
A three-dimensional (3D) structural model developed by OGNZL was provided to PSM which includes 73 3D wireframes of major faults and shears within the GPUG underground. At a meeting with OGNZL on 23 February 2026 to discuss the model, the following information was provided:

- The model provided is an update to the previous exploration model developed for RHOP in 2022
- Modelling has been undertaken using Leapfrog and is periodically updated as required
- Modelling inputs include:
  - Drilling intercepts
  - Underground development and open pit highwall face mapping
  - Surface fault traces from high resolution LiDAR topography and historic photogrammetric topography surfaces
  - Survey pick-up of fault traces.
- Fault modelling has focused on the GPUG working areas where there is greater data density, and as such, these areas are of a higher confidence. Away from the GPUG working areas the data density and hence number of modelled faults is lower.
- Modelled faults are largely in and around the GPUG working areas, i.e. few faults outside for the working area are modelled.

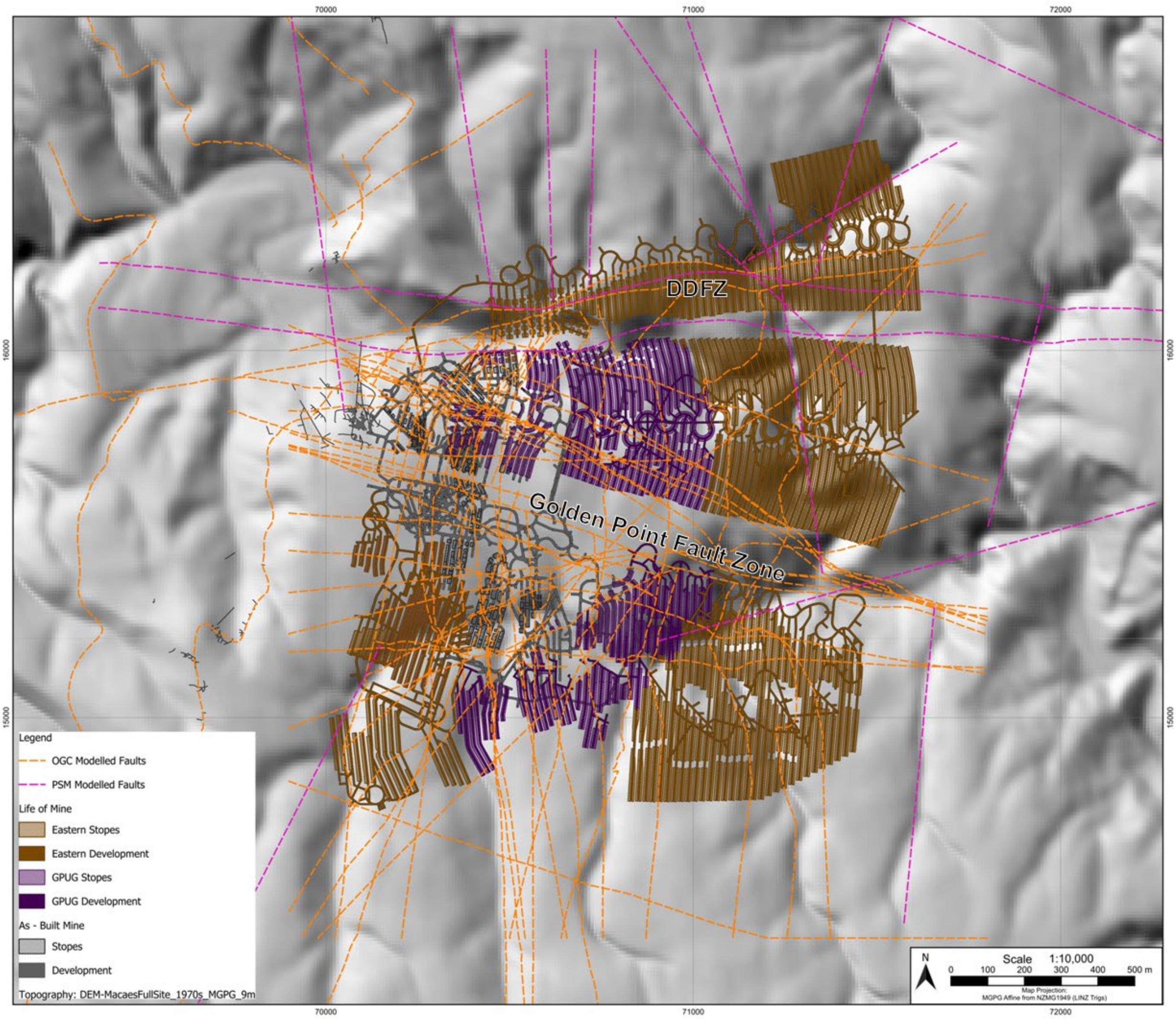
The OGNZL modelled structural orientation trends are summarised below in Table 3 and shown stereographically in Inset 9. The intercepts of the modelled wireframes with the pre-mining topography from 1970s are shown in Inset 10.

Table 3 – Summary of OGNZL Modelled Fault Sets

Fault Set	Dip (°)		Dip Direction (°)		Commentary
	Mean	±	Mean	±	
Set 1	60	10	190	35	Observed in north wall of RHOP
Set 2	35	15	280	20	Ramp shears – antithetic to Macraes Shear Zone
Set 3	75	10	015	15	
Set 4	50	20	095	20	Foliation parallel shears



Inset 9: Stereographic projection of OGNZL modelled fault structures for GPUG.

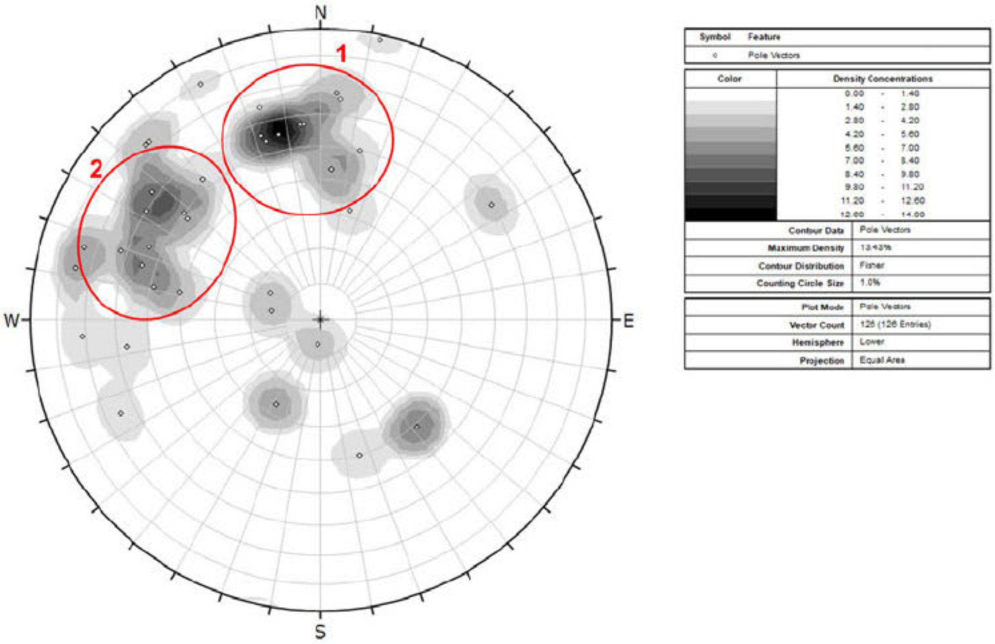


Inset 10: Plan view of modelled fault traces provided by OGNZL intersected with pre-mining topography.

Inset 11 presents a stereographic projection of the faults mapped in the GPUG development by OGNZL. The major sets identified in the mapping data closely align with similarly oriented sets of modelled faults; they are:

- Mapped Fault Set 1, dips about 55° towards 170, aligns closely with Modelled Fault Set 1, refer Table 3
- Mapped Fault Set 2, dips about 55° towards 130, is similar in dip and dip direction as Modelled Fault Set 4, which closely align with foliation
- A westward dipping fault set is not present in the mapped data.

PSM have adopted the OGNZL fault model for this study. However, additional effort is required to address uncertainty associated with faults along and beyond Deepdell Creek.



Inset 11: Stereographic projection of OGNZL mapped fault structures for GPUG.

3.3.1.1 Fault Thickness

To assess the thickness of the modelled faults, two assessments were undertaken:

- Fault thickness based on RQD intervals
- Faults and shears geometries as observed in the open pit slopes
- Faults mapped in the GPUG development.

RQD

For the RQD assessment, domaining of the RQD data was undertaken, by grouping logged intervals into the following RQD domains based on section 3.2 below:

- RQD <10% to correspond to the fault/shear zone, equivalent to Class D
- RQD 10 to 70% to correspond to the fragmented zone around the fault zone, equivalent to Class C
- RQD >70% to correspond to the host rock, equivalent to Class B.

Modelled faults were intersected with the boreholes to obtain information about the thickness of the RQD domains. Average true thickness calculations for each of the fault sets listed above were completed with the results summarised in Table 4.

Table 4 – Summary of True Thickness of Fault Intervals by Borehole RQD

Fault Defect Set	Average True Thickness (m)	
	RQD: 0 to 10% RQD (Class D)	RQD: 10 to 70% (Class C)
Set 1	3.8	11.2
Set 2	3.5	19.5
Set 3	1.9	17.5
Set 4	3.6	15.1

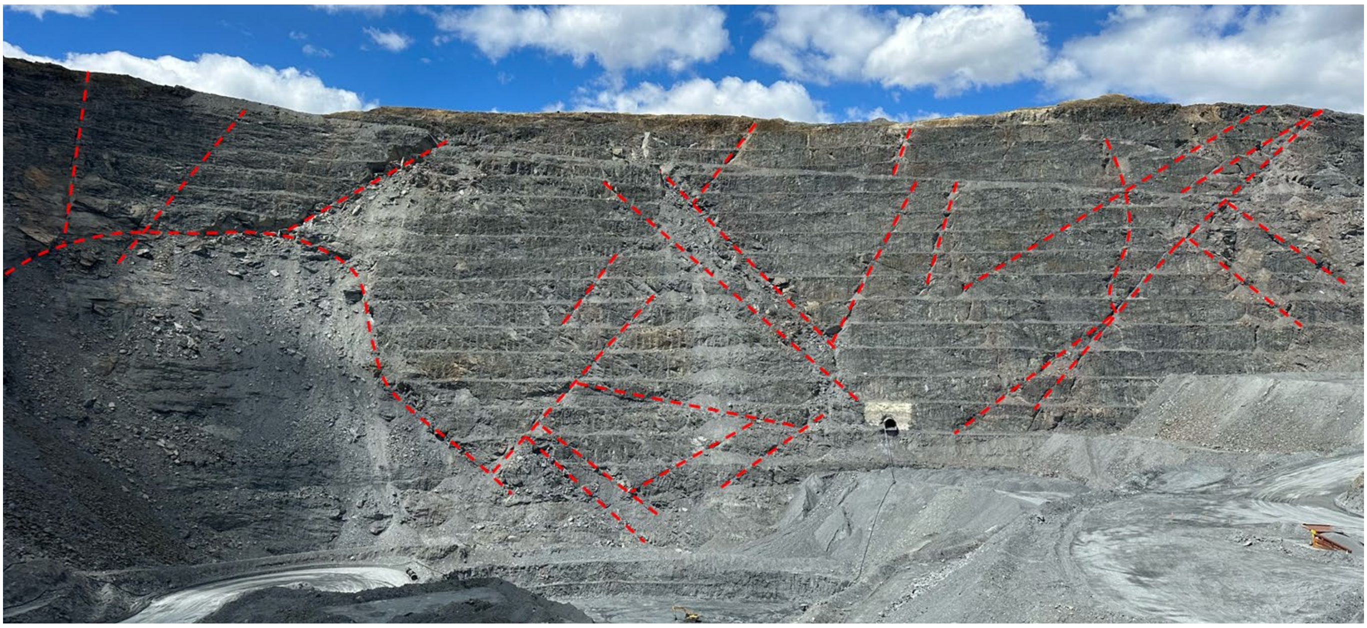
A limitation of this assessment is that there are intervals where numerous faults intersect the same RQD interval window. As such, this can lead to misrepresentation of thicknesses as larger than anticipated. Similarly, as RQD is assessed on a run-by-run basis, short runs can often be unfairly penalised during RQD logging.

Faults and Shears in the Open Pit Slopes

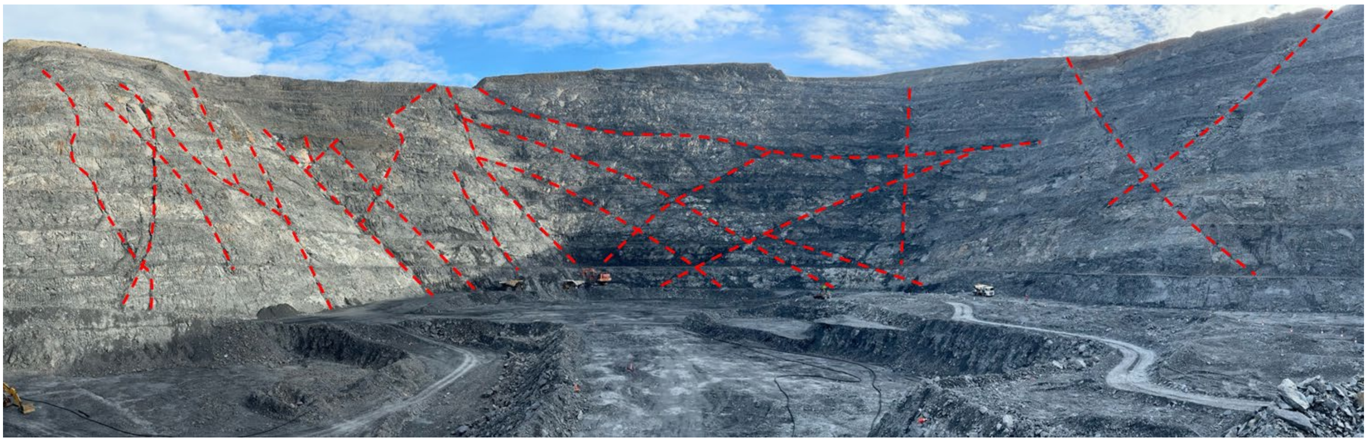
A review of fault and shear geometries as observed in the pit slopes was undertaken to verify borehole RQD assessment. Insets 12 and 13 below show observations of fault structures within pit slopes.

Faults were assessed to have the following thicknesses:

- Class D: typically, 1 m wide fault/shear zone
- Class C: zone around the fault typically totally 8 m wide (total true thickness).



Inset 12: Photo of Frasers Open Pit with major structures (red dashed lines). Review of structures relative to height of benches (15 m) Suggest that the Class C surrounding fault traces is typically 8 m in width.



Inset 13: Photo of Innes Mills Pit with major structures (red dashed lines). Review of structures relative to height of benches (15 m) suggest that the class c surrounding fault traces is typically 8 m in width.

Mapped Faults

Table 5 presents a summary of the fault gouge and fault damage zones mapped in the GPUG development. The following points provide discussion on the mapped data versus the open pit observations and RQD review:

- Mapped faults comprise a wide range of thicknesses and include many small intervals. This is likely to be due to the accessibility for mapping small structures compared to the open pit
- The review of RQD focussed on the modelled through-going faults, therefore these faults are likely to have a larger thickness and may be more representative of the scale of faults controlling global deformation
- Faults mapped in the underground may be different in character due to the nature of the excavation. Faults in the underground may appear tighter than in open pit slopes.

Table 5 – Summary of Mapped Fault Gouge and Damage Zone Thicknesses

	Fault Gouge (mm)	Fault Damage Zone (mm)
Mean	70	2000
Median	220	2500
Maximum	6,450	13,000
Minimum	2	300
Number of Measurements	1,718	74

3.3.2 Additional Modelled Faults

This section presents the methodology for adding faults to the fault model, particularly around Deepdell Creek. The methodology adopted is based on collation of lineaments in various surfaces, review of diamond core, review of mapping data (including the GCR provided by OGNZL), and development of wireframes for new faults.

3.3.2.1 Lineament Assessment

Lineaments are linear features that may represent the surface expression of major structures such as faults, shear zones, contacts, or joints.

A lineament assessment has been conducted over the GPUG area and surrounds. Lineaments have been recognised in the topographic surface across the GPUG site from defined breaks in slope, linear ridges and valleys and drainage control.

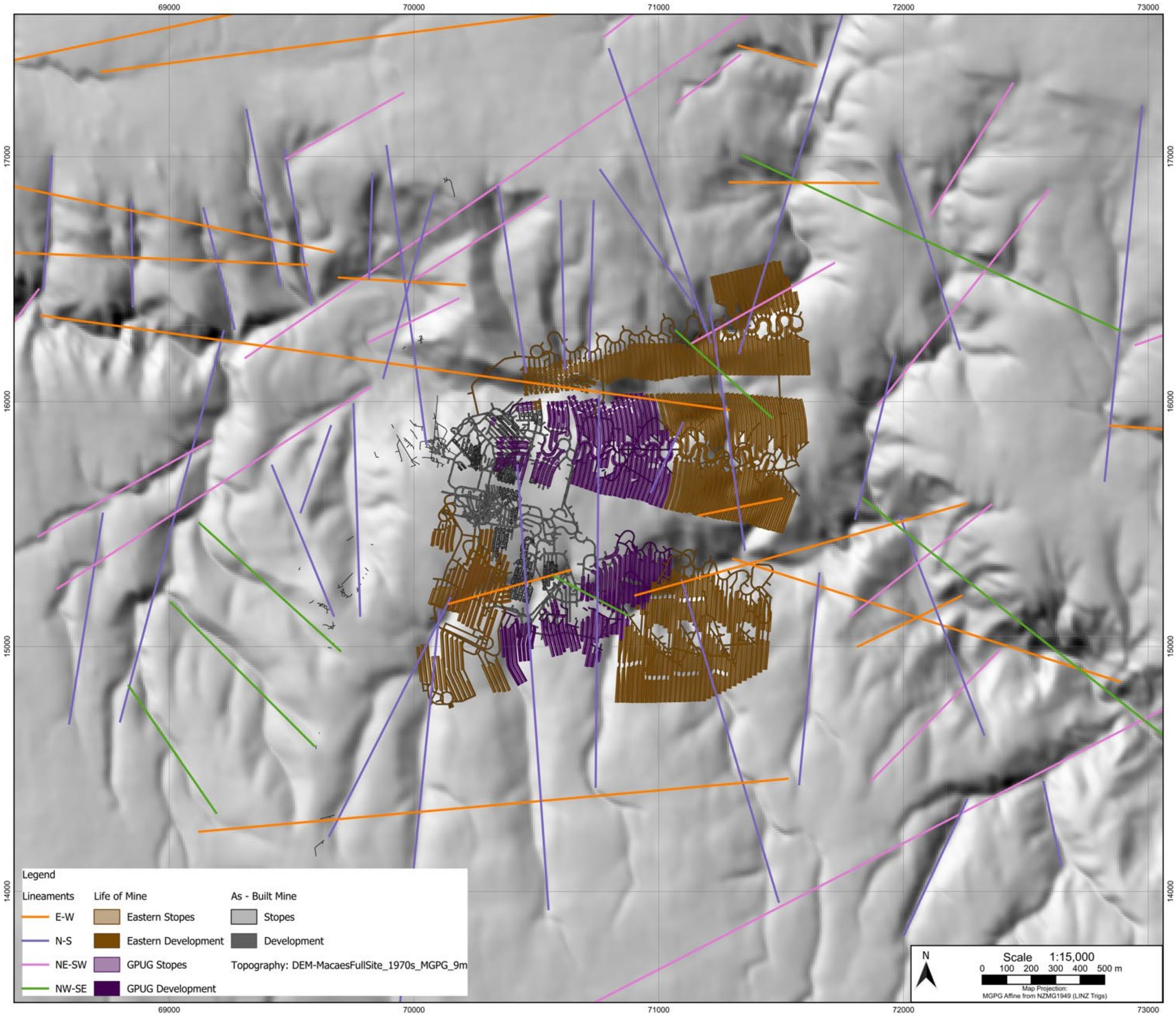
Data utilised for the lineament assessment included:

- Pre-mining topographic surface
- Aerial imagery
- Modelled base of weathering surface
- Modelled ore body solids.

The lineament assessment was conducted on all data listed above, utilising both 3D visualisation software with a 2x vertical exaggeration applied as well as hill shade models. Lineaments based on topography are the most prevalent due to data coverage and topographic relief.

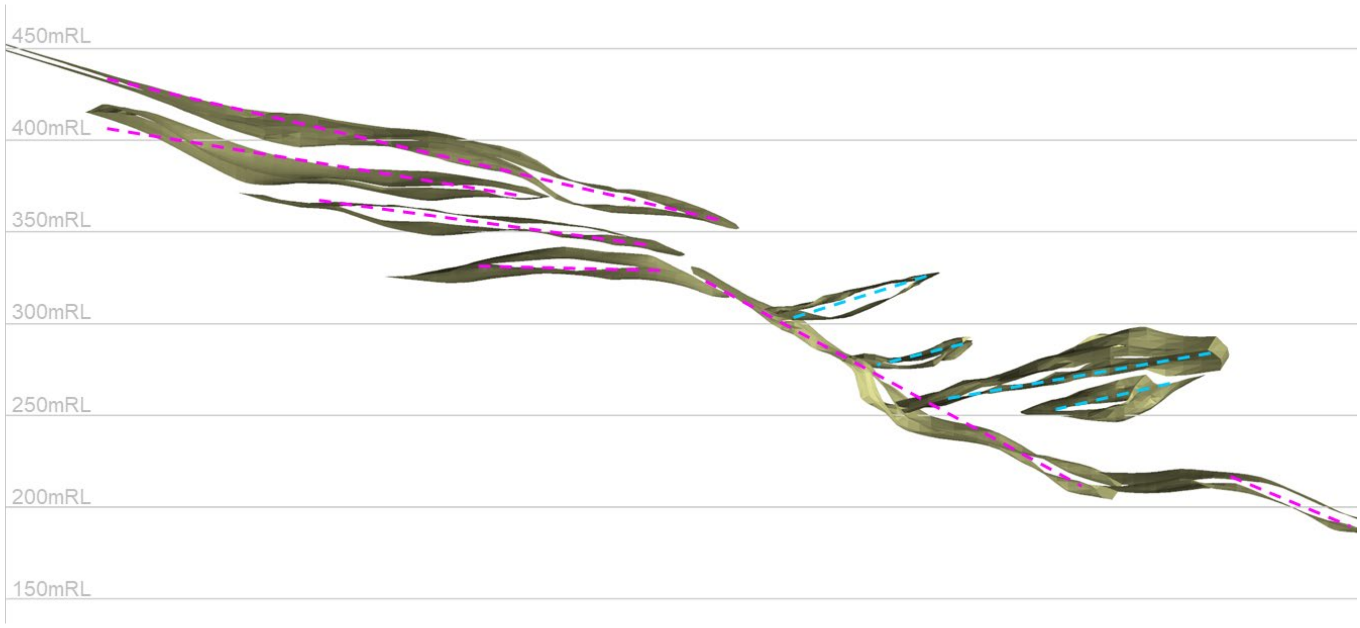
Inset 14 presents the lineaments identified during the lineament assessment. The assessment focused on the GPUG area and surrounds with lineaments categorised by orientation. The lineament orientations identified are summarised below and largely match the trends of the modelled faults mentioned above in Section 3.3.1:

- North-south trending
- East-west trending
- Less prevalent:
  - North-east south-west trending
  - North-west south-east trending.



Inset 14: Plan view of lineaments.

Inset 15 presents a cross-section view showing the lineaments identified in the ore solids. Lineaments in these lodes are typically oriented sub-horizontally towards the east or west – likely to form along foliation, but also local shear zones.



Inset 15: Cross-section (looking north) of modelled ore body lodes showing sub-horizontal linear trends towards the east (pink dashed lines) and west (blue dashed lines).

3.3.2.2 Mapping Data

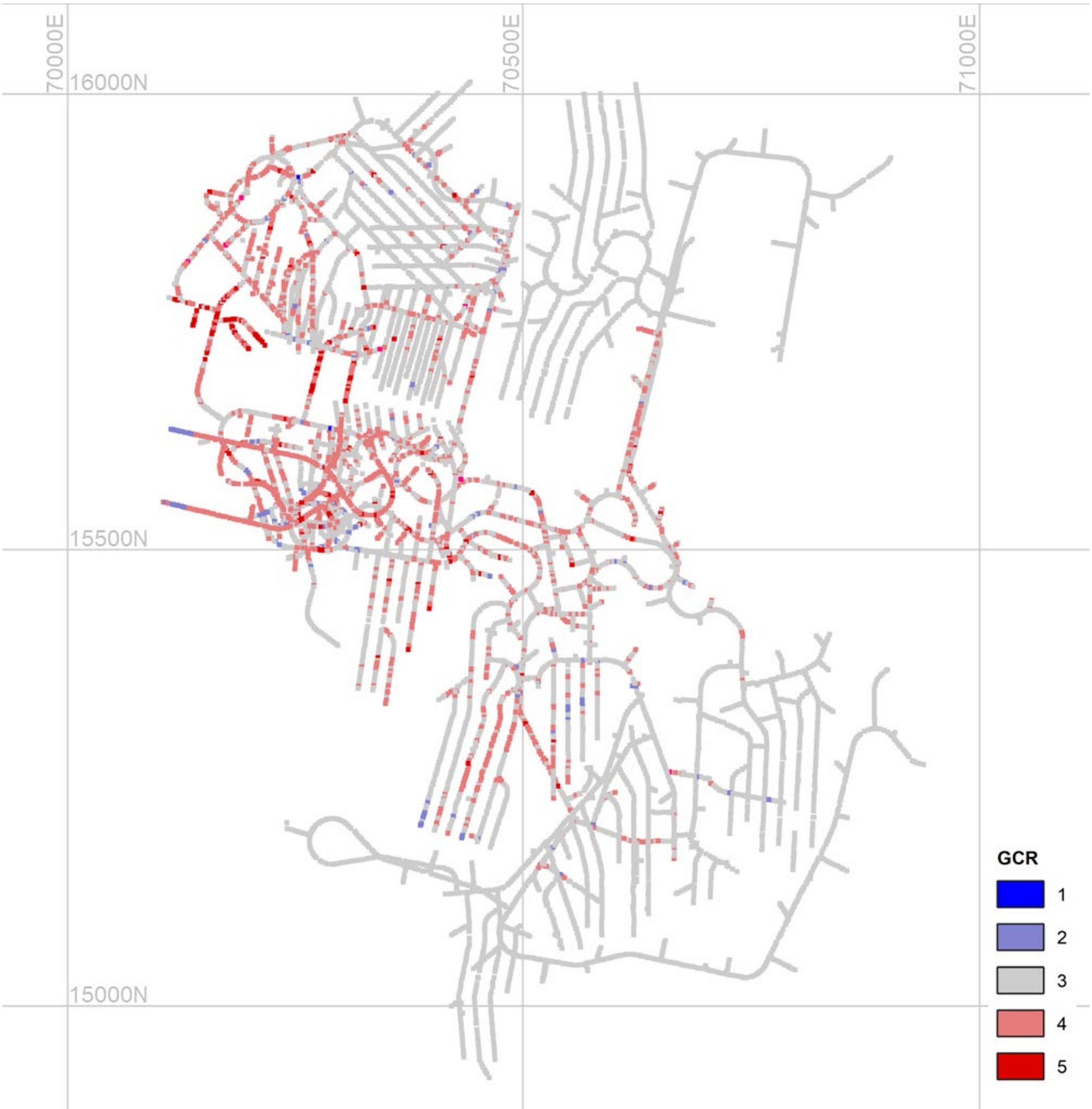
OGNZL have developed a Ground Condition Rating (GCR) for specific use in the Macraes underground operations. It is a rock mass rating scale and was used for each cut in the GPUG and is reproduced below in Table 6.

Table 6 – Ground Condition Rating Summary Table from OGNZL.

GCR	Face Mapping Observations	Rock Bolting-Drill Observations	Equivalent Q	Equivalent RMR	PSM Rock Mass Class	Equivalent GSI	Equivalent RQD
1 Very Strong	Intact or massive psammite can only be chipped with rock hammer, joints are widely spaced and not very prominent, joint surfaces are rough and undulating, tight with no or very little joint alteration. No faulting. Hanging wall is not present in face or backs.	Good consistent drilling in hard ground.	10+ Good	65+ Good to very good	A Lithified rock with frequent defects and rare shearing	65 (55-75)	100% Excellent
2 Strong	Blocky, requires several blows to fracture with rock hammer. Joints spaced 0.3 m to 1 m, not polished or slickensided, infill <5 mm. This is better than average ground, solid with no obvious faults or close jointing, more common in stockwork headings in between Hanging Wall and Lower zone lodes.	Softer ground, but not bogging steels.	4-10 Fair	55-65 Fair to good			75-90% Good
3 Fair	Blocky/disturbed, joints are closely spaced (>0.3 m) with smooth and planar surfaces, some joint alteration present. May be several obvious joint sets. Some small faults may be present (<10 mm thick) but the face looks hard with no major features or softer than normal rock. Minimal overbreak.	Ground drills on low pressure with occasional/rare bogged steel.	1-4 Poor	40-60 Fair	B Fractured rock with frequent defects and some shearing	55 (45-65)	50-75% Fair
4 Very Weak	Disintegrated, rock crumbles when hit. Joints closely spaced, unfavourably oriented, open, altered, or slickensided. Faults common with gouge thickness 10-100 mm. Seepage flow may be present. These faces usually have either a rock unit that is softer than average for that lithology, or a fault or joint where rock has fallen out below creating overbreak.	Very poor ground with frequent bogging of rods. Bolts/split sets hammer in twice as fast as they would in competent ground.	0.1-1 Very Poor	20-40 Poor	C Fractured rock with frequent shearing	30 (20-40)	25-50% Poor
5 Extremely Weak	Laminated/highly sheared rock mass, intense alteration (rotten), open fractures, multiple large continuous and persistent faults (thickness >100 mm) or significant fault zone. Seepage flows common. Significant overbreak (metres) may be present in backs or walls. Face needs extensive scaling prior to sampling and will often be supported.	Drill steels need to be manually featured (to avoid bogging). Bolts feed in with no percussion and may fall out.	<0.1 Extremely Poor	<20 Very Poor	D Fragmented / sheared rock	20 (10-30)	<15% Very Poor

Inset 16 shows the GCR by cut as provided by OGNZL. The following observations can be made from the GCR data provided:

- Drives which terminate in the north, near the Deepdell Creek and corresponding DDFZ are rated as 3, corresponding the Class B rock (section 3.2). This suggests that the DDFZ is yet to be intersected within GPUG development
- The upper levels of development, corresponding from the start of development in 2020 H2 through to 2022 H2, inclusive, correspond to predominantly 4 and 5 ratings. Possible reasons for this could be:
  - Small-scale faulting (ie 5 to 10 mm thick) resulting in a weaker rock mass associated with the staked lodes. Not all the cuts are located within modelled faults, these small-scale faults were too numerous to be modelled
  - Poor blasting / mining practices during the early development which could have influenced the GCR
  - Inconsistent assignment of the GCR during its initial usage / development.
- Many modelled faults intersect cuts with ratings of 1 to 3 (Class B rock, section 3.2).

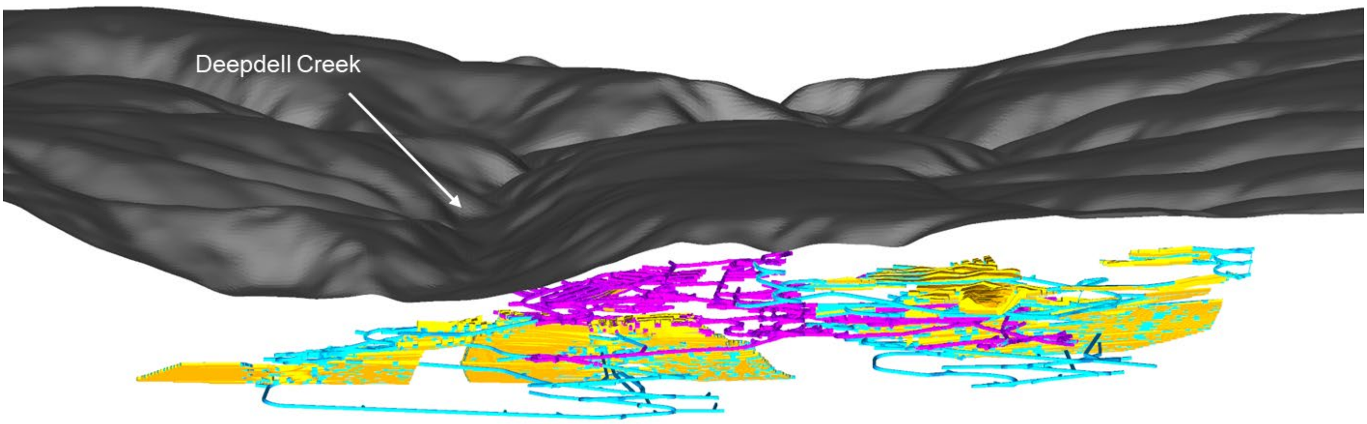


Inset 16: GCR for GPUG development drives.

3.3.2.3 Deepdell Fault Zone

The Deepdell Fault Zone (DDFZ) is an east-west trending fault zone inferred to be located beneath the Deepdell Creek Valley. The valley is a steeply incised 'v' shaped valley with a vertical relief of up to 150 m and is heavily vegetated, Insets 17 and 18. The majority of mining is on the southern side of the DDFZ, with a northern extension proposed on the northern side. The DDFZ is considered a major regional structure comprising various fault zones, rather than a singular 'mash zone' similar to MFZ, and as such a specific model has been developed to characterise this fault zone.

Inset 17: Photo of Deepdell Creek Valley looking south-east. Note the steep valley sides with evidence of exposed rock on the lower portions of the slope.



Inset 18: Oblique view looking east of the Deepdell Creek Valley relative to the proposed underground mine. Note That the Deepdell Creek Valley has greater topographic relief in comparison to the surrounding valleys.

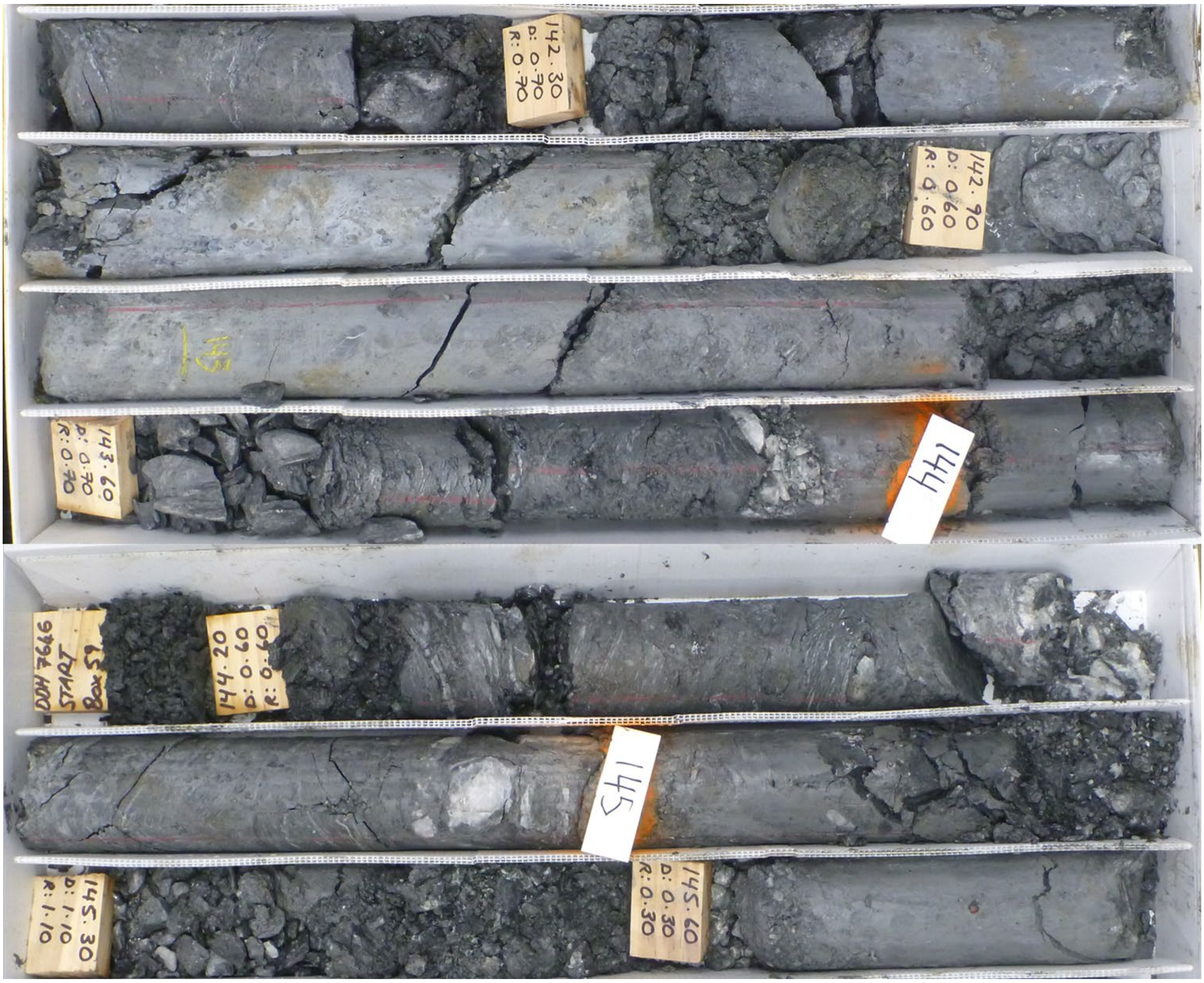
Core Photo Logging

To assist with characterisation of the DDFZ, photo logging has been undertaken utilising the core photograph library of 92 diamond boreholes selected near the interfered DDFZ trace. The purpose of the photo logging was to assess diamond core and record intervals of deformation that may be attributed to large scale faulting. Photo logging of boreholes was systematically assessed by identifying features that are potentially related to faulting.

Insets 19 to 21 present typical fault damage types observed in core photos. Each structure identified was classed as one of the following types:

- Fault Gouge Zone (Inset 19)– comprising primary zone of fault brecciated rock with fault gouge material
- Fragmented Zone (Inset 20) – highly disturbed rock with discrete zones of crush or shearing. Located proximal to fault gouge zones, often as a halo surrounding the fault gouge zones
- Fractured Zone (Inset 21) – rock which is typically distal to fault gouge zone but has evidence of disruption characterised by an increased degree of background fracturing.

The purpose of this classification was to differentiate the primary fault zone (fault gouge zone) from the surrounding increase in background fracturing and also delineate the extents of the zone and to characterise the rock mass condition within the fault zone.



Inset 19: Fault gouge zone – example from DDH7646.

Inset 20: Fragmented zone – example from DDH7664.

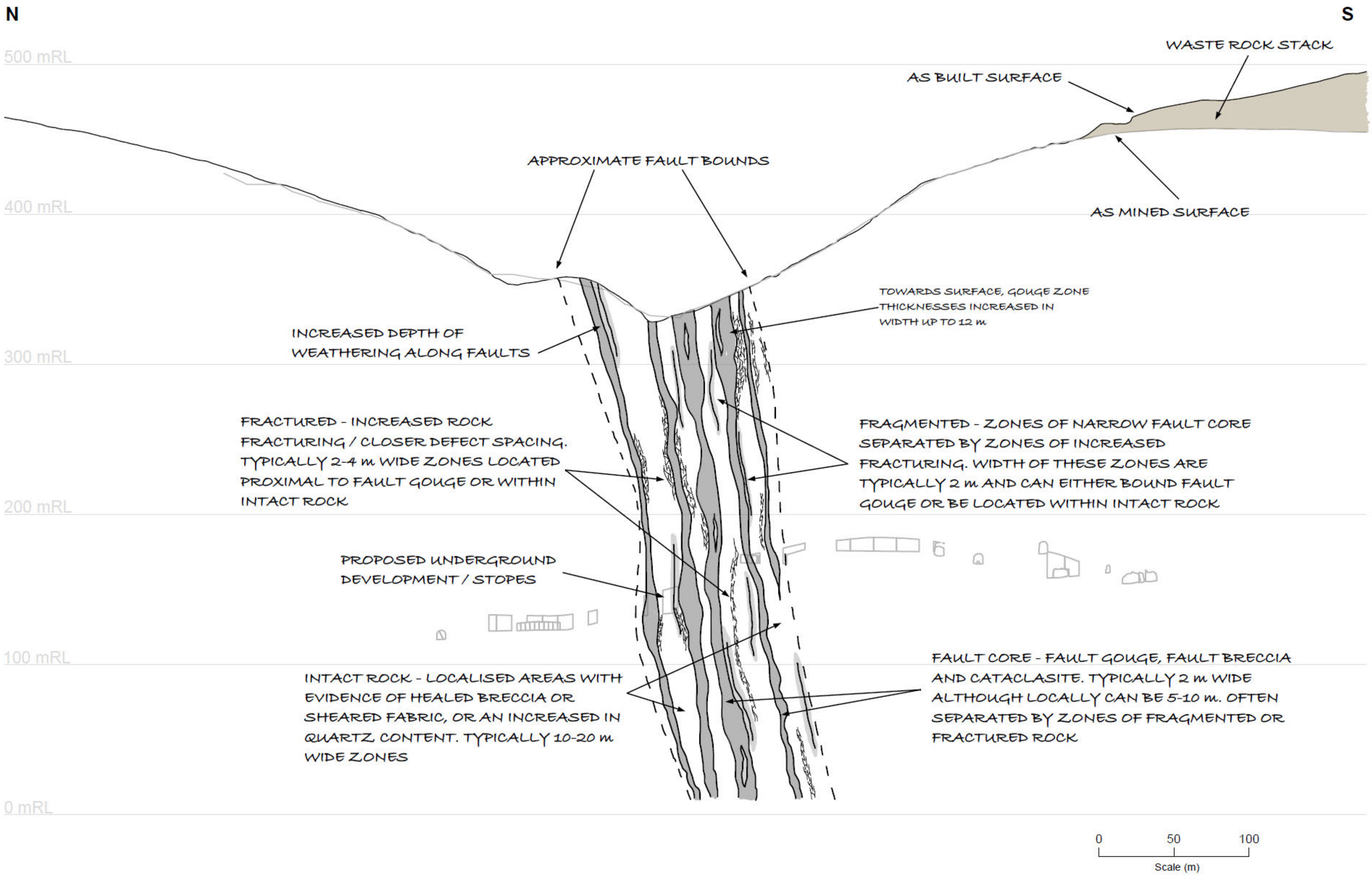
Inset 21: Fractured zone – example from DDH7776.

Fault Characterisation

The DDFZ is considered a major regional scale structure comprising multiple fault zones comprising clay gouge and fragmented rock with zones of intact rock. From review of the core photos from boreholes drilled proximal to the DDFZ, the following typical characteristics are anticipated for the DDFZ:

- Zones of rock fragments and / or clay typically separated by zones of intact rock:
  - Thickness of clay and/or rock fragment zones are typically 1 to 5 m separated by zones of intact rock typically 10 to 20 m.
- Infill typically consists of:
  - Angular rock clasts approximately 5 to 50 mm
  - Clay gouge and rock flour up to 2 m thick.
- Defect spacing in the surrounding fractured zones is typically 10 to 100 mm
- Oxidation is not anticipated, but possible along structures and at depth
- Intact rock is typically overprinted with a cataclastic texture, brecciation, an increase in alteration or veining or the foliation fabric is disturbed.

The shear strength parameters developed for the MFZ are based on back analyses of the pit slope performance at Frasers open pit north wall.



Inset 22: **Schematic cross-section of Deepdell Fault Zone (DDFZ).**

3.3.2.4 Fault Model Development

Methodology

The following section details the methodology adopted to develop 3D wireframes for faults outside the area previously modelled by OGNZL. Modelling focused on the areas beyond the current extents of the GPUG fault model, in particular north of GPUG. This has been undertaken using the datasets described in the previous sections, and includes:

- Lineaments identified in surfaces derived from topography or modelled surfaces
- Photo logged fault intervals associated with the Deepdell Fault Zone.

The process for wireframe modelling is summarised as follows:

1. Upload of the fault interval database and lineaments into the software *GeologyCore* developed by Maptek allowing the fault intervals to be visualised along borehole traces.
2. The modelling followed the following processes:
    a. For the DDFZ, borehole fault intervals identified from photo logging were linked with lineaments
    b. For all other regional structures, the global orientation was applied to the lineament from the fault set with the same trends presented in the 3D fault model provided by OGNZL, as outlined above in Section 3.3.1.
3. The wireframe was then extrapolated along the lineation strike and structural trend identified in the OGNZL modelled fault orientations, Inset 9:
    a. Regional structures adopted the global orientation from faults with the same trends presented in the 3D fault model provided by OGNZL:
        i. The global orientation was applied to the lineaments and modelled to best suit the line.
4. Wireframes were extrapolated and terminated based on:
    a. The limit of the associated lineament
    b. Against a 600 m buffer around the GPUG area (if no information suggested terminating earlier).

Results

A total of 16 fault structures were modelled from topographic lineaments as well as an updated DDFZ hanging and footwall. The surficial fault traces are presented in Inset 23 along with the traces of the faults modelled by OGNZL, and the wireframes (in *.dxf* format) provided electronically in Appendix B.

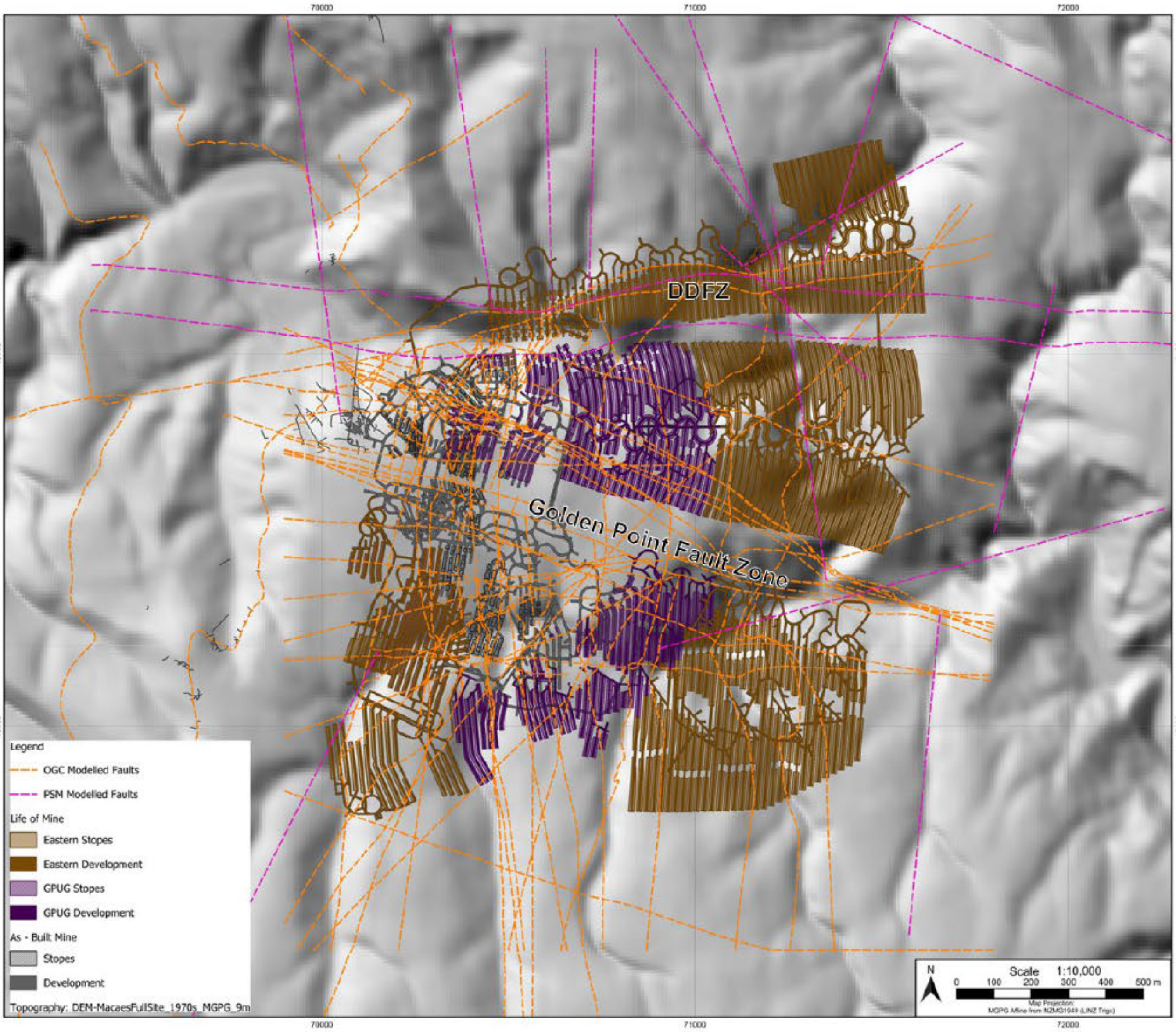
The additional modelled structures can be described as:

- North-south trending faults, sub-parallel to foliation
- East-west trending faults dipping moderately to the south
- DDFZ modelled as a south-southwest moderately dipping structure in alignment with the Deepdell Creek.

Modelling particularly focused on the area north of Deepdell Creek at a regional scale as the current OGNZL fault model does not extend beyond the DDFZ. The area north is considered important for surface settlement assessments as the proposed mining is to extend north of the DDFZ.

As the majority of these modelled structures are based on lineaments and typical orientations from existing OGNZL modelled faults, they have a low confidence as they are not linked to any other data sources. Additionally, due to the deformation history, there is likely to be complexity in the shape, orientation and dip of the faults that is not captured in the modelling. The modelling completed is an interpretation of the available data and our understanding of the geological history.

Following the initial draft of this report, the faults within and surrounding the DDFZ were refined with new data, principally mapping data from Panel 144 and 164. Addendum 1 presents the revised DDFZ model.



Inset 23: Plan view showing fault traces of PSM modelled faults and OGNZL modelled faults.

3.3.3 Structural Domains

Structural domains across Macraes were developed in 2016 based on available structural data, expected conditions, and an overarching understanding of the geological model. Newly available data, principally the 2023 televiewer measurements, has been added to the database and the trends forming the basis for the structural domains has been reviewed.

Structural domain (SD) boundaries have historically been defined by large scale structures across the Macraes operation and delineate into the three domains summaries in Table 7.

Table 7 – Summary of Macraes Structural Domains

Domain	Bounding Structures	Occurrence
SD1	Above HWS	Some upper development and stoping
SD2	Between HWS and FF	Majority of development and stoping will be located within this
SD3	Below FF	Below the proposed underground extension – will not be intersected

Due to the high accuracy of acoustic televiewer (ATV) imaging, the ATV dataset was adopted for the basis of the structural model. Table 8 presents the ATV data for SD1 and SD2 by structure type. SD3 is not represented stereographically as no planned underground development or stoping are formed in this domain.

SD1

The following five defect sets define Structural Domain 1 (SD1):

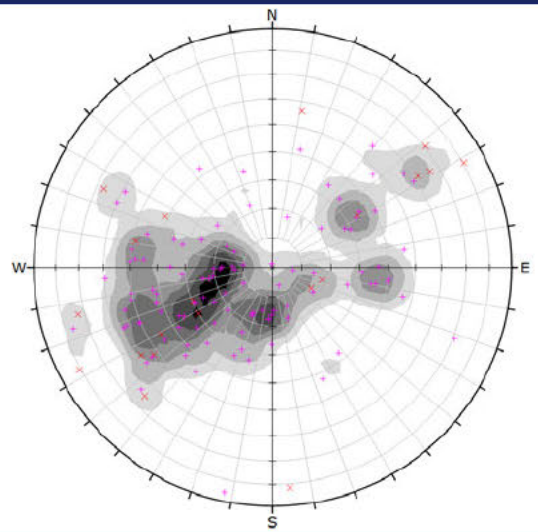
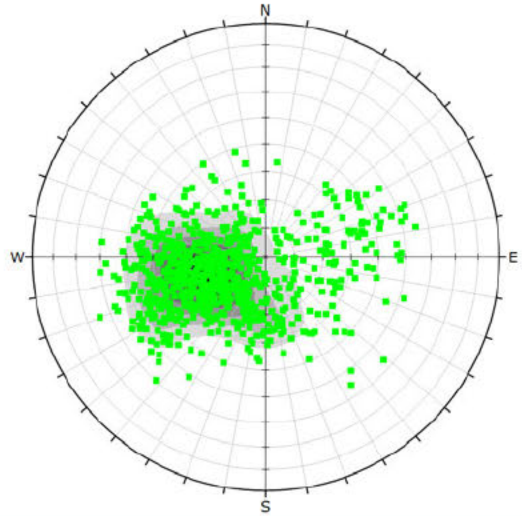
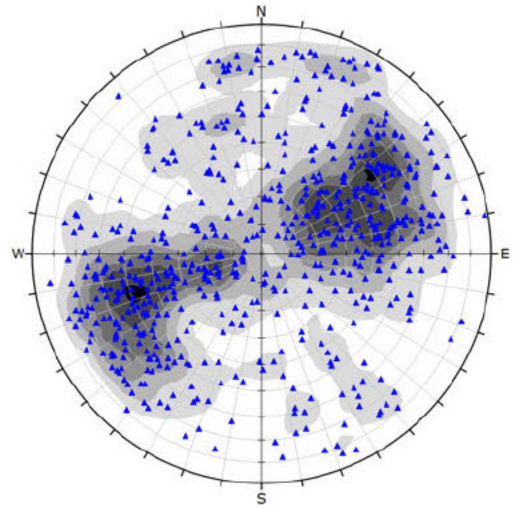
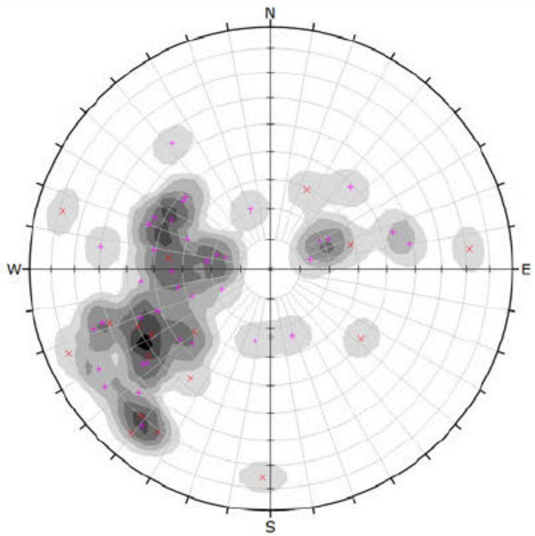
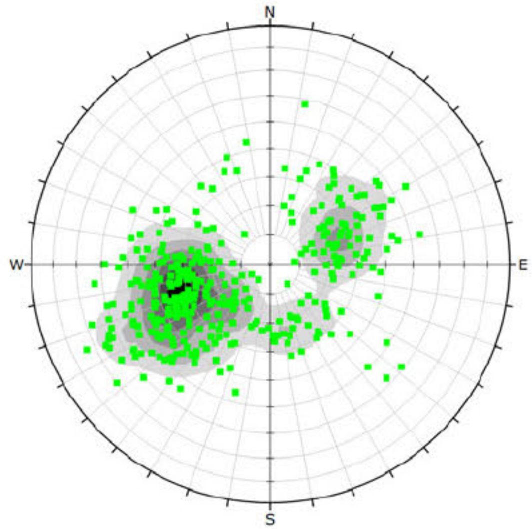
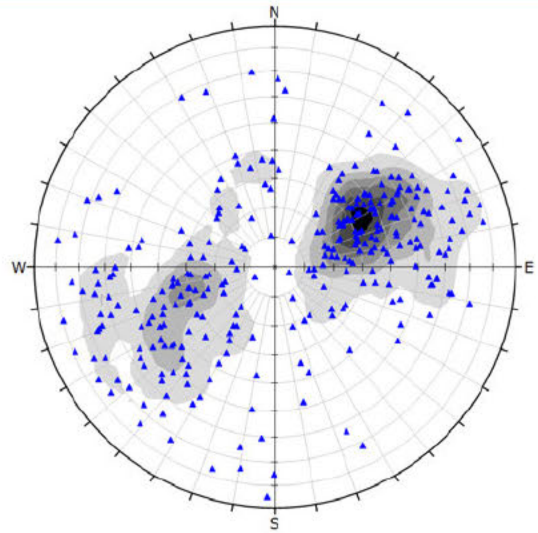
- North-south striking shears and foliations that are shallowly to moderately dipping to the east. These sets are parallel to the FF and HWS. Faults, shears and crush zones are often infilled with clay and rock fragments up to and greater than 200 mm thick
- Joints moderate to steeply dipping to the southwest
- Joints moderate to steeply dipping to the east
- Shallowly to moderately dipping shears towards the west
- Shallowly dipping foliation toward the east.

SD2

The same five defect sets are represented in SD1 and Structural Domain 2 (SD2) with the key difference being:

- North-south trending fault and shears dip steeper towards the east
- Absence of moderately dipping shear to the west. Note, westerly dipping faults have been mapped in GPUG development
- Steeply dipping joints to the north-east are less prominent than SD1
- A secondary foliation set dipping shallowly towards the southwest.

Table 8 – Summary of Structural Domains from neighbouring RHOP

Domain	Faults & Shears	Foliation	Joints
SD1			
SD2			

3.4 Groundwater

The groundwater setting described here is based on PSM's experiences at Macraes and the large bodies of work undertaken by GHD (GHD, 2026) and WSP (WSP,2023). This section is intended to summarise the groundwater conditions relevant to the geotechnical considerations.

Regionally, the groundwater level at Macraes is at about 30 m below ground level.

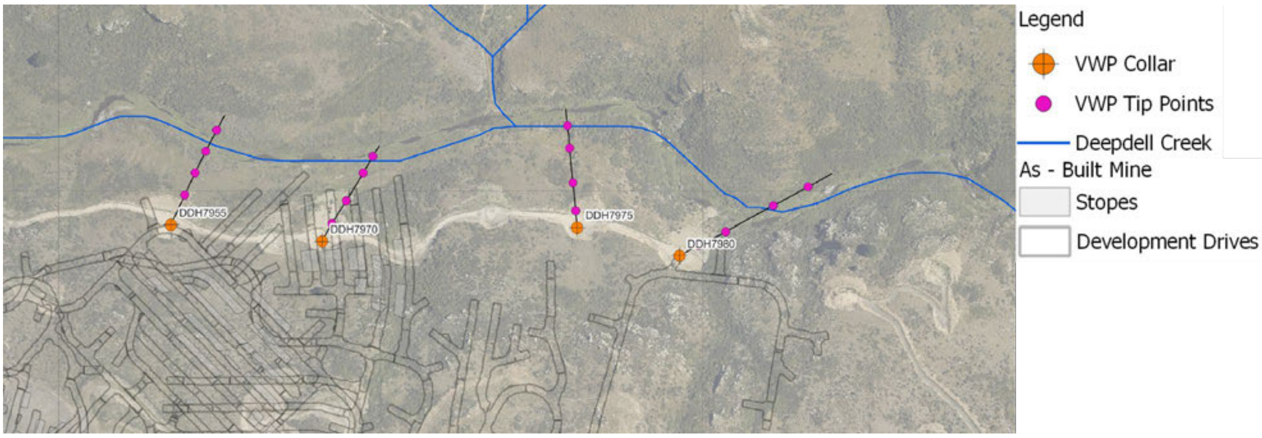
The groundwater setting at GPUG is based on (WSP, 2023) and can be summarised as a vertically stratified sequence of hydrogeological rock mass units:

- Surficial units comprise the WRS, loess, colluvium, and alluvium for shallow discontinuous unconfined aquifers. These units have a moderate to high permeability and absorb rainfall recharge flowing towards Deepdell Creek
- Weathered schist is about 5 to 30 m thick, and thicker in some parts. This unit has significantly higher permeability than the underlying unweathered schist, forms the most hydraulically active layer in the sequence, and provides the most direct connection between surface recharge and the underlying rock mass
- The underlying unweathered schist hosts the majority of GPUG:
  - Permeability declines with depth at approximately one order of magnitude per 40 m — a well-defined logarithmic trend supported by 56 hydraulic test intervals across seven boreholes
  - Horizontal K (K_h) significantly exceeds vertical K (K_v), estimated at approximately one order of magnitude difference, due to the dominance of sub-horizontal foliation partings as the primary flow pathway
  - Faulted and fractured zones can be locally more permeable, however targeted testing of major structures in 2022 returned generally low permeability results, suggesting vertically persistent permeable fault zones are uncommon in this setting.

The low permeability of the overlying weathered schist results in the very low groundwater flow reported in GPUG, as low as 1 l/s. Based on groundwater modelling, WSP predict groundwater inflows to the underground mine to peak at about 2.5 to 3 l/s.

Vibrating wire piezometers (VWP's) installed in 2022(refer Inset 24, and OGNZL, 2025b) . PSM has reviewed the provided data and have made the following observations:

- VWP's installed in DDH7955 and 7970 show groundwater drawdown of about 10 to 150 m
- Drawdown begins in step with the development drives mined for Panels 110 and 144 in the first half of 2025
- Smaller drawdown is associated with early drives developed for Panel 164 at DDH7975
- The rock mass above and surrounding the existing underground development is considered dry.



Inset 24: Location of VWP's installed in boreholes along Deepdell Creek.

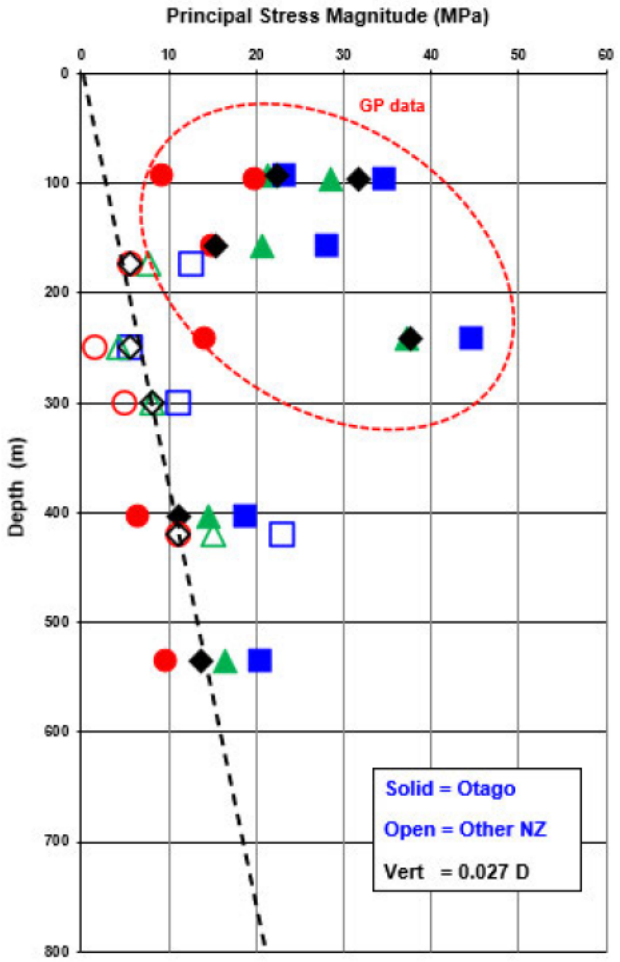
3.5 In Situ Stress

In-situ stress applicable to GPUG are listed in Table 9 and are adopted from previous work (Geotechnica, 2022).

Table 9 – In Situ Stress Regime

Stress	Magnitude (MPa)	Dip (°)	Dip Direction (°)
σ_v	0.027 x depth		
σ_1	σ_v x 1.6	40	278
σ_2	σ_v x 1.2	51	90
σ_3	σ_v x 0.55	1	5

Inset 25 presents the in-situ stress data recorded for Otago and New Zealand (Geotechnica, 2022). The results show that there is a higher magnitude than would be expected based on the database of previous testing in New Zealand.



Inset 25: Stress gradient comparison with other New Zealand test results (Geotechnica, 2022).

Acoustic emissions testing is conducted by applying stress, usually compression, to a core sample whilst monitoring the acoustic signals produced as the sample deforms.

The test results typically represent the maximum stress a sample has experienced over its geological lifetime. If the current stress state is lower than the maximum stress previously experienced, the test may not accurately reflect the current stress conditions. Therefore, it is difficult to determine the test's validity in relation to the current stress regime and may only serve as an upper bound or an adverse case stress scenario.

GPUG is noted to have significantly higher stress gradients and is expected to be more prone to deformation at a shallower depth than has been experienced at FRUG.

Based on comparison of the GPUG results vs the stress gradients for New Zealand, there is some uncertainty associated in the values obtained via acoustic emissions testing.

3.6 Geotechnical Parameters

The geotechnical parameters presented here are based on the geotechnical assessment and analyses undertaken at Macraes (PSM, 2026).

3.6.1 Intact Strength

Intact rock strength has been evaluated as an input to rock mass strength estimates. Intact strength data has been compiled by PSM over the past 30 years from a large suite of drill core logging estimates, point load strength testing and laboratory UCS testing. Table 10 presents a summary of the intact rock strengths at RHOP.

Table 10 – Intact Rock Strengths – Comparison of Data Sources

<table>
<tr><th rowspan="2">Rock Mass Unit</th><th rowspan="2">Field Estimate Equivalent UCS (MPa)</th><th colspan="2">UCS Testing – (MPa)</th><th colspan="2">Axial PLSI Equivalent UCS (MPa)</th><th colspan="2">Diametral PLSI Equivalent UCS (MPa)</th></tr>
<tr><th>Range</th><th>Mean</th><th>Range</th><th>Mean</th><th>Range</th><th>Mean</th></tr>
<tr><td>Class A</td><td>10 - 25</td><td>n/a (1)</td><td>75(1)</td><td>13 - 177</td><td>48</td><td>6 - 75</td><td>28</td></tr>
<tr><td>Class B</td><td>10 - 25</td><td>32 - 105</td><td>57</td><td>3 - 199</td><td>42</td><td>1 - 147</td><td>34</td></tr>
<tr><td>Class C</td><td>3 - 25</td><td>40 - 70</td><td>47</td><td>1 - 142</td><td>35</td><td>1 – 139</td><td>24</td></tr>
<tr><td>Class D</td><td>0.1 – 1.5</td><td colspan="2">No tests completed</td><td>n/a</td><td>15</td><td colspan="2">No tests collected</td></tr>
<tr><td>Class E</td><td>Soil strength</td><td colspan="6">No tests collected</td></tr>
</table>

3.6.2 Triaxial Shear Strength

Table 11 summarises the interpreted Mohr-Coulomb strength parameters derived from soil rock mass unit triaxial testing.

Table 11 – Summary of Adopted Mohr-Coulomb Triaxial Shear Strengths

Rock Mass Unit	Indicated Shear Strength	
	Cohesion (kPa)	Friction Angle (°)
Class E	100	38
Hanging Wall Shear	50	20
Footwall Fault	0	9
All modelled Faults	50	20
Waste Rock Backfill	0	37

3.6.3 Rock Mass Strength

Rock mass shear strengths were assessed for the geotechnical rock mass units following the Hoek-Brown failure criterion (Hoek and Brown, 2019) and using the GSI system. The mean values are based on geotechnical logging, geomechanical lab testing, and PSM's experience with multiple pit designs and slope behaviour observations at Macraes over the past 30 years.

The GSI / Hoek-Brown methodology is empirically derived and requires:

1. An evaluation of the intact strength (UCS).
2. An assessment of the Geological Strength Index (GSI).
3. An empirical constant (m_i), which is estimated based on engineering experience.

Due to the limited testing, m_i was estimated based on PSM's experience with similar materials.

These values provide a curved rock mass shear strength envelope for each geotechnical unit. Where appropriate, the curved strength envelope has been approximated by equivalent Mohr-Coulomb strength parameters cohesion (c') and angle of friction (Φ).

3.6.4 GSI Assessment

The Geological Strength Index (GSI) values derived for this assessment are generated via two methods:

- Bienawski (1989) method:
  - An assessment of individual relevant RMR_{89} input parameters based on the typical characteristics for the RMU
  - Conversion of the RMR89 rating to GSI using the following relationship:

$$GSI = RMR_{89} - 5$$

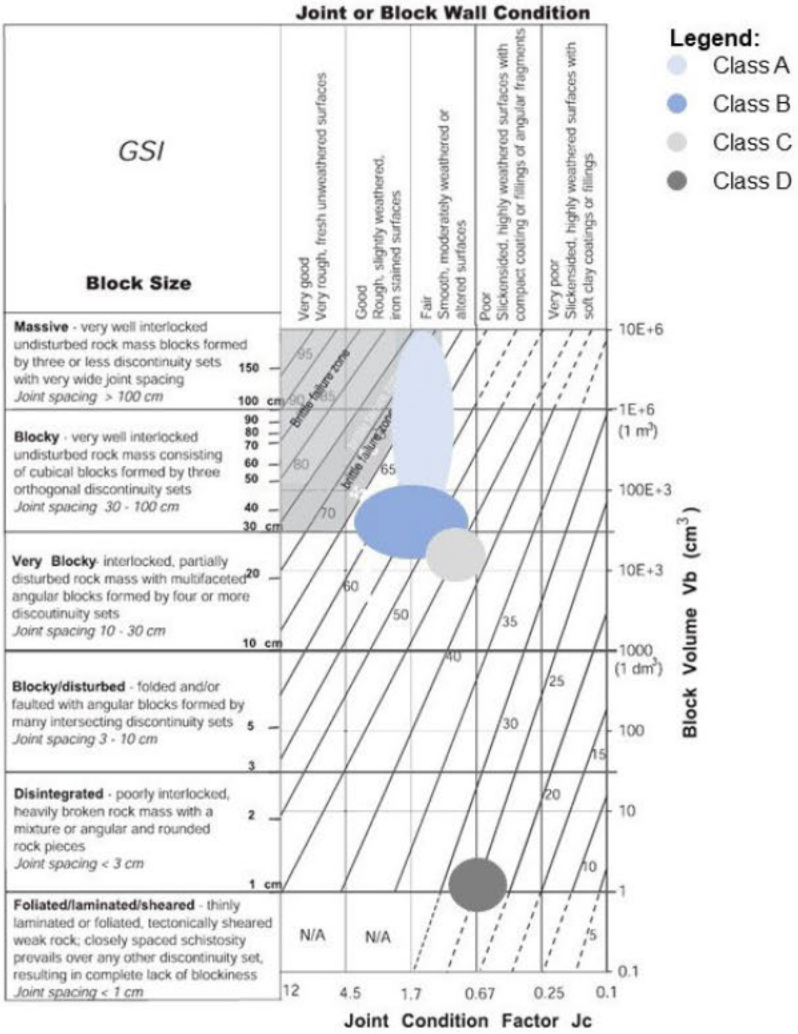
- Cai et al (2004) method:
  - An approach obtained from estimates of block volume and joint condition.

Table 12 presents a summary of the estimated GSI values for the RMR_{89} and Cai method, adopted from RHOP. Inset 26 presents the estimated GSI range for each unit based on the Cai 2004 method.

For this assessment the Cai 2004 method for GSI estimation has been adopted.

Table 12 – Summary of Estimated GSI Values

RMU	Bienawski 1989	Cai 2004
Class A	61	65 (60-75)
Class B	59	55 (45-65)
Class C	48	45 (40-50)
Class D	25	20 (20-30)
Class E	30	30



Inset 26: Summary of GSI estimate for the GPUG rock mass based on the RHOP assessment using the Cai 2004 Method (Cai et al, 2004).

3.6.5 Adopted Rock Mass Shear Strengths

Table 13 presents the adopted rock mass shear strengths for this assessment.

Table 13 – Adopted Rock Mass Shear Strengths

Rock Mass/Class	Unit Weight (kN/m³)	Hoek-Brown Parameters				Mohr-Coulomb Parameters	
		UCS (MPa)	GSI	m_i	D	Cohesion c' (kPa)	Friction Angle ϕ' (°)
Class A	0.027	40	65	12	0	NA	
Class B		40	55				
Class C		35	45				
Class E / Weathered Zone	0.025	NA				100	38
DDFZ						100	40
Waste Rock Backfill / Embankment Fill	0.020					10	37

3.6.6 Density, Modulus and Poisson's Ratio

Table 14 summarises the estimated values for unit weight, tensile strength, rock mass modulus, and Poisson's Ratio.

Table 14 – Summary of Unit Weight, Tensile Strength, Rock Mass Modulus and Poisson's Ratio

Rock Mass Unit	Unit Weight (kN/m^3)	Tensile Strength (kPa)	Rock Mass Modulus (E_{mass}) (MPa)	Poisson's Ratio *v*
Class A	27	0.2	2,000	0.25
Class B	27	0	1,500	0.25
Class C	27	0	1,000	0.3
DDFZ	20	0	500	0.35
Class E	25	0	100	0.35
Waste Rock Backfill	20	0	100	0.35

3.6.7 Defect Shear Strengths

The adopted defect shear strengths for GPUG are based on PSM's previous work at RHOP and IM7/8 and presented below in Table 15.

Table 15 – Summary of Defect Shear Strengths

Structure	Cohesion (kPa)	Friction Angle (°)	Tensile strength (MPa)	Normal Stiffness (MPa/m)	Shear Stiffness (MPa/m)
Hanging Wall Shear	50	20	0	1,000	100
Footwall Fault	0	9	0	100	10
All other Faults	50	20	0	1,000	100

3.7 Geotechnical Uncertainties

The following uncertainties apply to this work:

- The character and orientation of the modelled faults have a moderate degree of uncertainty and may impact the underground design and performance as faults have been modelled from lineaments and typical orientations only
- The estimated width, condition, and geotechnical parameters (i.e. shear strength) of the DDFZ is inferred. Drilling has largely focused on the southern extent of this structure
- Thickness of modelled faults is expected to vary locally
- Presence of unidentified major fault structures. This is particularly true as mining progresses north and east into previously unmined/unmodelled areas
- Ground behaviour and potential change to hydraulic conditions:
  - At present, site specific information is not available to inform the strain and/or subsidence to form cracks and offset, and what crack geometry is required before hydraulic conditions are altered.

4. Potential Effects

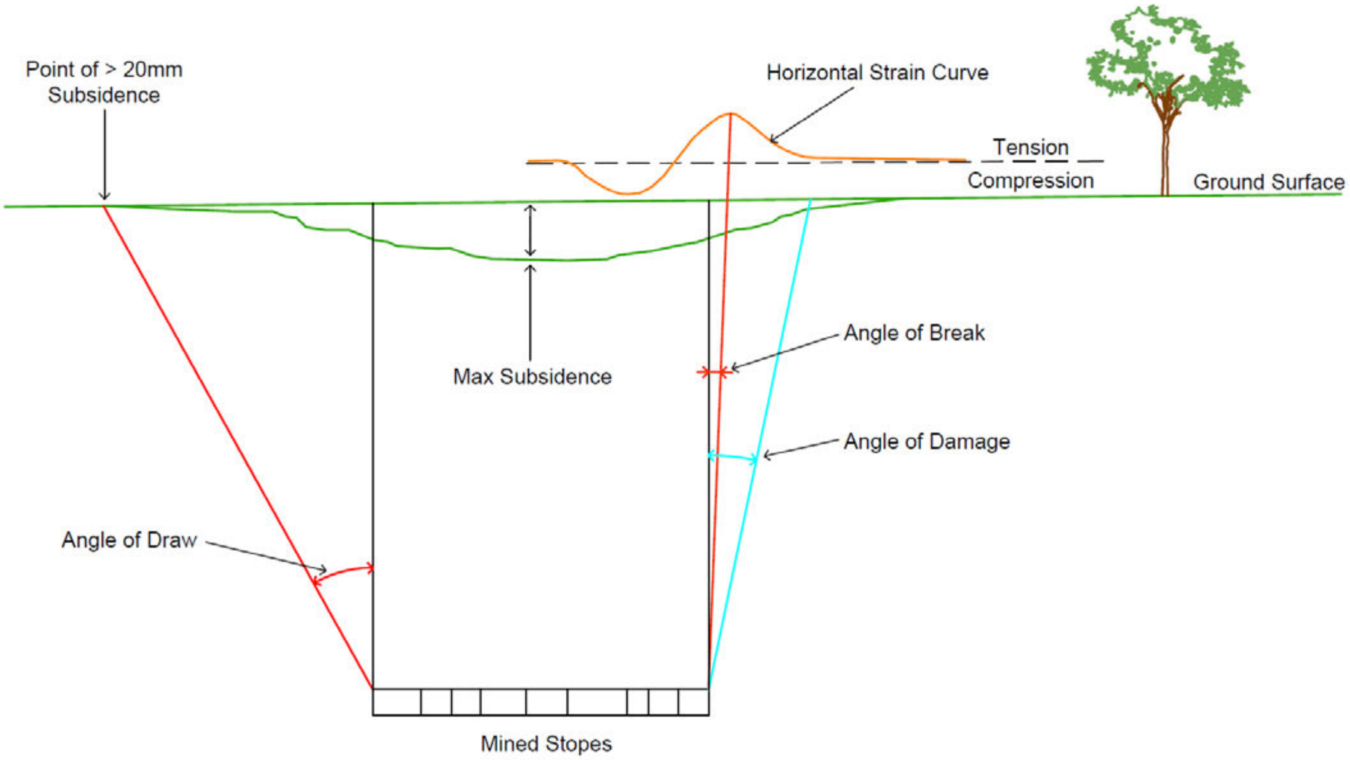
The following section describes the potential effects that commonly occur at ground surface due to underground mining.

4.1 Subsidence

4.1.1 Angle of Draw

Angle of draw is defined as the angle between a line drawn vertically from the stope edge and a line drawn from the stope edge at the mining horizon to a point on the surface where the vertical subsidence has reached an acceptably low level, regarded as 20 mm or less in the mining industry, as discussed in section 4.1.2.

Inset 27 presents a figure showing the geometry of the angle of draw.



Inset 27: Schematic cross section illustrating angle of draw.

In the mining industry, angle of draw is a common concept used in providing protection to surface features because the offset distance is easily definable on the basis of overburden depth, the distance is fixed and does not change, and the distance can be determined prior to any subsidence monitoring data becoming available.

The angle of draw can vary with increasing depth; however, the relationship is unclear and geotechnical model dependent.

4.1.2 20 mm of Subsidence

Typically, the accuracy that subsidence can be surveyed is of the order of 20 mm. Although relative survey accuracy is typically better than 20 mm, there are practical challenges of achieving repeat surveys over extended periods of time when sighting targets over large distances in often complex terrain

This level of accuracy is acceptable because natural variations in ground level caused by diurnal and seasonal moisture changes are typically recognised as being up to about 10 to 50 mm (Cameron et al, 2023). In practice, shrink swell in reactive clay soils can be much larger. For this assessment, PSM have adopted 20 mm as the amount of ground movement that occurs naturally.

On this basis, a threshold of 20 mm of vertical subsidence is commonly accepted as the practical point for defining the limit of vertical subsidence given its asymptotic nature beyond the edge of caved voids, i.e. stopes.

4.2 Chimneying

Chimneying in underground mining is the upward propagation of a void or failure zone from an excavation (like a stope, raise, or cave) toward the surface or higher levels, forming a near-vertical column — often called a chimney.

The key mitigating circumstance which reduces the likelihood of chimneying, is that voids (i.e. drives and stopes) commonly converge and the overbreak and failed materials typically choke off the voids due to bulking of the failed materials to fill the available voids.

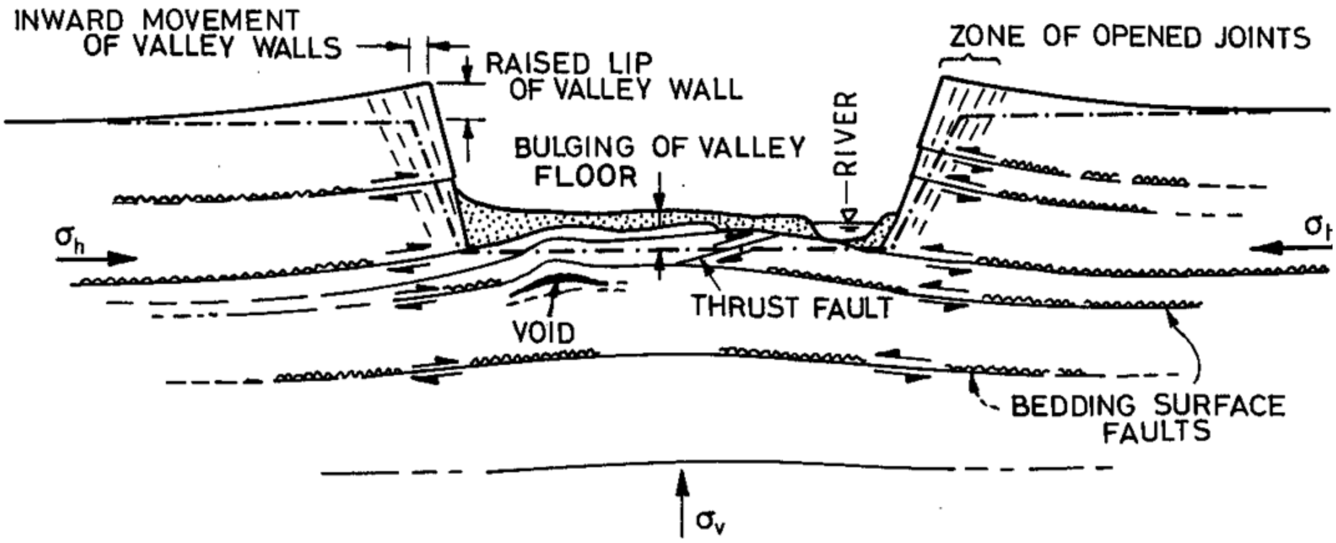
Factors that may increase the height of caving include:

- Multi-level large extractions
- Ongoing extraction or erosion of caved material
- A lack of competent rock mass to support roof bridging.

Chimneying or excessive vertical propagation and caving of a void is a particular risk in weak rock, soil and fault zones that extend upwards and do not support the formation of a stable roof.

4.3 Valley Bulging

Valley bulging is a natural phenomenon, as part of the ongoing natural erosion, stress concentration formation and movement on defects. This natural process can leave a valley more sensitive to the effects of mine subsidence due to mobilisation of shear surfaces (Patton and Hendren, 1972).



Inset 28: Complex valley structures related to stress release in weak, flat-lying rocks (based on Patton and Hendron, 1972).

Mining induced movement along existing defects associated with valley bulging can occur when mining is located beneath or adjacent to the valley. Induced movement due to mining commonly takes the form of valley closure (or a reduction in distance between the sides of the valley) and less commonly as an apparent reduction in subsidence at the valley floor due to floor heave (Patton and Hendren, 1972). This local reduction in subsidence or uplift is commonly referred to as 'upsidence'. Closure and subsidence are often considered forms of non-conventional subsidence.

Closure and subsidence are usually accompanied by localised changes in tilt and curvature and associated with high compressive strain in the centre of the valley and horizontal closure of the valley sides.

Currently proposed mining is to the north and south of the valley and there are access drives proposed below the valley. In addition to the potential to cause mining induced deformation in their own right, there is potential for deformation to occur in combination with the effects of valley bulging.

Both closure and subsidence tend to concentrate on planes of weakness such as bedding/foliation, joints and shears (defects). Consequently, measurement of movement on such defects is important in understanding how mining induced movement is manifest within the sides and base of valleys. If movement is concentrated on one or two planes of weakness, then this may lead to areas of local instability such as buckling or significant change in properties such as permeability. These effects can affect the ability of the valley sides and floor to contain water, with potential consequent impact.

In the context of GPUG and more specifically Deepdell Creek, the defined valley to the north and east of the operation there is potential that valley bulging has occurred which may be represented in the analysed InSAR data, discussed in the following section. However, unlike a horizontally bedded deposit, due to the inclination of foliation, combined with complex through-going geological structure, the measurable effects at GPUG are likely to be more subtle.

4.4 Conceptual Groundwater Response to Rainfall and Mining-Induced Changes

The groundwater system is characterised by a water table below which the ground is fully saturated, and above which it is typically unsaturated under baseline conditions. Below the groundwater table, pore pressures are hydrostatic and increase linearly with depth, analogous to conditions beneath a standing body of water. Above the water table, the ground generally remains unsaturated except during and shortly after rainfall recharge events.

Rainfall recharge produces a transient groundwater response, whereby infiltration causes a temporary rise in groundwater levels. This can result in saturation of materials above the prevailing water table for a limited duration, after which conditions gradually return to their pre-event state. This behaviour is considered representative of conditions in slopes above Deepdell Creek.

VWP data discussed in section 3.4 indicates dewatering of the existing GPUG drive and stopes removes groundwater from the rock mass between the ground surface and the base of the underground. This phenomenon is occurring without subsidence. Recharge of the groundwater system may be occurring via existing water ways and rainfall, however, groundwater is stored within the fracture network resulting in slow recharge and low storativity.

As mine induced subsidence occurs at the ground surface, new tension cracks and/or existing natural defects are likely to dilate, especially where subsidence and strain is high – resulting in greater connectivity between the underground mine and the ground surface. The hydraulic permeability of the rock mass and fault zones increases.

5. Observed Performance

5.1 General Site Observations

A site visit was completed by Principal Geotechnical Engineer, Adrian Smith of PSM between 3 and 4 March 2026. Key observations form the site visit are summarised below:

- GPUG mining areas were observed to be relatively dry
- Drive support observed in declines and other main drives consisted of:
  - Primarily split sets or MDX bolts and mesh, typically installed in Class B rock mass conditions:
    - Shotcrete installed in some Class C rock mass.
  - Lattice girders and thick shotcrete through fault zones, inferred as Classes C and D.
- Varying levels of squeezing were observed, an example is shown in Inset 29, ranging from minor rib and back deformation to convergence approaching 50% of the span, driven by ground conditions (Class C) as well as adjacent mining
- Most stopes have caved to some extent, with only a few remaining open
- PSM is not aware of any instances of chimneying at GPUG. Chimneying has been reported between FRUG and the Frasers open pit where the crown pillar was approximately 30 m.

Inset 29: Photo of a development ore drive in GPUG Panel 150 showing squeezing ground.

5.2 Underground Behaviour

Performance of the existing underground excavations has been observed to include a range of squeezing as well as some defect control deformation.

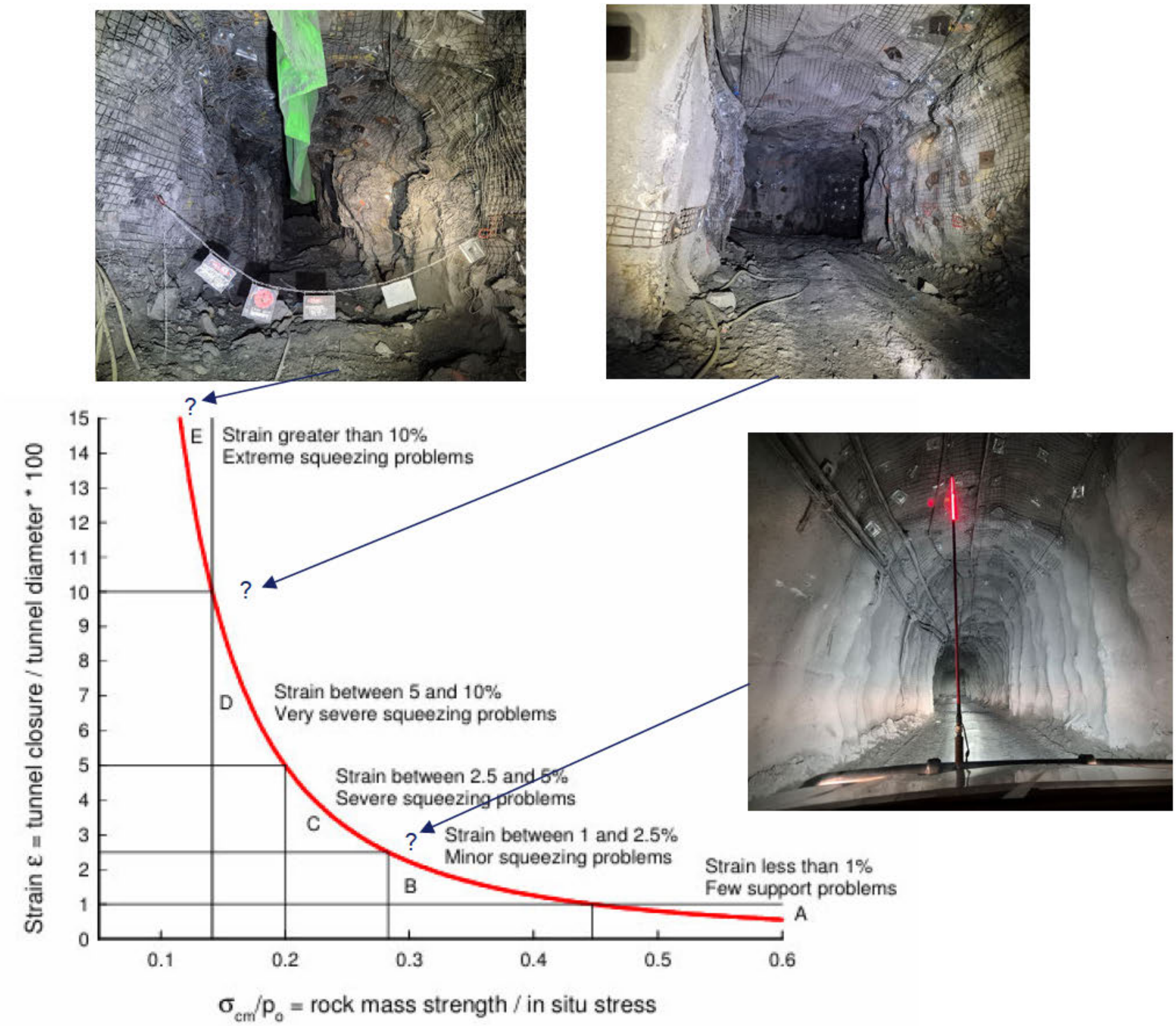
5.2.1 Drive Performance

There are a number of classification systems for squeezing of underground excavations, for example Hoek and Marinos (2000). The table describing the classification system, including the range of strain (closure divided by effective diameter) is replicated in Table 16.

Selected photos from GPUG have been used to illustrate the range of observed squeezing within the framework in Inset 30.

Table 16 – Tunnel Squeezing Classifications (Hoek and Marinos, 2000)

Category	Strain, ε (%)	Geotechnical Issues	Support Types
A	< 1	Few stability problems and very simple tunnel support design methods can be used. Tunnel support recommendations based upon rock mass classifications provide an adequate basis for design.	Very simple tunnelling conditions, with rock bolts and shotcrete typically used for support.
B	1 to 2.5	Convergence confinement methods are used to predict the formation of a 'plastic' zone in the rock mass surrounding a tunnel and of the interaction between the progressive development of this zone and different types of support.	Minor squeezing problems which are generally dealt with by rock bolts and shotcrete; sometimes with light steel sets or lattice girders are added for additional security.
C	2.5 to 5	Two-dimensional finite element analysis, incorporating support elements and excavation sequence, are normally used for this type of problem. Face stability is generally not a major problem.	Severe squeezing problems requiring rapid installation of support and careful control of construction quality. Heavy steel sets embedded in shotcrete are generally required.
D	5 to 10	The design of the tunnel is dominated by face stability issues and, while two-dimensional finite element analyses are generally carried out, some estimates of the effects of forepoling and face reinforcement are required.	Very severe squeezing and face stability problems. Forepoling and face reinforcement with steel sets embedded in shotcrete are usually necessary.
E	>10	Severe face instability as well as squeezing of the tunnel make this an extremely difficult three-dimensional problem for which no effective design methods are currently available. Most solutions are based on experience.	Extreme squeezing problems. Forepoling and face reinforcement are usually applied and yielding support may be required in extreme cases.



Inset 30: Examples from GPUG and approximate strain, adapted from Hoek and Marinos, 2000.

5.2.2 Stope Performance

Mining of stopes is conducted in retreat with stopes typically extracted to a size which is economic and commonly semi-stable. Observed stopes had usually converged and caved over time.

5.2.3 Chimneying

As GPUG progresses down dip to the east, the depth of cover increases, and the likelihood of chimneying to surface diminishes. Where GPUG is proposed to extend beneath the backfilled Golden Point or Round Hill open pits, where the depth of cover above the voids is thin, the potential for chimneying to occur is more likely.

At Macraes, upwards cave propagation is known to have reached approximately 30 m above large stopes in FRUG where caving intercepted with the Frasers open pit. There have been no occurrences of caving to the natural ground surface at Macraes above either FRUG or GPUG. Despite this there is some uncertainty around the maximum caving height that has occurred and further borehole investigation is planned. Deep surface borehole wire extensometers have been installed above the panels 144 and 164 to measure vertical strain and caving. The deepest fixed node is 20 to30 m above the panel roof and to date the strain measurement is zero.

5.3 Surface Subsidence

Inset 31 presents a summary of GPUG and the approximate vertical displacements measured over the past 5 years. Detailed plans of cumulative movements, interpreted from InSAR L-Band data are provided in Appendix C, with X-Band data in Appendix D.

Additionally, cross-sections were developed to present the cumulative movements as a profile relative to mine voids, presented in Appendix E, while incremental movements over time are presented in Appendix F.

Key observations, features, and areas of note are summarised below:

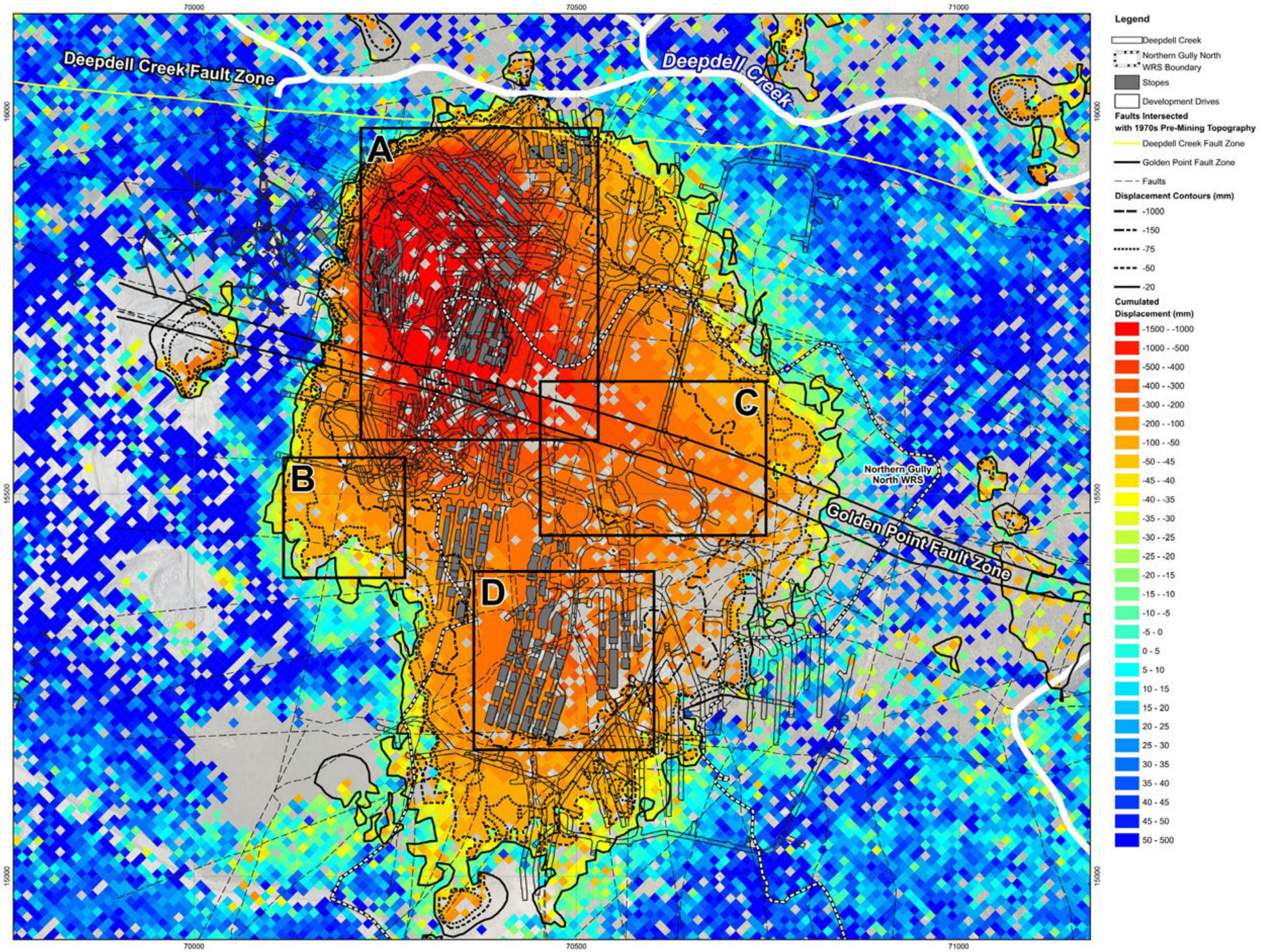
- Multi-level stoping through the stacked lodes (Inset 31, area A) has the greatest subsidence for the two-year period in excess of 1,000 mm
- Valley bulging associated with mine subsidence is not observed along Deepdell Creek due to zero underground mining below the valley
- Based on Area B where the existing open pit wall is near GPUG, a vertical component of pit slope deformation of about 100 mm is indicated (Inset 31)
- While faults structures are anticipated to relay deformation in the form of subsidence, in particular the Golden Point Fault Zone, offsets in the perimeter of subsidence do not appear to align with the modelled faults. This is likely related to the accuracy of projected faults rather than the lack of fault-controlled deformation
- Limited underground development and no stoping has occurred in area C (Inset 31) yet approximately 300 mm of vertical movement is detected. This movement is inferred to a component of settlement of the Northern Gully North WRS and some component of rock mass subsidence due to underground workings. Area C is also where the WRS is thickest at 60 m thick
- Area D (Inset 31) corresponds to active stoping and development over the period assessed, with the cumulative displacement up to approximately 300 mm
- The measured angle of draw (20 mm subsidence) ranges between 0 and 33°. The angle of draw may be influenced by geological controls. To assess this, the selected angle of draw measurements were split into areas and orientations to identify whether a geological and/or mining control is present:
  - West of Area A:
    - 0 to 33°.
  - East of Area A, likely influenced by WRS settlement:
    - 31°.
  - East of Area D, where angle of draw may follow along foliation:
    - 29 to 30°.
  - West of Area D, possibly masked by WRS:
    - 24 to 33°.
  - North of area A, adjacent to Deepdell Creek, possible influenced by the DDFZ:
    - 2 to 31°.

While there is some variability in the minimum angle of draw, the maximum is usually about 31 to 33°.

It is important to note the subsidence signature above GPUG is complicated by:

- Surface topographic relief of around 150 m, including Deepdell Creek valley
- Golden Point open pit highwall and associated highwall deformation and horizontal relaxation that has occurred since it was excavated (around 2000-2002) 20 years prior to starting GPUG
- Northern Gully Waste Rock Stack (WRS) with associated ongoing rockfill settlement
- Non-regular underground mine development

  Multiple mining levels in some locations, i.e. stacked lodes.



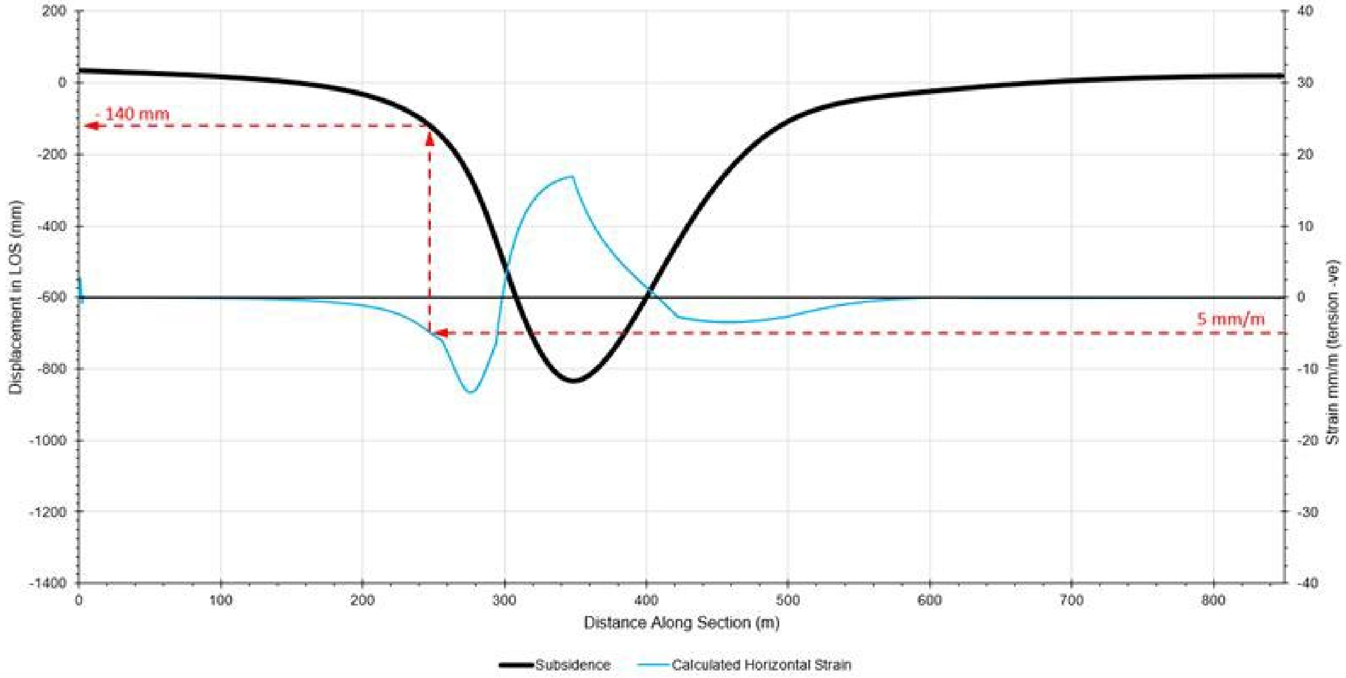
Inset 31: GPUG – InSAR L-Band cumulated displacement in LOS descending mode – Jan 2024 to Feb 2026.

5.4 Strain Assessment

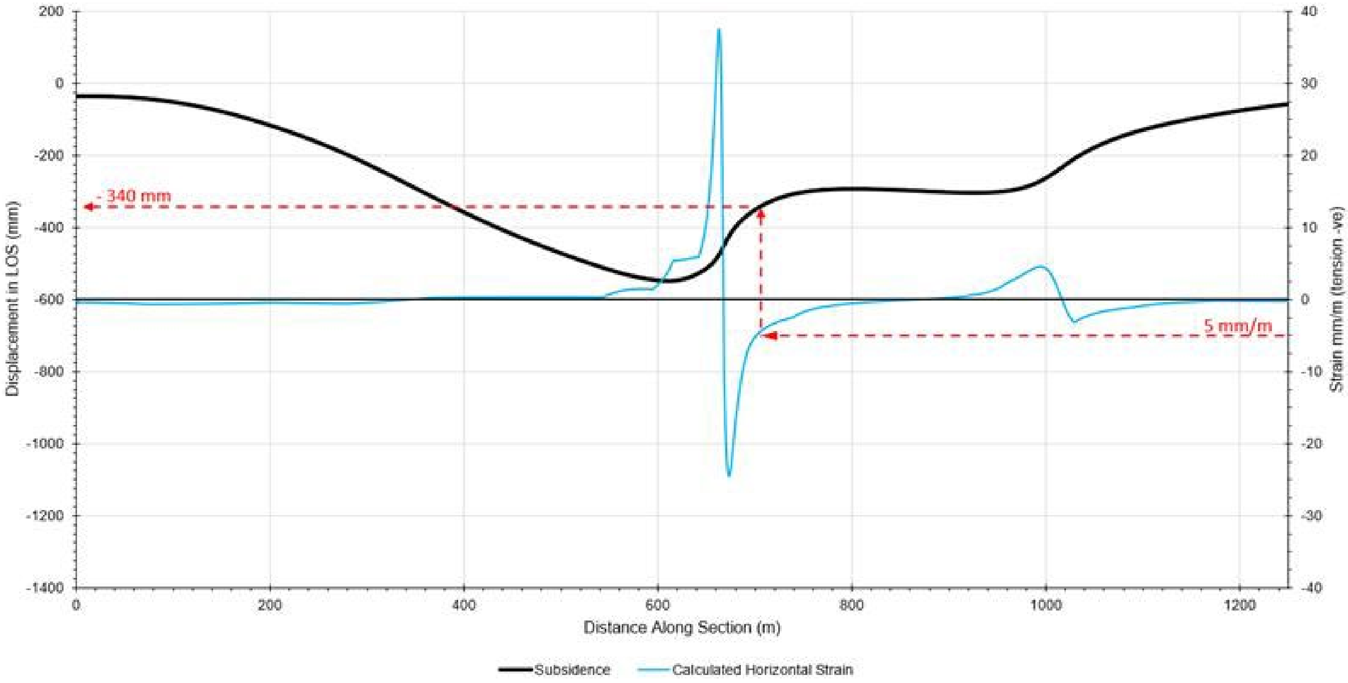
Preliminary assessment of the predicted effects has been undertaken by estimating the horizontal strain at the ground surface from the InSAR based mine subsidence measurements detailed in Section 6.3 . The horizontal strain can be estimated from the radius of curvature of the surface subsidence profile (Oreteck, 2022).

The final subsidence profile along cross-sections A, B, C and D (Appendix E) has been curve-fitted using a best-fit spline function to calculate the tilt and the radius of curvature as the first and second derivatives of the subsidence profile. The calculated radius of curvature is converted to horizontal strain by multiplying it using the depth of influence for a hogging segment of the subsidence profile. The depth of influence is assumed to be half of the total overburden thickness.

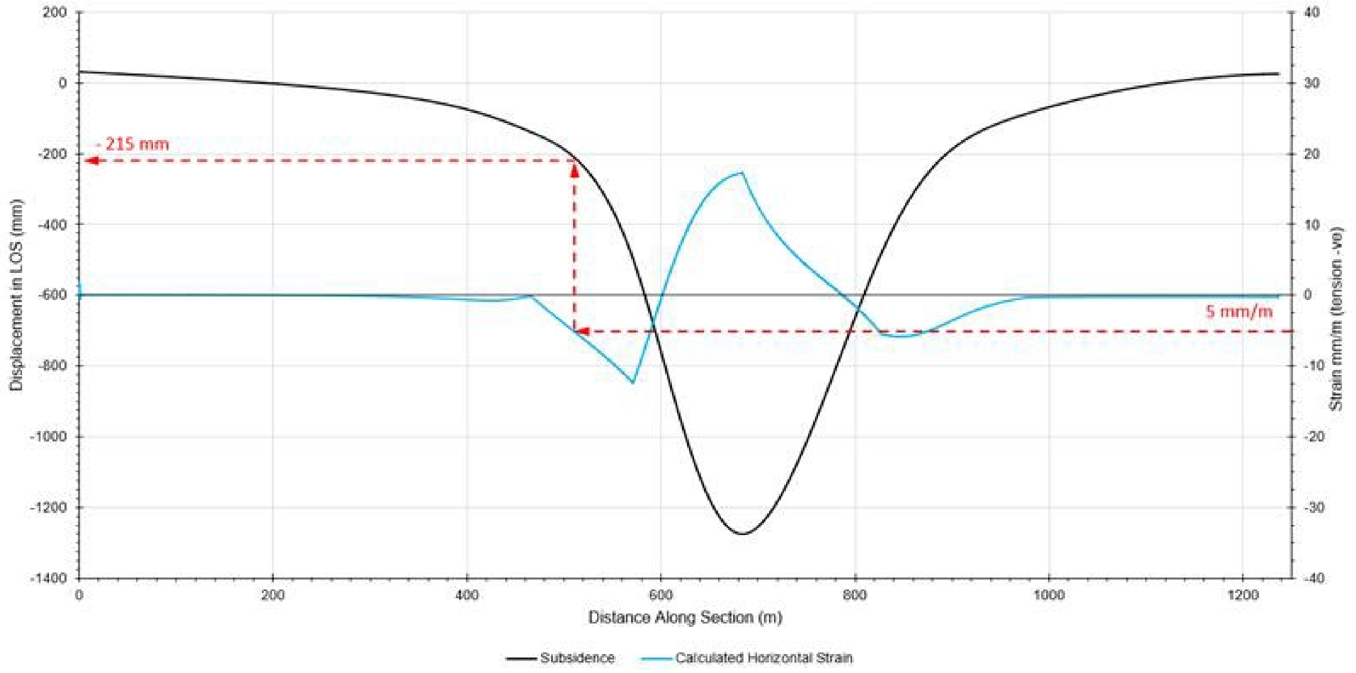
Insets 32 to 35 show the best-fit curve for the subsidence profile and the calculated horizontal strains along cross-sections A to D. The location of the cross-sections is presented in Figure 1.



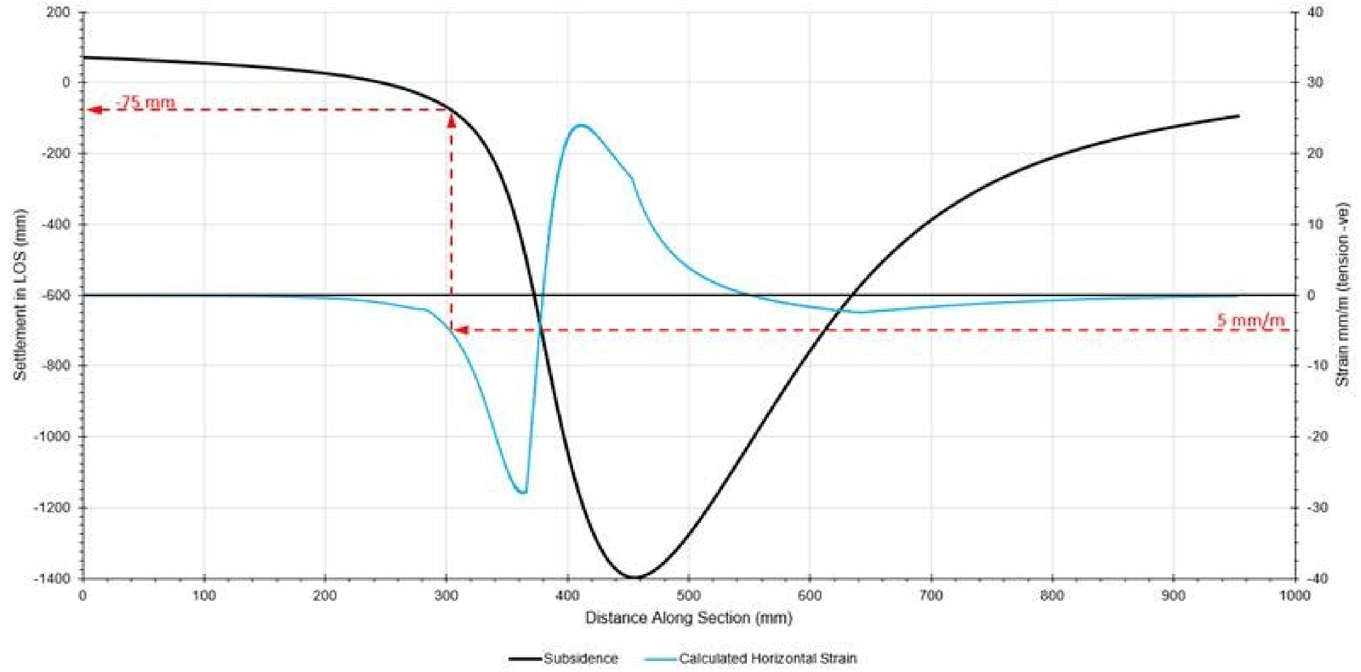
Inset 32: Section A – calculated horizontal strain and subsidence profile.



Inset 33: Section B – calculated horizontal strain and subsidence profile.



Inset 34: **Section C – calculated horizontal strain and subsidence profile.**



Inset 35: **Section D – calculated horizontal strain and subsidence profile.**

These plots indicate calculated maximum tensile strain along these cross-sections are:

- Section A 12 mm/m
- Section B 25 mm/m
- Section C 15 mm/m
- Section D 28 mm/m.

Horizontal strains larger than 5 mm/m may cause existing joints to dilate and new tension cracks to form. The following points list the corresponding subsidence at 5 mm/m:

- Section A 140 mm
- Section B 340 mm, note this maximum strain occurs on the right side of the subsidence curve, which is unusual and therefore considered an outlier
- Section C 215 mm

- Section D	75 mm.

Based on these results, a conservative estimate of the tolerable subsidence limit before cracking occurs can be assumed to be 75 mm.

Measurements of the angle of draw were made between stopes and the 75 mm subsidence contour resulting in an angle of 5% horizontal strain of between 0 and 24°. Therefore, a practical limit for mining up to Deepdell Creek could be based on this angle.

PSM expects this limit/angle to be reduced as overburden thickness increases. Hence, as new information (monitoring and site investigation) becomes available this limit can be refined.

6. Geotechnical Stability Analysis

6.1 Introduction

A geotechnical stability assessment has been undertaken to simulate ground deformation associated with ongoing underground mining activities and to assess potential impacts at surface.

PSM acknowledge the ground deformations are highly dependent on the three-dimensional (3D) effects associated with mining and caving of underground voids. The most realistic simulation is likely from 3D stability analyses. However, 2D analyses provide an opportunity to undertake rapid simulations of localised responses to specific ground behaviour and deformation mechanisms at a conceptual level.

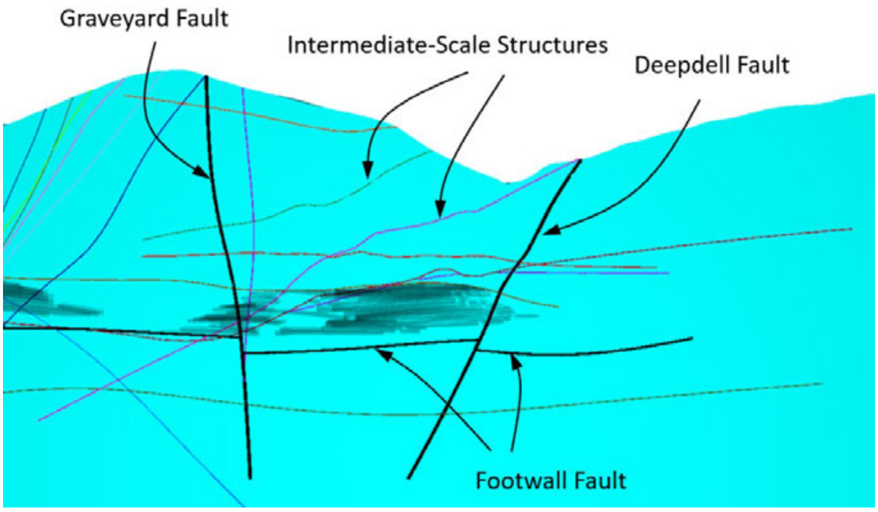
The analysis focuses on the interpreted extent of underground workings, geological conditions and rock mass characteristics, with particular consideration given to fault zones and areas of disturbed ground. Available surface survey data has been reviewed to support comparison with analytical predictions and to assess the performance of the ground response.

6.2 Previous Analyses

Two-dimensional and three-dimensional non-linear numerical stability analyses were previously undertaken as part of GPUG feasibility and consenting studies to evaluate the performance of stoping and interaction between the Golden Point open pit, Deepdell Creek, and the underground stoping at GPUG. PSM understands those analyses have informed the current Subsidence and Ground Control Management Plan (SGCMP) developed by OGNZL for GPUG. As the document is considered to be “live”, ongoing updates to the site ground model and GPUG monitoring data enable constant refinement and calibration of the mines performance precedent. Where applicable, modifications will continue to be made throughout mining as confidence in the expected ground response evolves.

PSM has reviewed the baseline analyses (OreTeck, 2022). The following points provide a summary of the inputs, results, and conclusions:

- Inputs:
  - The analyses adopt a model based on the interpreted Geological Strength Index (GSI)
  - Rock mass properties are developed on variable GSI (UCS fixed to 40 MPa, and m_i fixed at 10)
  - The analyses model three major faults and a series of intermediate scale structures
  - Deepdell Fault is modelled as a discrete structure
  - Stope sizes below Deepdell Creek were reduced to 50%, 60% and 70% ore extraction designs, ie 50% off total recovery achieved with smaller stopes.
- Results:
  - Model outputs predicted less than 100 mm vertical displacement at the ground surface associated with GPUG mining
  - Stopes achieving only 70% ore extraction showed about 100 mm of vertical subsidence in troughs along Deepdell Creek. Note that the measured maximum subsidence at GPUG is more than 1,000 mm (refer section 5.3)
  - Deepdell Creek was predicted to be unaffected by the significant surface settling due to the limited mining extraction to the north and planned stand-off distance from the creek.



Inset 36: Cross-section through previous 3D model conducted by OreTeck/Geotechnica (OreTeck, 2022).

6.3 2D Numerical Analysis

To assist in predicting ground behaviour, 2D stability analyses were undertaken. While the mine layout and geotechnical model interaction largely requires 3D analyses, this 2D analysis provides early insight on the possible behaviours.

6.3.1 Methodology

2D numerical analyses were undertaken using RS2 to assess the deformation response associated with the underground workings and to provide an indicative comparison with subsidence data (Section 5.3).

The modelling approach comprised:

- Back-analysis (calibration against measured surface deformation)
- Forward analysis (prediction of potential impacts at Deepdell Creek).

The rock mass was modelled using the Hoek–Brown failure criterion for Classes A, B and C materials, while major faults and shears were explicitly represented using Mohr-Coulomb parameters. The adopted rock mass and defect parameters are as described in Section 3.6 which is consistent with units developed as part of PSM's long standing open pit mine geotechnics program within the Macraes Operation.

6.3.2 2D Model Calibration

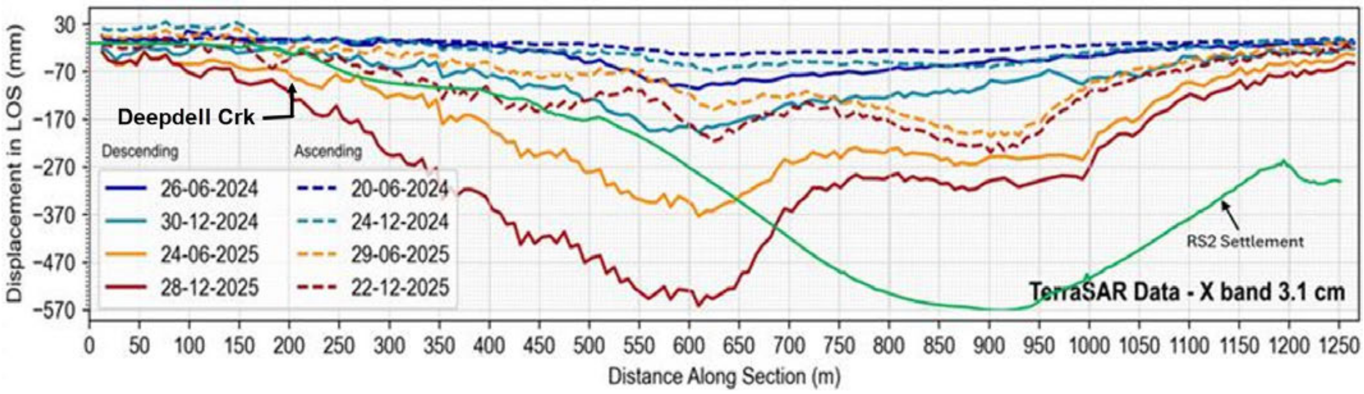
The expected performance of the voids and drives in fractured rock mass is that they progressively fail and become filled with caved material over time. In reality, this caved material would provide some degree of confinement and support to the surrounding rock mass. However, this behaviour is not explicitly captured in the RS2 modelling approach, where excavations are represented as voids without internal support, which can lead to unrealistically large deformation in highly yielded zones.

To represent this expected behaviour, the numerical analyses include low-stiffness normal 'springs' applied to excavation boundaries. The adopted spring stiffness values were intentionally kept low relative to the surrounding rock mass and structural stiffness to approximate the limited confinement provided by caved material while minimising artificial restraint on deformation.

Section B was used to calibrate the adopted normal spring stiffness. Figure 1 presents the location of Section B. The springs were assigned a normal stiffness of 10 MN/m/m and applied along the underground excavations at approximately 5 to 10 m spacing.

Inset 37 presents a comparison between the modelled surface settlement and the measured InSAR displacement post the 2025 excavation. The results indicate that the peak settlement magnitude is well matched; however, a 300 m spatial offset in the location of the peak is observed.

This spatial discrepancy is considered to reflect the limitations of the 2D modelling approach, where the predicted deformation is sensitive to the position and representation of underground openings within a given section and does not fully capture the 3D distribution of the workings, i.e. the largest measured displacements are associated with the stacked lodes/multi-level stopes which are just off the section line at about 400 to 600 m (along section line).



Inset 37: Comparison between modelled surface settlement and measured survey data.

6.3.3 Prediction of Future Settlement at Deepdell Creek

The modelling approach was subsequently applied to Section E and Section B, both crossing Deepdell Creek, incorporating additional interpreted 'artificial' mine openings in Section B in the vicinity of Deepdell Creek to represent potential future mining conditions.

The modelling results are presented in Appendix G, and indicate that mining directly below the creek is likely to result in surface settlement of approximately:

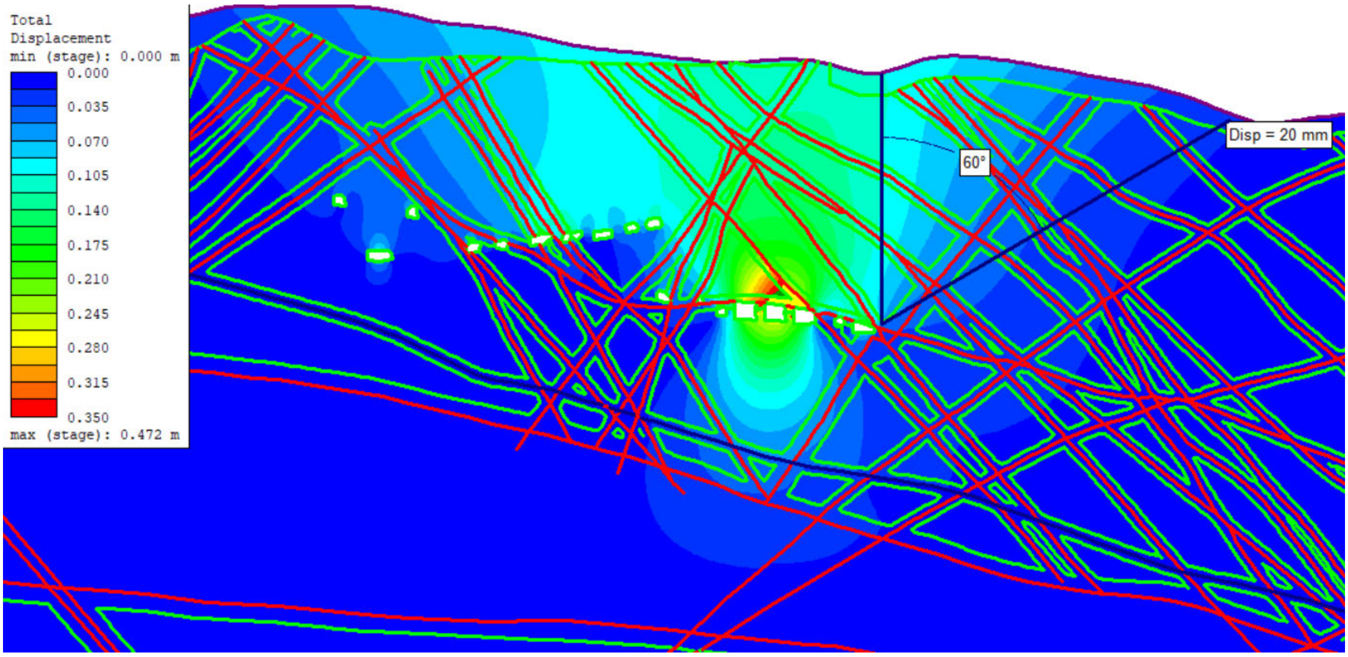
- 600 to 900 mm at Deepdell Creek to the north of GPUG
- 50 to 80 mm at Deepdell Creek in the east where the depth of overburden is greater.

These results are just an indicator of the expected magnitude. PSM expects that 3D analyses will provide a better estimate of those displacements at the creek. However, the accuracy of the geotechnical model also becomes critical in these areas.

6.3.4 Surface Influence from Underground Mining

The modelling results also indicate that ground deformation at surface is primarily controlled by the depth of mining, geometry of stopes, rock mass stiffness, and the presence of structural features such as faults and shears. Maximum deformation is generally predicted to occur directly above the mined stopes, where stress relief and yielding are most concentrated. With increasing horizontal distance from an underground opening, the magnitude of subsidence strain reduces progressively.

The angle of draw (to 20 mm subsidence) assessed in Section A is 60°, as shown in Inset 38. This is significantly greater than the angle of draw indicated by the InSAR data - the 2D simulation is projecting subsidence much further than reality. The modelling also indicates surface deformation reduces to approximately 30 to 60% of the peak value at angle of draw at about 45°. This result suggests the model is not realistically simulating observed ground behaviours and may be over-estimating subsidence.



Inset 38: Section A – reduction in surface deformation with decreasing influence angle.

6.4 3D Numerical Analysis

This section presents the model setup, parameters, staging and results of the three-dimensional stability analyses undertaken for the GPUG mine extension.

The results present herein show significant simulated deformation near Panels 144 and 164. When presented those results, OGNZL paused mining in the panels concerned, pending refinement of the geometry and geotechnical model with new data. Following the model refinement, the stability analyses were updated. The model refinement and revised stability analyses are presented in Addendum 1.

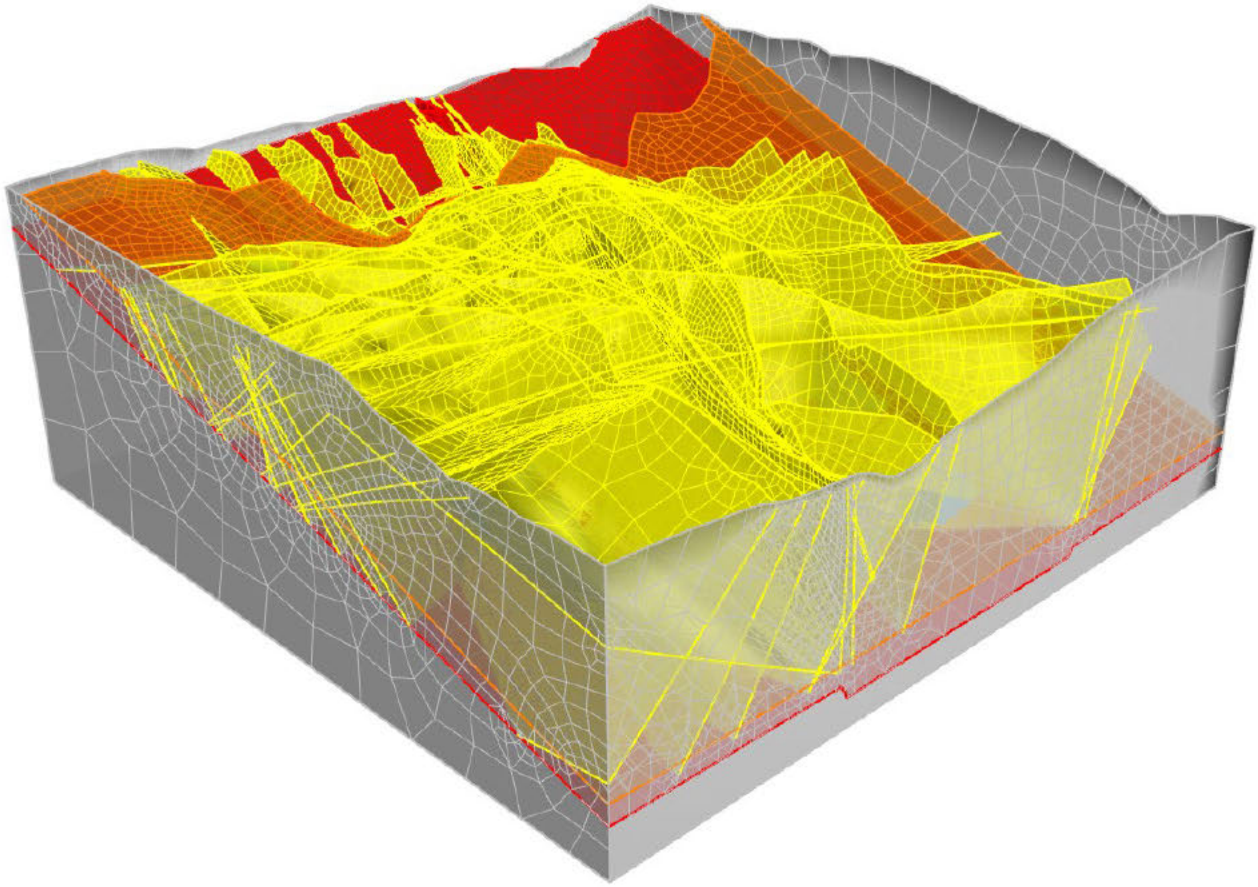
6.4.1 Model Description and Set-Up

The 3D numerical modelling has been undertaken using the commercial software FLAC3D version 9.5 from Itasca. The model extent is approximately 2,000 m by 2,200 m in plan and about 1,000 m deep, with the underground mining extent positioning centrally within the model domain. The finite element mesh comprises approximately 9 million elements with a refined element size of 2 m applied within and surrounding the drives and stopes. Element size is progressively coarsened with distance from the stope excavation zone to optimize computational efficiency while maintaining accuracy in the zone of interest.

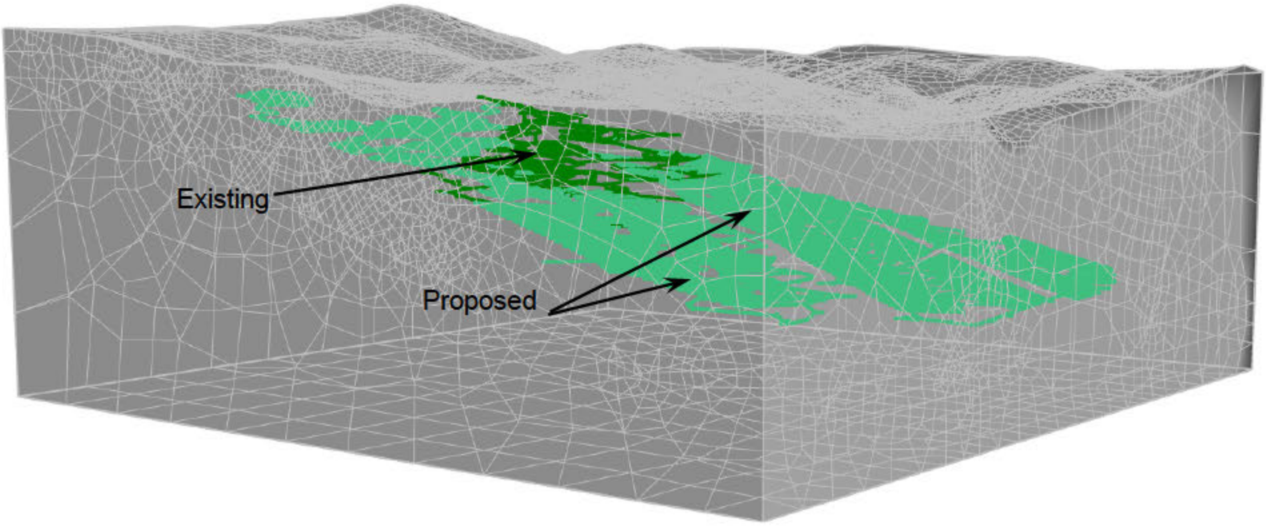
The model geometry set-up for the 3D analysis incorporated the following surfaces:

- As-built extent of the modern underground mining undertaken since 2020
- The proposed extent of LOMP and MP4 underground mining
- Current as-built and as-mined site topographic surfaces
- OGNZL and PSM modelled faults (Inset 23).

Insets 39 and 40 show an overview of the model geometry showing the key features included in the model.



Inset 39: An overview of the 3D model geometry.



Inset 40: An overview of the 3D model geometry showing the modelled underground workings.

6.4.2 Material Parameters and In-Situ Stress

The rock mass strength and deformation parameters presented in Tables 13 and 14 have been adopted in the numerical analysis. Faults are modelled as zones of class C material. Rock mass units have been modelled using a strain-softening approach to capture the squeezing ground behaviour observed in drives and the roof collapse observed in stopes. Calibration of the extent of strain softening will be undertaken on the basis of the observed ground movement data.

The modelled in-situ stress conditions are based on the test data presented in Table 9. The following in-situ stress conditions were considered for this modelling assessment:

- Vertical stress: $\sigma_v = \gamma \times depth$
- Major horizontal stress: $\sigma_{NS} = 1.0 \times \sigma_v$ (Base case) and $\sigma_{NS} = 1.6 \times \sigma_v$ (Sensitivity case)
- Minor horizontal stress: $\sigma_{EW} = 1.0 \times \sigma_v$ (Base case) and $\sigma_{EW} = 1.2 \times \sigma_v$ (Sensitivity case).

A preliminary comparison of subsidence results between the base case and sensitivity case indicates that the lower in-situ stress condition (base case) is more critical for subsidence predictions. Hence, only the base case in-situ stress results are presented in this report.

The groundwater is anticipated to drain into the underground excavations and therefore groundwater pressure has not been incorporated in the current model.

6.4.3 Model Staging and Model Runs

The adopted model staging comprises the following phases:

- Initialisation phase to establish the pre-mining in-situ stresses conditions
- Phase 1 – Simulation of mining of the as-built developments and stopes using the biannual sequencing provided by OGNZLOCG. The results from this phase are compared with observed surface subsidence data to calibrate the model parameters
- Phase 2 – Simulation of progressive mining of the currently consented workings together with the proposed MP4 developments and stopes. The assumed mining sequence involves staged extraction of the western and northern expansions, followed by staged mining of the eastern extensions. The results from this phase are used to assess the impact of the proposed extensions on surface subsidence.

The following model runs have been undertaken:

- **Base Case Analysis:**
  - Mining of all GPUG workings (existing, consented and MP4 proposed) modelled in two phases (i.e. Phase 1 for the existing GPUG workings and Phase 2 for the proposed GPUG). Phase 1 results used to calibrate the model parameters.
- **Standoff Case 1:**
  - Scenario incorporating an underground mining standoff zone defined by a 30° draw angle from Deepdell Creek, with no mining occurring within the standoff zone.
- **Standoff Case 2:**
  - Partial extraction within the standoff zone involving mining of approximately one-third of the proposed GPUG stopes (i.e. “hit-and-miss” extraction of one in three stopes within the 30° draw angle zone).

6.4.4 Results

Results of the FLAC3D analysis are presented in Appendix H and include contours of surface settlement, horizontal movement and tensile strains at the ground surface. These results will be used to assess potential impacts of the proposed underground mining on Deepdell Creek and other surface features.

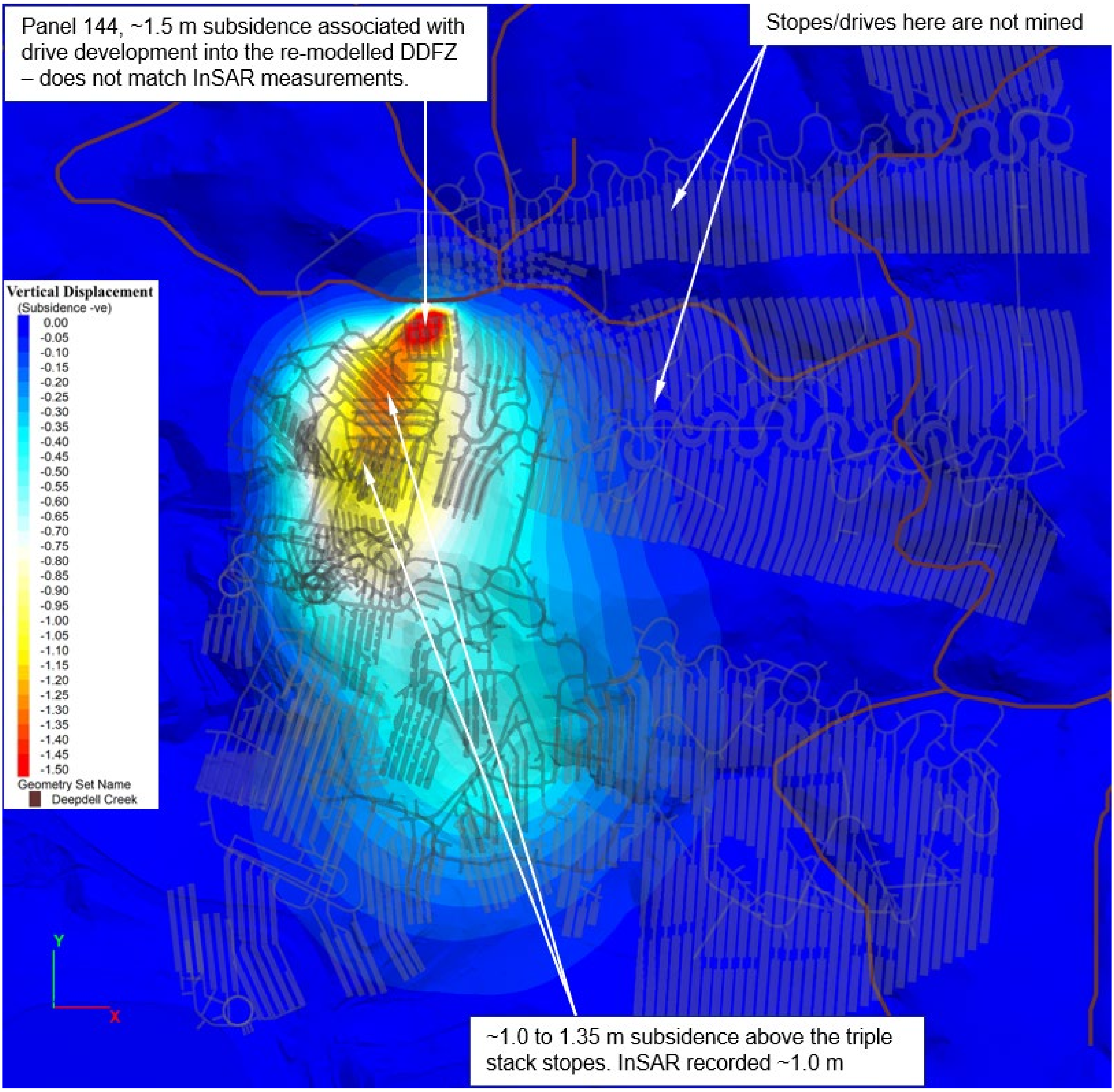
6.4.4.1 Model calibration

Calibration of the 3D numerical model was undertaken to match observed ground behaviour, including the surface subsidence, rock mass squeezing and stope roof collapse described in Section 5. Capturing these behaviours required introducing post-peak strain-softening behaviour for Class A, B and C rock masses. The calibration process involved a modest reduction in GSI by about 30% to derive strength parameters that results in simulated subsidence similar to measured subsidence.

Results from Phase 1 of the calibration (Run 1) indicated the following:

- The maximum simulated subsidence (vertical displacement) is about 1.5 m, however, this was where the GPUG drives intersect the remodelled DDFZ (Panel 144), refer Inset 41. The measured subsidence in this area is only about 100 mm indicating the remodelled DDFZ is too far south and should be updated

- About 1.0 to 1.35 m of subsidence is simulated above the triple stack stopes/lodes. This simulated displacement is similar to the measured subsidence of about 1.0 m in a similar location
- Outside of where the WRS is, the simulated subsidence footprint closely aligns with the -20 mm subsidence outline measured in InSAR data (refer Inset 31).



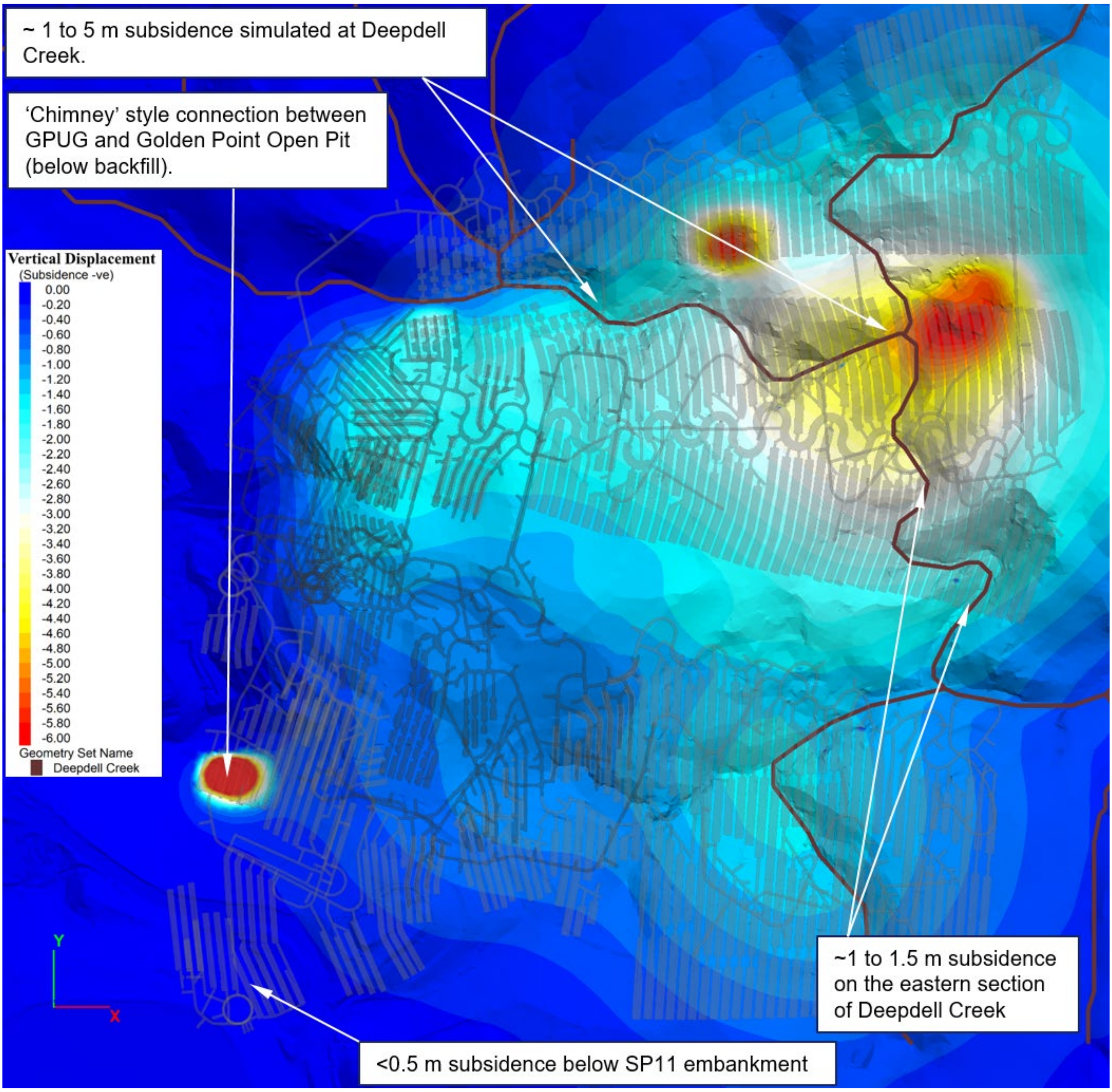
Inset 41: Vertical displacement (subsidence) simulated for as-mined GPUG.

6.4.4.2 Base Case Scenario

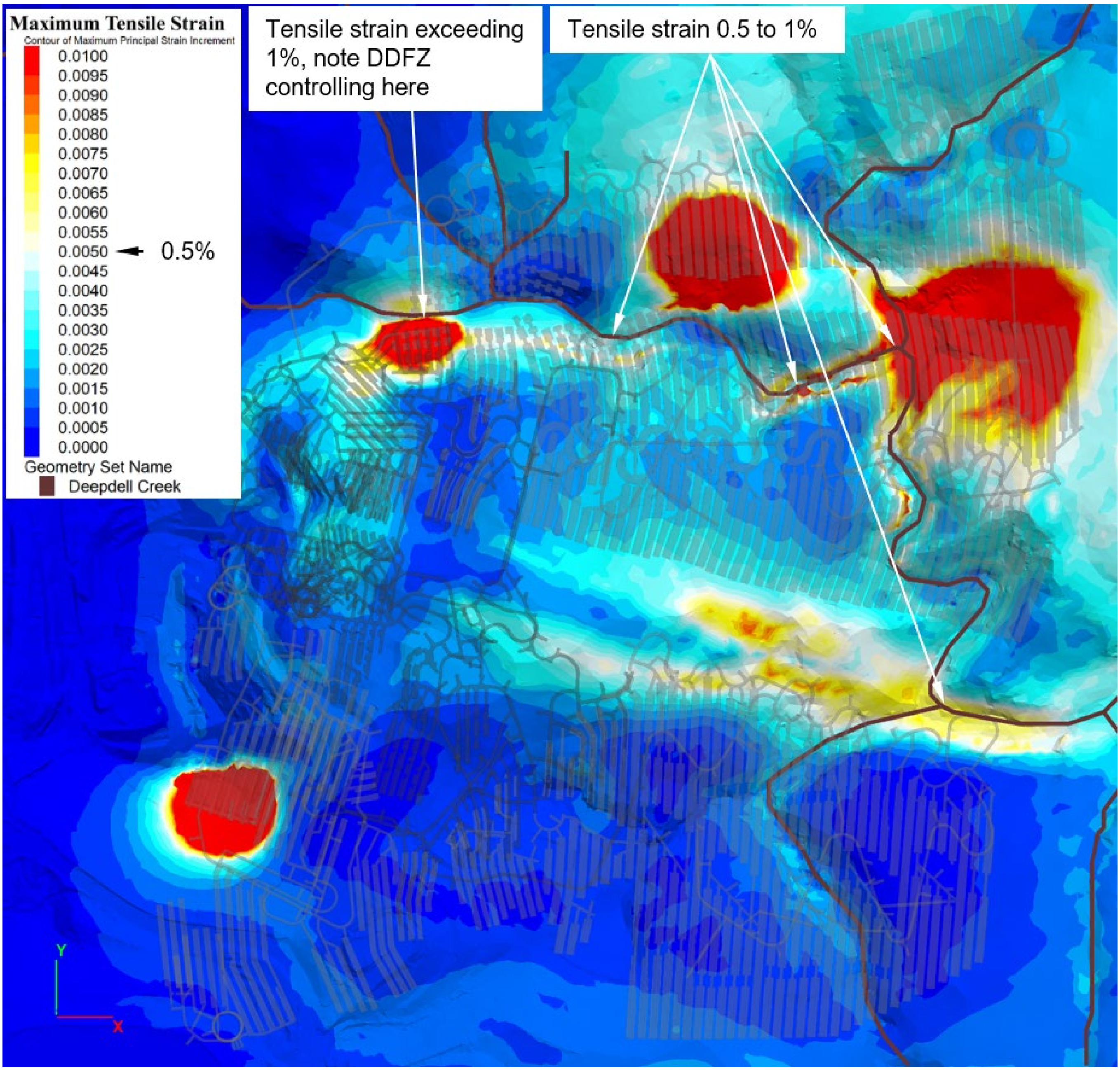
The surface settlement plots presented in Appendix H indicated a predicted maximum surface subsidence of up to 5 m for the base case scenario, i.e. full mine plan, refer Inset 42. The maximum surface subsidence was predicted at the eastern end of Deepdell Creek – again this is in the DDFZ. Considering the simulated subsidence here is an order of magnitude greater than the measured subsidence, we anticipate the remodelled fault zone location and/or shear strength is too conservative and should be reassessed.

The following points summarise our observations:

- Tensile strain predictions indicate the tensile strain along Deepdell Creek is typically less than 0.5 % (i.e. < 5 mm/m), however a maximum tensile strain of up to 1.5% (i.e. 15 mm/m) was predicted at some localised areas along the creek, refer Inset 43
- A 'chimney' style failure in areas of GPUG where rock cover is shallow, particularly near the southern end of the Golden Point open pit
- The valley where Deepdell Creek flows, has about 3 m of horizontal movement in the N-S direction, indicating some 'closure'.



Inset 42: Vertical displacement (subsidence) simulated for full GPUG mine plan.



Inset 43: **Tensile strain simulated for full GPUG mine plan. Refer to Addendum 1 for revised stability model results.**

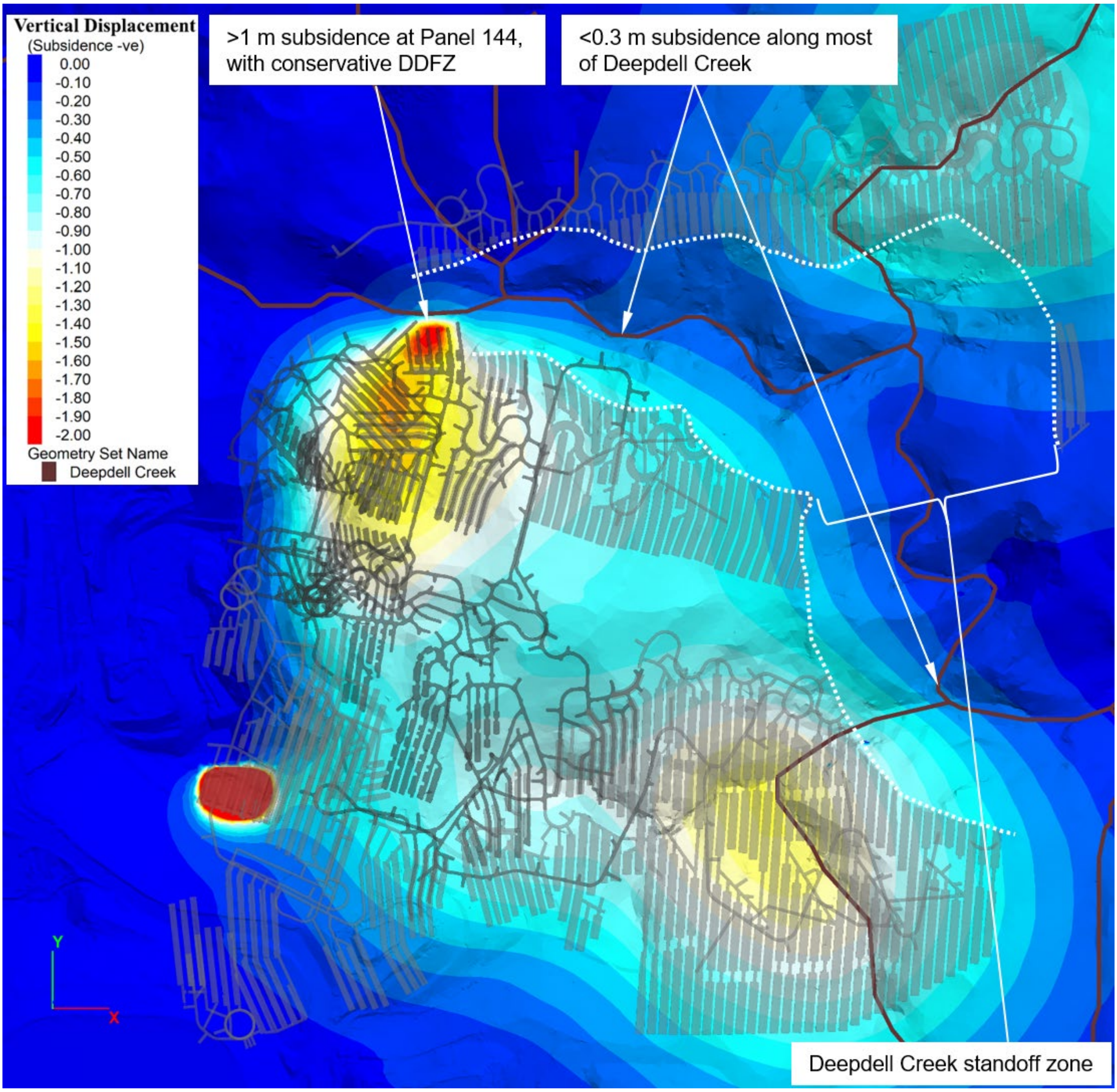
6.4.4.3 Standoff Case Scenarios

Two additional analyses were undertaken to assess surface subsidence and tensile strains along Deepdell Creek for scenarios where the proposed GPUG mining is restricted to areas outside the 30° standoff limit from the creek, as discussed in section 5.3. The following cases have been modelled:

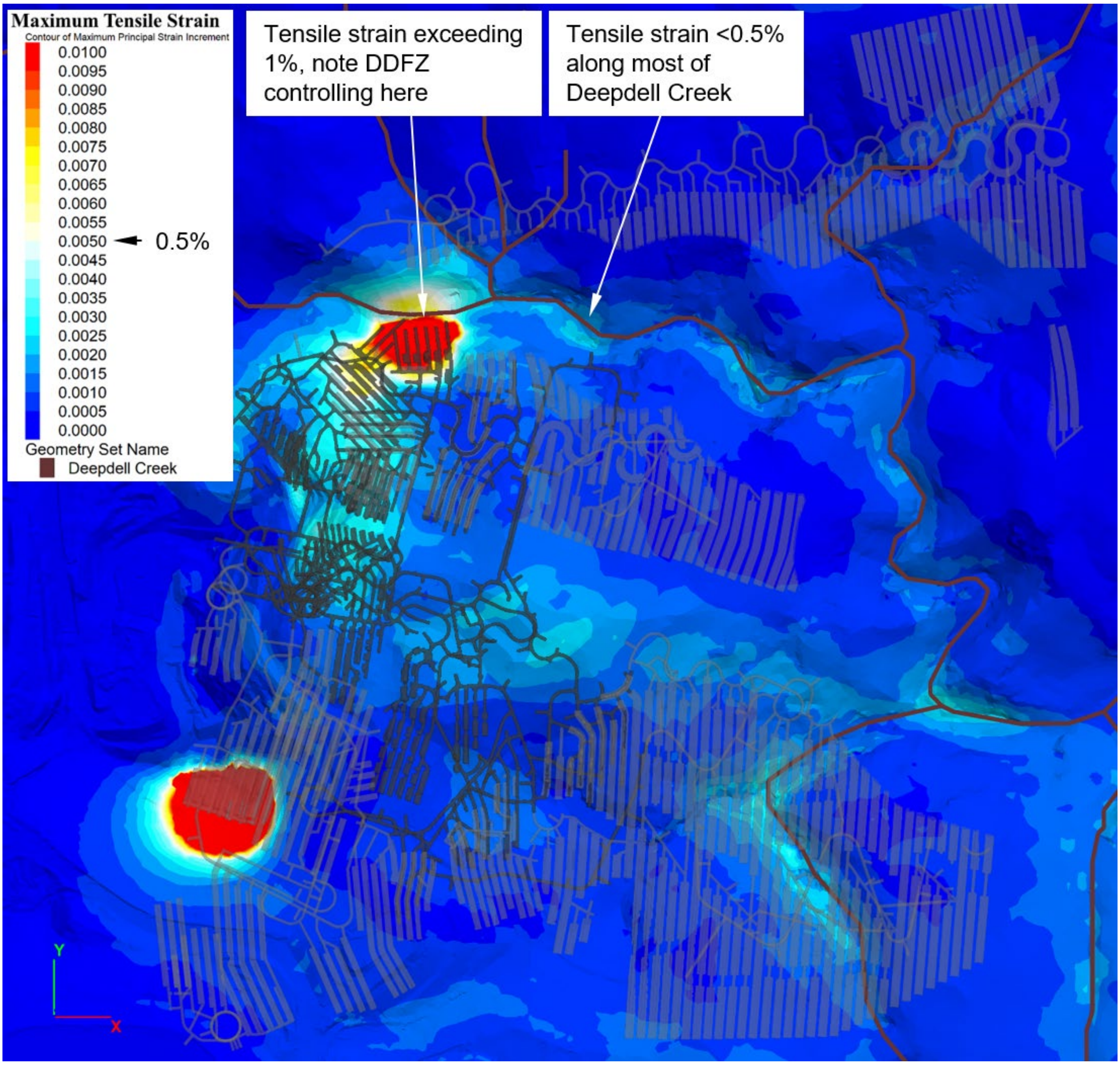
- Standoff Case 1 represents mining the previously consented mine layout and no mining within the standoff zone for the mine extension
- Standoff Case 2 represents partial extraction with one in three stopes mined within the standoff zone
- Standoff Case 3 represents no mining within the standoff zone, including the previously consented panels.

Surface settlement predictions for these scenarios indicate a significant reduction in subsidence along Deepdell Creek compared to the base case. Graphic outputs are presented in Appendix H, the following points summarise our observations.

- Standoff Case 1 – mining the consented layout and zero mining within the Deepdell Creek standoff zone:
  - Up to 1 m subsidence and in some isolated zones 0.3 to 0.7% tensile strain is simulated at Deepdell Creek
  - The highest tensile strain and horizontal 'closure' of the valley (~1 m) is above Panel 144 where the DDFZ is conservatively modelled to intersect the panel.
- Standoff Case 2 – consented mining only and mining every third stope in the Deepdell Creek standoff zone:
  - The reduction in ore recovery leaves larger pillars to support caved stopes, which is reflected with less subsidence and tensile strain at Deepdell Creek
  - Up to 0.9 m subsidence and in some isolated zones up to 0.5% tensile strain is simulated at Deepdell Creek
  - Again, the highest tensile strain (~1%) is above Panel 144 where the DDFZ is conservatively modelled to intersect the panel.
- Standoff Case 3 – zero mining within the Deepdell Creek standoff zone:
  - Less than 0.5 m subsidence and less than 0.5% tensile strain along most of Deepdell Creek
  - Higher subsidence (0.9 m) and tensile strain (0.7%) near Panel 144 with the conservatively modelled DDFZ.



Inset 44: **Vertical displacement (subsidence) simulated for GPUG extension with Deepdell Creek standoff zone.**



Inset 45: Tensile strain simulated for GPUG extension with Deepdell Creek standoff zone.

6.4.5 Summary of Results

The following points summarise the results of the 3D analyses:

- A 3D model has been developed for GPUG, where rock mass shear parameters have been reduced to closely align simulated subsidence with measured subsidence
- Subsidence at Deepdell Creek, where Panel 144 is located, is anticipated to be up to 5 m, with the maximum tensile strain of 1.5% for the planned GPUG. Note, the DDFZ is conservatively modelled here and simulated subsidence are an order of magnitude larger than measured subsidence
- A standoff zone similar to the Angle of Draw (30°) below Deepdell Creek reduces maximum simulated subsidence to about 0.3 m and tensile strain to less than 0.5% along most of the creek
- Mining every third stope within the standoff zone results in less subsidence (~0.9 m) and tensile strain than the full mine extension. The maximum tensile strain is predicted to be less than 0.5%.

7. Predicted Effects

This assessment focused on the predicted effects that underground mining at GPUG may have to the following receptors:

- Deepdell Creek
- Backfilled Golden Point open pit workings
- SP11 embankment.

This section presents the predicted effects the underground mining method and layout (Section 2) coupled with the geotechnical model (Section 3).

7.1 Deepdell Creek

Based on our understanding of the geotechnical model, stoping directly below Deepdell Creek is likely to cause significant subsidence (in the order of >1,000 mm) that may lead to dilation of existing fractures in the rock mass and faults zones and/or opening of new cracks. As demonstrated in section 6.4.4.3 based on this assessment subsidence at the creek should be anticipated, unless a stand-off distance/offset and careful ground control management is applied.

How subsidence manifests at the creek is uncertain. GPUG is planned to cross under Deepdell Creek in the north (Inset 46, A), here the fault zone that the creek is formed along, is inferred to comprise thick zones of sheared rock and clay. Deformation along clay zones may behave differently than rock on rock deformation. While clay zones may be able to ‘heal’ and limit surface water inflows to the underlying rock mass, rock-on-rock deformation is more likely to dilate creating a void for surface water to flow through – potentially connecting with GPUG.

As GPUG progresses eastward, it again crosses under Deepdell Creek (Inset 46, B). The geotechnical model here is less certain. Deepdell Creek follows a lineament, which is likely to be one of (or a combination of) the following geological features:

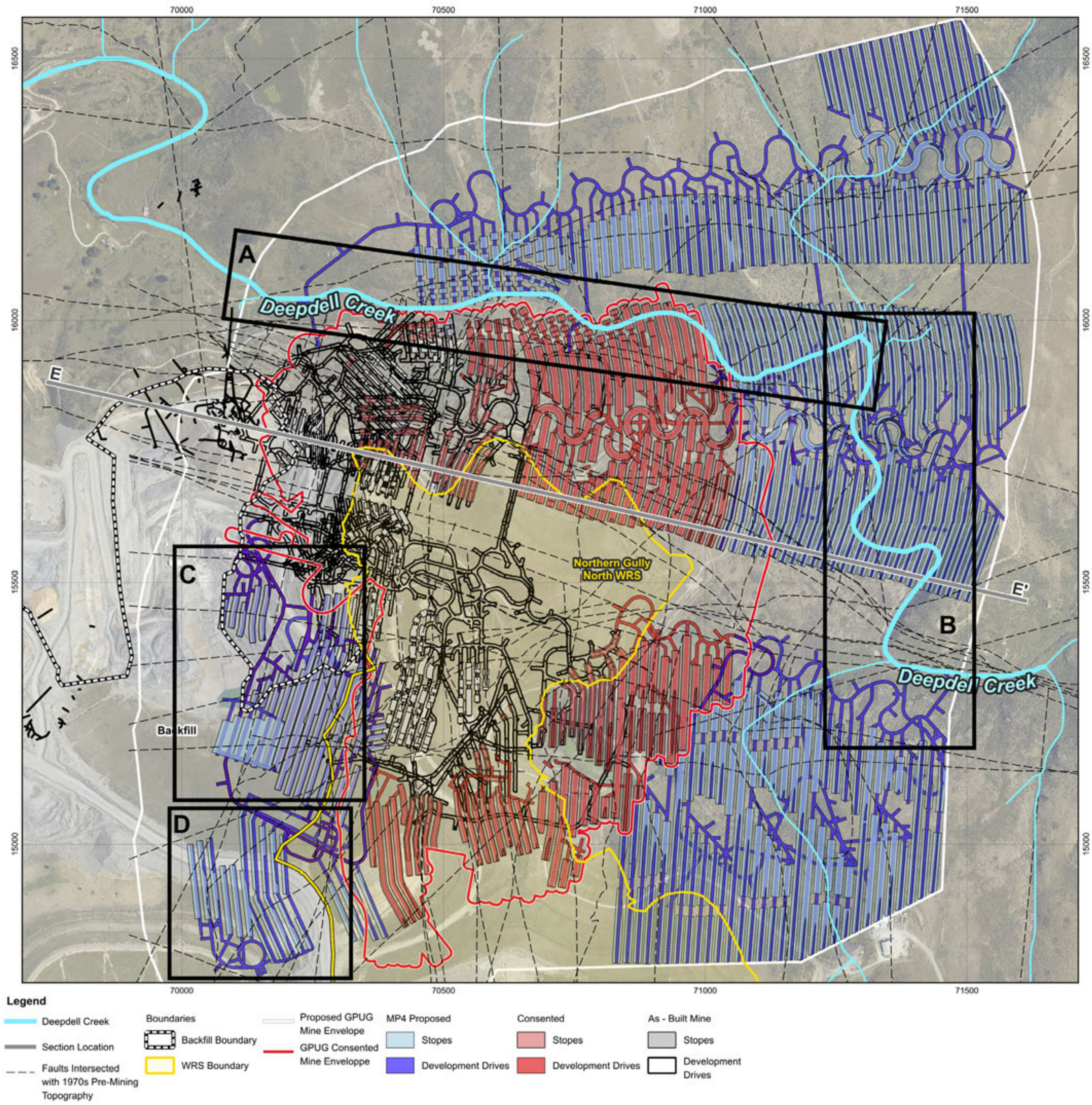
- Discrete fault zone shallowly dipping towards east – similar to the Footwall Fault
- Fault zone oriented more steeply towards east or subvertical – similar to Northern Gully Fault
- Foliation or shear foliation.

In the east at Deepdell Creek, significant subsidence (>1,000 mm) is also expected when mining is directly below the creek. While the depth of cover increases, the likelihood of the voids ‘choking off’ increases as well therefore limiting subsidence at ground surface – this is common in deep hard rock and flat-lying strata.

Continuous fault structures may provide connectivity between underground stopes and the surface, enabling deformation and potentially facilitating fluid flow. Monitoring data from both surface and underground instrumentation is critical in the identification and management of subsidence adjacent to Deepdell Creek. When combined with ongoing site investigation data and improvement of the geotechnical model, OGNZL can continue to collect new data on ground behaviour to inform:

- Tensile strains at which rock begins cracking
- At which point differential subsidence causes rock-on-rock displacement and dilation
- How new cracks and rock-on-rock dilation changes the hydraulic permeability of the rock mass.

As this new data comes to light and analyses are updated, PSM expects the risks to the creek and behaviour of the rock mass to be better understood and therefore allow for underground mining closer to the creek.



Inset 46: **Key receptors possibly impacted by GPUG. Receptors are, Deepdell Creek (A and B), Round Hill Open Pit and backfill (C), and SP11 Embankment (D).**

7.2 Round Hill Open Pit and Backfill

GPUG West comprises underground stopes directly below the historic pit highwalls and floor of Round Hill (Inset 46, C). This area of the pit has been backfilled with typical run-of-mine waste rock that is saturated up to around RL340

As stoping approaches the backfill from beneath, there is a risk of 'inrush' due to overbreak or chimney caving. Inrush is the sudden, uncontrolled flow of water, mud, sand, or slurry into mine workings. It is a high-consequence hazard as it can flood areas rapidly, trap workers, and destabilise the ground. As the stopes cave/collapse, the water and fines within the backfill is likely to flow into the stope, ore-drive and beyond.

Chimneying in this area should also be expected. An inrush event could occur through a chimney, connecting the saturated backfill to the underground workings.

The risk of an inrush could be reduced to acceptable levels by draining the backfill. In addition to operational controls, probe holes drilled to confirm the geometry and to confirm drainage and geotechnical condition of the spoil prior to mining should be added. A risk assessment should be used to identify risks and mitigations including additional inspections or stand-offs and manage the residual risks.

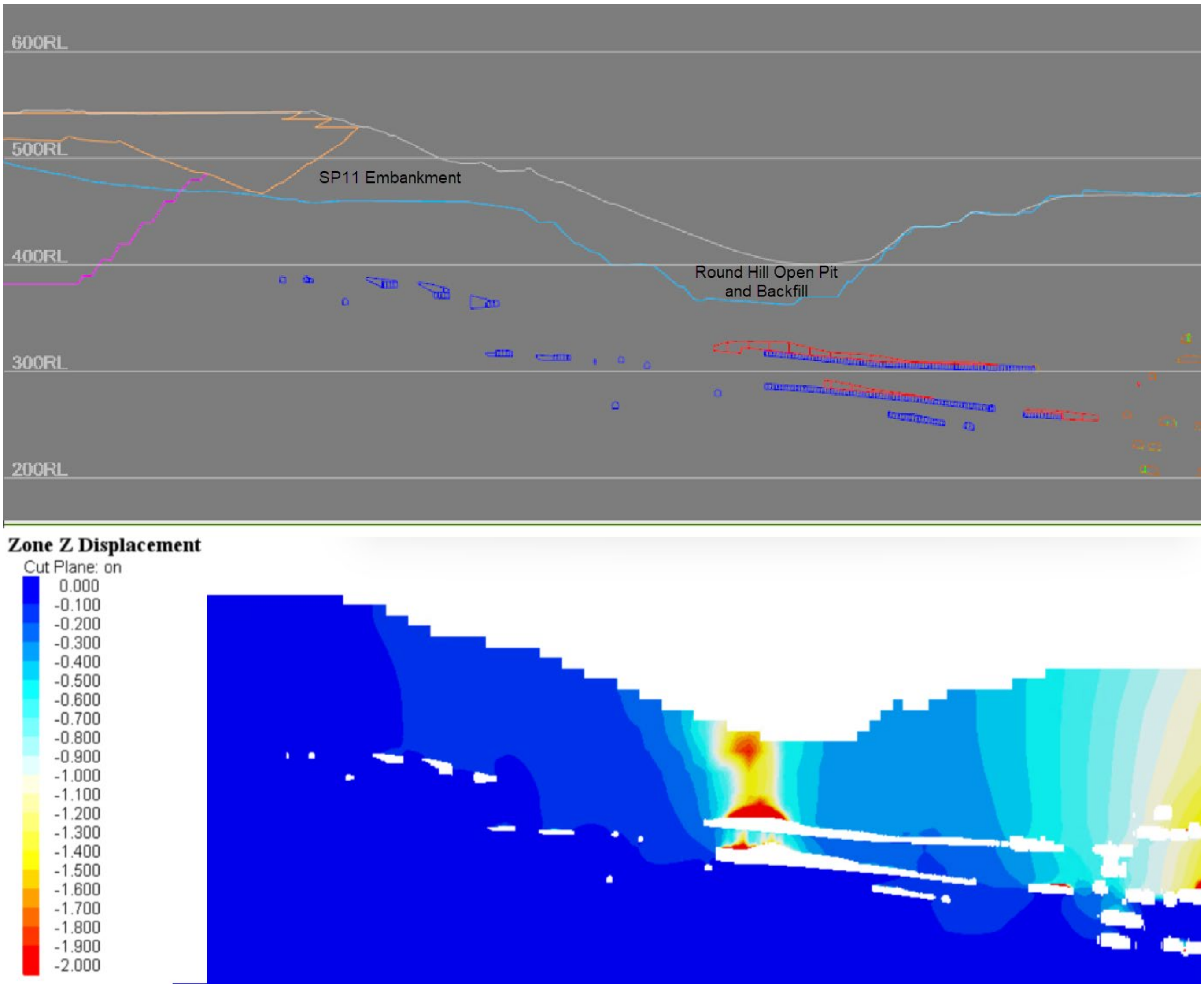
The proposed mining in Areas C and D will generate additional subsidence on the existing Golden Point pit wall and also of the backfilled Round Hill Pit. This effect may increase rockfall and batter scale instability risks depending on the presence and orientation of fault structures and small-scale geological features. Proposed management of this risk is listed as follows:

- Pit slope monitoring
- Catch bunds, setback distances, and exclusion zones.

These open pit risk management strategies are already included in the Ground Control Management Plan.

7.3 SP11 Embankment

The proposed underground expansion extends beneath the SP11 tailings storage facility (TSF) embankment (Inset 46, D). Modelling suggests that surface subsidence in this area up to 2 m could occur at the toe near the base of the Round Hill open pit backfill. The surface expression of subsidence is likely to be smoothed due to the thickness of rockfill above insitu rock. Subsidence effects on the TSF are considered separately by EGL.



Inset 47: Cross section through Round Hill Open Pit, Backfill and SP11 Embankment showing simulated subsidence.

8. Uncertainties and Management Strategies for Predicted Effects

As discussed throughout, it is important to understand that the geotechnical model carries significant uncertainty associated with the key receptors, particularly Deepdell Creek. These uncertainties lead to a conservative mining approach to protect the creek until more information is collected and detailed analyses undertaken to provide confidence that Deepdell Creek flows are not impacted due to mining at GPUG.

8.1 Model Uncertainty

Several uncertainties are identified in the geotechnical model (refer section 3.7) and the anticipated ground behaviour at GPUG. The following points summarise key uncertainties identified in this assessment:

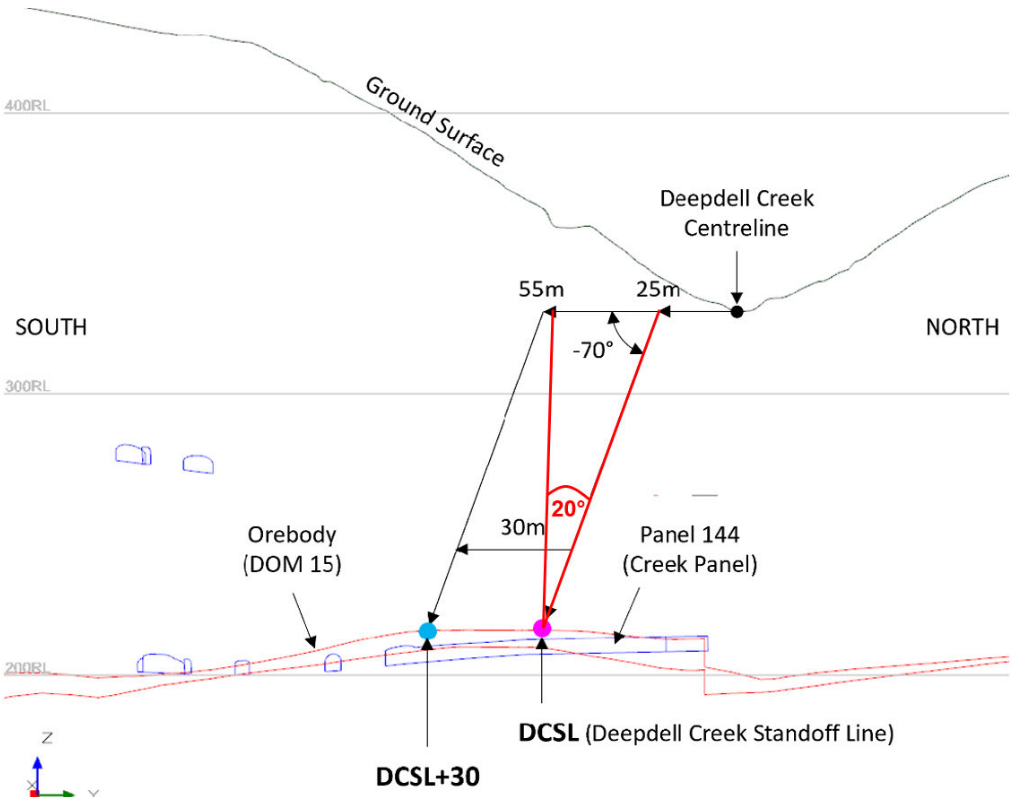
- Location, extent and character of faults outside of the current GPUG footprint
- The location, extent, and shear strength parameters of faults within the DDFZ below Deepdell Creek. At present the DDFZ is modelled as a ~100 m thick low strength mass, whereas in reality, it comprises discrete fault zones with moderate strength rock pillars
- Ground behaviour, specifically the anticipated cracking and the associated tensile strain and potential change in rock mass permeability caused by cracking and dilation of cracks due to ground movement.

8.2 Existing Subsidence Management Strategies

This section presents the existing plans and processes for managing predicted effects for GPUG as set out in the approved consent. The plans and processes are captured in the Subsidence Management Plan (SMP) developed for GPUG, presented in Appendix I. The SMP was developed based on the previous subsidence assessment undertaken by Oreteck (2022).

8.2.1 Mine Planning and Design

Mine panel designs are set back from Deepdell Creek by the Deepdell Creek Standoff line (DCSL), etc. Inset 48 presents the previously assessed and adopted angle of draw for Deepdell Creek, which is 20° - no mining was permitted in the DCSL. The DCSL was based on numerical analyses undertaken by Oreteck (2022).



Inset 48: OGNZL adopted Deepdell Creek offset, annotated with angle of draw (red).

8.2.2 Numerical Modelling

Numerical modelling is undertaken to improve predictive assumptions as the mine design is refined and as the geotechnical model and suite of calibration data improves.

8.2.3 Subsidence Monitoring

A comprehensive subsidence monitoring network has been established to monitor subsidence associated with GPUG with elevated attention to the vicinity of Deepdell Creek, refer Figure 3. The purpose of the network is to:

- Measure 3D displacement vector time history of subsidence
- Identify development of potential rock fall hazard
- Compare surface strain with numerical modelling predictions
- Compare groundwater behaviour with modelled response
- Provide triggers for the Deepdell Creek Subsidence Trigger Action Response Plan (TARP).

The monitoring program currently consists of:

- InSAR satellite monitoring
- Global Navigation Satellite System (GNSS) points specific to the Deepdell Creek area
- Borehole extensometers, installed south of Deepdell Creek above the 144 and 164 panels
- Vibrating wire piezometers (VWP) near Deepdell Creek; four tips installed within four boreholes
- Underground convergence points at various sites underground
- Underground LiDAR convergence
- Underground seeps inflow observations.

8.2.4 Deepdell Creek Subsidence TARP

The Deepdell Creek Subsidence TARP has been developed by OGNZL to manage the risks associated with subsidence at Deepdell Creek and provides guidance on monitoring requirements, trigger levels, and response actions.

The TARP trigger levels are relative to mining near or within the following boundaries:

- Deepdell Creek Standoff Line (DCSL), as illustrated in . This exclusion zone originates from the 2023 GPUG Extension Resource Consent Application:
  - 25 m south of the centre of the creek
  - Projected -70° (equivalent to an angle of draw of 20°) to the south, perpendicular to the creek.
- DCSL+30:
  - 30 m horizontal offset south of the DCSL.

TARP triggers have been defined by changes in the following:

- Stope performance, particularly within the DCSL+30 zone
- Surface deformation:
  - Vertical subsidence within 30 m of Deepdell Creek
  - Surface cracking within 50 m of Deepdell Creek.
- VWP pressures
- Change in flow measurements:
  - Stream flow loss at Deepdell Creek
  - Mine pumping rate
  - Underground flow to any area within DCSL+30.
- Multi-point borehole extensometers (MPBX) strain within 50 m (3D) of Deepdell Creek.

Refer to Appendix I for the actions and responses for trigger levels.

8.2.5 Technical Review

A subsidence review team is responsible for regular technical review of monitoring data and approval of mine designs.

8.3 Recommendations

8.3.1 Strain-Limiting

Holla and Barclay (2000) provide a review of requirements for underground mining beneath water bodies in different countries. Most set limits on tensile strain in the overlying rock, typically within 5 to 10 mm/m (0.5 to 1 %). Table 17 presents a summary of those requirements.

These values are greater than the strain limit of 4 mm/m noted by Wiliams and Hamstead (2013) below which water inflow is likely to occur, however this limit is based on experience in the UK and Australia undersea mining, (hence significantly higher-pressure head).

Barclay and Holla (2000) also note that the strain-limiting approach does not necessarily take into account the composition of the overburden, and that limiting surface strain is probably at best only a means of controlling the general strata disturbance.

Table 17 – Summary of Holla and Barclay (2000, Cameron et al, 2023) Reviewed Requirements for Mining Below Water Bodies

Country	Minimum Cover Thickness	Maximum Seam Thickness	Maximum Permitted Tensile Strain	Qualifications
UK	105 m	1.7 m	10 mm/m	Minimum thickness of carbonaceous strata of 60 m
Japan	60 m with no unconsolidated clay deposits	0.8 m	8 mm/m	Mining must be in section with dams
Chile	150 m	No restrictions	5 mm/m	Thickness of available seam 1.4 m
Canada	213 m	No restrictions	7.7 mm/m	Thickest available seam 2.7 m

PSM is not aware of any legislated requirements for mining below water bodies in New Zealand. However, for this assessment a tensile strain limit of 5 mm/m is adopted as a starting point with the objective to assess and potentially increase this when new monitoring data and information specific to GPUG is available.

8.4 Recommendations for the SMP

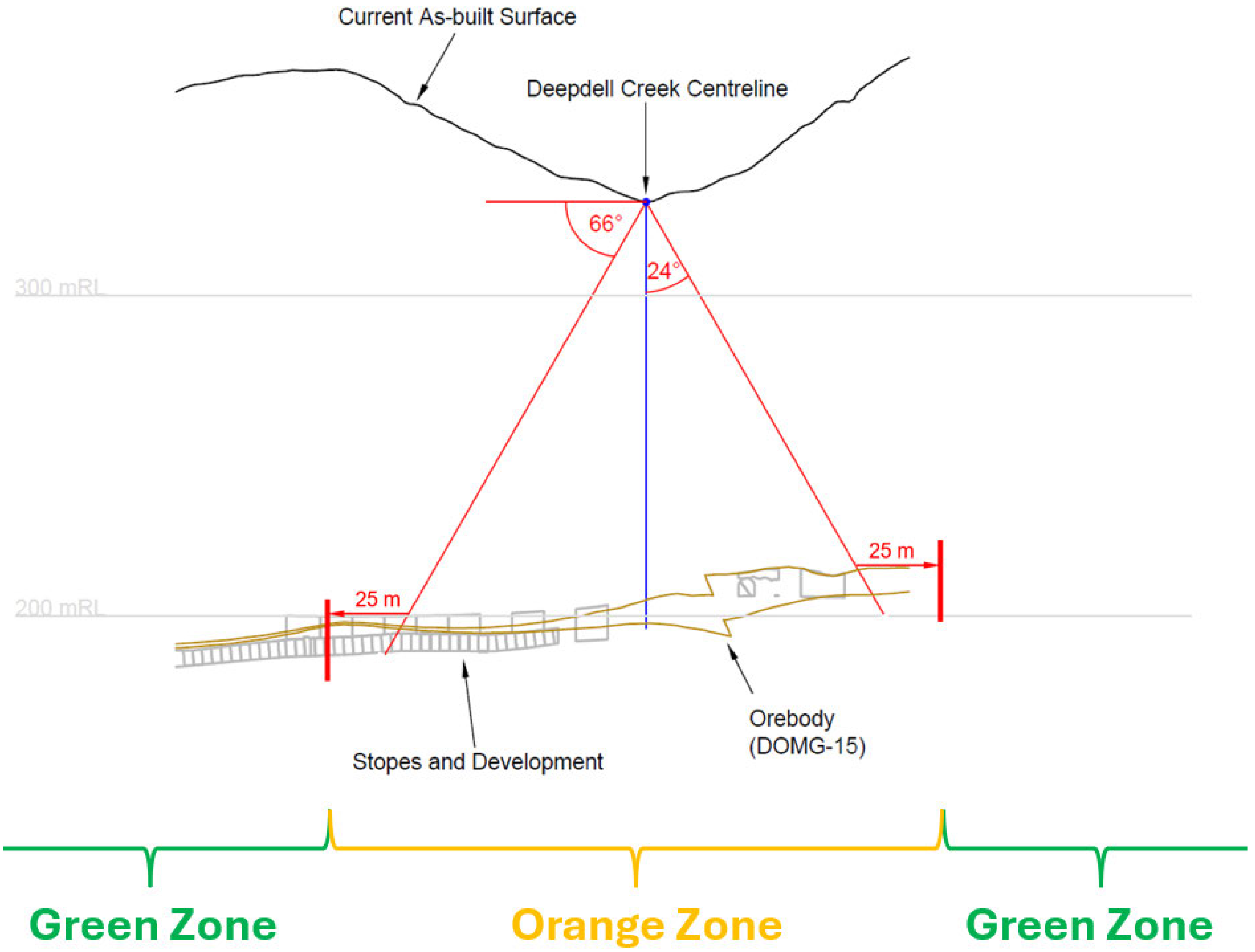
Based on the assessment and identified uncertainties presented in this report, the following points list our recommended amendments to the SMP to protect flowrates at Deepdell Creek:

1. Revise the preliminary DCSL based on conservative estimates for the spread of 0.5% horizontal strain which is an angle of influence of around 24° from vertical to the roof of the orebody, refer Inset 49. An additional 25 m horizontal offset should be applied either side of the creek centre line. The zone within the standoff is referred to as the Orange Zone:
    a. Development drives could be placed through the Orange Zone but will require heavy ground support to limit subsidence. Backfilling those drives at mine closure may also be required.
2. Mining within the Green Zone may occur without restriction, but monitoring of deformation is required to support future studies and predictions of ground behaviour.
3. Mining within the Orange Zone may occur following satisfactory results of ongoing monitoring, observations, detailed site investigation and geotechnical assessment that demonstrate the risk of potentially damaging subsidence and strain occurring at the creek are low:
    a. Recommended conservative and preliminary limits for deformation at the Deepdell Creek centreline are listed as follows:
        i. Strain 5 mm/m, or 0.5%
        ii. Subsidence -400 mm.

b. The preliminary limits can be updated based on the required information listed as follows:
    i. Subsidence and strain measurements to inform crack formation in rock
    ii. Changes in rock mass permeability due to subsidence induced cracking.

4. Expand on the current subsidence monitoring plan (section 8.2.3) with:
    a. Additional observations of subsidence surface expressions, i.e. at what strain and displacements do cracks appear in the ground surface (rocky ground vs loess topsoil, etc)?
    b. A network of automated prism monitoring shall be established, at a minimum:
        i. Along three section lines (refer Figure 3) with prisms spaced no-more than 20 m
        ii. Along the crest of the slope between Golden Point Pit and Deepdell Creek
        iii. Along the access roads which traverse the natural slope toward Deepdell Creek
        iv. Along the access road at the toe of the slope, within the Valley of Deepdell Creek
        v. Prisms along Deepdell Creek, including on rocky outcrops within the immediate vicinity of the creek.
    c. Additional GNSS points along the Deepdell Creek bank
    d. Additional GNSS points along section lines between GPUG decline and Deepdell Creek, running north-south
    e. Additional VWPs installed along the eastern segment of Deepdell Creek in selected geotechnical and/or exploration boreholes
    f. Additional MBPX's and/or Time Domain Reflectometry (TDR) in selected geotechnical and/or exploration boreholes.

Figure 3 presents a plan with the existing prism and GNSS network, and notional locations for additional monitoring.



Inset 49: Schematic showing application of the recommended preliminary DCSL.

8.5 Other Recommendations

The following points list other recommendations for mining within the Orange Zone:

1. Following reduction of uncertainty through additional site investigation, consider smaller stopes with wider pillars.
2. Consider paste backfill. A backfill pillar and reduced void can reduce the total deformations at ground surface:
   a. Paste backfilling stopes may allow for mining of remaining insitu pillar – which will also require paste backfill to reduce caving of stopes.

9. Conclusions

The following points list concluding comments:

- Surface subsidence of up to 2 m has been observed above the existing underground workings at GPUG
- Much of the subsidence occurs directly above the multi-level/stacked stopes but it is spread across horizontal distances in the order of 100 m. That is a 2 m drop in surface level occurs over a distance of 100 m. i.e. ~2%
- The equivalent maximum horizontal strain associated with this magnitude of subsidence is in the range of 10 to 30 mm/m
- This level of strain is sufficient to open existing rock joints and create new tension cracks
- If this horizontal strain occurs in Deepdell Creek, it could lead to a partial or complete loss of surface flow, as water drains into the deeper underlying strata through these opened or new pathways
- The current objective is to prevent the past observed ground performance from occurring with the Deepdell Creek
- An angle of influence was estimated based on our assessment of horizontal strain. A practical limit of 5 mm/m is considered appropriate, resulting in an angle of draw equal to 24°
- Three-dimensional numerical analyses support the standoff zone with less than 0.5% tensile strain along Deepdell Creek
- At this stage a preliminary standoff zone (Orange Zone) equal to the angle of influence (24°) from the centre line of Deepdell Creek plus an additional offset of 25 m should be imposed to exclude stoping activities
- Primary development, i.e. declines, access tunnels, cross-cuts, can be mined in the Orange Zone as long as ground support is adequate to prevent caving. No stoping within the Orange Zone until
  – The geotechnical model is refined and results of detailed analyses indicate the offset can be reduced – as demonstrated in Addendum 1
  – Stopes are supported to limit caving.
- The primary uncertainties that need to be understood to allow for mining within the Orange Zone are:
  – At what strain causes cracks to open at GPUG
  – How does subsidence affect hydraulic permeability.
- The risk of inrush associated with stoping below the Round Hill backfill can be managed by draining the backfill prior to mining and verifying with probe holes, refer to OGNZL Principal Hazard Management Plan.

The following points list recommendations to address the uncertainties prior to mining within the Orange Zone:

- Collect additional structural data via mapping and televiewer with boreholes targeting the Deepdell Fault Zone in particular
- Drill boreholes targeting faults that are modelled as adversely impacting the underground for confirmation of conditions
- Collect traverse mapping data during underground excavation
- Undertake surface mapping of areas around the DDFZ and possible exposures to further characterise the zone
- Routinely update the 3D major structure model as additional data becomes available

- Additional site investigation of boreholes to:
  - Investigate geotechnical parameters, in particular the shear strength and character of DDFZ
  - Investigate the geometry of the DDFZ to the north and east of GPUG
  - Investigate general geotechnical conditions of the GPUG extensions to the north and east.
- We recommend that additional monitoring is set up with a focus on Deepdell Creek and to collect data on ground behaviour.
- Monitoring data should be reviewed routinely by the technical review team as per the Subsidence Management Plan.

Many of the recommendations listed in this document have been implemented by OGNZL and are presented in Addendum 1.

Yours Sincerely

[redacted]

DANIEL STRANG
PRINCIPAL

[redacted]

ADRIAN SMITH
PRINCIPAL

[redacted]

RICHARD BREHAUT
PRINCIPAL

[redacted]

ROBERT BERTUZZI
SENIOR PRINCIPAL

References

1. OGNZL (2025a) Macraes Phase Four Project Description – Fast Track Approvals Act 2024 dated 21 November 2025
2. PSM71-371M DRAFT. Golden Point Underground Portal Plug Assessment. 25 March 2026.
3. PSM71-372M DRAFT. Options for management of groundwater connections through historic working to Deepdell Creek. 25 March 2026.
4. OGNZL (2020) Golden Point Underground Preliminary Feasibility Study.
5. Allibone, A. Jones, P. Blakemore, H. Craw, D. Mackenzie, D. Moore, J. (2018) Structural Setting of Gold Mineralisation within the Hyde-Macraes Shear Zone, Southern New Zealand. Society of Economic Geologists Inc. Economic Geology v 113, No 2, pp 347-375. 2018.
6. GHD (2026). Macraes Phase 4, FTA, Surface and Groundwater Assessment. 16 July 2026
7. WSP (2023). Golden Point Underground Mine (GPUG) – Extension Hydrogeological Assessment. 26 April 2023.
8. OGNZL (2025b). GPUG – Deepdell Creek Vibrating Wire Piezometers. 9 October 2025 Update.
9. Geotechnica. (2022) Macraes Mine – Golden Point Project. Updated geotechnical analysis of mining beneath the Deepdell Creek at the Golden Point Underground Project. 31 October 2022
10. PSM (2026). Macraes Phase Four Project – Open Pit Extensions – Geotechnical Stability. PSM71-363R
11. Hoek, E. and Brown, E.T., (2019) The Hoek-Brown failure criterion and GSI-2018 edition. Journal of Rock Mechanics and Geotechnical Engineering, 11(3), pp.445-463.
12. Bieniawski, Z.T., (1989) Engineering rock mass classification. New York: Jonh Wiley & Sons.
13. Cai, M., Kaiser, P. K., Uno, H., Tasaka, Y., Minami, M. (2004) Estimation of rock mass strength and deformation modulus of jointed hard rock masses using the GSI system. Int. J. RockMech. Min. Sci. 41(1), 3–19.
14. Cameron, D., Karim, M. R., Johnson, T., & Rahman, M. M. (2023) Influence of Weather, Soil Variability, and Vegetation on Seasonal Ground Movement: A Field Study. *Geotechnics*, *3*(4), 1085-1103. https://doi.org/10.3390/geotechnics3040059
15. Holla. L, Barclay. E, (2000) Mine subsidence in the southern coalfield, NSW, Australia
16. Williams and Hamstead (2013) Qualitative Risk Assessment of Longwall Coal Mining in the Southern Coalfield of NSW: Key outcomes of a workshop hosted by Sydney Catchment Authority - 24 July 2013 - Sydney
17. Patton and Hendren (1972). General Report on Mass Movements. Patton F.D. and Hendren A.J. Second International Congress of Engineering Geology, V-GR1-V-GR57
18. Hoek and Marinos (2000) Predicting tunnel squeezing problems in weak heterogeneous rock masses, Tunnels and Tunnelling International
19. OreTeck (2022). General Assessment for Golden Point Underground Norther Extension near Deepdell Creek Macraes Gold Operations. 15 December 2022.
20. Galvin J.M. (2016), *Ground Engineering-Principles and Practices for Underground Coal Mining*, Springer

Brisbane

Level 1, 500 Queen Street
Brisbane QLD 4000
+61 7 3220 8300

Sydney

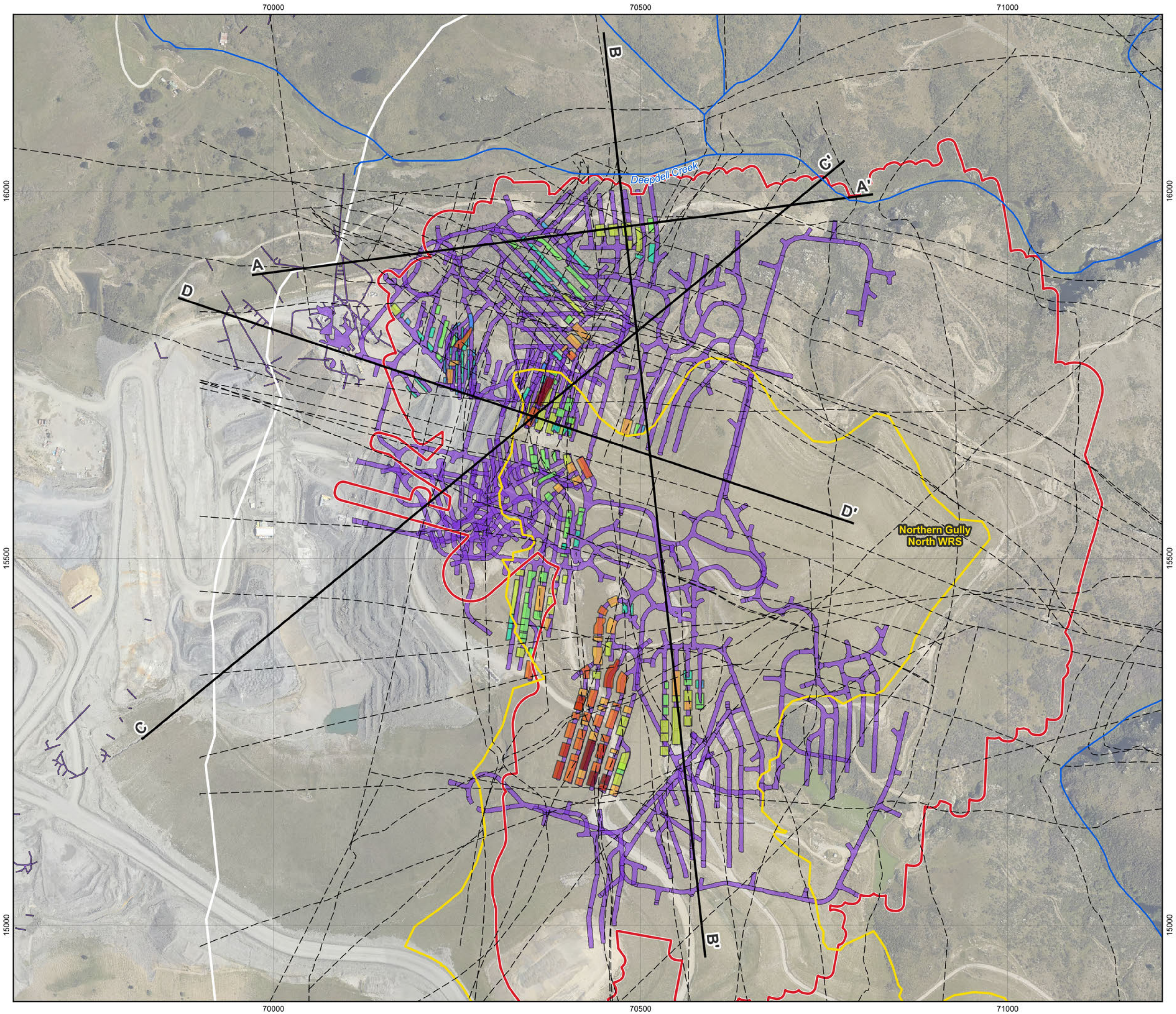
G3-56 Delhi Road
North Ryde NSW 2113
+61 2 9812 5000

Geelong

Suite 2, L4, 92-100 Brougham St
Geelong VIC 3220
+61 3 7068 5699

Perth

Level 3 22 Delhi Street
West Perth WA 6005
+61 8 9462 8400



Legend

- Deepdell Creek
- Section Locations
- Faults Intersected with 1970s Pre-Mining Topography
- Northern Gully North WRS Boundary

As-built Mine

- Development Drives

Stopes Height (m)
As mined

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 14
- 14 - 16
- 16 - 18
- 18 - 20

Scale 1:5,000

N

50 0 50 100 150 200 m

Map Projection:
MGP Affine from NZMG1949 (LINZ Trigs)
USER:100004

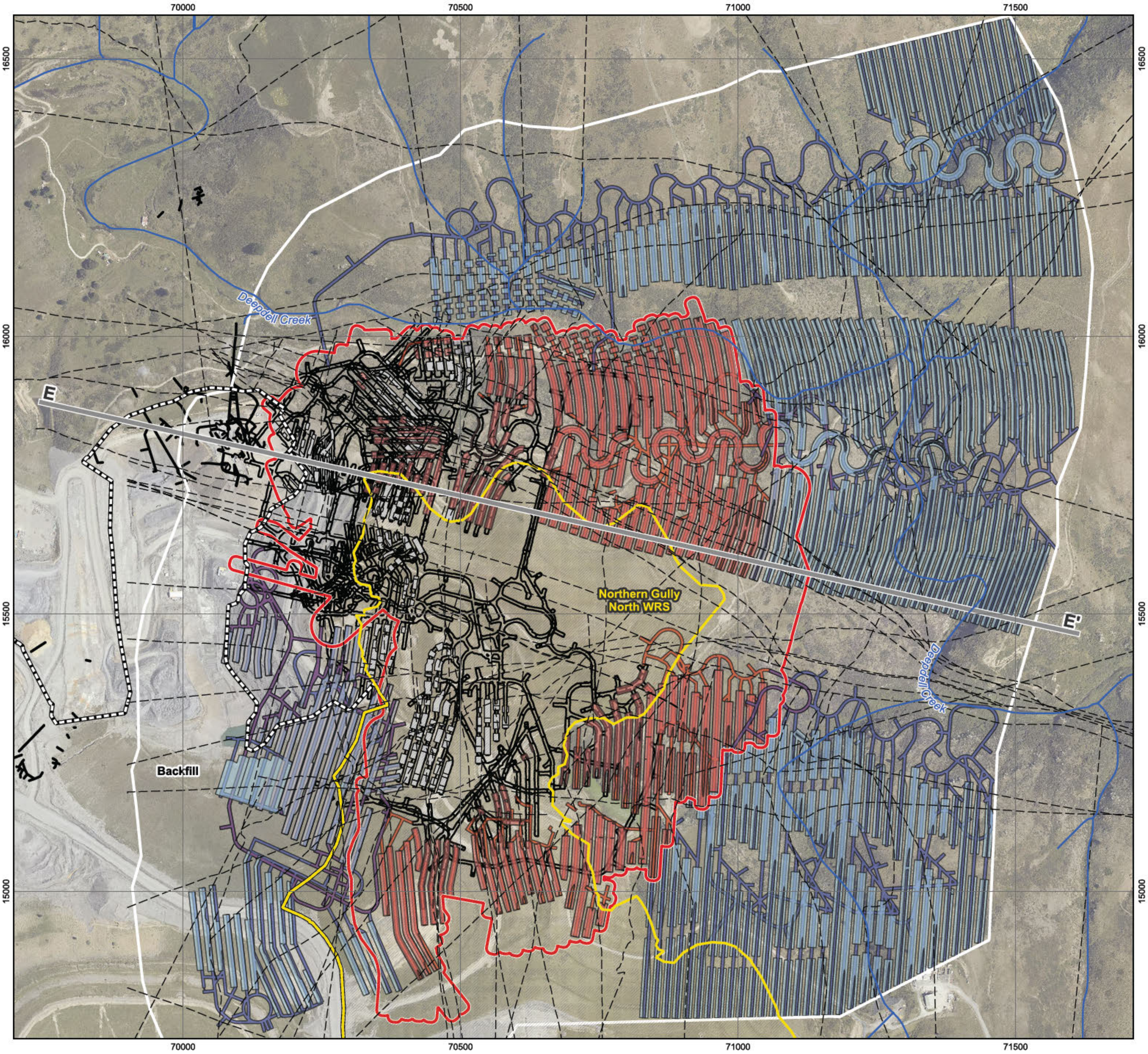
PSM

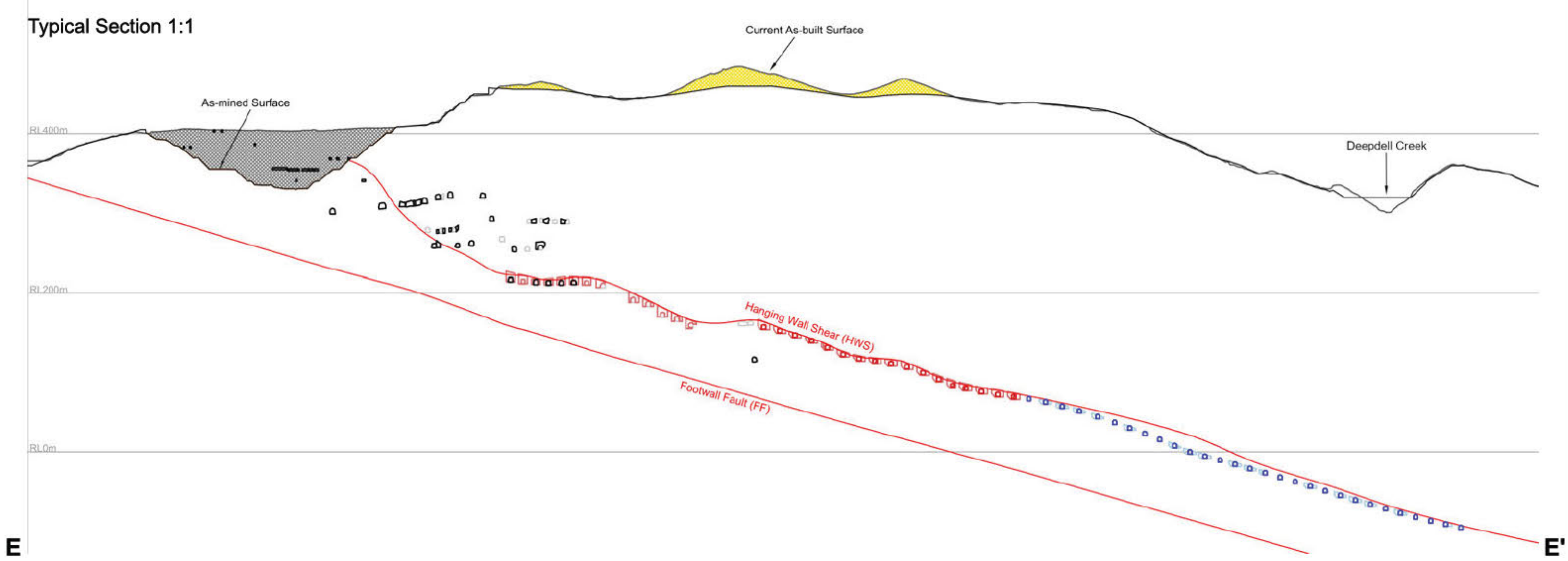
Created By:	Revision:
PSM	A
Date:	Paper Size:
29 Apr 2026	A3

OceanaGold (New Zealand) Limited
Macraes Phase Four Project
Golden Point Underground

AS-BUILT GPUG

PSM71-373R | FIGURE 1





Legend

- Deepdell Creek
- Section Location
- Faults Intersected with 1970s Pre-Mining Topography

Boundaries
- Backfill Boundary
- Northern Gully North WRS Boundary
- Proposed GPUG Mine Envelope
- GPUG Consented Mine Enveloppe

MP4 Proposed
- Stopes
- Development Drives

Consented
- Stopes
- Development Drives

As - Built Mine
- Stopes
- Development Drives

N

Scale 1:7,500

70 0 70 140 210 280 m

Map Projection:
MGP Affine from NZMG1949 (LINZ Trigs)

PSM

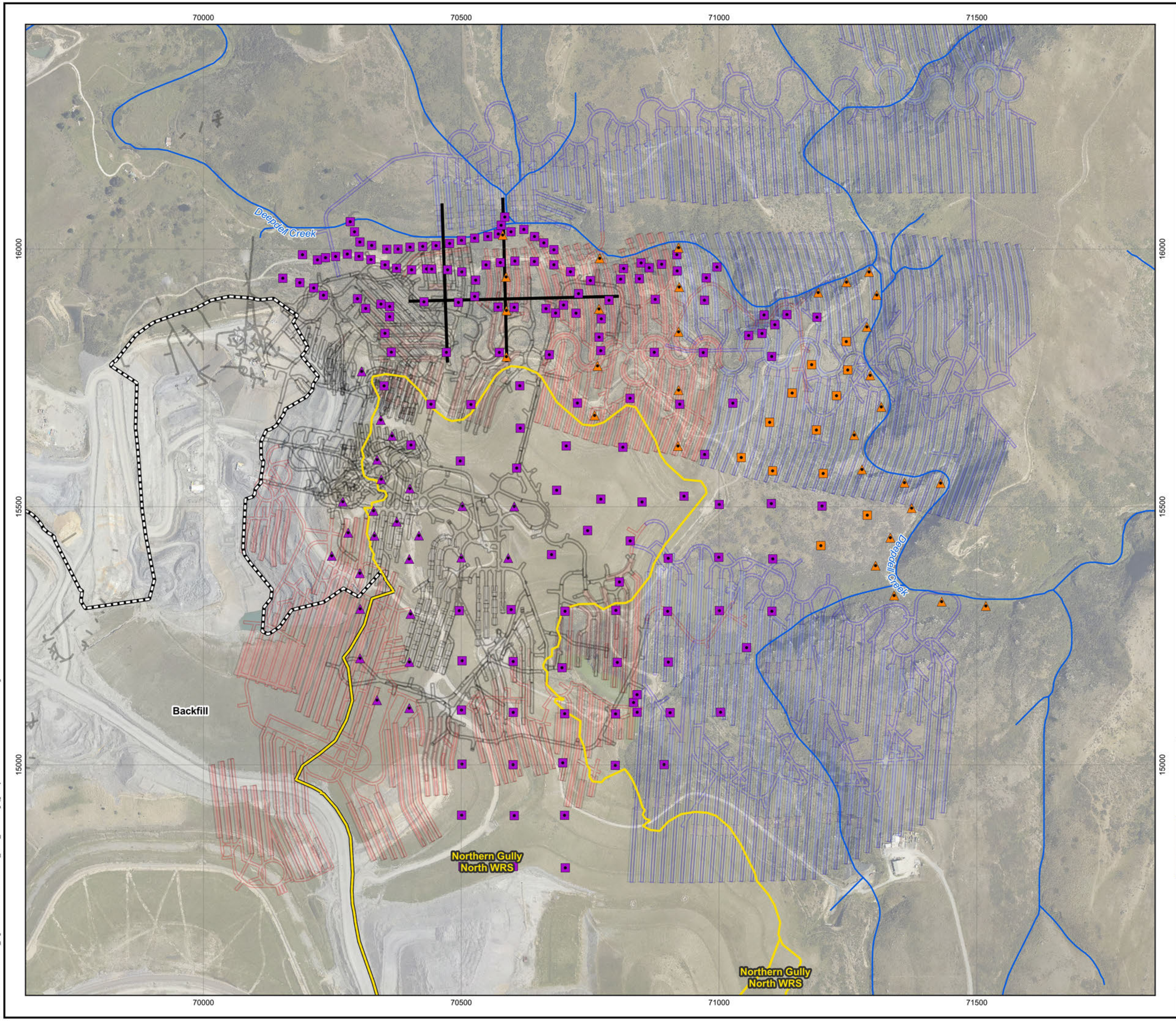
Created By: PSM	Revision: A
Date: 26 May 2026	Paper Size: A3

OceanaGold (New Zealand) Limited
Macraes Phase Four Project
Golden Point Underground

GPUG MINE OVERVIEW

PSM71-373R FIGURE 2

GIS\PSM71 Macraes\03_Figures\PSM71-373R\PSM71_373R_Mine_Location_and_sampling_SAR.qgz Layout: FIGURE 2 - GPUG Mine Overview



Legend

WRS_AOI_points

- Deepdell Creek

Monitoring

- OGNZL Prisms
- OGNZL GNSS Points
- PSM Nominal Prisms
- PSM Nominal GNSS Points
- PSM Recommended Prism Monitoring Section Lines

Boundaries

- Northern Gully North WRS Boundary
- Backfill Boundary

MP4 Proposed

- Stopes
- Development Drives

Consented

- Stopes
- Development Drives

As - Built Mine

- Stopes
- Development Drives

Scale 1:7,000

N

0 100 200 300 400 500 m

Map Projection: MGP Affine from NZMG1949 (LINZ Trigs)

PSM	Created By: PSM	Revision: A
	Date: 15 Jun 2026	Paper Size: A3

OceanaGold (New Zealand) Limited
Macraes Phase Four Project
Golden Point Underground

NOMINAL MONITORING PLAN

PSM71-373R	FIGURE 3

GIS - PSM71 Macraes\03_Figures\PSM71-373R\PSM71_373R_Monitoring.qgz Layout: FIGURE 3 - Nominal Monitoring Plan

Addendum 1

Golden Point Underground – Discrete Modelling of DDFZ and 3D Stability Analyses of Panels 144, 164, 204 and the Life of Mine Plan. PSM71-383L DRAFT. 3 August 2026

Appendix A
OGNZL Data Summary

Appendix B
Modelled Fault Wireframes (Provided Electronically)

Appendix C
InSAR L BAND Cumulative Movement

Appendix D
InSAR X Band Cumulative Movements

Appendix F
Cross Sections - Incremental Movement

Appendix G
2D Stability Analysis

Appendix H
3D Stability Analysis

Appendix I
GPUG Subsidence Management Plan