TOMINGLEY
GOLD OPERATIONS PTY LTD
(A wholly owned subsidiary of Alkane Resources Ltd)
ABN 53 149 040 371

Tomingley Gold Project

Modification Report
Modification 6

State Significant Development
MP 09_0155





Prepared by R.W. CORKERY & CO. PTY. LIMITED

March 2022

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State Significant Development MP09_0155

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Prepared for:

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EXECUTIVE SUMMARY

This *Modification Report* has been prepared by RW Corkery & Co. Pty. Limited on behalf of Tomingley Gold Operations Pty Ltd (the Applicant) to support the application to modify development consent MP 09_0155 for the Tomingley Gold Mine (the Proposed Modification).

The Proposed Modification seeks consent for the construction of Residue Storage Facility (RSF) 1. This would require the following.

- An increase in the capacity of RSF1 from approximately 8.93 million tonnes (Mt) to approximately 9.33Mt.
- A 2m increase in the approved maximum elevation of RSF 1 Stage 9 Cell 2 from 284.5 m AHD to 286.5m AHD, consistent with the approved Stage 9 Cell 1.

Construction of RSF1 Stage 9 Cell 2 would be undertaken between September and November 2022, in parallel with and using the same construction fleet as the approved construction of RSF2 Stage 1.

The Proposed Modification would not result in any additional surface disturbance within the Tomingley Gold Operations (TGO) Mine Site or any other changes to approved operations under MP 09_0155.

The Proposed Modification is required to ensure the adequate residue storage capacity and uninterrupted operation of the TGO Mine after RSF1 Stage 9 Cell 1 is filled in late 2022 and before RSF2 is commissioned in 2023.

This application is being made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*. The Proposed Modification complies with all preconditions for granting approval, including being substantially the same as Modification 3 of MP 09_0155, which forms the basis for comparison for subsequent modifications.

Assessments undertaken for Proposed Modification determined the following.

- Noise – construction of RSF1 Stage 9 Cell 2 would not result in exceedance of the relevant noise criteria. In addition, as the Proposed Modification would utilise the same construction fleet as that used for construction of RSF2 Stage 1, there would be no cumulative noise-related impacts.

  Operation of the RSF1 Stage 9 Cell 2 would, consistent with the existing operation of RSF1, be largely non-audible.
- Air quality – construction of RSF1 Stage 9 Cell 2 would not result in exceedance of the relevant air quality criteria. In addition, as the Proposed Modification would utilise the same construction fleet as that used for construction of RSF2 Stage 1, there would be no cumulative air quality-related impacts.

  Operation of the RSF1 Stage 9 Cell 2 would, consistent with the existing operation of RSF1, be largely non-dust generating as the residue surface is kept damp during residue placement.

- Visual amenity - the proposed additional 2m height of RSF1 Cell 2 is unlikely to be discernible from publicly accessible vantage points surrounding the TGO Mine Site. In addition, the Proposed Modification would not result in a significant change to the final landform.
- Surface water – the Proposed Modification would not result in significant changes to the approved water management system within the TGO Mine Site, including the existing risk of discharge of process water.
- Groundwater – the existing RSF1 is not resulting in adverse impacts to shallow groundwater in the immediate vicinity of the Facility and Proposed Modification is not expected to increase the risk of such an event occurring.

All other environmental aspects are unlikely to be affected by the Proposed Modification.

The Applicant contends that the Proposed Modification would be in the public interest as it would allow the Applicant to continue uninterrupted operations of the TGO Mine, providing for the continued employment, economic and other benefits without significant additional environmental impacts.

1. INTRODUCTION

1.1 SCOPE

This *Modification Report* has been prepared by RW Corkery & Co. Pty. Limited on behalf of Tomingley Gold Operations Pty Ltd (the Applicant) to support the application to modify development consent MP 09_0155 for the Tomingley Gold Mine (the Proposed Modification). The Tomingley Gold Mine (the TGO Mine) is located immediately to the south of Tomingley village in central western NSW (the TGO Mine Site) (see **Figure 1**). The TGO Mine is operated by Tomingley Gold Operations Pty Ltd, a wholly owned subsidiary of Alkane Resources Ltd (Alkane).

MP 09_0155 has been modified five times previously as follows.

- MOD1 (November 2013) - to adjust a range of commitments made during the original application which were no longer appropriate.
- MOD2 (April 2015) – to permit enhancement of the approved and constructed amenity bund and a cut back of the approved Caloma 1 Open Cut.
- MOD3 (July 2019) – to permit establishment of the Caloma 2 Open Cut, underground extraction from the Caloma 1 and 2 deposits and amendments to waste rock, surface water and soil management.
- MOD4 (May 2020) – to permit the construction and use RSF1 Stage 7 to Stage 9 Cell 1 and a commensurate increase in the height and aerial extent of the facility.
- MOD5 (May 2021) – to permit the construction and use of RSF2 Stages 1 and 2, an extension of the TGO Mine Site boundary to incorporate RSF2, use of Caloma 2 Open Cut for backfilling operations and the extension of Mine Life from 31 December 2022 to 31 December 2025.

The Proposed Modification seeks consent for the construction of RSF1 Stage 9 Cell 2. This would require the following.

- An increase in the capacity of RSF1 from approximately 8.93 million tonnes (Mt) to approximately 9.33Mt.
- A 2m increase in the approved maximum elevation of Cell 2 of RSF1 from 284.5m AHD to 286.5m AHD, consistent with the approved Stage 9 Cell 1.

The Proposed Modification would not result in any additional surface disturbance or any other changes to approved operations as per MP 09_0155.

Should the Proposed Modification be approved, construction operations for the proposed additional Cell would be likely to commence in Q4 2022.

The application to modify MP 09_0155 is made under Section 4.55(2) of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*. This *Modification Report* has been prepared to support that application and is generally consistent with the *State Significant Development Guidelines – Preparing a Modification Report* published by the (then) NSW Department of Planning, Industry and Environment dated July 2021.

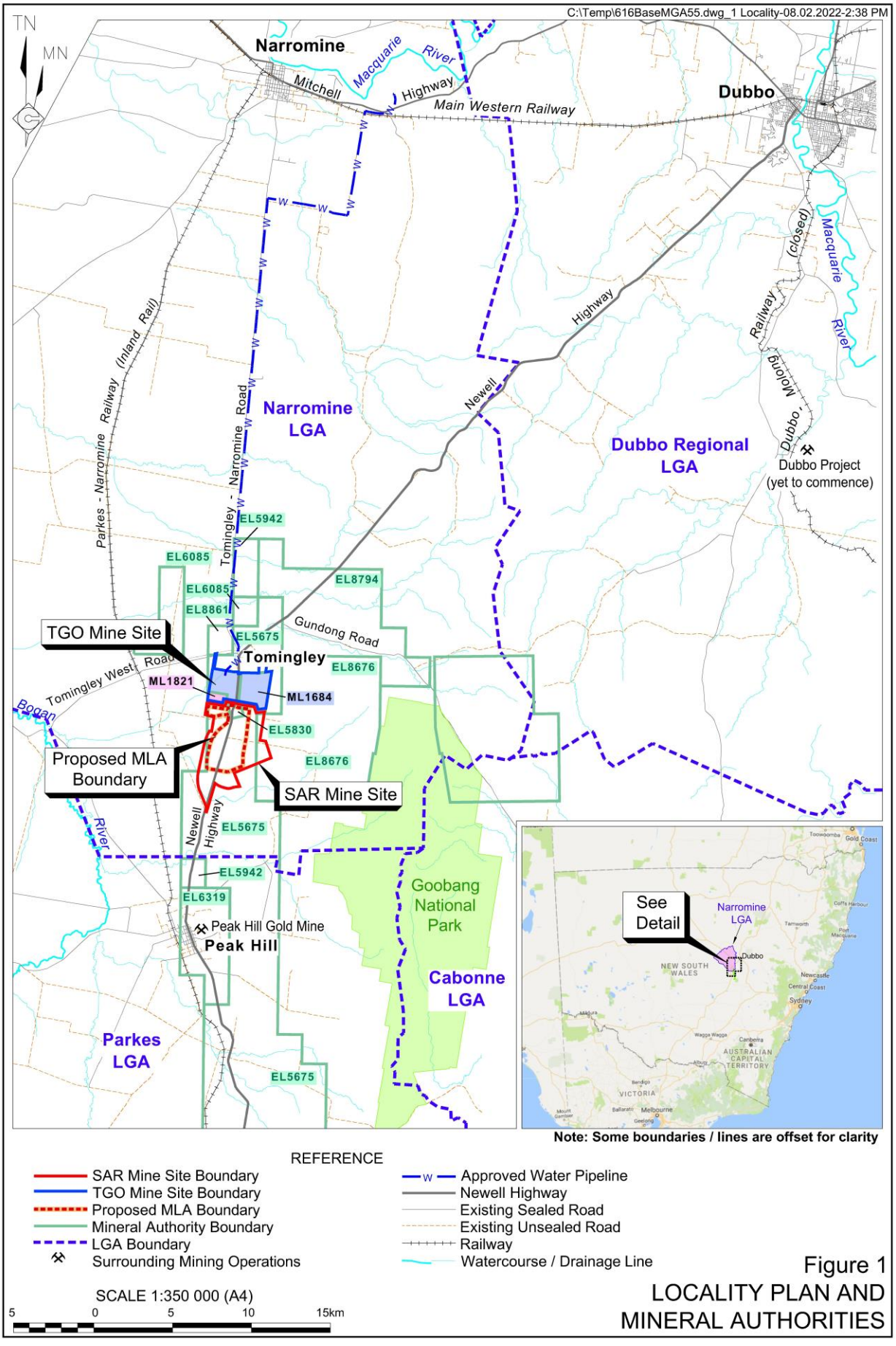


Figure 1
LOCALITY PLAN AND MINERAL AUTHORITIES

1.2 THE APPLICANT

The Applicant, Tomingley Gold Operations Pty Ltd, is the operator of the TGO Mine and is a subsidiary company of Alkane. Alkane is an Australian, publicly listed mining and exploration company which has been in existence since 1969. Alkane has a long-term involvement and ongoing commitment to the Central West of New South Wales and has substantial investment in the people and resources of the region. Alkane developed and operated the Peak Hill Gold Mine on the outskirts of Peak Hill (**Figure 1**) from 1996 to 2005 and has now largely rehabilitated that site.

Alkane also developed and is currently overseeing the operation the TGO Mine, as well as discovering and successfully obtaining all required approvals for the Dubbo Project (SSD-5251), located at Toongi, approximately 25km south of Dubbo (**Figure 1**). That project is now held by Australian Strategic Materials Limited which demerged from Alkane in July 2020.

Alkane also undertook the early exploration work on the McPhillamys prospect, currently the subject of a State Significant Development application by Regis Resources.

Finally, Alkane has an extensive package of exploration tenements throughout the Central West of NSW, with a recent discovery at Boda, north of Wellington, a significant focus for Alkane.

1.3 BACKGROUND

1.3.1 Approved TGO Operations

1.3.1.1 Overview of Approved Operations

Activities approved under MP 09_0155, as modified, include the following (**Figure 2**).

- Mining of four open cuts, with underground mining under three of the approved open cuts, namely Wyoming 1, Caloma 1 and Caloma 2.
- Placement of waste rock into three out-of-pit waste rock emplacements (Waste Rock Emplacements 1, 2 and 3) and two in-pit waste rock emplacement (Wyoming 3 and Caloma 2). Waste Rock Emplacements 2 and 3 are complete and, with the exception of a small area on the upper surface of Waste Rock Emplacement 3, are under rehabilitation.
- Construction and use of a carbon-in-leach Processing Plant and associated infrastructure, including a Run-of-Mine Pad, crushing, grinding and cyanide leaching circuits, workshops, ablutions facilities, stores, office area and car parking. The maximum approved rate of processing is 1.5Mtpa.
- Construction and use RSF1 (to Stage 9 Cell 1) and RSF2 (to Stage 2) for the storage of process residues.
- Construction and use of infrastructure, including:
  - dewatering ponds;
  - a water pipeline, from a licensed bore located approximately 7km to the east of Narromine;

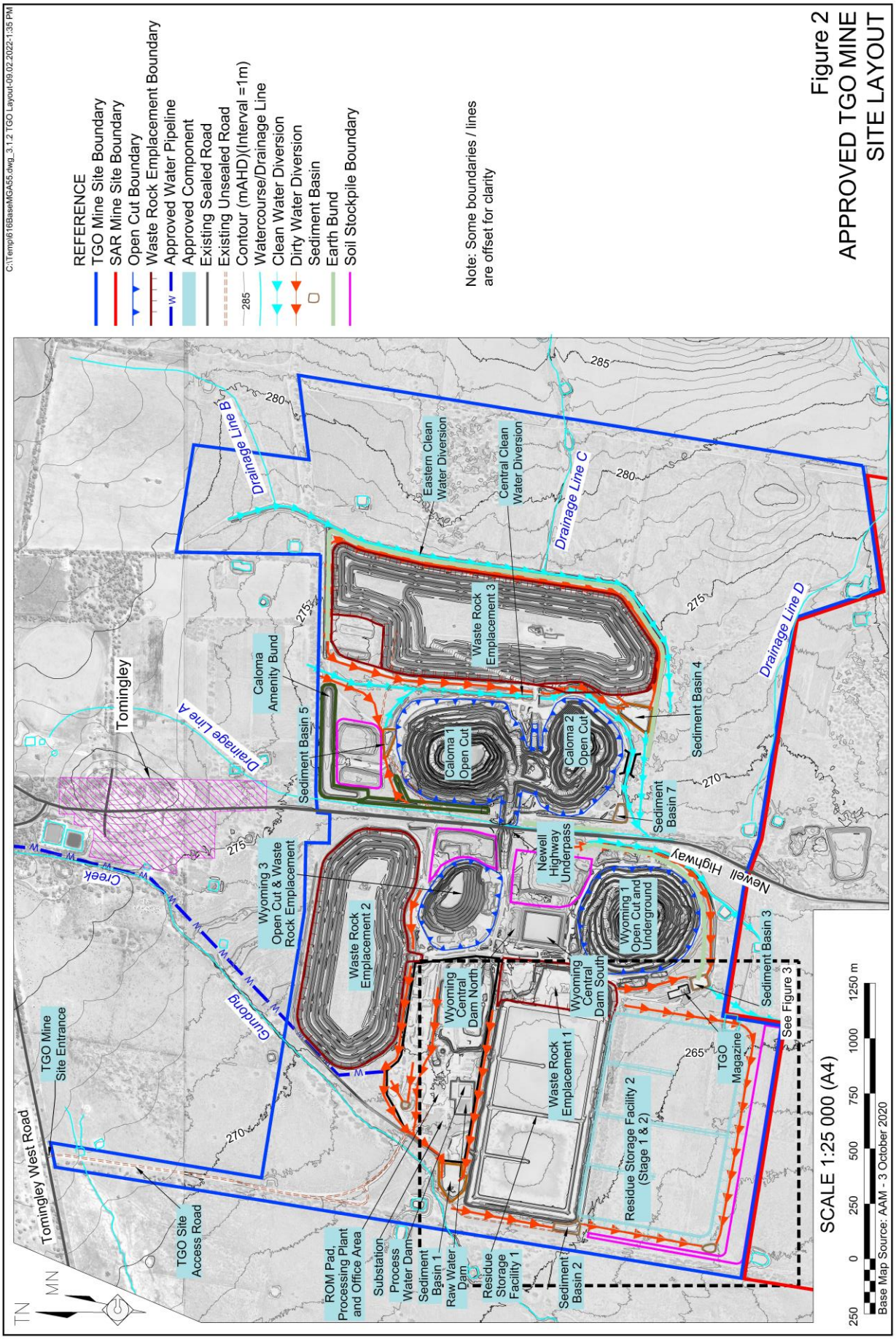


Figure 2
APPROVED TGO MINE
SITE LAYOUT
REFERENCE
TGO Mine Site Boundary
SAR Mine Site Boundary
Open Cut Boundary
Waste Rock Emplacement Boundary
Approved Water Pipeline
Approved Component
Existing Sealed Road
Existing Unsealed Road
Contour (mAHD)(Interval =1m)
Watercourse/Drainage Line
Clean Water Diversion
Dirty Water Diversion
Sediment Basin
Earth Bund
Soil Stockpile Boundary
Note: Some boundaries / lines are offset for clarity
C:\Temp\616BaseMGA55.dwg_3.1.2 TGO Layout-09.02.2022-1:35 PM
Tomingley
Tomingley West Road
TGO Mine Site Entrance
TGO Site Access Road
Drainage Line A
Drainage Line B
Drainage Line C
Drainage Line D
Gundong Creek
Caloma Amenity Bund
Sediment Basin 5
Eastern Clean Water Diversion
Central Clean Water Diversion
Waste Rock Emplacement 3
Caloma 1 Open Cut
Caloma 2 Open Cut
Sediment Basin 4
Sediment Basin 7
Newell Highway
Newell Highway Underpass
Wyoming 3 Open Cut & Waste Rock Emplacement
Waste Rock Emplacement 2
Wyoming 1 Open Cut and Underground
Wyoming Central Dam North
Wyoming Central Dam South
Waste Rock Emplacement 1
Sediment Basin 3
See Figure 3
TGO Magazine
Residue Storage Facility 2 (Stage 1 & 2)
ROM Pad, Processing Plant and Office Area
Substation
Process Water Dam
Sediment Basin 1
Raw Water Dam
Residue Storage Facility 1
Sediment Basin 2
TN
MN
SCALE 1:25 000 (A4)
250 0 250 500 750 1000 1250 m
Base Map Source: AAM - 3 October 2020

- various internal and external roads, including an underpass beneath the Newell Highway and upgrades to Tomingley West Road and associated intersections;
- a transformer and electrical distribution network within the TGO Mine Site and 20km 66kV electricity transmission line from the Peak Hill substation;
- various clean and dirty water management structures; and
- fenced and unfenced biodiversity offsets and vegetated amenity bunds.

Mining operations are approved until 31 December 2025.

1.3.1.2 Approved Residue Storage Facilities

Design of Approved Residue Storage Facilities

Figure 3 and **Table 1** present the layout and design criteria for the approved residue storage facilities. In summary, development consent for the approved residue storage facilities were granted as follows.

- RSF1 (Stages 1 to 6)..... Original Project Approval (2012)
- RSF1 (Stage 7 to Stage 9 Cell 1).....MOD4 (2020)
- RSF2 (Stages 1 and 2) MOD5 (2021)

Table 1
Approved Residue Storage Facilities Design Criteria

Design Component	RSF1		RSF2
Maximum approved stage	Stage 9, Cell 1	Stage 8, Cell 2	Stage 2
Maximum crest elevation	286.5m AHD	284.5m AHD	272.0m AHD
Maximum residue elevation	286.0m AHD	284.0m AHD	271.3m AHD
Slope of outer face	1:3 (V:H)		1:3 (V:H)
Design capacity (approximate)	8.93Mt		4.5Mt
Residue discharge	Perimeter discharge		Perimeter discharge
Decant system	Central decant		Central decant
Minimum decant pond capacity	1:10 000-year AEP flood event		1:10 000-year AEP flood event
External decant storage	Wyoming Central Dam		Wyoming Central Dam
Basal liner • Material • Permeability	Clay Maximum 1 x 10^{-9} over 1m		Clay Maximum 1 x 10^{-9} over 1m
Spillway	Not required, designed for no spill		Designed for no spill Emergency spillway for 1:1 000 AEP rainfall event
ANCOLD Category • Dam Failure Consequence • Environmental Spill Consequence	Significant Significant		Significant Low

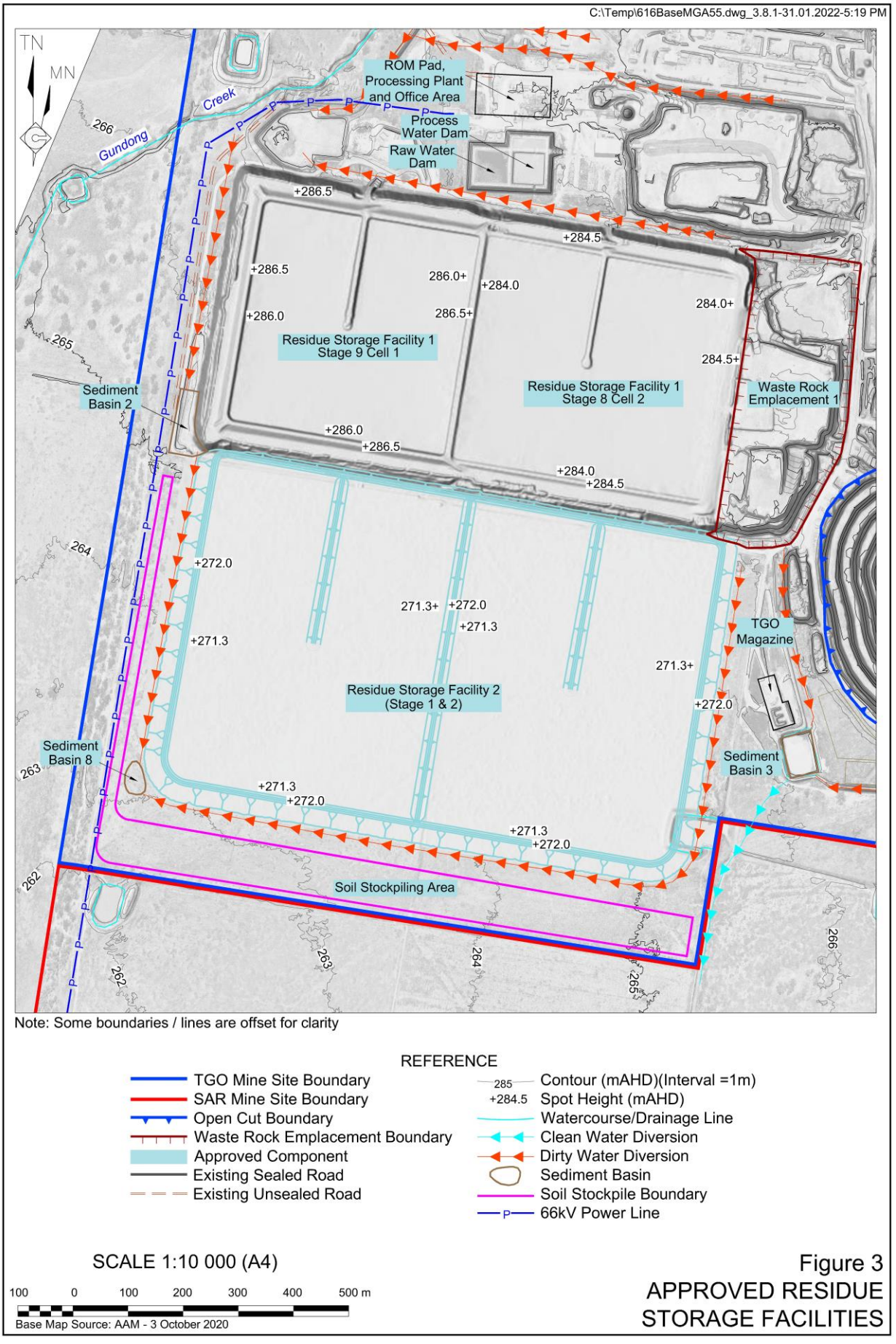


Figure 3
APPROVED RESIDUE STORAGE FACILITIES

Approval and Modification History

Stages 1 to 6 of RSF1 were approved as part of the original Development Consent for the TGO Mine in 2012. The foundation of RSF1 was investigated by DE Cooper & Associates Pty Ltd (DEC). A total of 25 test pits were excavated and determined that the foundation comprises stiff clay with some traces of sand. The hydraulic conductivity of the foundation was determined to be low to very low, with permeability testing returning results between 2.3 x 10^{-8}m/s and 1 x 10^{-9}m/s. DEC (2009) recommended ripping, moisture conditioning and compacting the foundation. The NSW Dam Safety Committee accepted that design presented by DEC (2009) met the requirements of the committee. Construction of the then final stage of the facility, namely Stage 6, commenced in early 2019 and with residue placement into Stage 6 commencing in early July 2019.

A modification application for in-pit residue placement within the Wyoming 3 Open Cut was prepared prior to the MOD4 application but was withdrawn in 2016 following extensive consultation with the NSW Environment Protection Authority. The principal issue of concern for the NSW Environment Protection Authority was the fact that a permeability barrier that complied with the Authority's *Tailings Dam Liner Policy* could not be established.

MOD4, approved in May 2020, sought approval for construction of Stage 7 to Stage 9 Cell 1 of RSF1, with residue placement into Stage 7 commencing in July 2020. **Table 2** presents the anticipated RSF1 storage capacity, as approved for MOD4.

Table 2
Estimated RSF1 Capacity

Construction Activity	Incremental Storage (Mt)	Additional Cumulative Storage (Mt)	Cumulative Storage (Mt)
Stage 6 Cell 2			6.57
Stage 7 Cell 1	0.47	0.47	7.04
Stage 7 Cell 2	0.51	0.98	7.55
Stage 8 Cell 1	0.45	1.43	8.00
Stage 8 Cell 2	0.50	1.93	8.50
Stage 9 Cell 1	0.43	2.36	8.93
Source: GHD (2019) – After Table 7-1			

MOD5, approved in May 2021, sought approval for the construction and use of RSF2 Stages 1 and 2, with a combined storage capacity of 4.5Mt.

Construction and Operation of RSF1

The embankments of RSF1 have been constructed primarily using waste rock sourced from existing Waste Rock Emplacements or from ongoing mining operations. Each Stage, with the exception of the eastern embankment, is constructed using upstream lifts whereby the embankment for the subsequent Stage is constructed on the surface of the residue emplaced during the previous Stage. The eastern embankment has been constructed using centreline lifts and utilises the existing Waste Rock Emplacement 1.

The Facility operates as a subaerial residue deposition facility, with residue deposited from spigots around the perimeter of the Facility. Residue is deposited onto a "beach", with supernatant water permitted to flow to one of two central decant towers from where it is pumped to either the Process Water Dam or the Wyoming Central Dam South (**Figure 2**).

A perimeter service road and seepage collection drain are located adjacent to the southern, western and northern embankments, with any potential seepage water collected within a seepage collection pond located adjacent to the southwest section of RSF1.

RSF1 has operated largely without incident throughout the life of the TGO Mine to date.

Planned Construction and Operation of RSF2

RSF2 Stages 1 and 2 were approved under MOD5. Conditional requirements of MOD5 require that RSF2 be constructed "using the centreline lift construction methodology, unless otherwise agreed by the Secretary." This, together with a range of other matters, has resulted in the delays to the completion of the final detailed design for RSF2 Stage 1. The contract for construction of RSF2 Stage 1 is expected to be awarded in April 2022, with construction expected to require approximately 9 to 12 months to complete, assuming no significant weather or other delays. RSF2 is therefore expected to be ready to accept residue in April 2023.

1.3.2 Operation of the Mine

Construction of the TGO Mine commenced in February 2013 with open cut mining commencing in November 2013. Underground mining development from a portal in the Wyoming 1 Open Cut commenced in January 2019, with ore production from stopes commencing in December 2019.

The Applicant is currently undertaking underground mining operations within the Wyoming 1, Caloma 1 and Caloma 2 deposits.

Open cut mining recommenced within the Caloma 1 Open Cut for the Caloma Eastern Cutback in October 2020 and is expected to continue until February 2023.

The TGO Mine operates up to 365 days per year and 24 hours per day using two 12 hour shifts and processes up to 1.5Mtpa of gold ore. A total of 230 personnel were employed at the TGO Mine in January 2022.

It is anticipated that during the FY2021/2022 between $4 million and $5 million will be spent on products and services with local businesses, approximately $124,000 will be paid to Narromine Shire Council and approximately $3 million will be paid to the State of NSW in royalties.

Table 3 presents the publicly available production figures for the Mine to June 2021. In summary, approximately 7.46Mt of ore was processed between the commencement of mining operations and 30 June 2021. The maximum annual rate of processing was 1.14Mt in 2015, less than the approved maximum rate of processing of 1.5Mtpa.

Table 3
Previous Production Statistics

Production	Units	Financial Year ending 30 June				
		2014	**2015**	**2016**	**2017**	
Waste mined	bcm	4 635 684	5 730 661	6 199 820	7 679 110	
Ore mined	t	545 550	1 286 291	1 285 454	1 222 868	
Ore milled	t	359 096	1 140 704	1 096 105	1 087 983	
		2018	**2019**	**2020**	**2021**	**Total**
Waste mined	bcm	3 165 414	657 647	50 473	1 218 779	29 337 588
Ore mined	t	1 589 811	400 187	335 879	778 236	7 464 276
Ore milled	t	1 092 602	998 703	838 743	928 531	7 542 467
Source: Alkane Resources Ltd – June Quarterly Reports for each financial year						

1.3.3 Approved SAR Exploration Decline Activities

The Applicant was granted approval for the San Antonio Roswell (SAR) Exploration Drive under the *Mining Act 1992* by the Resources Regulator on 7 May 2020. That approval was subsequently modified on 13 September 2021. The approved activities include the following (**Figure 4**).

- Development of an underground exploration drive from the existing Wyoming 1 underground workings to an underground position to the west of the San Antonio and Roswell (SAR) deposits.
- Establishment and use of ancillary infrastructure, including a single ventilation rise. The SAR Exploration Drive Ventilation Rise will be the only surface disturbance associated with the exploration program.
- Drilling of approximately 72 000m of exploration drill holes.
- Extraction of one or more bulk samples totalling no greater than 20 000t.
- Collection of data that for mine planning and environmental assessment purposes.

1.3.4 Proposed TGEP Operations

The Applicant, as part of a separate development application, is currently seeking development consent for the Tomingley Gold Extension Project (TGEP) for the construction and use of the SAR Mine to access the recently identified SAR deposits, located immediately south of the TGO Mine Site (the SAR Mine Site).

The TGEP comprises two components as follows.

- Approved TGO Mine operations (**Figure 2**). These activities are undertaken in accordance with development consent MP 09_0155 (see Section 1.3.1). The approved activities would continue under any new development consent, with MP 09_0155 to be surrendered following receipt of the new development consent and all required approvals for the Project.

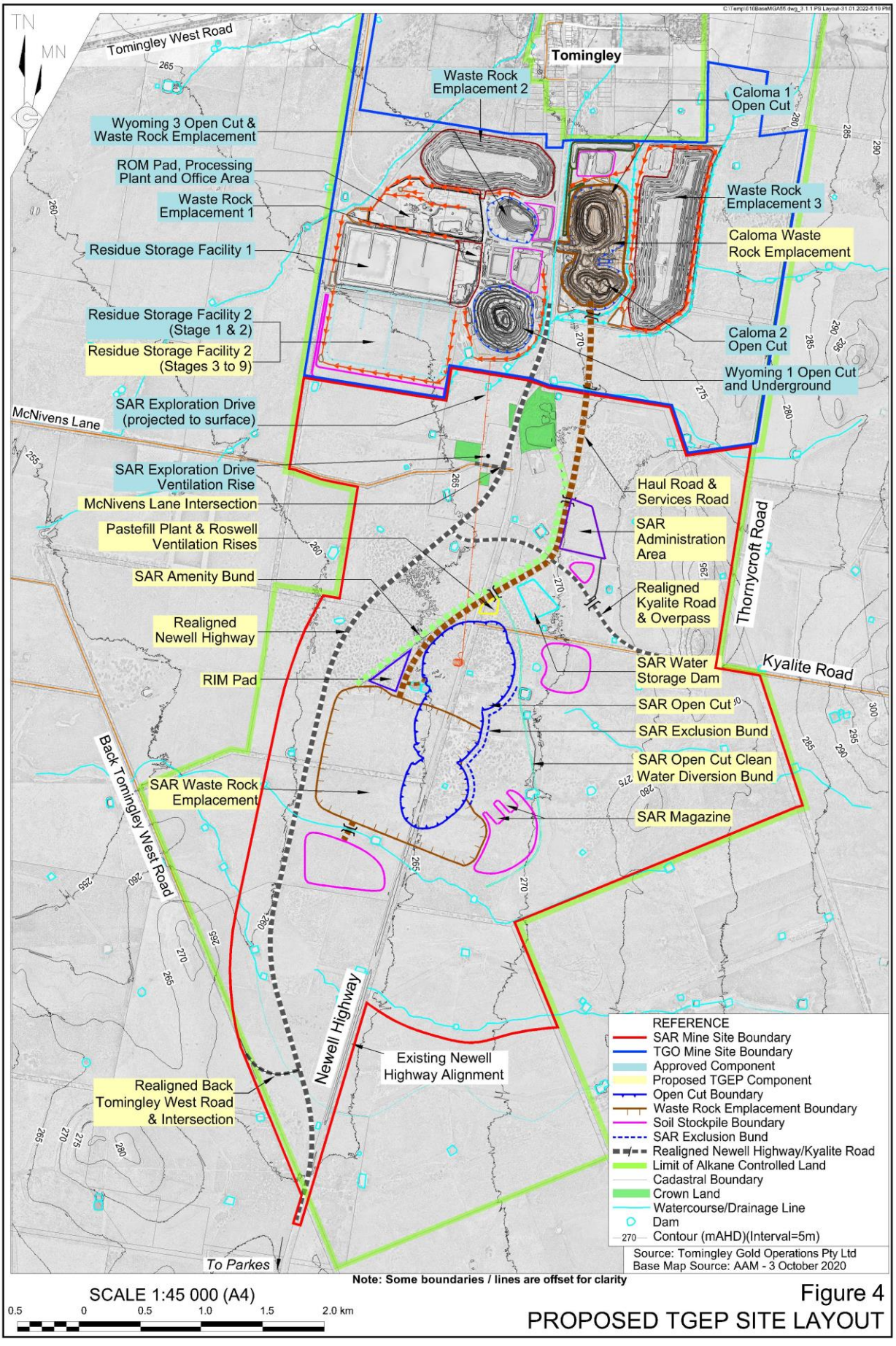


Figure 4
PROPOSED TGEP SITE LAYOUT

- The proposed SAR Mine operations and additional or modified TGO Mine operations, including the following (**Figure 4**).
  - Realigned Newell Highway and Kyalite Road and associated intersections .
  - The SAR Open Cut and Underground Mine.
  - Construction of two waste rock emplacements, namely the Caloma Waste Rock Emplacement, within the Caloma 1 and Caloma 2 Open Cuts, and SAR Waste Rock Emplacement, within the southern and central sections of the SAR Open Cut.
  - The SAR Amenity Bund, Haul Road and Services Road between the SAR Open Cut and the Caloma 2 Open Cut.
  - Minor modifications to the Processing Plant to increase the approved maximum processing rate from 1.5Mtpa to 1.75Mtpa and use of the Plant to process ore from the SAR Open Cut and SAR and TGO Mine underground mining operations.
  - Increased capacity for RSF2, from Stage 2 to Stage 9, with a maximum elevation of 286m AHD (**Figure 5**).
  - Associated surface and underground activities and infrastructure.

In addition, the TGEP would include an extension of the approved mine life, from 31 December 2025 to 31 December 2032.

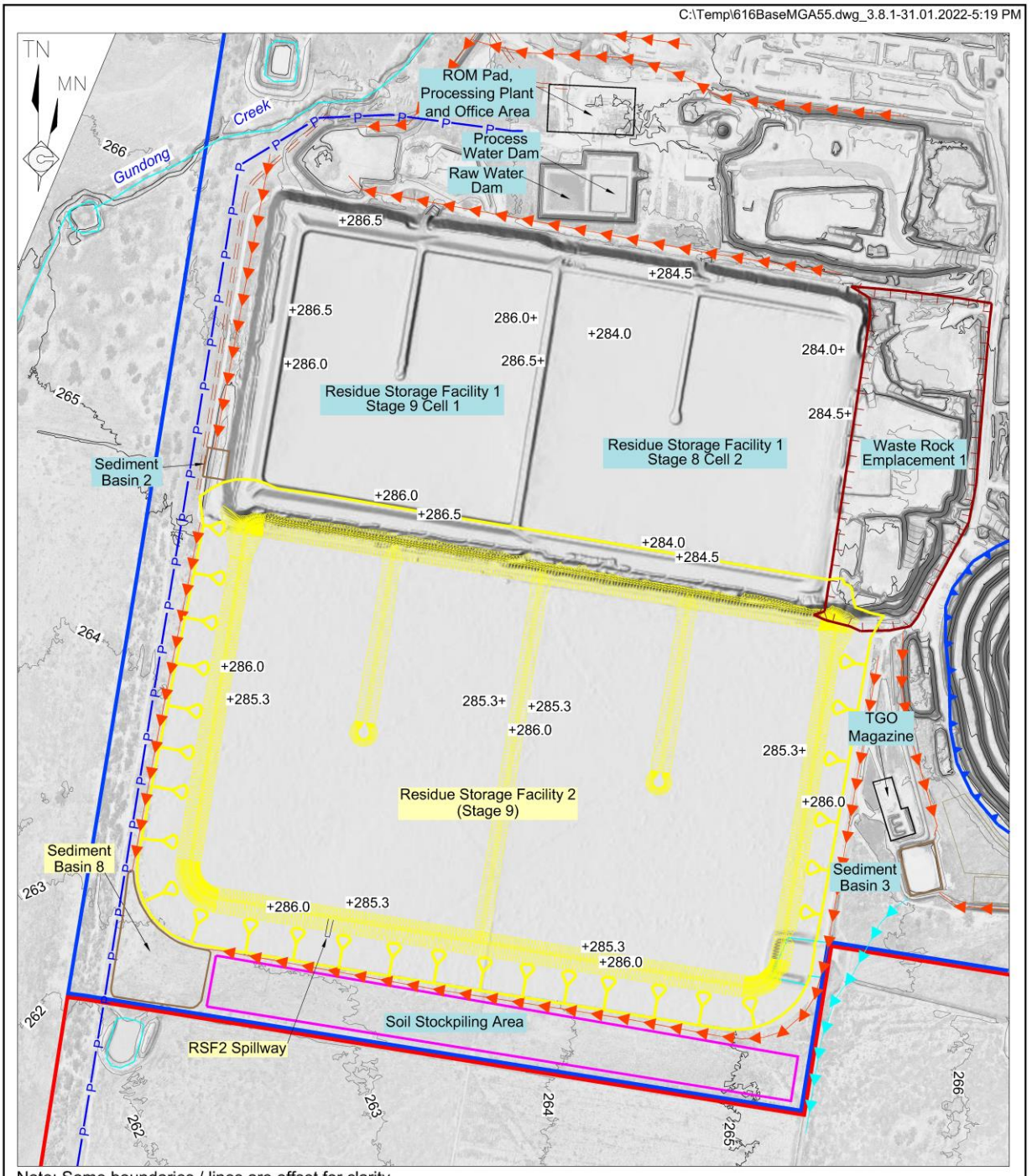
1.3.5 Scheduling of TGO and TGEP Operations

Table 4 presents the anticipated schedule for construction and operation/filling of the approved RSF1 to Stage 9 Cell 1 and RSF2 Stage 1, as well as the anticipated construction and operation of the proposed RSF1 Stage 9 Cell 2 and best case (earliest) commencement of major TGEP construction operations.

In summary, the Applicant anticipates that the approved RSF1 Stage 9 Cell 1 will be filled by the end of December 2022 and RSF2 Stage 1 will not be available to accept residue until April 2023. As a result, RSF1 Stage 9 Cell 2 will be required to permit continued operation of the TGO Mine between January and April 2023. Construction of RSF1 Stage 9 Cell 2 will be required to be complete by early December 2022.

Construction of RSF1 Stage 9 Cells 1 and 2 and RSF2 Stage 1 would be undertaken concurrently and would utilise a single construction fleet.

In addition, under a best-case scenario for determination of the application for development consent for TGEP of 30 June 2022, a further 6 months of preparatory activities would be required. Preparatory activities would include but would not be limited to preparation and approval of management plans, application for and receipt of additional approvals, commissioning of construction contractors, site survey and mark out and other minor works. As a result, major TGEP earthworks would not commence until January 2023 at the earliest.



Note: Some boundaries / lines are offset for clarity

REFERENCE

- TGO Mine Site Boundary
- SAR Mine Site Boundary
- Open Cut Boundary
- Waste Rock Emplacement Boundary
- Approved Component
- Proposed TGEP Component
- Existing Sealed Road
- Existing Unsealed Road
- 285 Contour (mAHD)(Interval =1m)
- +284.5 Spot Height (mAHD)
- Watercourse/Drainage Line
- Clean Water Diversion
- Dirty Water Diversion
- Sediment Basin
- Soil Stockpile Boundary
- P 66kV Power Line

SCALE 1:10 000 (A4)

100 0 100 200 300 400 500 m

Design Source: GHD (2021a)
Base Map Source: AAM - 3 October 2020

Figure 5
PROPOSED TGEP RESIDUE STORAGE FACILITY 2 - STAGES 3 TO 9

Table 4
Anticipated TGO and TGEP Scheduling

	2022								2023			
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Approved TGO Residue Storage Facility Operations												
RSF1 Stage 8 Cell 2 Operation												
RSF1 Stage 9 Cell 1 Construction												
RSF1 Stage 9 Cell 1 Operation												
RSF1 Stage 9 Cell 2 Construction[1]												
RSF1 Stage 9 Cell 2 Operation[1]												
RSF2 Stage 1 Construction												
RSF2 Stage 1 Operation												
Proposed TGEP Operations												
Receipt of TGEP Approval/Surrender of MP 09_0155 (best case)												
Preparatory tasks[2]												
TGEP construction/major earthworks[2]												

Note 1: Pending receipt of approval for the Proposed Modification

Note 2: Pending receipt of development consent for TGEP.

Blue = Approved TGO Component; Pink = Proposed MOD6 Component; Yellow = Proposed TGEP Component

= RSF1 and RSF2 constructed using a single construction fleet

1.4 NEED FOR THE MODIFICATION

Table 4 presents the anticipated scheduling of construction and operation of the approved RSF1 and RSF2. In summary, RSF1 Stage 9 Cell 1 is expected to be full by end of December 2022.

As identified in Section 1.3.1, MOD5 added an additional condition to MP 09_0155 requiring that RSF2 be constructed "using the centreline lift construction methodology, unless otherwise agreed by the Secretary." This, together with a range of other matters, has resulted in the delays to the completion of the final detailed design for RSF2 Stage 1. Allowing for those delays, together with the expected time required to engage the construction contractor and complete construction of RSF2 Stage 1, that Facility is not expected to be ready to accept residue until April 2023

In light of the above, the applicant anticipates that RSF2 will not be available when RSF1 Stage 9 Cell 1 is at full capacity. As a result, RSF1 Stage 9 Cell 2 will be required to permit continued operation of the TGO Mine during the Q1 2023.

1.5 FEASIBLE ALTERNATIVES CONSIDERED

1.5.1 Reduction or Cessation of Mining and Processing Operations

The Applicant considered a reduction or cessation of mining and/or processing operations to reduce the volume of residue prior to commissioning of RSF2. This option was determined not to be feasible for the following reasons.

- The Applicant would be required to standdown or dismiss a substantial proportion of its workforce. In addition, supply contracts with local suppliers would be required to be suspended. The resulting social and economic disruption would be very substantial and not justified.
- The Applicant would suffer substantial reputational damage, with adverse impacts on relationships with suppliers, customers and its shareholders.

1.5.2 Staged Construction of RSF2

The approved design of RSF2 includes the concurrent construction of Stage 1 Cell 1 and Cell 2. Therefore, the potential exists for the Applicant to construct each Cell separately which may allow for early commencement of deposition within the Facility. The Applicant considers this not to be feasible for the following reasons.

- Construction of RSF2 requires substantial excavation and other earthworks. These works cannot be undertaken for Cell 1 alone, with a substantial proportion of Cell 2 required to be constructed to allow Cell 1 to be completed.
- The sequential construction of each Cell would likely result in significant increases to construction times and costs compared to the proposed concurrent construction method.
- Potential for weather or COVID related delays in construction could equally impact construction of RSF2 Cell 1 as concurrent construction of both Cells. As a result, sequential construction may not actually bring forward the date in which RSF2 would be available.
- RSF2 has been designed as a two-cell structure, with the central embankment intended to be supported on both sides by deposited residue. Completion only Cell 1 initially would likely require additional buttressing and or an increased risk of failure of the central embankment.

2. STRATEGIC CONTEXT

2.1 STRATEGIC PLANS

2.1.1 Economic Development Strategy for Regional NSW

The *Economic Development Strategy for Regional NSW* published by the Department of Trade and Investment, Regional Infrastructure and Services aims to drive economic growth in regional NSW. The Strategy covers all of regional NSW, encompassing all industries and sectors within the State, with mining highlighted as one of the key drivers of economic growth. The Strategy identifies five high level goals encompassing twenty-three actions for Governments. The following identifies those areas where the Strategy provides strategic support for the Proposed Modification.

Goal 1 – Promote key regional sectors and regional competitiveness

The Strategy highlights the mining industry as one of the top three contributors to Gross Regional Product, alongside manufacturing and healthcare and social assistance. The Proposed Modification would be consistent with the following actions.

- Action 1.2 - Increase the value of NSW's mineral industry and the energy sector.

  The Proposed Modification would help to increase the value of the NSW mineral industry by ensuring no avoidable interruptions to the continued extraction of a State-owned resource and the continued support, employment and development of the Applicants' employees, contractors and suppliers.

Goal 2 – Drive regional employment and regional business growth

Regional employment and business growth is a key goal of the Strategy, with a number of Government actions and programs in place to support this goal. The Strategy identifies increasing the regional skill base to offset the effects of population decline as a key priority; in particular, the development of youth and Aboriginal employment outcomes.

- Action 2.1 - Promote regional job creation.

  The Proposed Modification would enable the retention of existing positions, ensuring the continuation of flow-on economic effects of consistent employment levels.

- Actions 2.4 and 2.5 - Increase regional skills base and improve Aboriginal employment and business outcomes.

  The Proposed Modification would allow the Applicant to continue to employ apprentices and trainees and contribute to training programs for the local community, including the Peak Hill and Narromine Aboriginal communities. The Applicant is a significant sponsor of the Clontarf Foundation through Narromine High School. The current three-year partnership the Clontarf Foundation seeks to improve the education, discipline, life skills, self-esteem and employment prospects of young Aboriginal and Torres Strait Islander men.

2.1.2 Central West and Orana Regional Plan 2036

The *Central West and Orana Regional Plan 2036* (the Plan) published by the NSW Department of Planning and Environment in June 2017 sets out the NSW Government's blueprint for the future of the Central West and Orana Regions to 2036. The Plan covers an area including Nyngan and Condobolin in the west, Cowra in the South, Oberon and Lithgow in the east and Coonamble and Coonabarabran in the north. The Plan identifies four goals, each with multiple sub-goals or directions, as follows. The following also identifies how the Proposed Modification is consistent with each of those goals.

Goal 1 – The most diverse regional economy in NSW

The Plan identifies that agriculture, manufacturing and mining are the Regions' traditional industries. However, health, education and tourism sectors present new opportunities for economic growth. The Proposed Modification would be consistent with the following Directions.

- Direction 1: Protect the region's diverse and productive agricultural land.

  The Proposed Modification would not disturb additional agricultural land or adversely impact on such land.

- Direction 7: Enhance the economic self-determination of Aboriginal communities.

  The Applicant has a long history of working with the Peak Hill Aboriginal community to promote training and business opportunities and has recently engaged with the Clontarf Foundation to assist young Aboriginal men.

- Direction 8: Sustainably manage mineral resources.

  The Proposed Modification would ensure that capacity constraints do not limit the Applicant's ability to continue to operate the TGO Mine at peak efficiency.

Goal 2 – A stronger, healthier environment and diverse heritage

The Plan identifies that the Regions have some of Australia's most unique ecological systems and that achieving environmentally sustainable development will balance rural and urban compatibility issues. The Proposed Modification would represent the most efficient use of the land already disturbed within the TGO Mine Site and would not result in any additional disturbance.

The Plan identifies that the Regions have some of Australia's most unique ecological systems and that achieving environmentally sustainable development will balance rural and urban compatibility issues. The Proposed Modification would be consistent with the following Directions.

- Direction 13: Protect and manage environmental assets.

  The Proposed Modification would not result in disturbance of additional undisturbed land. Similarly, the Proposed Modification would not result in additional groundwater, surface water, air quality or other impacts.

- Direction 16: Respect and protect Aboriginal heritage assets.

  The Proposed Modification would not result in disturbance of additional undisturbed land or Aboriginal objects.

Goal 3 – Quality freight, transport and infrastructure networks

The Plan identifies that the Central West and Orana regions are a major exporter of agricultural, mining and other value-added products and relies on efficient freight and transport infrastructure. The Proposed Modification would not result in changes to the road network or off-site transportation.

Goal 4 – Dynamic, vibrant and healthy communities

The Plan identifies that Central West and Orana is home to some of the most diverse communities in NSW. Population growth will not be evenly distributed, with larger towns such as Orange, Bathurst, Mudgee and Dubbo expected to grow, while the population of smaller towns and villages is likely to remain relatively stable or in some cases decline. These smaller communities can grow and prosper by leveraging economic opportunities and jobs from an increasing number of value-adding investments.

The Proposed Modification would be consistent with the following Directions.

- Direction 23: Build the resilience of towns and villages.

  The Proposed Modification would ensure that the steady inflow of economic stimulus delivered to the local community would not be disrupted by a period of reduced activity within the TGO Mine Site.

- Direction 24: Collaborate and partner with Aboriginal communities.

  The Applicant has a long history of collaborating with the Peak Hill Aboriginal community. The Proposed Modification would ensure the Applicant could continue to provide the resources for that ongoing collaboration.

2.1.3 Central Orana Regional Economic Development Strategy

The *Central Orana Regional Economic Development Strategy 2018 – 2022* relevantly aims to capitalise on the growth potential of the mining sector to boost economic development of the Region. The Strategy identifies mining as a growing industry in the Region and that growth in mining sector will likely increase demand in the construction, manufacturing, professional, scientific and technical services and transportation sectors. The Strategy proposes to capitalise on the growth in the mining industry to drive development in renewable energy projects and major infrastructure projects, while providing training opportunities for local and increasing demand for skilled and professional services.

2.1.4 Narromine Shire Community Strategic Plan 2027

The Narromine Shire Community Strategic Plan 2027 provides the community vision and aspirations for the future of the Narromine Shire and a long-term framework to guide and influence delivery of that vision. The Plan lists a number of relevant guiding principles. The following also identifies how the Proposed Modification is consistent with each of those principles.

Principle 1 – Vibrant communities

The Proposed Modification would ensure that the Applicant can continue to offer a range of training and education opportunities for its employees and others consistent with Action 1.3 of the Plan.

Principle 2 – Growing our economy

The Proposed Modification would ensure that the TGO Mine could continue to operate at peak efficiency. The subsequent flow-on effects of maintaining current operating levels would help to sustain local communities and skill bases, and therefore would be consistent with each of Actions identified under this Principle.

Principle 3 – Protecting and enhancing our environment

The Proposed Modification would not result in the disturbance of any additional land and therefore is generally consistent with Principle 3. By utilising the existing RSF1, the Proposed Modification also represents the most efficient use of existing disturbed land.

3. OVERVIEW OF THE PROPOSED MODIFICATION

3.1 INTRODUCTION

The Proposed Modification seeks consent for the construction and use of Stage 9 Cell 2 of RSF1. The Proposed Modification would not result in any other changes to the assessed and approved operations within the TGO Mine Site. The following subsections describe the Proposed Modification. **Appendix 1** presents an updated and consolidated Project Description.

3.2 OVERVIEW OF THE PROPOSED MODIFICATION

Table 5 presents an overview of the Proposed Modification.

3.3 MODIFIED RSF1

3.3.1 Introduction

A concept design for the approved RSF1 Stage 7 to 9 was prepared by GHD in support of MOD4. The resulting report is referred to hereafter as GHD (2019) and is presented as **Appendix 2**. That report, dated December 2019, was initially prepared incorporating RSF1 Stage 9 Cell 2. However, during preparation, it was determined that that RSF1 Stage 9 Cell 2 would not be required based on the following.

- An assumption that RSF2 would be available earlier than the currently anticipated time of April 2022. As described in Section 1.3.5 and 1.4, that assumption is no longer accurate, with RSF1 Stage 9 Cell 1 expected to be full by December 2022 and RSF2 not expected to be available until April 2023.
- A recognition that the preferred final landform for RSF1, in the absence of an approved RSF2, would be for the upper surface to be free draining from west to east. Constructing RSF1 Cell 2 to Stage 8 only would facilitate establishment of that final landform.

As a result, reference is made in GHD (2019) to the fact that RSF1 Stage 9 Cell 2 would not be required. Notwithstanding this, GHD (2019) includes a description and assessment of the following components of RSF1 Stage 9 Cell 2 relevant to the Proposed Modification.

- Stability analysis for Stage 9 Cell 1 and Cell 2 (see Section 4 and Appendix B of GHD (2019)).
- Water balance, incorporating the full footprint to RSF1 (see Section 5 of GHD (2019)).
- Seepage analysis for Stage 9 is relevant to both cells (see Section 6.3.2 of GHD (2019)).
- Concept design included RSF1 Stage 9 Cell 2, as presented in Figures 03, 04, 05

In addition, consistent with industry practice and previous modification applications, GHD (2019) presents a conceptual design for the Residue Storage Facility. Prior to the construction of each successive Stage of the Facility, the Applicant has and would continue to complete pre-construction reports which present detailed designs and assessments relevant to each Stage. If approval for the Proposed Modification is granted, the RSF1 Stage 9 pre-construction report would include detailed designs for both Cell 1 and Cell 2. The detailed design would be consistent with the conceptual design presented in this document and would be compliant with all requirements of the Australian National Committee on Large Dams, the NSW Dam Safety Committee and currently accepted practice for Australian dam engineering.

This section presents a description of the modified Facility, including a summary of the relevant findings and assumptions of the existing engineering and assessment reports for the Facility.

Table 5
Overview of the Proposed Modification

	Original Application	MOD1 November 2013	MOD2 April 2015	MOD3 July 2016[1]	MOD4 May 2020	MOD5 May 2021	MOD6 Current Application
Limits on Approval	• Life of the Mine – until 31/12/2022 • Rate of processing – 1.5Mtpa	• No change	• No change	• No change	• No change	• Life of the Mine – until 31/12/2025 • No other change	• No change
Mining Operations	• Open cut – Caloma 1, Wyoming 1 and Wyoming 3 – Conventional open cut drill, blast, load and haul • Underground – Wyoming 1 – In-pit portal – Conventional long-hole open stoping – Waste rock backfill of completed stopes	• No change	• Open cut – Minor cutback of Caloma 1 to address geotechnical issues with wall stability	• Open cut – Additional minor cutback of Caloma 1 – Development of Caloma 2 • Underground – Underground mining of Caloma 1 and Caloma 1 and exploration of Wyoming 1 – Lining of the workings associated with Wyoming 1, Caloma 1 and Caloma 2	• No change	• No change	• No change
Waste Rock Management	• 3 x surface waste rock emplacement – WRE1, WRE2, WRE3 – Total design volume = 29.66Mm^3 – Maximum height = 40m – Non-acid forming waste rock	• No change	• No change	• Backfilling of Wyoming 3 Open Cut with waste rock. • Extension of WRE3	• Importation of up to 335 000t or 161 250m^3 of waste rock associated with the SAR Exploration decline	• Placement of waste rock into Caloma 2 Open Cut • No other change	• No change

Table 5 (Cont'd)
Overview of the Proposed Modification

	Original Application	MOD1 November 2013	MOD2 April 2015	MOD3 July 2016[1]	MOD4 May 2020	MOD5 May 2021	MOD6 Current Application
Processing Operations	• Conventional carbon-in-leach (CIL) process, comprising – ROM Pad – Crushing, screening and grinding circuit – Gravity circuit – CIL circuit – Gold room • Annual throughput = up to 1.5Mtpa	• No change	• No change	• No change	• Importation of up to 20 000t of bulk sample for batch processing and testing within the Processing Plant.	• No change	• No change
Residue Management	• RSF1 – Two cells – Area - 42ha – Maximum Stage – Stage 6 – Maximum crest elevation – 280.5m AHD. – Maximum residue elevation – 280.0m AHD. – Design volume – 4.8Mm^3 – Liner – engineered clay – Construction method – upstream lifts – Perimeter discharge, centre decant	• Amendment of fauna deterrent measures • Cyanide monitoring – Monitoring location – residue transfer pipe inlet (not outlet). – WAD cyanite monitoring (not total cyanide)	• No change	• Construction of a downstream lift for Stage 2 of the Residue Storage Facility	• RSF1 – Stages 7 to 9 – Increased capacity to approximately 8.93Mt. – Increase in maximum elevation from 280.5m AHD to 286.5m AHD. – Increased footprint from approximately 50ha to approximately 55ha	• RSF2 – Stages 1 and 2 – Capacity – 4.5Mt – Maximum elevation – 271.3m AHD – Footprint – approximately 64.3ha • No other change	• RSF1 – Stage 9 Cell 2 – Increased capacity to approximately 9.33Mt. – Increase in maximum elevation of Cell 2 from 284.5m AHD to 286.5m AHD. • No other change

Table 5 (Cont'd)
Overview of the Proposed Modification

	Original Application	MOD1 November 2013	MOD2 April 2015	MOD3 July 2016[1]	MOD4 May 2020	MOD5 May 2021	MOD6 Current Application
Water Management	• Water balance (priority order) – Storages – Residue Storage Facility, Process Water Dam, Settling Dam, Mine Dewatering Ponds 1 and 2, Raw Water Dam Sediment Basins 1 to 5. – Sources – process water dams, sediment basins, water supply pipeline (1GL/year). – Uses – dust suppression, processing. • Sediment and Erosion Control. – Sediment Basins 1 to 5, clean and dirty water diversions. – Separation of clean, dirty and contaminated water.	• No change	• No change	• Minor adjustments to the Central Clean Water Channel and WRE3 Dirty Water Drain and construction of Sediment Basins 6 and 7 and Wyoming Central Dam.	• No change	• No change. RSF2 to be internally draining with capacity to store 1 in 10 000 AEP rainfall event. • Water balance indicates adequate capacity to store process/decant water.	• No change

Note 1: MOD3, determined in July 2016, forms basis for comparison for modification applications submitted after the date on which MP 09_0155 was transitioned from a Part 3A to a State Significant Development Project, namely 16 August 2019.

3.3.2 Design of the Modified Residue Storage Facility

Figures 3 and **6**, respectively, present the approved and proposed layout of RSF1. **Table 6** presents an overview of the design criteria for the approved and proposed Facility. In summary, the design of RSF1 Stage 9 Cell 2 would be substantially the same as that for the remainder of RSF1. No material additional buttressing or land disturbance is anticipated and the Proposed Modification would result in the final elevation of residue within both Cells 1 and 2 being approximately 286m AHD.

Table 6
Comparison of Approved and Modified RSF1

Design Component	Approved RSF1		Proposed Modification	
Maximum approved stage	Stage 9, Cell 1	Stage 8, Cell 2	Stage 9, Cell 1	Stage 9, Cell 2
Maximum crest elevation	286.5m AHD	284.5m AHD	286.5m AHD	286.5m AHD
Maximum residue elevation	286.0m AHD	284.0m AHD	286.0m AHD	286.0m AHD
Slope of outer face	1:3 (V:H)		1:3 (V:H)	
Design capacity (approximate)	8.93Mt		Approximately 9.33Mt	
Residue discharge	Perimeter discharge		Perimeter discharge	
Decant system	Central decant		Central decant	
Minimum decant pond capacity	1:10 000-year AEP flood event		1:10 000-year AEP flood event	
External decant storage	Wyoming Central Dam		Wyoming Central Dam	
Basal liner • Material • Permeability	Clay Maximum 1 x 10^{-9} over 1m		Clay Maximum 1 x 10^{-9} over 1m	
Spillway	Not required, designed for no spill		Not required, designed for no spill	
ANCOLD Category • Dam Failure Consequence • Environmental Spill Consequence	Significant Significant		Significant Significant	

3.3.3 Construction and Operation of the Modified Residue Storage Facility

Consistent with the approved RSF1, construction of RSF1 Stage 9 Cell 2 would utilise waste rock material sourced from existing Waste Rock Emplacements or from ongoing mining operations. With the exception of the eastern embankment, the Cell would be constructed using upstream lifts whereby the facility embankment would be constructed on the surface of the residue emplaced during the previous Stage (**Figure 7**). The eastern embankment would be constructed using centreline lift methodology, with the existing Waste Rock Emplacement 1 acting as the buttress for the embankment.

Construction operations for RSF1 Stage 9 Cell 2 would be undertaken concurrently with construction of RSF2 Stage 1 and would utilise the same construction fleet. Consistent with the approved RSF2 construction operations, construction would be undertaken between 7:00am and 6:00pm only and would be expected to take 4 to 6 weeks to complete.

The Facility would continue to operate as a subaerial residue deposition facility, with residue deposited from spigots around the perimeter of the Facility. Residue would be deposited onto a "beach", with supernatant water permitted to flow to a central decant tower from where it would be pumped to either the Process Water Pond or the Wyoming Central Dam (**Figure 2**).

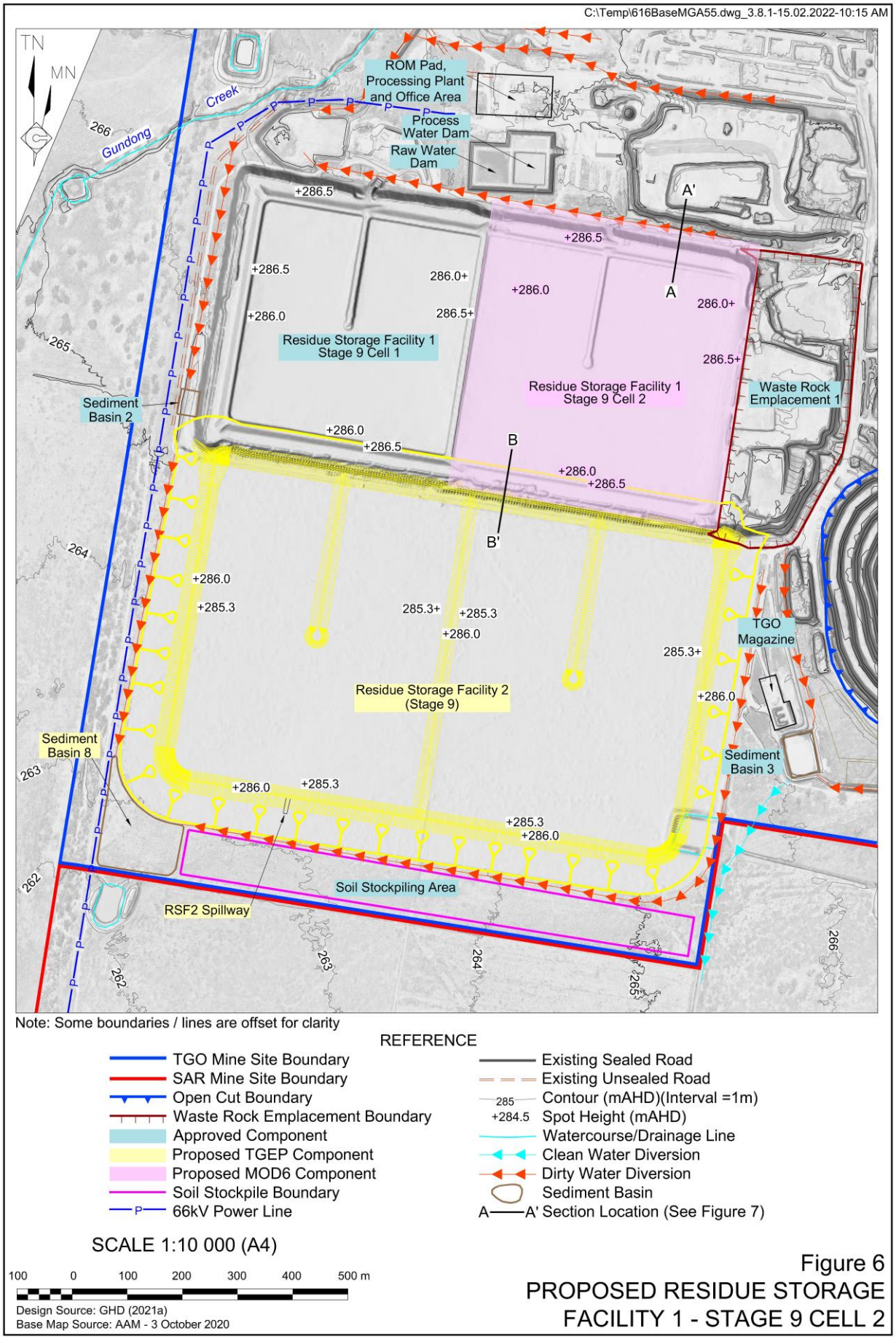


Figure 6
PROPOSED RESIDUE STORAGE FACILITY 1 - STAGE 9 CELL 2

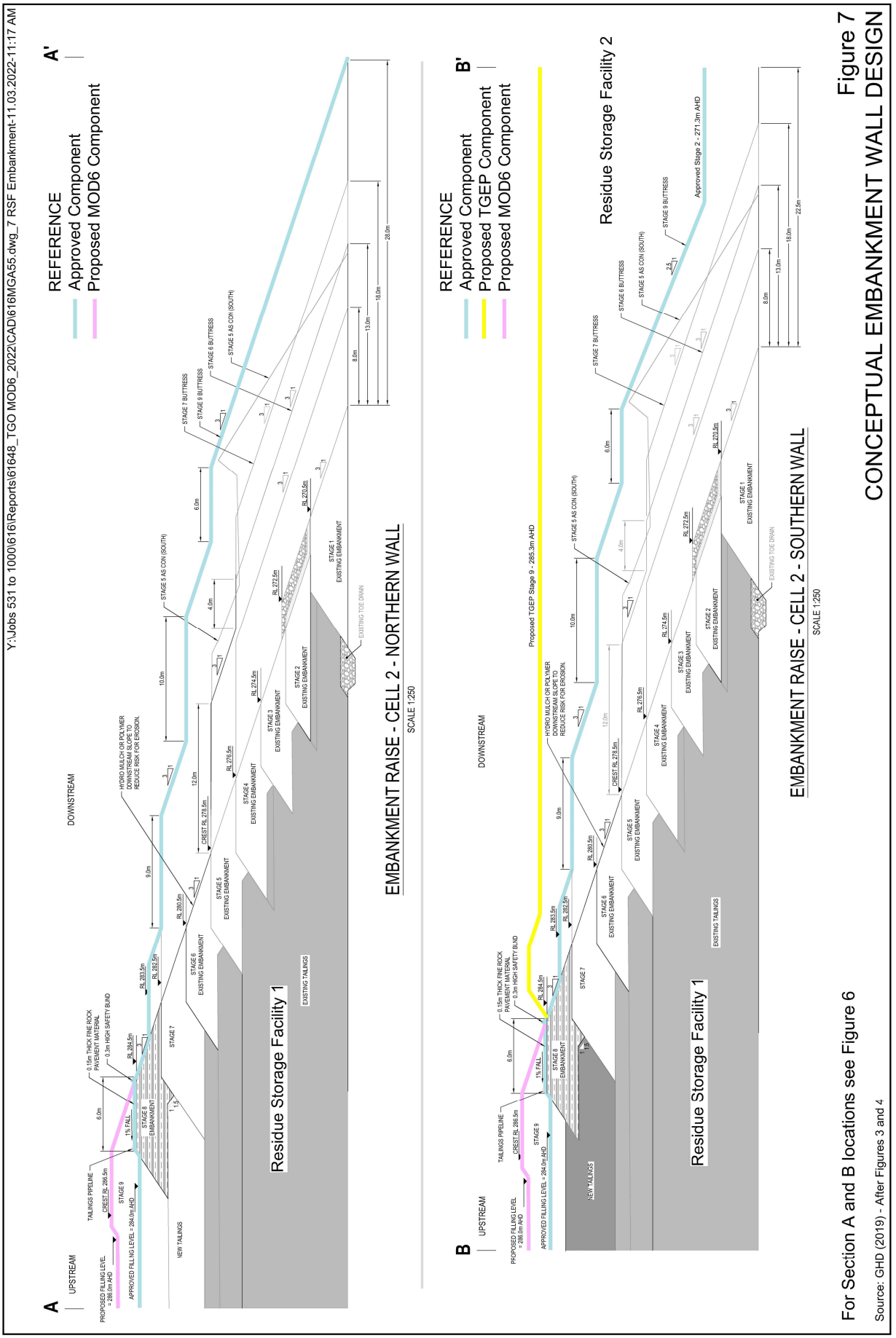


Figure 7
CONCEPTUAL EMBANKMENT WALL DESIGN

For Section A and B locations see Figure 6

Source: GHD (2019) - After Figures 3 and 4

3.3.4 Stability Analysis

GHD (2019) undertook an analysis of the stability of the Stage 7 and Stage 8 and 9 Raises for Cells 1 and 2. The detailed results of those assessments are presented in Sections 3 and 4 of GHD (2019). In summary, GHD (2019) determined that Cell 2 had the same buttress requirements for both Stage 8 and Stage 9. As a result, the Proposed Modification does not require additional buttressing or increased disturbance area.

Detailed design for the RSF would further clarify the buttress requirements.

3.3.5 Water Balance Analysis

GHD (2019) undertook an analysis of the water balance for the Residue Storage Facility, including Stage 9 Cell 2, under mean, as well as 5th and 95th percentile rainfall conditions. The detailed results of that analysis are presented in Section 5 of GHD (2019). In summary, GHD (2019) determined that even under 95th percentile wet rainfall years, the volume of water within the process water system would remain very substantially under the maximum capacity of approximately 575ML.

3.3.6 Seepage Analysis

GHD (2019) undertook an analysis of expected seepage from RSF1, including Stage 9 based on a one-dimensional calculation of vertical advective flow. The detailed results of those assessments are presented in Sections 3 and 4 of GHD (2019). Three scenarios were modelled as follows.

1. Seepage from decant pond to the base the residue.
2. Seepage from decant pond to shallow groundwater assuming a foundation permeability of 1 x 10^{-8}m/s.
3. Seepage from decant pond to shallow groundwater assuming a foundation permeability of 1 x 10^{-9}m/s.

Table 7 presents the results of that analysis. In summary, the modelling indicates that the construction of Stage 9, including Cell 2, of the Facility would result in a marginal reduction in the seepage rate from the decant pond when compared with Stage 6 for Scenarios 1 and 2 and a marginal increase in the rate for Scenario 3.

Table 7
Results of Seepage Analysis

Scenario	Stage 6		Stage 9	
	Calculated seepage volume (kL/d)	Seepage time (years)	Calculated seepage volume (kL/d)	Seepage time (years)
Scenario 1	23.1	33.4	22.8	52
Scenario 2	22.7	57.1	22.6	70
Scenario 3	4.9	265.7	6.9	230
Source: GHD (2019) – After Table 6.1				

3.3.7 Site Decommissioning and Rehabilitation

Decommissioning of RSF1 and 2 would be broadly consistent with the approved closure concept for Facilities. However, construction of RSF1 Stage 9 Cell 2 would require a reorientation of surface water flows from the Facility. **Figure 8** presents the conceptual final landform for the combined Residue Storage Facility, as modified. In summary, the proposed final landform would comprise the following.

- A reshaped RSF1 that would direct surface water to an engineered drop structure constructed on the embankment between RSF1 and 2.
- A reshaped RSF2 that would direct surface water evenly across the surface of the Facility to be discharged to natural drainage via non-concentrated flow on the western, southern and eastern embankment of the Facility.

A detailed closure plan would be prepared a minimum of 3 years prior to the closure of the combined facility, namely by 31 December 2022 or by 31 December 2029 in the event that the TGEP application is approved. That plan would present detailed closure designs, including shaping and capping requirements and an assessment of the stability of and seepage from the closed Facility in the short, medium and long-term.

Notwithstanding the above, the following indicative procedures would be implemented during closure of the Facility.

- On completion of placement of residue, the decant ponds would be emptied and the tailings surface permitted to dry out. Chemical dust suppressants would be utilised to prevent dust lift-off as required.
- The surface of RSF1 would be regraded to permit surface water to flow to an engineered drop structure between the Residue Storage Facilities 1 and 2.
- The surface of RSF2 would be regraded to permit surface water to flow outward from the drop structure to the outer western, southern and eastern embankments.
- The upper surface of the facility would be capped indicatively with 1m of clay and revegetated to grassy woodland as indicated in the currently approved MOP.
- Perimeter drains would be established to direct water from the surface of the Residue Storage Facility to natural ground level, then to a suitable storage facility prior to the completion of revegetation operations.
- Consistent with the approved TGO Mine, once the revegetation operation are complete and testing indicates that discharged water would not pollute surrounding waters, surface water would be permitted to be discharged from the TGO Mine Site.

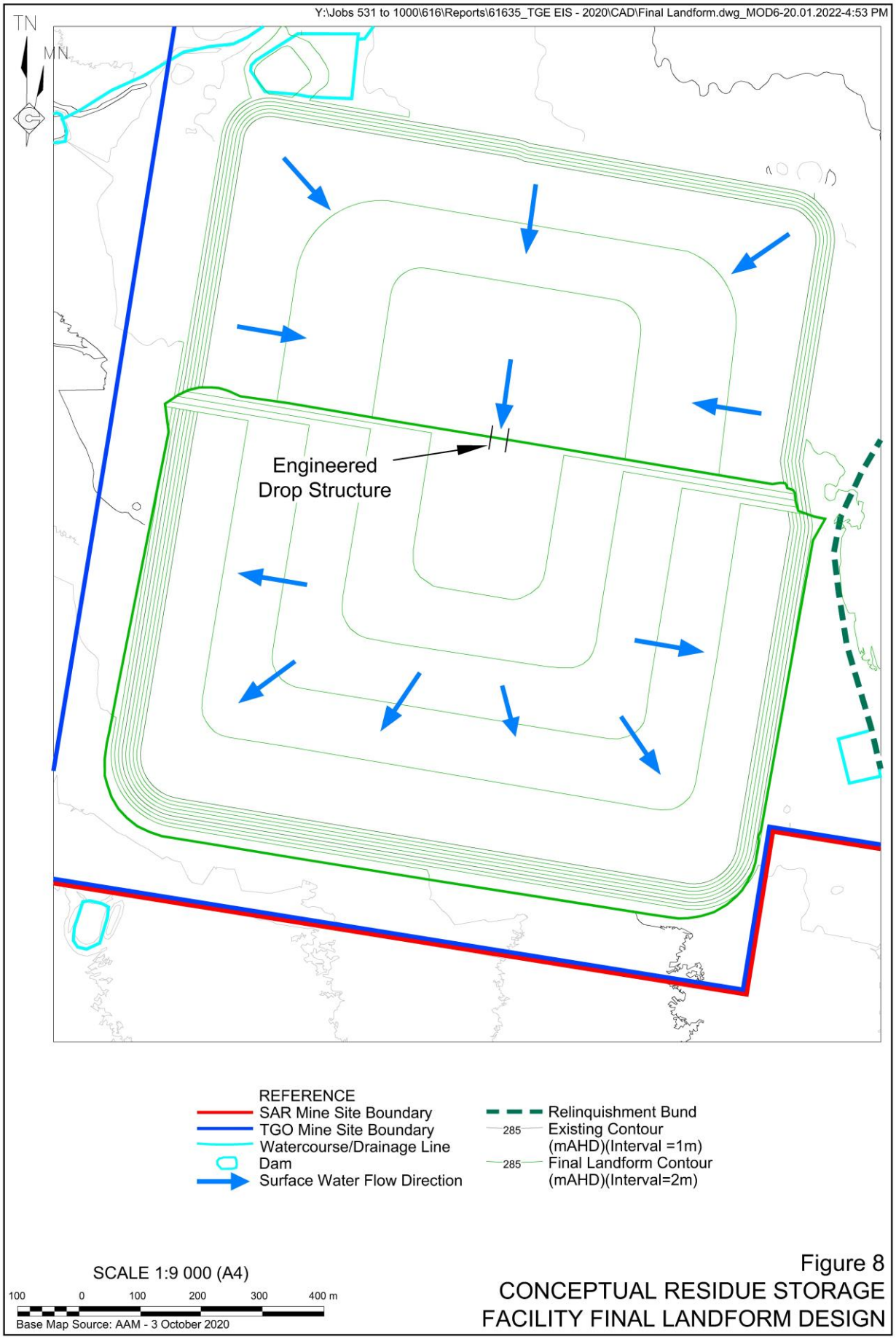


Figure 8
CONCEPTUAL RESIDUE STORAGE FACILITY FINAL LANDFORM DESIGN

4. STATUTORY CONTEXT

4.1 INTRODUCTION

This section identifies the relevant statutory requirements that must be considered by the consent authority before the development application may be determined. The relevant statutory requirements are described in terms of power to grant approval, permissibility, and other required approvals. The section concludes with the statutory compliance matters that must be considered by the consent authority.

4.2 EXISTING APPROVALS AND REGULATORY CONTROLS

Table 8 presents the approvals, leases and licences held for the existing TGO Mine. An application for development consent for the Tomingley Gold Extension Project is currently before the Department of Planning and Environment.

Table 8
Current Consents, Authorisations and Licenses

Page 1 of 2

Number	Granted by	Grant Date	Expiry Date	Purpose
Development Consent				
MP09_0155	Minister for Planning and Infrastructure	24 Jul 2012	31 Dec 2025	• Construction and operation of the TGO Mine. • Modified 5 times (see Section 1.1).
Mineral Authorities (see **Figure 1**)				
ML1684	Minister for Mineral Resources	11 Feb 2013	11 Feb 2034	Mining activities at the TGO Mine.
ML1812		19 Nov 2021	11 Feb 2034	
EL5675		17 Jan 2000	16 Jan 2023	Exploration Activities.
EL5830		05 Apr 2001	04 Apr 2022	
EL5942		03 May 2002	02 May 2024	
EL6085		20 May 2003	20 May 2024	
EL6319		12 Oct 2004	11 Oct 2020	
EL8676		27 Nov 2017	27 Nov 2023	
EL8794		20 Sep 2018	20 Sep 2024	
Licences – Environmental				
EPL20169	Environment Protection Authority	23 Oct 2012	Renewed annually	Regulation of noise, dust and water emissions from the Mine Site.
Flood Work Approval 80FW723901	Department of Primary Industries – Office of Water	21 Sep 2015	2 Jan 2028	Approval for Gundong Creek levy.
WAL20270	Department of Primary Industries – Office of Water	20 Aug 2012	NA	Licence to extract groundwater up to 1 000ML/year from the water supply bore east of Narromine.
WAL28643	Department of Primary Industries – Office of Water	13 Aug 2013	NA	Licence to extract groundwater up to 220ML/year from NSW Murray Darling Basin Fractured Rock Aquifer.
WAL29266	Department of Primary Industries – Office of Water	16 Jan 2012	N/A	Licence to extract groundwater up to 70ML/year from NSW Murray Darling Basin Fractured Rock Aquifer.

Table 8 (Cont'd)
Current Consents, Authorisations and Licenses

Number	Granted by	Grant Date	Expiry Date	Purpose
Licences – Environmental (Cont'd)				
Works Authority Deed	RMS	-	-	Newell Highway underpass.
S34A Crowns Lands Licence RI517394	Minister for Crown Lands	26 Jun 2013	Ongoing	Licence to permit construction of electricity infrastructure.
On-Site Sewerage Management System Approval	Narromine Shire Council	30 Sep 2013	Ongoing	Approval to operate sewage treatment facility within the Mine Site.
Source: Tomingley Gold Operations Pty Ltd				

4.3 STATUTORY REQUIREMENTS FOR THE PROJECT

4.3.1 Power to Modify the Consent

Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* states the following.

> *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent …*

Clause 2.7(2) of the *State Environmental Planning Policy (Planning Systems) 2021* states the following.

> *The Independent Planning Commission is also declared, under section 4.5(a) of the Act, to be the consent authority in respect of an application to modify a development consent that is made by a person who has disclosed a reportable political donation under section 10.4 of the Act in connection with the modification application.*

As the Applicant has not made a reportable political donation, the Minister for Planning and Homes, or their delegate, is the consent authority and has the power to modify MP 09_0155.

4.3.2 Permissibility

The TGO Mine Site includes land zoned under the *Narromine Local Environmental Plan 2011* (Narromine LEP) as:

- RU1 - Primary Production; and
- SP2 – Infrastructure (**Figure 9**).

Open cut and underground mining are permissible as follows in each of these zones.

- Zone RU1 – Open cut mining is permissible with consent in Zone RU1.

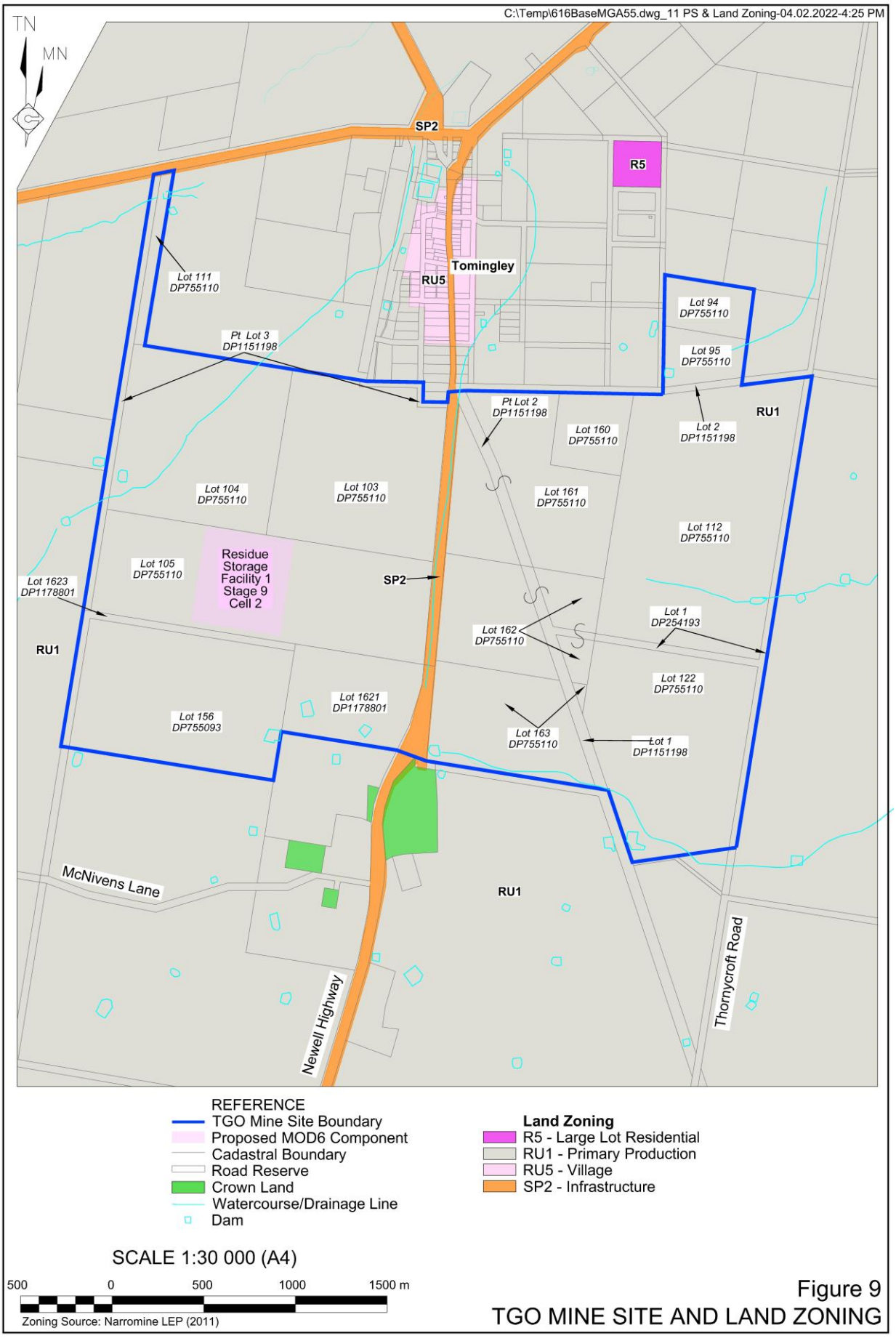


Figure 9
TGO MINE SITE AND LAND ZONING

- Zone SP2 – Mining is prohibited on land zoned SP2. However, aquaculture, a type of agriculture, is permissible with consent on land within that Zone. Clause 2.9(1)(b)(i) of the *State Environmental Planning Policy (Resources and Energy) 2021* (Resources SEPP) permits mining with consent on any land where agriculture is permissible.
- Underground mining is permissible with consent on any land under Clause 7(1)(a) of the Mining SEPP.

4.3.3 Other Approvals

Other approvals that are required to be amended or modified to carry out the Proposed Modification include the following.

- Dams Safety NSW

  RSF1 is a declared dam under the *Dams Safety Act 2015*. Detailed design and related reports will be required to be provided to Dams Safety NSW prior to and following construction of RSF1 Stage 9 Cell 2.

No amendments or modifications to the following approvals will be required for the following reasons.

- Mineral Authorities – the Proposed Modification would not result in disturbance outside the areas of the existing ML1684.
- Environment Protection Licence – the Proposed Modification would not result in additional activities that are not already approved under EPL20169. In addition, no additional environmental monitoring would be required, with all existing groundwater and surface water monitoring programs to continue.
- *Water Management Act 2000* Licences – the Proposed Modification would not result in an increase in the volume of water to be taken.

4.4 PRECONDITIONS TO EXERCISING THE POWER TO GRANT APPROVAL

Table A3.1 in **Appendix 3** presents an overview of the relevant pre-conditions to the consent authority exercising its power to grant approval.

4.5 MANDATORY MATTERS FOR CONSIDERATION

Table A3.2 in **Appendix 3** presents an overview of the relevant mandatory matters for consideration by the consent authority in determining the application for development consent.

5. ENGAGEMENT

5.1 GOVERNMENT AGENCY CONSULTATION

Department of Planning and Environment

The Applicant consulted with Department of Planning and Environment (DPE) during preparation of this Modification Report with a *Briefing Paper* outlining the Proposed Modification provided on 25 January 2022.

The DPE requested the following matters be included in the *Modification Report*.

- The impact of increased capacity on existing buttressing design and requirements (see Section 3.3 and **Appendix 2**).
- The need for consideration of potential impacts of the integration of RSF1 and RSF2 to visual amenity in regard to the approved design and that proposed as part of the TGEP (See Sections 3.3.7 and 6.4).

Other Government Agencies

The *Briefing Paper* for the Proposed Modification was sent to the following agencies on 25 January 2025.

- Narromine Shire Council
- Department of Regional NSW – Resources Regulator
- NSW Environmental Protection Agency
- Dams Safety NSW
- Department of Regional NSW – Mining, Exploration and Geoscience

Reponses were received from the NSW Environmental Protection Agency, Dams Safety NSW and Mining, Exploration and Geoscience; however, no specific requests for information or otherwise was received.

5.2 COMMUNITY CONSULTATION

The Applicant has engaged in extensive community consultation in relation to its activities within the TGO Mine Site, as well as for the Tomingley Gold Extension Project and the Proposed Modification. Consultation has included the following.

- Community newsletters[1]

  Community Newsletters 24 to 27 were released in November 2020, May and October 2021 and February 2022. Each newsletter provided an update on the Tomingley Gold Extension Project status and the Proponent's work to extend and continue the life of the Mine. Newsletter 27 provided an overview of the Proposed Modification.

[1] Community newsletters are available at https://www.alkane.com.au/projects/tomingley-gold-project/tomingley-gold-operations/community-resources/tgo-community-newsletter/

- Community Consultative Committee[2]

  The Community Consultative Committee met in February, May and November 2021 and February 2022. The Applicant raised the Proposed Modification with the Committee at the February 2022 meeting. No comments were received, with the Committee supportive of the modification.

- Individual landholder meetings.

  The Proponent has met face to face with surrounding landholders on multiple occasions throughout 2021 and 2022, including with landholders to the south of the TGO Mine Site on 8 February 2022. During the February 2022 meetings, the Proposed Modification was discussed, and no concerns or issues were raised. Indeed, the landholders expressed surprise that a modification was required at all.

[2] CCC meeting minutes are available at https://www.alkane.com.au/projects/tomingley-gold-project/tomingley-gold-operations/community-resources/consultative-committee/

6. ASSESSMENT OF IMPACTS

6.1 INTRODUCTION

This section provides an assessment of the impacts associated with those features of the local environment which could potentially be affected by the Proposed Modification. This Section includes an assessment of the anticipated environmental impacts of the Proposed Modification, taking into account the Applicant's prior environmental performance and the existing approved management and mitigation measures. A description of the proposed design and/or operational safeguards is also presented. This Section concludes with an overview of those environmental aspects that would not be impacted by the Proposed Modification, and a justification for why that is the case.

6.2 NOISE

6.2.1 Local Setting and Assessment Criteria

Figure 10 presents the location of residences surrounding the TGO Mine Site. The closest sensitive receptors to RSF1 Stage 9 Cell 2 are Residences R2 and R6, at a distance of approximately 2.2km and 2.3km respectively.

Condition 3A of Schedule 3 of MP 09_0155 identifies relevant noise criteria for the TGO Mine. In summary, day-time noise criteria for Residences R2 and R6 are as follows. Evening and night-time criteria are not relevant for the Proposed Modification as the proposed construction operations would be undertaken during the day-time only.

- Residence R2.....36dB(A)
- Residence R6.....35dB(A)

It is noted that the *Noise Policy for Industry* default day-time noise criteria is 40dBA, substantially higher than the criteria identified y MP 09_0155 as those criteria were established in accordance with the now superseded *Industrial Noise Policy.*

6.2.2 TGO Environmental Performance

The Applicant has engaged Muller Acoustic Consulting Pty Limited (MAC) to undertake monthly attended noise monitoring surrounding the TGO Mine Site, including at Residences R2 and R6, since June 2016.[3] There have been no non-compliances with the relevant compliance criteria at either of these residences since monitoring commenced.

In addition, there have been no noise-related complaints in relation to the TGO Mine since August 2017 and no complaints related to construction of RSF1.

[3] Monthly noise monitoring reports are available from https://www.alkane.com.au/projects/tomingley-gold-project/tomingley-gold-operations/tgo-reports/environmental-reports/.

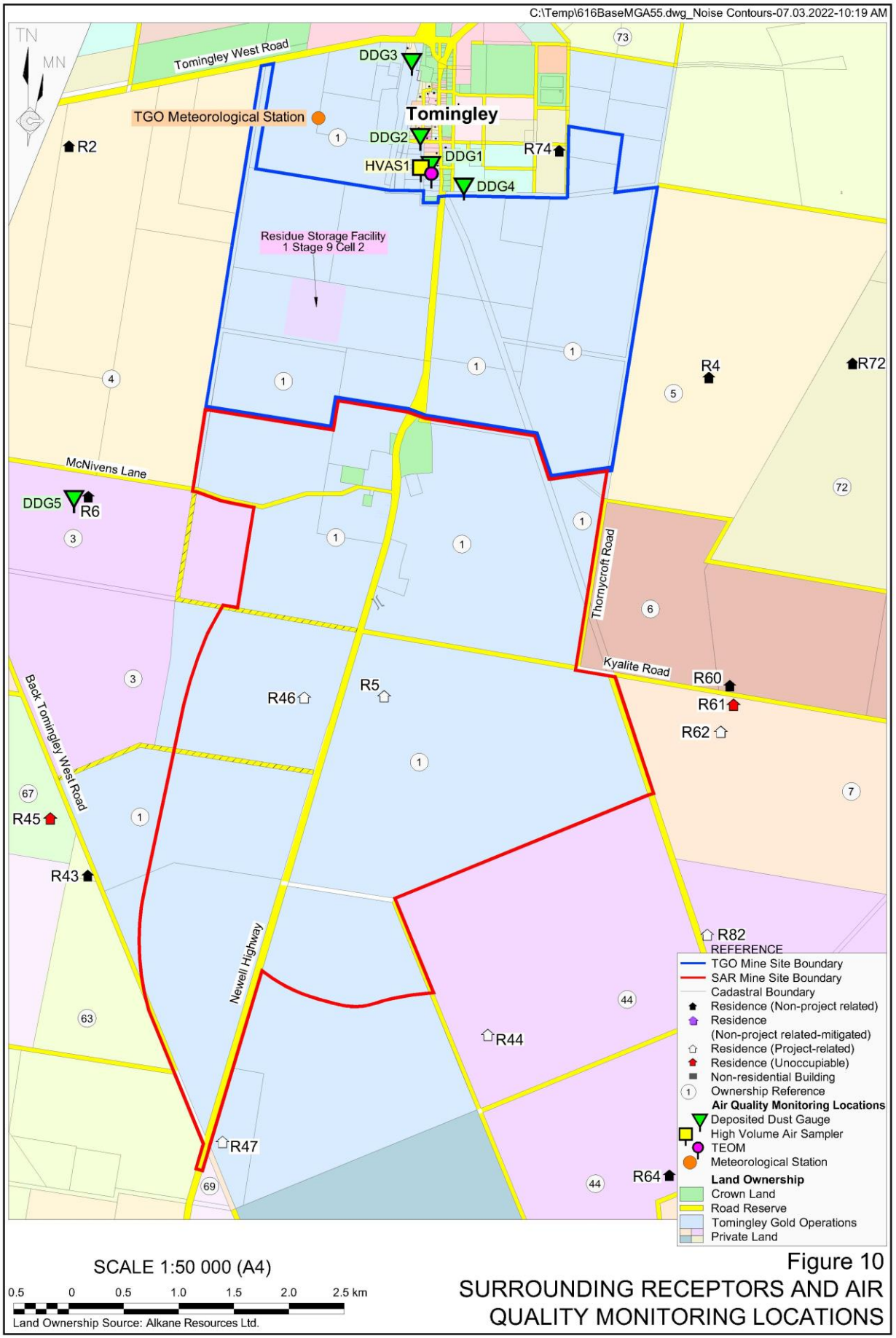


Figure 10
SURROUNDING RECEPTORS AND AIR QUALITY MONITORING LOCATIONS

6.2.3 Management and Mitigation Measures

The Applicant would continue to implement the following relevant noise-related management and mitigation measures.

- Continue to implement the approved *Noise Management Plan*. That plan would be reviewed following modification of the development consent and, if required, it would be revised.
- Utilise broadband reversing alarms on all mobile equipment.
- Continue to use meteorological forecasting information to identify periods of noise enhancing conditions such as inversions or noise enhancing winds to inform planning of surface activities.
- Ensure that all personnel are inducted prior to work at the TGO Mine Site, including in regard to noise impacts.
- Continue to undertake attended noise monitoring at selected locations surrounding the TGO Mine Site.

6.2.4 Assessment of Impacts

6.2.4.1 Introduction

The assessment of noise-related impacts associated with construction of RSF1 Stage 9 Cell 2 has been undertaken using two methodologies as follows.

- Reliance on previously completed noise assessment for Modification 5 (construction of RSF2 Stages 1 and 2).
- Reliance on attended noise monitoring undertaken during prior RSF1 construction operations.

6.2.4.2 Prior Noise Assessment

The Application for MOD 5 of MP 09_0155 relied upon a *Noise Impact Assessment* for the construction of RSF2 Stages 1 and 2 prepared by MAC and referred to hereafter as MAC (2020). A copy of MAC (2020) is presented as Appendix 4 of RWC (2020).

MAC (2020) is considered to be representative of noise emissions associated with the Proposed Modification for the following reasons.

- MAC (2020) assessed concurrent TGO mining operations and construction of RSF2 Stages 1 and 2.
- Construction of RSF1 Stage 9 Cell 2 would be undertaken concurrently with construction of RSF2 Stage 1 and would utilise a single construction fleet. As a result, the Proposed Modification would not result in additional noise emissions from the TGO Mine Site compared to those assessed for MOD 5.

- During construction of RSF1 Stage 9 Cell 2, noise emitting equipment would be located further from Residences R2 and R6 than during construction of RSF2. As a result, MAC (2020) is likely to overestimate noise impacts associated within construction RSF1 Stage 9 Cell 2.

Table 9 presents the results of the noise assessment undertaken by MAC (2020). In summary, noise emissions at Residences R2 and R6 during construction of RSF2 Stage 1 and 2 are expected to comply with both the day-time noise criteria identified in Condition 3A of Schedule 3 of MP 09_0155 and the default Noise Policy for Industry criterion. As a result, noise emissions at Residences R2 and R6 during construction of RSF1 Stage 9 Cell 2 would similarly comply with those criteria.

Table 9
Predicted Operational Noise Levels

Residence	TGO Mining Operations Alone	Residue Storage Facility – Bulk Earthworks	Residue Storage Facility – Final Trim	Project Approval Criteria dB $L_{Aeq(15min)}$	Noise Policy for Industry Criterion dB $L_{Aeq(15min)}$
R2	27	34	<30	36	40
R6	27	35	31	35	
Source: MAC (2020) – After Table 7					

6.2.4.3 Prior Noise Monitoring

The following presents the approximate dates during which construction operations for RSF1 were undertaken.

- RSF1 Stage 1 2013
- RSF1 Stage 2 ..... June to October 2015
- RSF1 Stage 3 .....July to October 2016
- RSF1 Stage 4 ..... March to August 2017
- RSF1 Stage 5 ..... March to July 2018
- RSF1 Stage 6 .....November 2019
- RSF 1 Stage 7 ..... November to December 2020
- RSF1 Stage 8 Cell 1..... August 2021 to present

Monthly attended monitoring was undertaken at both Residences R2 and R6 during construction of Stages 3 to 8. In all cases, noise emissions were determined to be less than the relevant criteria.[4]

6.2.4.4 Conclusion

Based on the above, the Applicant contends that construction of RSF1 Stage 9 Cell 2 would not result in exceedance of the relevant noise criteria. In addition, as the Proposed Modification would utilise the same construction fleet as that used for construction of RSF2 Stage 1, there would be no cumulative noise-related impacts.

[4] Monthly noise monitoring reports are available from https://www.alkane.com.au/projects/tomingley-gold-project/tomingley-gold-operations/tgo-reports/environmental-reports/.

Operation of the RSF1 Stage 9 Cell 2 would, consistent with the existing operation of RSF1, be largely non-audible.

6.3 AIR QUALITY

6.3.1 Local Setting and Assessment Criteria

The air quality setting surrounding the TGO Mine Site is typical of rural environments in central NSW, with particulate matter the principal pollutant. Emissions of particulate matter are predominantly associated with the following.

- Agricultural sources, including ploughing, sowing and stock moving in paddocks.
- Transport-related sources, including vehicles travelling on unsealed roads.
- Wind generated sources, including emissions from disturbed or non-vegetated land surrounding the TGO Mine Site.
- TGO-related sources, including emissions associated with material movements and management, the operation of fixed and mobile plant and wind erosion from disturbed sections of the TGO Mine Site, including waste rock emplacements and other disturbed areas.

Figure 11 presents the wind rose for calendar year 2017 based on data collected at the TGO Meteorological Station. In summary, winds are predominantly from the east-northeast.

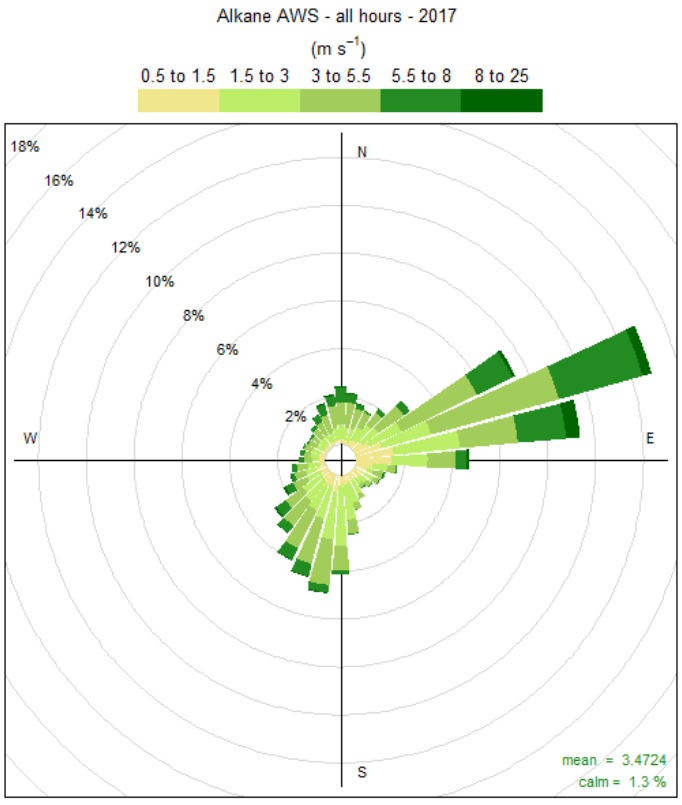


Figure 11
TGO Mine Site Wind Rose – 2017

Source: Northstar (2020) – Figure 12

Table 10 presents the air quality criteria identified by Condition 17 of Schedule 3 of MP 19_0155 for the TGO Mine.

Table 10
Air Quality Criteria

Particulate Matter Type	Averaging Period	Impact	Criterion
Total Suspended Particulates	Annual	Total	90µg/m^3
PM_{10}	Annual	Total	25µg/m^3
	24 hour	Total	50µg/m^3
Deposited Dust	Annual	Incremental	2g/m^2/month
		Cumulative	4g/m^2/month

6.3.2 TGO Environmental Performance

The Applicant operates the following air quality monitoring network surrounding the TGO Mine Site (**Figure 10)**.

- A Tapered Element Oscillating Microbalance (TEOM), which continuously measures PM_{10} (particulate matter with an aerodynamic diameter of 10µm or less) in the southern section of Tomingley village.
- A High-Volume Air Sampler that measures total suspended particulates (TSP) on a 6-day rotating cycle in the southern section of Tomingley village.
- Five dust deposition gauges that measure deposited dust levels on a monthly cycle at various locations around the perimeter of the TGO Mine and within Tomingley village, including in the vicinity of Residence R6 (DDG5).

The Applicant has a strong history of compliance with the air quality criteria specified **Table 10**.[5] There have been no exceedances of the annual average deposited dust criteria at DDG5 since monitoring commenced in July 2013. Section 6.3.4.3 presents an overview of the deposited dust monitoring data at DDG5 since 2015. There have been three individual months with deposited dust levels substantially higher than 4g/m^2/month, namely December 2015, January 2019 and February 2020. The 2015 result was attributable to harvesting operations adjacent to the dust gauge and the 2019 and 2020 results to regional-scale dust storms. The impact of the 2019 and 2020 drought is also evident in the results.

There have been no air quality-related complaints in relation to the TGO Mine since March 2018 and no complaints related to construction of RSF1.

[5] Monthly environmental monitoring reports are available from https://www.alkane.com.au/projects/tomingley-gold-project/tomingley-gold-operations/tgo-reports/environmental-reports/.

6.3.3 Management and Mitigation Measures

The Applicant would continue to implement the following relevant air quality-related management and mitigation measures.

- Continue to implement the approved *Air Quality Management Plan*. That Plan would be reviewed following modification of the development consent and, if required, it would be revised.
- Disturb only the minimum area necessary for mining operations.
- Use water sprays/sprinklers or water carts on internal, unsealed roads and in other areas to minimise dust emissions, as required.
- Clearly mark all haul roads and other roads and tracks and ensure that signposted speed limits are complied with.
- Minimise drop heights during loading and unloading of waste rock and ore and avoid tipping material down a tip face.
- Apply water to material stockpiles prior to loading, transportation and unloading to limit dust emissions, as required.
- Monitor meteorological conditions (including via automated alerts) to identify periods of adverse weather (little or no rainfall and wind speeds above 30km/h) and implement appropriate additional mitigation measures, including:
  - increased use of water sprays and water carts; and
  - relocation or ceasing operations likely to generate significant dust emissions.
- Undertake visual monitoring and mandatory reporting of visible dust emissions to site supervisors and implement measures to minimise or reduce observed dust emissions.
- Monitor real-time dust emissions (including via automated alerts) using the existing real-time dust monitor and implement measures to minimise or reduce observed dust emissions when predefined triggers are exceeded.
- Progressively implement the following additional management measures as a Trigger Action Response Plan in the event that the existing TEOM indicates elevated concentrations of $PM_{10.}$
  - Reduce speed of haul trucks and increase the frequency of watering if safe to do so.
  - Cease the transportation and unloading of material.

6.3.4 Assessment of Impacts

6.3.4.1 Introduction

The assessment of air quality-related impacts associated with construction of RSF1 Stage 9 Cell 2 has been undertaken using two methodologies as follows.

- Reliance on previously completed air quality assessment for Modification 5 (construction of RSF2 Stages 1 and 2).
- Reliance on prior air quality monitoring undertaken during prior RSF1 construction operations.

6.3.4.2 Prior Air Quality Assessment

The Application for MOD 5 of MP 09_0155 relied upon an *Air Quality Impact Assessment* prepared by Northstar Air Quality Pty Ltd (Northstar) (Northstar, 2020). A copy of Northstar (2020) is presented as Appendix 5 of RWC (2020). That assessment was prepared in accordance with the *Approved Methods for the Modelling and Assessment of Air Quality in NSW* (NSW EPA, 2017).

Northstar (2020) is considered to be representative of particulate emissions associated with the Proposed Modification for the following reasons.

- Construction of RSF1 Stage 9 Cell 2 would be undertaken using the construction fleet that would be used for the construction of RSF2. The Proposed Modification would not result in an overall increase in the quantum of emissions associated with the Proposed Modification.
- The location of particulate emissions associated with construction of RSF1 Stage 9 Cell 2 would be similar to those associated with construction of RSF2 as the two Facilities are located adjacent to each other.

Tables 11 and **12** present an overview of the results of the air quality assessment undertaken by Northstar (2020) for MOD5 as it applied to Residence R6.In summary, the incremental and cumulative impacts associated with construction of RSF2 at Residence R6 are expected to be substantially less than the relevant air quality criteria. For the reasons identified above, the Applicant contends that air quality impacts associated with construction of RSF1 Stage 9 Cell 2 would be no greater than those assessed by Northstar (2020).

Table 11
Modelled Incremental Air Quality Impacts

	Annual average µg/m³				Maximum 24-hour µg/m³	
Receptor	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**Dust Deposition[2]**	**PM_{10}**	**$PM_{2.5}$**
Criterion	**90**	**25**	**8**	**2**	**50**	**25**
Maximum[1]	0.5	0.2	<0.1	<0.1	3.0	0.7
R6	0.5	0.2	<0.1	<0.1	2.4	0.5
Note 1: Maximum of all receptors assessed Note 2: Units = g/m²/month						
Source: RWC (2020) – After Table 22. Originally After Northstar (2020) – Table 18.						

Table 12
Modelled Cumulative Annual Average Air Quality Impacts

Receptor	Annual average µg/m³		
	TSP	PM_{10}	Dust Deposition[2] (background from DDG5)
Criterion	**90**	**25**	**4**
Maximum	47.3	20.1	<1.8
R6	47.3	20.1	<1.8
Note 1: Maximum of all receptors assessed Note 2: Units = g/m²/month			
Source: RWC (2020) – After Table 23. Originally After Northstar (2020) – Table 19.			

It is noted that Northstar (2020) did not assess air quality impacts associated with Residence R2. The Applicant anticipates, however, that air quality impacts at that residence would be less than those assessed for Residence R6 for the following reasons.

- The prevailing wind in the vicinity of the TGO Mine Site is from the east-northeast.
- Residence R6 is located downwind of RSF1, namely to the west-southwest.
- Residence R2 is located to the northwest of RSF1, or roughly perpendicular to the prevailing wind direction. Winds from the southeast, namely from RSF1 towards Residence R2, are amongst the least common wind direction recorded at the TGO Mine Site.
- As a result, particulate emissions from RSF1 would be expected to substantially lower at Residence R2 than at Residence R6.

6.3.4.3 Prior Air Quality Monitoring

Figure 12 presents the results of deposited dust monitoring at DDG5 located in the vicinity of Residence R6 between 2015 and 2021. The periods during which RSF1 construction operations were being undertaken and also presented. In summary, there is no discernible increase in deposited dust levels at DDG5 during periods of RSF1 construction when compared with non-construction periods.

6.3.4.4 Conclusion

Based on the above, the Applicant contends that construction of RSF1 Stage 9 Cell 2 would not result in exceedance of the relevant air quality criteria. In addition, as the Proposed Modification would utilise the same construction fleet as that used for construction of RSF2 Stage 1, there would be no cumulative air quality-related impacts.

Operation of the RSF1 Stage 9 Cell 2 would, consistent with the existing operation of RSF1, be largely non-dust generating as the residue surface is kept damp during residue placement.

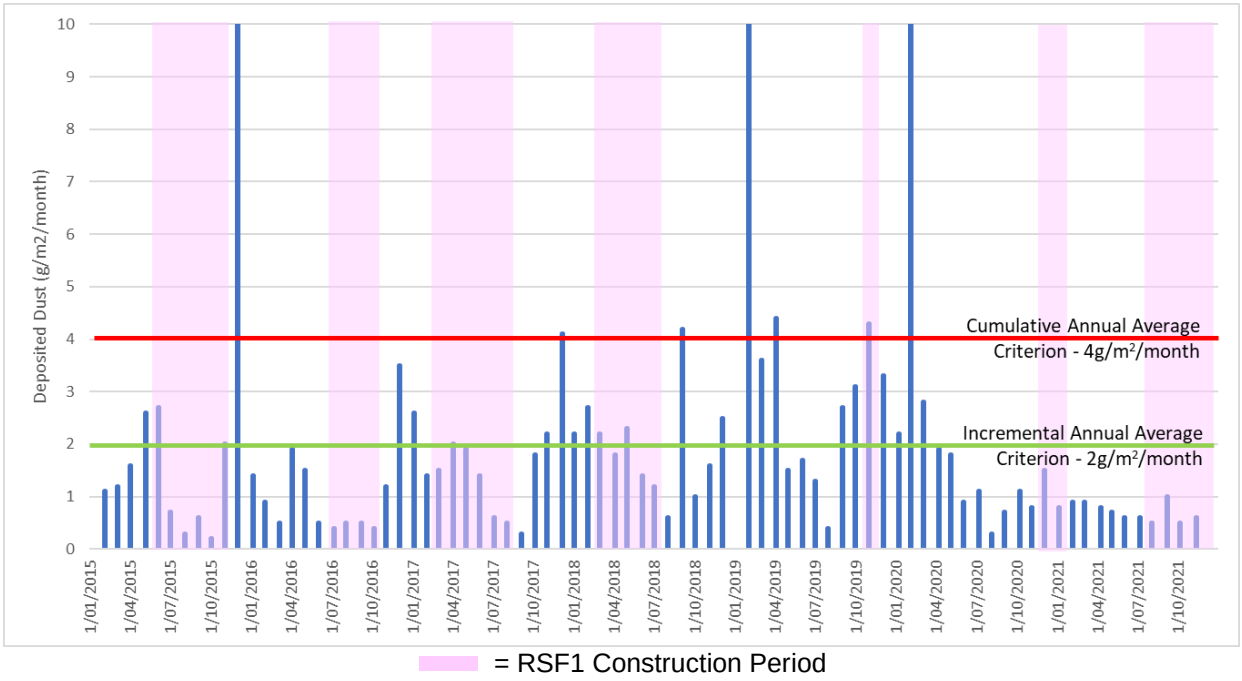


Figure 12
DDG5 Deposited Dust Monitoring Results – 2015 to 2021

Data Source: Tomingley Gold Operations Pty Limited

6.4 VISUAL AMENITY

6.4.1 Local Setting

With the exception of the TGO Mine Site, the existing visual amenity surrounding the TGO Mine Site is typical of rural areas in the central west of NSW, with the outlook from most rural residences and other vantage points including land used for agriculture, transportation or other infrastructure, as well as remnant native vegetation. Outlooks from residences within Tomingley village include views of surrounding buildings, established trees and smaller vegetation and the Newell Highway and other local roads.

The approved TGO Mine is prominent within the visual landscape in close proximity to the TGO Mine Site, however, at greater distances, the TGO Mine Site is typically obscured by intervening vegetation.

The Residue Storage Facilities are and would continue to be primarily visible from the south, west and northwest, with views from the north and east obscured by Waste Rock Emplacements 1 and 2. The closest publicly accessible vantage point with views of RSF1 is McNivens Lane, located approximately 1.4km from RSF1 Stage 9 Cell 2. The closest private residence is Residence R6, located approximately 2.2km from RSF1 Stage 9 Cell 2.

6.4.2 Proposed Changes to the Visual Landscape

The Proposed Modification would result in an increase in height of RSF1 Cell 2 by approximately 2m to 286.5m AHD, consistent with the approved height of RSF1 Cell 1.

No other changes to the approved landform are proposed.

6.4.3 Assessment of Impacts

The Applicant contends that the proposed change to the visual amenity from surrounding vantage points would be negligible for the following reasons.

- The proposed 2m increase in the height of the RSF1 Cell 2 would be insignificant in comparison to the existing visual footprint of the TGO Mine and commensurate with the approved final height of Cell 1.
- A 2m lift on the RSF1 Cell 2 would occupy between 0.08º and 0.05º of view from McNivens Lane and residence R6 and is unlikely to be perceptible to most if not all viewers.

6.5 SURFACE WATER

6.5.1 Local Setting and Environmental Performance

In the vicinity of the TGO Mine Site, surface water drains generally from east to west, from the higher elevations of the Herveys Range within the Goobang National Park, located approximately 10km to the east of the Project Site, to the Bogan River, located approximately 8km to the west of the Project Site (**Figure 1**).

Watercourses surrounding the TGO Mine Site are typically indistinct and ephemeral. The principal watercourse that flows through the TGO Mine Site is Gundong Creek, an ephemeral watercourse that flows to the southwest (**Figure 2**). Gundong Creek is located immediately to the west of RSF1.

The Applicant manages surface water within the TGO Mine Site based on the principle of separation of various classes of water. RSF1 is located within the process water catchment. Surface water within this catchment is retained within the TGO Mine Site and is not permitted be discharged from site.

Jacobs (2021a) undertook an assessment of surface water for TGEP and determined the following based on water quality monitoring for Gundong Creek undertaken by the Applicant between July 2015 and December 2017.

- Water quality for a range of analytes exceeds the relevant water quality objectives both upstream and downstream of the TGO Mine Site.
- In particular, nutrient concentrations are very high, with elevated levels of metals, including aluminium, iron, chromium, copper, zinc, selenium and lead.
- As these results are observed in samples from both upstream and downstream of the Project Site, Jacobs (2021a) determined that they are unrelated to the Applicant's operations.

6.5.2 Proposed Changes to Final Landform Drainage

During the operational life of the Facility, the Proposed Modification would not result in any substantial changes to the approved surface water management system for RSF1.

At the end of the life of the TGO Mine, the Proposed Modification would result in minor changes to the direction of drainage on the final RSF1 landform. The currently approved final landform incorporates a west to east drainage, with discharge via an engineered drop structure in the eastern wall of the Facility. The proposed final landform would comprise a north to south drainage direction, with an engineered drop structure in the southern wall of the Facility, discharging to RSF2.

6.5.3 Management and Mitigation Measures

The Applicant would continue to implement the following relevant management and mitigation measures.

- Continue to implement the approved *Water Management Plan*. That plan would be reviewed following modification of the development consent and, if required, it would be revised.
- Ensure that Mine and Process Water are not permitted to be discharged from the TGO Mine Site.

6.5.4 Assessment of Impacts

The Applicant contends that the Proposed Modification would have a negligible impact on the surrounding surface water environment for the following reasons.

- There would be no change to the approved water management system as described in the *Water Management Plan*. In particular, decant water from the RSF would continue to flow or be pumped to the Process Water dam or the Wyoming Central Dam. The Proposed Modification would not result in an increased risk of discharge of surface water from the TGO Mine Site.
- There would be no change in the approved water balance or level of water consumption.
- There would be no change in the quality or quantity of surface water downstream of the TGO Mine Site, or the risk of discharge of contaminated water.

6.6 GROUNDWATER

6.6.1 Local Setting and Environmental Performance

The Conceptual Groundwater Model for the TGO Mine Site includes three distinct aquifers as follows.

- Perched aquifer: A shallow and localised perched water table system associated with the larger drainages, particularly Gundong Creek.
- Cainozoic alluvial groundwater system: The Cainozoic alluvial system comprises a relatively thick layer of generally low permeability fluvial sediments. In the vicinity of the TGO Mine Site this unit has been shown to be unsaturated and represent a largely impermeable aquitard.

- Fractured rock groundwater system: The fractured rock groundwater system hosts the regional water table. The primary permeability of these basement lithologies is very low, with potential for enhanced permeability associated with structural deformation and discontinuities, zones of mineralisation, and chemical weathering within the transition zone from completely oxidised saprolite to moderately weathered formation.

Regional groundwater monitoring is undertaken at seven locations within and surrounding the TGO Mine Site (**Figure 13**). The 2020 Annual Review (TGO, 2020) identified that groundwater levels and quality within the monitored bores is not affected by mining-related activities.

Jacobs (2021b) undertook an assessment of groundwater for TGEP and determined the following in relation to water levels within surrounding monitoring bores (**Figure 13**).

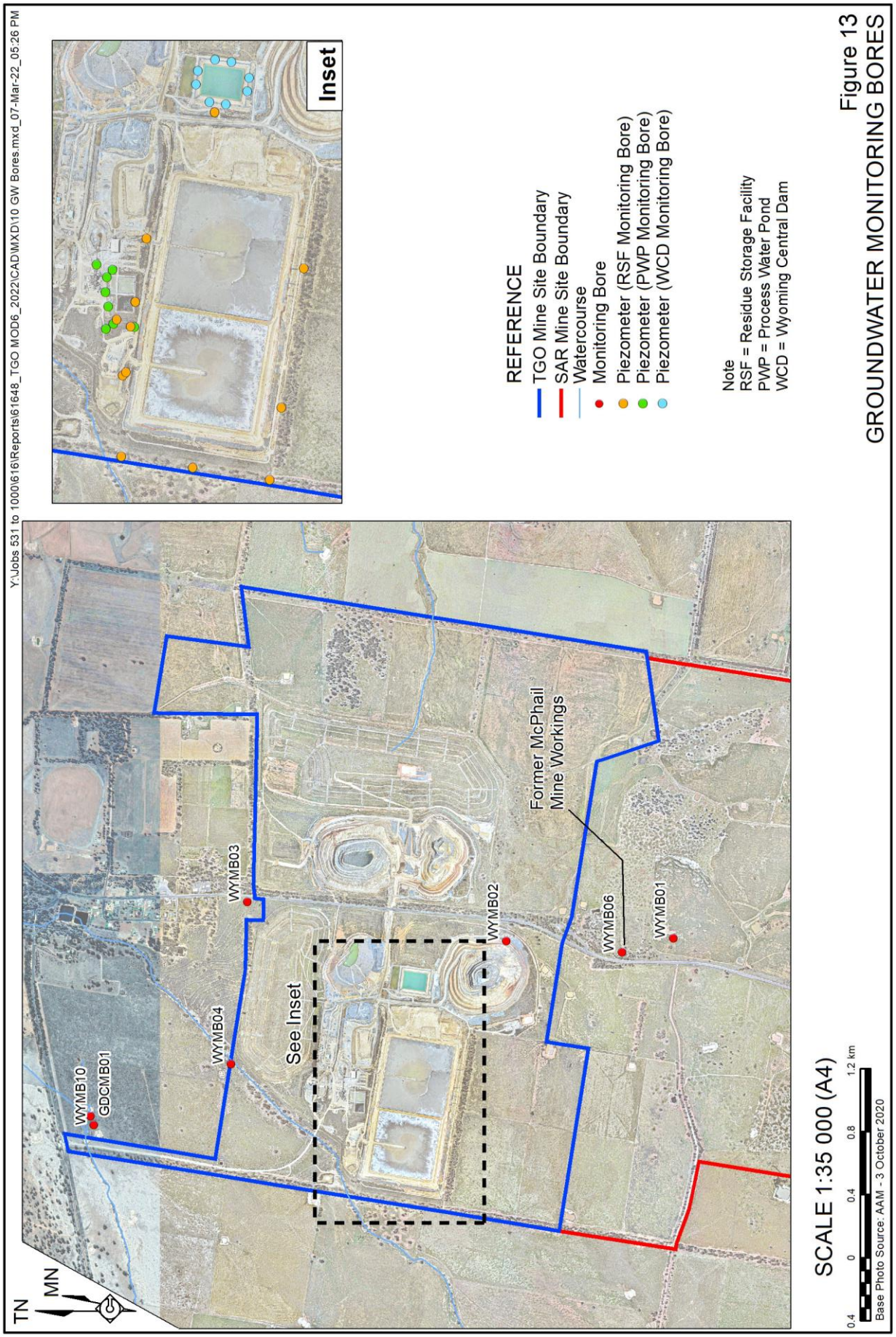
- Water levels within the shallow alluvial aquifer is relatively stable, with long-term trends reflective of long-term climatic influences;
- The hard rock monitoring bores WYMB03, WYMB04 and WYMB10 (located over 700m from existing mining operations) display relatively stable to slightly increasing water level trends, likely reflective of long-term climatic influences;
- Water levels within WYMB02, located adjacent to the Wyoming 1 Open Cut, show a distinct declining trend and response to mining since mid-2016. Prior to 2016 water levels were very stable.
- Hard rock monitoring bores WYMB01 and WYMB06 display different responses to the other hard rock monitoring bores, with both monitoring bores responding to a significantly wet period in mid- to late-2016. These bores are in close proximity to the historic McPhails Gold Mine (**Figure 13**). Surface water is known to flow into these workings following moderate rainfall and Jacobs (2021b) interpret this response to be a result of surface water inflows.

The quality of shallow groundwater in the vicinity of RSF1 is monitored in 10 shallow piezometers (**Figure 13**). In summary, groundwater chemistry results do not indicate geochemical changes in shallow groundwater consistent with influence from residue decant water.

6.6.2 Management and Mitigation Measures

The Applicant would continue to implement the following relevant management and mitigation measures.

- Continue to implement the approved *Water Management Plan*. That plan would be reviewed following modification of the development consent and, if required, it would be revised.
- Continue to monitor groundwater levels and quality in bores and piezometers with and surrounding the TGO Mine Site and review resulting data to determine if the approved or proposed activities are adversely impacting on groundwater levels or quality.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Inset
REFERENCE
TGO Mine Site Boundary
SAR Mine Site Boundary
Watercourse
Monitoring Bore
Piezometer (RSF Monitoring Bore)
Piezometer (PWP Monitoring Bore)
Piezometer (WCD Monitoring Bore)
Note
RSF = Residue Storage Facility
PWP = Process Water Pond
WCD = Wyoming Central Dam
Figure 13
GROUNDWATER MONITORING BORES
WYMB10
GDCMB01
WYMB04
WYMB03
See Inset
WYMB02
Former McPhail
Mine Workings
WYMB06
WYMB01
TN
MN
SCALE 1:35 000 (A4)
0.4 0 0.4 0.8 1.2 km
Base Photo Source: AAM - 3 October 2020

6.6.3 Assessment of Impacts

As identified in Section 3.3.4, GHD (2019) determined the construction of RSF1 Stage 9 would not result in a significant change in the seepage rate from the Residue Storage Facility. In addition, groundwater monitoring has indicated that the Residue Storage Facility is not currently resulting in seepage to groundwater. As a result, the Proposed Modification is not expected to result in significant impacts to groundwater in the vicinity of the TGO Mine Site.

6.7 ENVIRONMENTAL ASPECTS WHICH WOULD BE UNAFFECTED

Table 13 presents the environmental aspects which would be unaffected by the Proposed Modification, and a justification for that conclusion.

Table 13
Environmental Aspects which would be Unaffected by the Proposed Modification

Environmental Aspect	Justification
Blasting and vibration	The Proposed Modification would not result in any modification of the approved blasting operations.
Biodiversity	The Proposed Modification would not result in any additional disturbance within the TGO Mine Site and therefore there would be no additional disturbance of native vegetation or habitat. In addition, the use of RSF1 Stage 9 Cell 2 would be consistent with the approved use of the approved Facility. As a result, there would be no additional indirect impacts on native fauna.
Heritage	The Proposed Modification would not result in any additional disturbance within the TGO Mine Site and therefore there would be no opportunity for disturbance to any known or unknown Aboriginal or cultural heritage site.
Traffic and transportation	The Proposed Modification would not result in additional employment or usage of diesel or other consumables. As a result, there would be no additional heavy or light vehicle movements on public roads during construction or operation of RSF1 Stage 9 Cell 2.
Hazards, chemicals and radiation	The Proposed Modification would not result in modification of the approved processing operations or management of hazardous materials.
Waste	The Proposed Modification would not result in any modification of the approved management of waste.
Socio-economic	The Proposed Modification would mitigate the risk that RSF2 would not be available when the approved RSF1 Stage 9 Cell 1 is at capacity. As a result, the Proposed Modification would ensure the continued, uninterrupted operation of the TGO Mine. The socio-economic impact of the Proposed Modification would therefore be positive.

7. JUSTIFICATION OF THE MODIFIED PROJECT

7.1 ACTION TAKEN TO AVOID / MINIMISE IMPACTS

The following presents the actions that have been or would be taken to avoid or minimise impacts associated with the Proposed Modification.

- A single construction fleet would be used to construct RSF1 Stage 9 Cell 2 and RSF2 Stage 1, thereby eliminating additional cumulative noise and air quality impacts associated with concurrent construction operations.
- A detailed design of RSF1 Stage 9, including both Cells 1 and 2 would be prepared prior to the commencement of construction operations to ensure that the Facility is constructed in a manner that complies with all regulatory, guideline and industry requirements.

7.2 CONSISTENCY WITH STRATEGIC CONTEXT

The Proposed Modification is generally consistent with the *Economic Development Strategy for Regional NSW* in that it would allow the TGO Mine to remain competitive in the regional mining sector and allow for the Applicant to maintain and build upon existing employment levels and skills.

The Proposed Modification is consistent with the Goals of the *Central West and Orana Regional Plan 2036* in that it would allow for:

- continued diversification of the local and regional economy, providing valuable non-agricultural income and economic activity in a time of very significant drought;
- the ongoing protection of agricultural lands;
- sustainable management of mineral resources; and
- the continued provision of education and training opportunities.

The Proposed Modification is consistent with the *Central Orana Regional Economic Development Strategy 2018 – 2022* which focuses on the strategic development of mining in the Region to further develop and realise the positive flow-on effects of investment in infrastructure and employment.

Similarly, the Proposed Modification is consistent with each of the Principles of the *Narromine Shire Community Strategic Plan 2027*, in particular, supporting vibrant local communities, growing the local economy and protecting the local environment.

7.3 COMPLIANCE WITH STATUTORY REQUIREMENTS

7.3.1 Introduction

Section 4 and **Appendix 3** provide an overview of the Proposed Modification's compliance with relevant statutory requirements and where various requirements have been addressed in this document. The following subsections address relevant statutory requirements that have not been addressed elsewhere in this document.

7.3.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal legislation regulating development in NSW. The Proposed Modification is sought under Section 4.55(2) of that Act. Section 4.15(1) of the EP&A Act describes the matters for consideration by a consent authority in evaluating a Project for determination. **Table A3.2** of **Appendix 3** identifies where each matter has been addressed in this document.

Section 1.3 of the EP&A Act presents the objects of the Act. **Table 14** presents each of the objects of the Act and identifies how the Proposed Modification is consistent with each.

Table 14
Objects of the EP&A Act

Object	Consistency with the Project
The objects of this Act are as follows.	
a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The Proposed Modification would provide for the uninterrupted development and operation of the TGO Mine, thereby permitting the existing social and economic benefits associated with the Mine to continue.
b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	Section 7.5.2 discusses how the Project is consistent with the principles of ecologically sustainable development. It is considered that the Proposed Modification would be developed in an efficient manner that will take into account the value of environmental and social resources to the local and regional community both now and in the future.
c) to promote the orderly and economic use and development of land,	The Proposed Modification would provide for the uninterrupted development and operation of the TGO Mine, thereby maximising the orderly and economic use of the TGO Mine Site.
d) to promote the delivery and maintenance of affordable housing,	Not relevant.
e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats	The Proposed Modification would not result in disturbance of additional land and would not impact upon conservation of threatened and other species of native animals and plants, ecological communities or their habitats.
f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	The Proposed Modification would not result in disturbance of additional land and would not impact on the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).
g) to promote good design and amenity of the built environment,	The Applicant would complete detailed design for RSF1 Stage 9 in accordance with all regulatory, guideline and industry standards.
h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	
i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	Not relevant.
j) to provide increased opportunity for community participation in environmental planning and assessment.	The Applicant has demonstrated a longstanding commitment to ongoing consultation and community and stakeholder.

7.3.3 Narromine Local Environmental Plan 2011

The principal local planning instrument for the Proposed Modification is the *Narromine Local Environmental Plan* (LEP) *2011*. Under that plan, the TGO Mine Site is located within land zoned RU1 – Primary Production and SP2 – Infrastructure. Section 4.3.2 addresses matters related to permissibility of the Project and Table A3.1 of **Appendix 3** addresses matters related to a range of other Clauses within the Narromine LEP. **Table 15** presents an assessment of the Proposed Modification against the objects of each of the above Zones.

Table 15
Narromine LEP Zone Objectives

Object	Consistency with the Project
Zone RU1 – Primary Production	
To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.	The Proposed Modification would not result in disturbance of additional land and would not impact upon primary production or resource lands.
To encourage diversity in primary industry enterprises and systems appropriate for the area.	
To minimise the fragmentation and alienation of resource lands.	
To minimise conflict between land uses within this zone and land uses within adjoining zones.	The Proposed Modification would not change the land use within the TGO Mine Site.
Zone SP2 – Infrastructure	
To provide for infrastructure and related uses.	The Proposed Modification would not result in disturbance of additional land and would not affect the provision of infrastructure.
To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The Proposed Modification would not change the land use within the TGO Mine Site.

7.4 CONSISTENCY WITH COMMUNITY VIEWS

Sections 5.1 and 5.2 present an overview of the engagement carried out for the Proposed Modification and the views of the community surrounding the Project Site. Overall, the Applicant contends that the Community has very little interest in the Proposed Modification and views it as simply a continuation of the approved TGO Mine operations.

7.5 SCALE AND NATURE OF ANTICIPATED IMPACTS

7.5.1 Introduction

The following subsections present an overview of how the Proposed Modification is consistent with the principles of ecologically sustainable development, a brief summary of the anticipated biophysical, social and economic impacts of the Project assuming the implementation of proposed mitigation and management measures.

7.5.2 Ecologically Sustainable Development

7.5.2.1 The Precautionary Principle

In order to satisfy this principle of Ecologically Sustainable Development (ESD), emphasis must be placed on anticipation and prevention of environmental damage, rather than reacting to it.

Throughout the development of both the approved Residue Storage Facility and the Proposed Modification, the Applicant and GHD have adopted an anticipatory approach to impacts by undertaking an analysis of the risks posed by the successive development of the Facility, including both Residue Storage Facilities 1 and 2. Examples of matters relating to the precautionary principle that were considered during the various stages of the Proposed Modification include the following.

- The design of RSF1 Stage 9 was prepared in accordance with the relevant guidelines, including all requirements of the Australian National Committee on Large Dams, the NSW Dam Safety Committee and currently accepted practice for Australian dam engineering.
- The performance of the existing RSF1 has been monitored and reviewed by GHD during each successive Stage of the Facility to ensure that it was not resulting adverse environmental impacts, with the results of those reviews used during preparation of the design for the next Stage.
- The design of the Proposed Modification was chosen to minimise disturbance to land not already the subject of prior disturbance and in a manner which is commensurate with the existing approved Facility, further reducing potential and avoidable environmental impacts.
- The results of existing and contemporary impact assessments from recognised experts in the fields of noise, air quality, water, and socio-economics were reviewed in consideration of the Proposed Modification to ensure that potential adverse impacts were well understood and identify the need for further assessments, where relevant.

As a result, the precautionary principle has been considered during all stages of the design and assessment of the Proposed Modification. The approach adopted provides a high degree of certainty that the Proposed Modification would not result in any major unforeseen impacts.

7.5.2.2 Social Equity

Social equity embraces value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to the community. Social equity includes for both inter-generational (between generations) and intra-generational (within generations) equity considerations.

As demonstrated throughout Section 6, the Proposed Modification would have little effect on those considerations. On this basis, it is not considered there would be any change to impacts on social equity of the TGO Mine as a result of the Proposed Modification.

7.5.2.3 Conservation of Biological Diversity and Ecological Integrity

The protection of biodiversity and maintenance of ecological processes and systems are central goals of sustainability. It is important that developments do not threaten the integrity of the ecological system as a whole or the conservation of threatened species in the short- or long-term.

As identified in Section 3.3 and throughout Section 6, the Proposed Modification would not result in any additional disturbance of land within the TGO Mine Site. Therefore, the Proposed Modification would not result in any unacceptable reduction in biodiversity values or ecological integrity.

7.5.2.4 Improved Valuation and Pricing of Environmental Resources

The issues that form the basis of this principle relate to the acceptance that the polluter pays, all resources are appropriately valued, cost-effective environmental stewardship is adopted and the adoption of user pays prices based upon the full life cycle of the costs.

The value placed by the Applicant on environmental resources is evident in the considerable resources invested in designing and managing the existing Residue Storage Facility. On balance, it is assessed that the Proposed Modification provides for the continued recovery of gold, while not significantly increasing impacts on the environment.

7.5.3 Biophysical Considerations

Potential biophysical impacts of the Proposed Modification have been assessed in Section 6. The following provides a brief overview of the residual biophysical impacts of the Proposed Modification.

- Noise – construction of RSF1 Stage 9 Cell 2 would not result in exceedance of the relevant noise criteria. In addition, as the Proposed Modification would utilise the same construction fleet as that used for construction of RSF2 Stage 1, there would be no cumulative noise-related impacts.

  Operation of the RSF1 Stage 9 Cell 2 would, consistent with the existing operation of RSF1, be largely non-audible.

- Air quality – construction of RSF1 Stage 9 Cell 2 would not result in exceedance of the relevant air quality criteria. In addition, as the Proposed Modification would utilise the same construction fleet as that used for construction of RSF2 Stage 1, there would be no cumulative air quality-related impacts.

  Operation of the RSF1 Stage 9 Cell 2 would, consistent with the existing operation of RSF1, be largely non-dust generating as the residue surface is kept damp during residue placement.

- Visual amenity – the proposed additional 2m height of RSF1 is unlikely to be discernible from publicly accessible vantage points surrounding the TGO Mine Site. In addition, the Proposed Modification would not result in a significant change to the final landform.

- Surface water – the Proposed Modification would not result in significant changes to the approved water management system within the TGO Mine Site, including the existing risk of discharge of process water.
- Groundwater – the existing RSF1 is not resulting in adverse impacts to shallow groundwater in the immediate vicinity of the Facility and Proposed Modification is not expected to increase the risk of such an event occurring.

All other environmental aspects are unlikely to be affected by the Proposed Modification.

7.5.4 Socio-economic Considerations

The Proposed Modification would result in:

- continued and uninterrupted employment of local residents;
- continued and uninterrupted expenditure by TGO Mine personnel in commercial facilities of Tomingley and other towns; and
- the indirect flow-on benefits associated with the afore-mentioned employment and economic contributions.

On the basis of the above and the fact that the Proposed Modification could be undertaken without affecting the amenity of surrounding residents it would have a positive influence on the socio-economic conditions of the village of Tomingley and surrounding region. As a result, it is considered that on balance the Proposed Modification would provide for a net socio-economic benefit.

7.6 COMPLIANCE MONITORING AND COMMUNICATION

The Applicant would continue to monitor and report on the environmental performance of its operations and compliance with the relevant conditional requirements of all approvals, licences and consents in accordance with current procedures.

7.7 REMAINING UNCERTAINTIES

Given the relatively minor nature of the Proposed Modification and the fact that RSF1 Stage 9 Cell 2 would simply be an additional cell on an existing Residue Storage Facility that has been successfully operating without incident since 2014, the remaining uncertainties are considered to be negligible.

7.8 CONSEQUENCE OF NOT PROCEEDING

The consequences of not proceeding with the Proposed Modification include an increased risk of an interruption in the operation of the TGO Mine, with the associated adverse social and economic impacts that would occur.

7.9 THE PUBLIC INTEREST

In concluding this document, the Applicant contends that the Proposed Modification would be in the public interest for the following reasons.

- Continued, uninterrupted employment for approximately 230 people currently employed by the Applicant.
- Continued, uninterrupted payment of wages and salaries and the purchase of goods and services.
- Continued, uninterrupted payment of taxes, royalties, rates and other contributions.
- Continued, uninterrupted economic activity in a rural area largely dependent on the Applicant's operations and participation in the local community.
- Continued, uninterrupted extraction of a State-owned resource in a manner that does not result in significant additional environmental impacts.

8. REFERENCES

DE Cooper & Associates Pty Ltd (DEC) (2009). *Tomingley Gold Project Residue Management Design Report* - October 2009.

Jacobs Australia Pty Limited (2021a). *Surface Water – EIS Technical Report,* Part 5 of the *Specialist Consultant Studies Compendium* accompanying the EIS for the Tomingley Gold Extension Project. Prepared on behalf of Tomingley Gold Operations Pty Limited.

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Appendices

(Total No. of pages including blank pages = 94)

Appendix 1 Revised Project Description (20 pages)

Appendix 2 RSF1 Stages 7-9 Concept Design Report (60 pages)

Appendix 3 Preconditions to the Granting of Approval and Mandatory Matters for Consideration (12 pages)

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Appendix 1

Revised Project Description

(Total No. of pages including blank pages = 20)

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A1.1 FOREWORD

This Revised Project Description for Tomingley Gold Operations (the TGO Mine) has been prepared in accordance with *Appendix E of the State Significant Development Guidelines – Preparing a Modification Report*. It should be noted that the original Project Description for the TGO Mine was first prepared in 2011 based on now superseded guidelines, and as such the following text has been adapted from the current approved *Mining Operations Plan*. In addition, as the following has been prepared for use post-approval of the Proposed Modification, the Revised Project Description has been drafted as though approval has been granted, with proposed changes associated with Modification 6 shown in red text.

A1.2 PROJECT OVERVIEW

The TGO Mine is located immediately to the south of the village of Tomingley, in the Central West of NSW (**Figure A1.1**). The TGO Mine Site covers two Mining Leases, as shown on **Figure A1.1**. Mining Lease (ML) 1684 was issued 11 February 2013, and Mining Lease 1821 was issued 19 November 2021. For the purpose of this document, the area covered by ML1684 and ML1821 is referred to as the "TGO Mine Site".

The approved TGO Mine includes the following (**Figure A1.2**).

- Extraction of waste rock and gold ore material from surface and underground mining operations.
- Placement of waste rock:
  - onto or within three above-ground Waste Rock Emplacements (WREs);
  - as backfill into two Open Cuts; and
  - various amenity bunds and site infrastructure.
- Processing operations for the production of gold doré.
- Placement of process residues into two Residue Storage Facilities.
- Exploration, including the San Antonio and Roswell (SAR) Exploration Drive and associated activities require to support the exploration activities.
- Water management infrastructure, including a pipeline to an external borefield, various on-site diversions, drains, sediment basins and dams.
- Various other ancillary infrastructure and services to support mining activities, such as administration and workshops, roading, stockpiles and a network of environmental monitoring locations.

The following subsections present an overview the key elements of the TGO Mine Site. Further information can be found in the approved *Mining Operations Plan*.

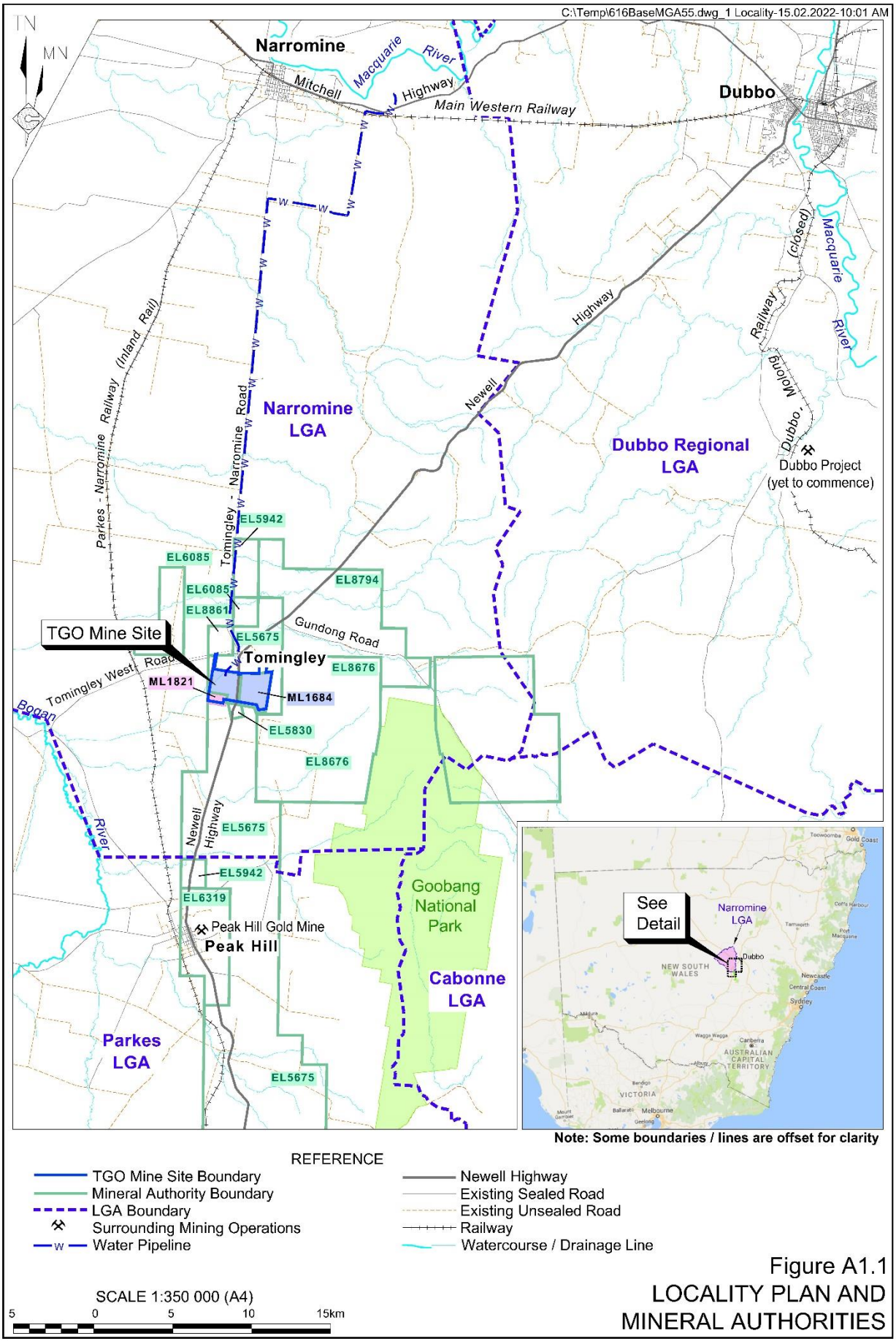


Figure A1.1
LOCALITY PLAN AND MINERAL AUTHORITIES

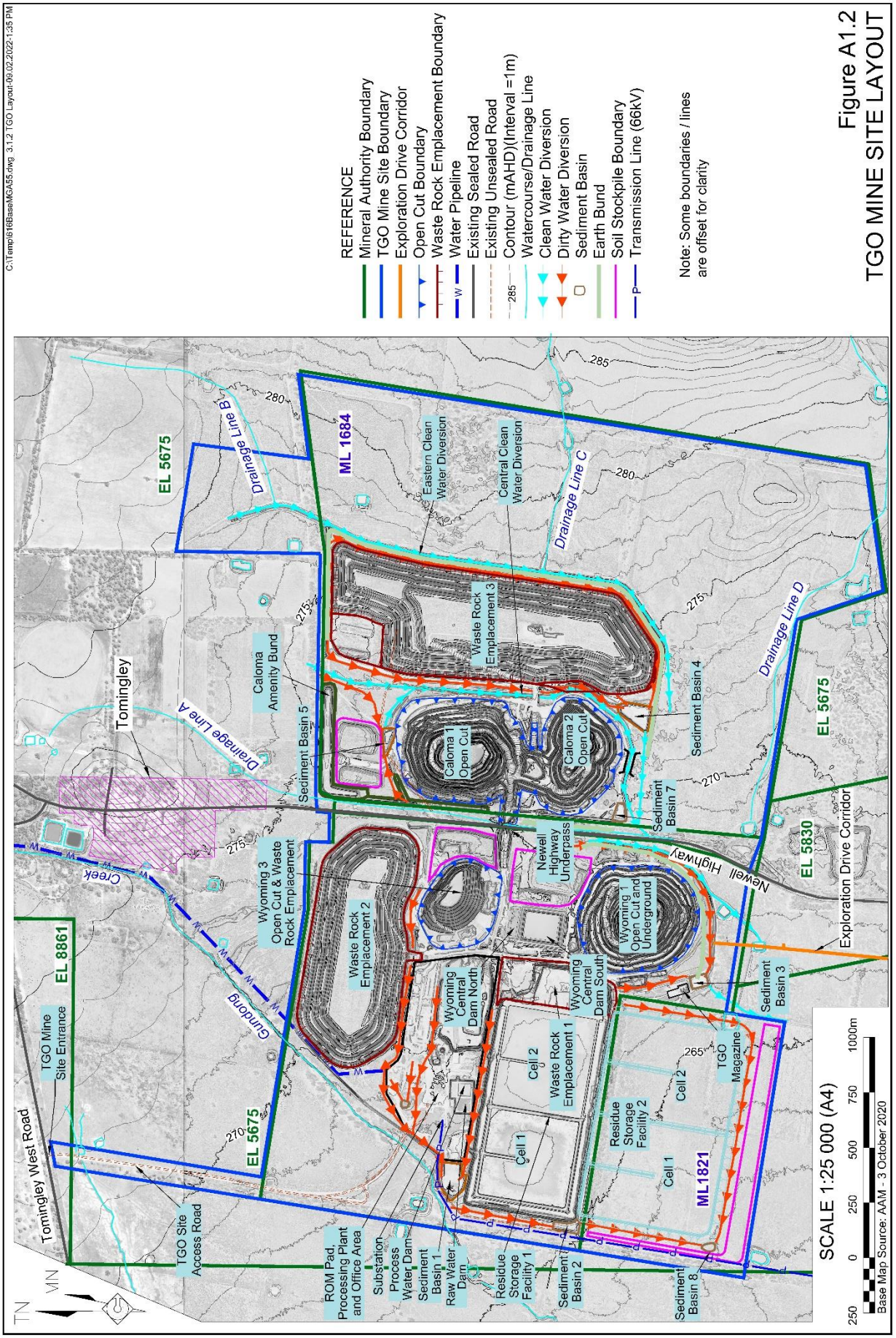


Figure A1.2
TGO MINE SITE LAYOUT
REFERENCE
Mineral Authority Boundary
TGO Mine Site Boundary
Exploration Drive Corridor
Open Cut Boundary
Waste Rock Emplacement Boundary
Water Pipeline
Existing Sealed Road
Existing Unsealed Road
Contour (mAHD)(Interval =1m)
Watercourse/Drainage Line
Clean Water Diversion
Dirty Water Diversion
Sediment Basin
Earth Bund
Soil Stockpile Boundary
Transmission Line (66kV)
Note: Some boundaries / lines are offset for clarity
EL 5675
EL 8861
EL 5830
ML 1684
ML1821
Drainage Line B
Drainage Line C
Drainage Line D
Drainage Line A
Eastern Clean Water Diversion
Central Clean Water Diversion
Caloma Amenity Bund
Sediment Basin 5
Waste Rock Emplacement 3
Caloma 1 Open Cut
Caloma 2 Open Cut
Sediment Basin 4
Sediment Basin 7
Newell Highway Underpass
Wyoming 3 Open Cut & Waste Rock Emplacement
Waste Rock Emplacement 2
Wyoming Central Dam North
Wyoming Central Dam South
Wyoming 1 Open Cut and Underground
Waste Rock Emplacement 1
Cell 2
Cell 1
Residue Storage Facility 2
TGO Magazine
Sediment Basin 3
Exploration Drive Corridor
Newell Highway
Tomingley
Tomingley West Road
TGO Mine Site Entrance
TGO Site Access Road
ROM Pad, Processing Plant and Office Area
Substation
Process Water Dam
Sediment Basin 1
Raw Water Dam
Residue Storage Facility 1
Sediment Basin 2
Sediment Basin 8
Gundong Creek
SCALE 1:25 000 (A4)
250 0 250 500 750 1000m
Base Map Source: AAM - 3 October 2020
TN MN
C:\Temp\616BaseMGA55.dwg, 3.1.2 TGO Layout-09.02.2022-1:35 PM

A1.3 ANCILLARY INFRASTRUCTURE

The TGO Mine includes the following ancillary infrastructure required to support ongoing operations within the TGO Mine Site, as shown generally on **Figure A1.2**.

- Roading and transport:
  - TGO Site Access Road between then TGO Mine Site and Tomingley West Road.
  - Staff and visitor car parking.
  - Various internal haul and service roads.
  - The Newell Highway Underpass.
- 66kV transmission line and substation.
- Caloma Amenity Bund.
- Topsoil and subsoil stockpiles.
- Biodiversity stewardship areas (see **Figure A1.8** in Section A1.10).

A1.4 MINING OPERATIONS

A1.4.1 OPEN CUT MINING OPERATIONS

A1.4.2 CALOMA OPEN CUTS

Figure A1.3 presents the approved layout for the Caloma 1 and 2 Open Cuts, including the Caloma Eastern Cutback.

The Caloma 1 Open Cut is located to the east of the Newell Highway and is linked to the processing facilities by the Newell Highway underpass. The footprint of the open cut is an irregular ellipse, with a long axis of approximately 580m, a width of approximately 400m and a total disturbed area of approximately 19ha. The first stage of mining within Caloma Open Cut was completed in August 2017, with mining of a cutback of the north-eastern section of the Open Cut (an approved activity under MOD3) recommencing October 2020. Cutback of Caloma 1 is anticipated to continue for approximately 29 months from commencement.

The Caloma 2 Open Cut is located to the east of the Newell Highway, to the south of the Caloma Open Cut, and is linked to the processing facilities by the Newell Highway underpass. The footprint of the Caloma 2 Open Cut is roughly circular, with an approximate diameter of 400m and area of 15ha. Mining within Caloma 2 Open Cut commenced in November 2017 was completed in January 2019.

Mining of the Caloma Eastern Cutback, approved as part of MOD3 for MP 09_0155, is currently in progress. Ore is transported via the Newell Highway Underpass to the TGO ROM Pad and processed using the TGO Processing Plant. Waste rock is placed in-pit within the Caloma 2 Open Cut or stockpiled within Waste Rock Emplacement 1 for use in construction or capping of residue storage facilities.

Mining of the Caloma Eastern Cutback will complete open cut mining within the Caloma 1 Open Cut.

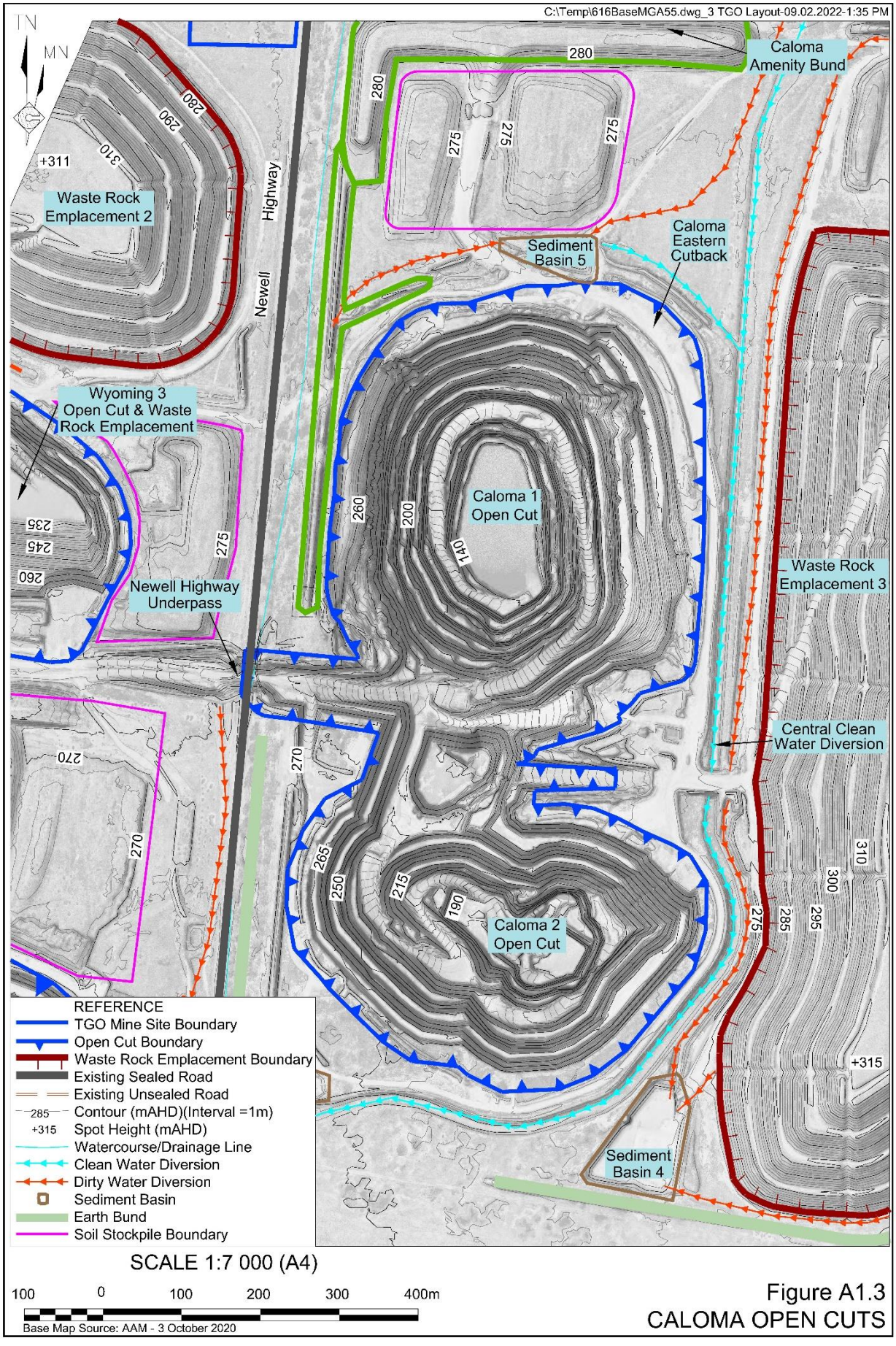


Figure A1.3
CALOMA OPEN CUTS

A1.4.3 WYOMING OPEN CUTS

Figure A1.4 presents the approved layout for the Wyoming 1 and 2 Open Cuts.

The footprint of the Wyoming 3 Open Cut is an irregular, east-west orientated ellipse with a long axis of approximately 420m and a width of approximately 270m covering approximately 10ha. Mining within Wyoming 3 Open Cut was completed in November 2015. The Open Cut is partly backfilled with waste rock and is currently used for storage of water within the TGO Mine Site, with a capacity in excess of 1 000ML (**Figure A1.4**).

The footprint of the Wyoming 1 Open Cut is approximately 19ha, forming an irregular ellipse with a long axis orientated northwest of approximately 475m and a width of approximately 430m. Mining within Wyoming 1 Open Cut was completed in early December 2018. A number of portals within the Wyoming 1 Open Cut provide access to underground mining operations.

A1.4.4 UNDERGROUND MINING OPERATIONS

The Wyoming 1 Underground mine was approved as part of the original application for development consent in 2011. The Caloma 1 and Caloma 2 Underground mines were approved in MOD3. For the purposes of this document, these operations are collectively referred to as the TGO Underground Mine.

Figure A1.5 presents an isometric view of the TGO Underground Mine. Access and ventilation is provided via a number of portals in the Wyoming 1 Open Cut. A portal has also been established within the southern wall of the Caloma 1 Open Cut, primarily for ventilation and emergency egress.

Underground development currently utilises a jumbo, or underground drill rig, to drill a pattern of holes which are loaded with explosives and the in-situ material fragmented. Underground blasting operations are undertaken 24-hours per day, 7 days per week. Fragmented material is loaded into underground haul trucks using an underground loader.

Ore is extracted using long-hole open stoping and is transported to the TGO ROM Pad and processed using the TGO Processing Plant. Waste rock is either used to backfill completed stopes or is transported to the surface and placed within the Wyoming 1 Open Cut or Waste Rock Emplacement 1.

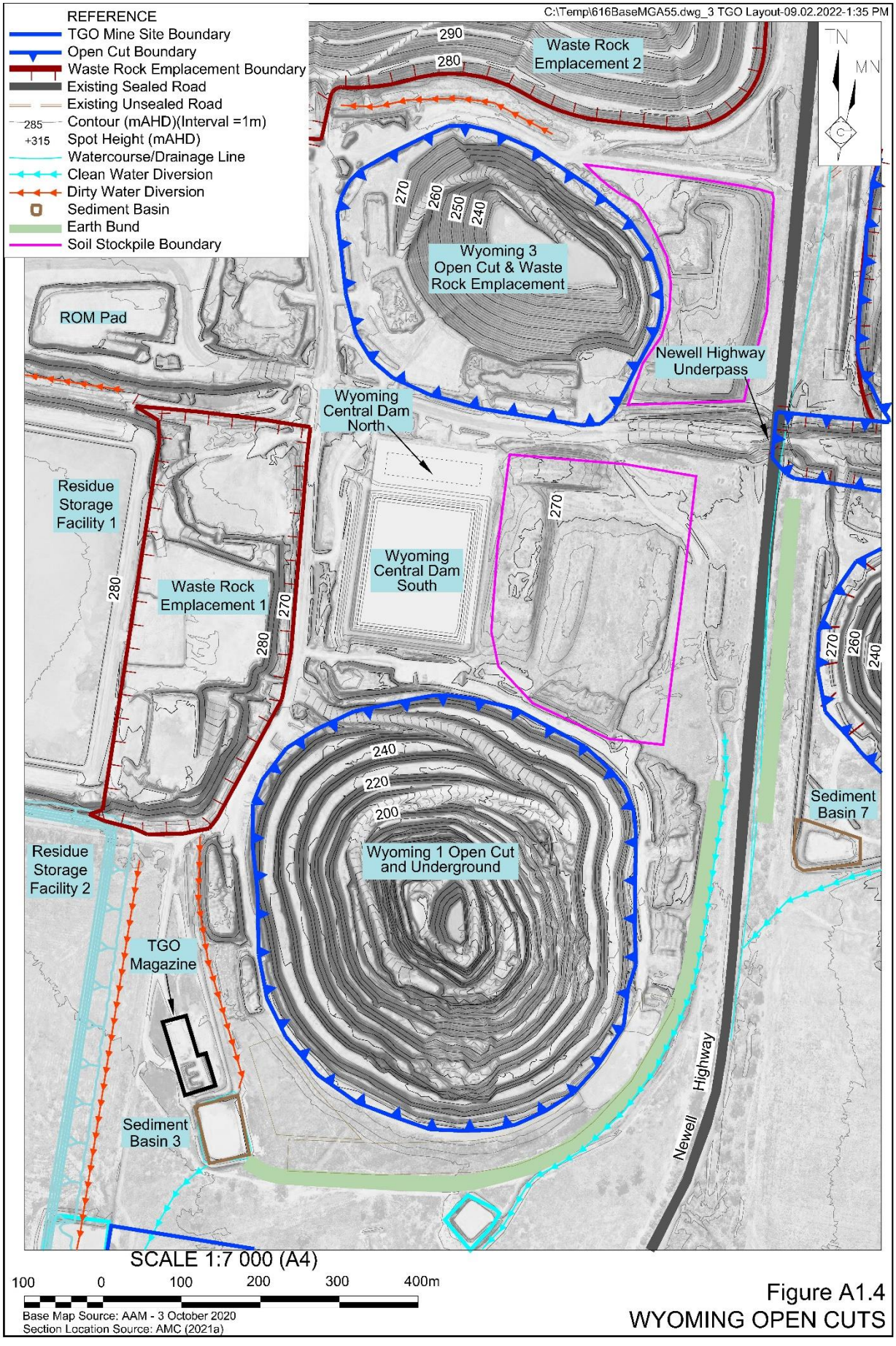
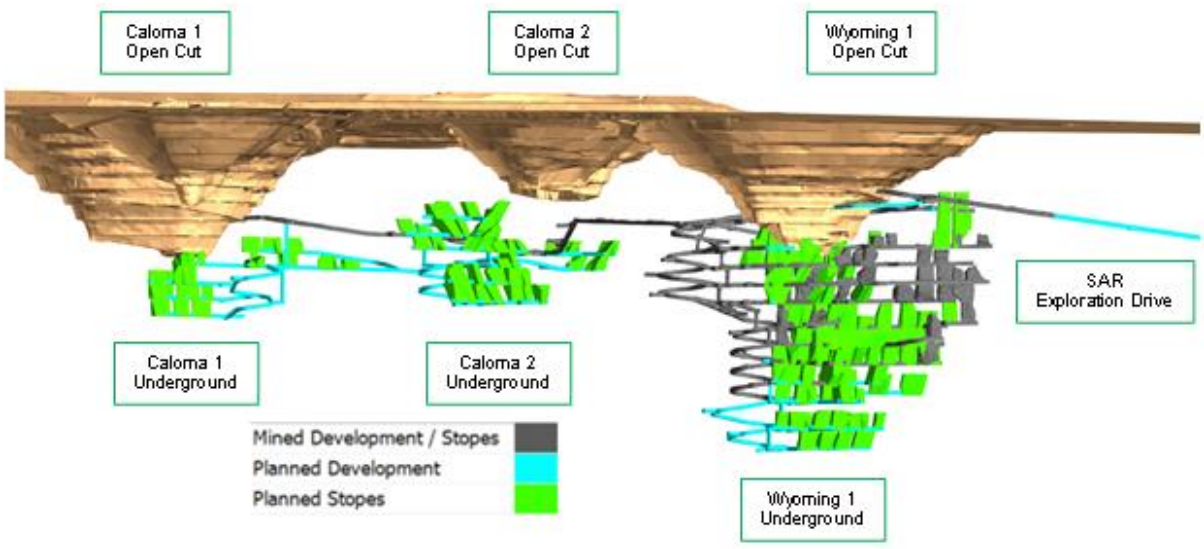


Figure A1.4
WYOMING OPEN CUTS



Source: Tomingley Gold Operations Pty Ltd

Figure A1.5
TGO UNDERGROUND MINING OPERATIONS – LOOKING EAST

A1.5 WASTE ROCK MANAGEMENT

All waste rock extracted during the life of the TGO Mine will either be:

- stored in one of three Waste Rock Emplacements;
- used for backfilling of the Wyoming 3 and/or Caloma 2 Open Cuts;
- used to construct the Caloma Amenity Bund;
- used to backfill completed stopes; or
- placed in a temporary waste rock stockpile within the Wyoming 1 Open Cut.

Table A1.1 presents the indicative design criteria for each Waste Rock Emplacement and the Caloma Amenity Bund.

Table A1.1
Indicative Waste Rock Emplacement Design Criteria

	Waste Rock Emplacement						Caloma Amenity Bund	
	1		2		3			
Design Criteria	**Design**	**Current**	**Design**	**Current**	**Design**	**Current**	**Design**	**Current**
Area (ha)[1]	13	13	47.2	47.2	66.1	66.1	3.2	3.2
Maximum height (m)	35	35	40	40	40	40	10	10
Lift heights (m)	10	10	10	10	10	10	10	10
Number of lifts	3.5	3.5	4	4	4	4.0	1	1
Berm widths (m)	5	5	5	5	5	5	-	-
Batter Slope (V:H)	1:3	1:3	1:3	1:3	1:3	1:3	1:3	1:3
Volume (million m^3)[1]	1.9	1.04	11.2	15.8	14.0	12.9	0.5	0.5
Note 1: The reduction in area and volume of waste rock is a result of a reduction in mining from Wyoming 1 and a correction to the swell factor applied (reduced from 28% to 21%)								
Source: Tomingley Gold Operations Pty Ltd								

A1.6 PROCESSING OPERATIONS

A1.6.1 ROM PAD AND CRUSHING AND GRINDING CIRCUIT

Ore material is transported to and stockpiled on the ROM pad. A front-end loader is used to transfer ore to the ROM bin from where it is transferred to a primary jaw crusher and then a secondary cone crusher. A range of screens and conveyors sort and recirculate crushed material. The crushed material is transferred via conveyor either directly to the grinding circuit or to a crushed ore stockpile. Material from the crushed ore stockpile is transferred to the grinding circuit using a front-end loader.

The grinding circuit comprises a single stage ball mill with a diameter of 5m and a grinding length of 8.2m. The ore is combined with water and steel balls to further reduce the size of the crushed ore. The overflow from the ball mill flows to a trommel, to remove scat material, with the trommel underflow pumped to a bank of cyclones which classify the material, returning oversize material of greater than 106µm to the ball mill. The dense material in the cyclone underflow is passed to the gravity circuit. Cyclone overflow material less than 106µm is sent to the Carbon-in-Leach (CIL) circuit.

The grinding circuit has a nominal feed rate of 125t/h for unweathered material, with higher throughputs achievable when processing softer, oxidised material.

A1.6.2 GRAVITY AND LEACH CIRCUITS

The gravity circuit comprises a centrifugal concentrator which further separates dense and less dense material, with the dense, gravity concentrate pumped to an intensive leach circuit and the less dense material pumped back to the grinding circuit.

The CIL circuit comprises six 979m^3 agitated tanks. The ground ore flows to Tank 1 where a weak solution of sodium cyanide and other additives are added. The cyanide dissolves the gold into solution as the ore and cyanide solution is passed from Tank 1 to Tank 6. Lime is added to increase the pH of the solution and prevent volatilisation of the cyanide and compressed air or oxygen is added to increase the dissolved oxygen concentration. In each tank, the additives are managed to maximise the recovery of gold.

The dissolved gold is recovered from the solution through adsorption onto activated carbon granules which flow counter current, namely from Tank 6 to Tank 2 where it is removed from the circuit. The gold-loaded carbon is then collected and transferred to the elution circuit.

In addition, the gravity concentrate, which typically contains much higher concentrations of gold than the feed for the CIL circuit, is passed to an intensive leach circuit where the concentrate is subjected to an intensive cyanidation process, operated at higher temperatures and pressures than a standard CIL circuit. The gold-bearing solution from the intensive leach circuit is transferred to the elution circuit and the tail from the intensive leach circuit is passed to the grinding circuit.

A1.6.3 GOLD ROOM OPERATIONS

Loaded carbon from the CIL circuit is transferred to an elution circuit which contains a strong solution of hot caustic and cyanide. This step re-dissolves the adsorbed gold into a concentrated solution. The gold-bearing solution from the intensive leach is then combined with the elution solution and together they are recovered onto steel wool using electrowinning. Activated carbon stripped of gold is returned to the CIL circuit for re-use.

The gold-covered steel wool is then fired with a range of fluxes in a furnace to produce gold doré, or unrefined gold bars, which are then transferred securely from the TGO Mine Site for further refining off site.

A1.6.4 RESIDUE THICKENING AND CYANIDE DESTRUCTION

The remaining slurry from the CIL circuit is removed and flows to a thickener where water is removed to recover as much of the cyanide as possible for reuse in the CIL circuit. The remaining material is then treated using a cyanide destruction circuit and the residue is pumped to the residue storage facilities.

A1.6.5 REAGENT MANAGEMENT

Table A1.2 presents the reagents and consumables regularly used within the Processing Plant. All reagents are received, stored, used and managed in accordance with the TGO Mine *Hazardous Materials Management Plan.*

Table A1.2
Processing Reagents and Consumables

Reagent	Purpose	Form	Maximum Storage Capacity	Dangerous Goods Code
Cyanide and cyanide compounds	Leaching of gold	Liquid	2 x 100 000L tanks	6.1 (toxic)
Sodium hydroxide (caustic)	pH management during elution and intensive leach	Liquid	20 000L tank	8 (corrosive)
Hydrochloric acid (33%)	Regeneration of activated carbon	Liquid	30 000L tank	8 (corrosive)
Lime (quick lime and hydrated lime)	pH management during leaching and cyanide detoxification	Solid	2 x silos	nil
Sodium Metabisulphite	cyanide detoxification	Solid	35 x 1.2m^3 bulka bags stored in a bunded reagent store	Nil
Copper sulphate	Catalyst in the cyanide detoxification process	Liquid	25 x 1m^3 Intermediate Bulk Containers in a bunded reagent store	9 (misc)
Liquefied Petroleum Gas (LPG)	Heating	Liquified gas	4 x 7.5m^3 tanks	2.1 (flammable gas)
Liquid oxygen	Management of dissolved oxygen in CIL Circuit	Liquified gas	60m^3 tank	2.2 (non-flammable, non-toxic gas)

Source: Tomingley Gold Operations Pty Ltd – *Hazardous Materials Management Plan* – after Section 5

A1.6.6 CYANIDE AND CYANIDE COMPOUNDS

Cyanide is transported to the TGO Mine Site as solid briquettes using 22t isotainers. On arrival on site, the isotainers are connected to the cyanide storage tanks within a bunded, concrete sealed area and water is pumped from the storage tanks into the isotainers to dissolve the briquettes. The resulting solution is stored within the two tanks in a concrete bunded area adjacent to the Processing Plant.

Cyanide solution is added to the leach circuit in the quantities required. The pH of the cyanide leach solution is managed through the addition of lime and caustic to minimise the potential for volatilization of hydrogen cyanide, a gas with the potential for adverse impacts on humans and animals. Monitoring of cyanide concentrations in the leach solution and air is undertaken continuously and personnel evacuated in the event that excessive cyanide gas is detected. Measures are implemented immediately to reduce the concentration of hydrogen cyanide within the Processing Plant.

EPL 20169 nominates the following discharge limits for weak acid dissociable cyanide discharged into the residue storage facilities as follows. These limits are achieved through the use of a cyanide destruction circuit prior to discharge of residue.

- 90^{th} percentile limit.....20mg/L
- 100^{th} limit.....30mg/L

A1.6.7 OTHER REAGENTS

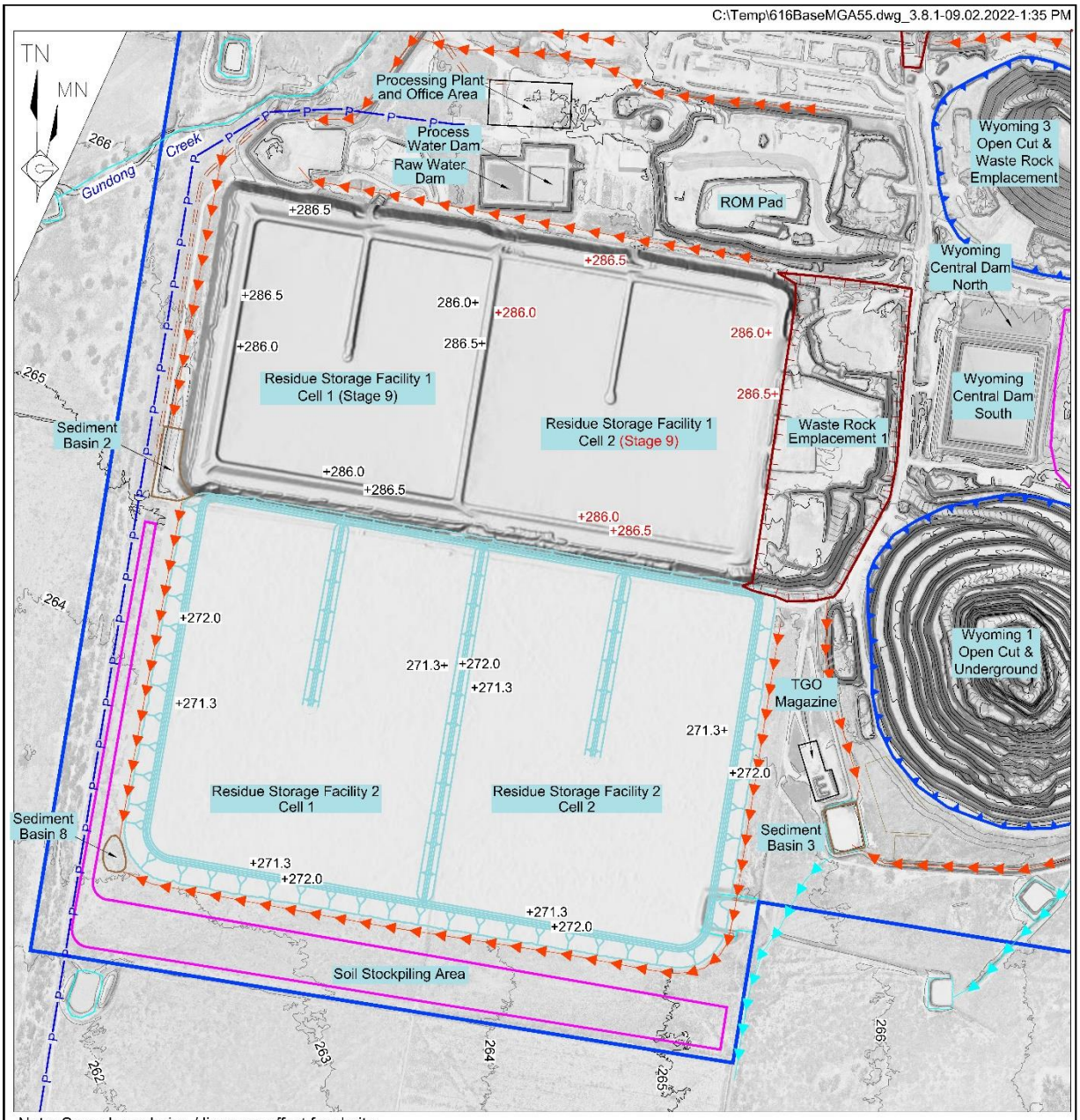
All other reagents are managed in accordance with their Safety Data Sheets, manufacturer's instructions and the procedures identified in the *Hazardous Materials Management Plan.*

A1.7 RESIDUE MANAGEMENT

A1.7.1 DESIGN OF THE RESIDUE STORAGE FACILITIES

Figure A1.6 and **Table A1.3** present the layout and design criteria for the approved residue storage facilities. In summary, development consent for the approved residue storage facilities were granted as follows.

- Residue Storage Facility 1 (Stages 1 to 6)..... Original Project Approval (2012)
- Residue Storage Facility 1 (Stages 7 to 8 (Cell 2) and 9 (Cell 1)) MOD4 (2020)
- Residue Storage Facility 2 (Stages 1 and 2) MOD5 (2021)
- Residue Storage Facility 1 (Stage 9 of Cell 2) MOD6 (2022)



Note: Some boundaries / lines are offset for clarity

REFERENCE

- TGO Mine Site Boundary
- Open Cut Boundary
- Waste Rock Emplacement Boundary
- Existing Sealed Road
- Existing Unsealed Road
- Contour (mAHD)(Interval =1m)
- Spot Height (mAHD)
- Watercourse/Drainage Line
- Clean Water Diversion
- Dirty Water Diversion
- Sediment Basin
- Soil Stockpile Boundary
- 66kV Power Line

SCALE 1:11 000 (A4)

100 0 100 200 300 400 500 m

Base Map Source: AAM - 3 October 2020

Figure A1.6
RESIDUE STORAGE FACILITIES

Table A1.3
Approved Residue Storage Facilities Design Criteria

Design Component	Residue Storage Facility 1	Residue Storage Facility 2
Maximum approved stage	Stage 9 - Cell 1 and Cell 2	Stage 2 - Cell 1 and Cell 2
Maximum crest elevation	286.5m AHD	272.0m AHD
Maximum residue elevation	286.0m AHD	271.3m AHD
Slope of outer face	1:3 (V:H)	1:3 (V:H)
Design capacity (approximate)	Approximately 9.33Mt	4.5Mt
Residue discharge	Perimeter discharge	Perimeter discharge
Decant system	Central decant	Central decant
Minimum decant pond capacity	1:10 000-year AEP flood event	1:10 000-year AEP flood event
External decant storage	Wyoming Central Dam	Wyoming Central Dam
Basal liner • Material • Permeability	 Clay Maximum 1 x 10^{-9} over 1m	 Clay Maximum 1 x 10^{-9} over 1m
Spillway	Not required, designed for no spill	designed for no spill Emergency spillway for 1:1 000 AEP rainfall event
ANCOLD Category • Dam Failure Consequence • Environmental Spill Consequence	 Significant Significant	 Significant Low

A1.7.2 OPERATION OF THE RESIDUE STORAGE FACILITIES

Residue is deposited from spigots around the perimeter of each cell to form a "beach", with supernatant water permitted to flow to central decant towers from where it is pumped to either the Process Water Pond or the Wyoming Central Dam (see **Figure A1.6**).

Management of the residue discharge cycles to maintain a damp surface is used to manage dust emissions. In the event that tailings discharge is halted for a period, chemical polymer dust suppressants may be applied to the surface of the residue to prevent dust lift off.

The concentration of weak acid dissociable cyanide in residue discharged to the Facility is less than 20mg/L 90% of the time, with a maximum concentration of 30mg/L at all times. Seepage from the facilities is collected using perimeter collection drains and is directed to one or more seepage collection ponds from where it is be pumped to the surface of the Facility. A network of piezometers is maintained and monitored to detect seepage from the Facility.

A1.8 SAN ANTONIO ROSWELL EXPLORATION DRIVE

The SAR Exploration Drive was approved by the Resources Regulator for exploration activities on 7 May 2020, with further approval granted on 13 September 2021. The purpose of the SAR Exploration Drive is to better define the known resources to the immediate south of the TGO Mine Site and within Exploration Licences EL 5675 and EL 5830 (**Figure A1.1**).

The approved activities included the following.

- Development of an exploration drive from the existing TGO Underground Mine.
- Establishment and use of ancillary infrastructure, including a ventilation rise to the north of McNivens Lane.
- Drilling of approximately 72 000m of exploration drill holes.
- Extraction of one or more bulk samples totalling no greater than 20 000t.

A1.9 WATER MANAGEMENT

A1.9.1 CLASSES OF WATER

All water within the TGO Mine Site is classified as follows.

- Clean water – comprising surface water from areas upslope of the TGO Mine Site. Clean water is diverted around disturbed sections within the TGO Mine Site and permitted to flow to natural drainage. Existing clean water diversions provide flood protection for flood events up to a 1% Annual Exceedance Probability[1] (AEP) flood event.
- Raw water – comprising externally sourced water that is imported to site for mining-related purposes. Raw water is currently supplied via the approved water pipeline from the approved "Woodlands" borefield.
- Dirty water – comprising surface runoff generated within disturbed sections of the TGO Mine Site that are not within the process water catchment. Dirty water runoff is intercepted and managed by a series of dirty water drains and sediment basins.

  Existing and proposed sediment basins are and would be designed to manage sediment-laden runoff generated by the 10 day, 90th percentile rainfall event. Dirty water intercepted by the TGO sediment basins is currently used for mining-related purposes.

  Accumulated surface water within the existing TGO sediment basins may be discharged off site following testing to confirm that the water meets the relevant criteria nominated under EPL 20169. Notwithstanding this, the TGO Mine Site currently operates as a nil discharge site.
- Mine water – comprising water accumulating with the existing open cuts and underground workings. Mine water is retained on site within the existing Wyoming 3 Open Cut for reuse for mining-related purposes. Mine water is not to be discharged to natural drainage.
- Process water – comprising water that has been used for ore processing and or exposed to residue. Process water is stored within the lined Process Water Dam or Wyoming Central Dam – South and is used for processing purposes only.
- Wastewater - comprising effluent generated on site.

[1] The Annual Exceedance Probability is the probability that a rainfall event will occur in any 12-month period. A 1% AEP rainfall event has a 1 in 100 chance of occurring in any one year. Such a rainfall event is commonly referred to as a 1 in 100-year rainfall event.

A1.9.2 TGO MINE SITE WATER MANAGEMENT INFRASTRUCTURE

Figure A1.7 and **Table A1.4** present the water management infrastructure within the TGO Mine Site.

Table A1.4
TGO Mine Site Water Management Infrastructure

Water Storage	Volume (ML)	Source[2]	Destination/Use[2]
Raw water			
Raw Water Dam	10.7	External supply pipeline	Process Water Dam Wyoming Central Dam North Processing Plant
Dirty water[1]			
Sediment Basin 1	35	Overland flows from disturbed sections of the TGO Mine Site	Wyoming 3 Open Cut Discharged via Licenced Discharge Points (emergency only)
Sediment Basin 2	8		
Sediment Basin 3	11.7		
Sediment Basin 4	32.8		
Sediment Basin 5	12.8		
Sediment Basin 7	2.7		
Sediment Basin 8	42		
Mine water			
Wyoming 3 Open Cut	1 300 (nominal)	Sediment Basins Open Cut and underground workings SAR Water Storage Dam	Wyoming Central Dam North SAR Water Storage Dam
Wyoming Central Dam North	17.4	Wyoming 3 Open Cut Raw Water Dam	Dust suppression Process Water Dam TGO Underground
Process water			
Process Water Dam (including Settling Pond)	13.4	Wyoming Central Dam South Wyoming Central Dam North Raw Water Dam Thickener Residue Storage Facilities	Processing plant
Wyoming Central Dam South	162.5	Residue Storage Facilities	Process Water Dam
Residue Storage Facilities	Variable (200ML assumed for site water balance)	Processing Plant	Process Water Dam Processing Plant Wyoming Central Dam South

Note 1: Sediment Basin 6 has not been constructed.

Note 2: See **Figure A1.2**

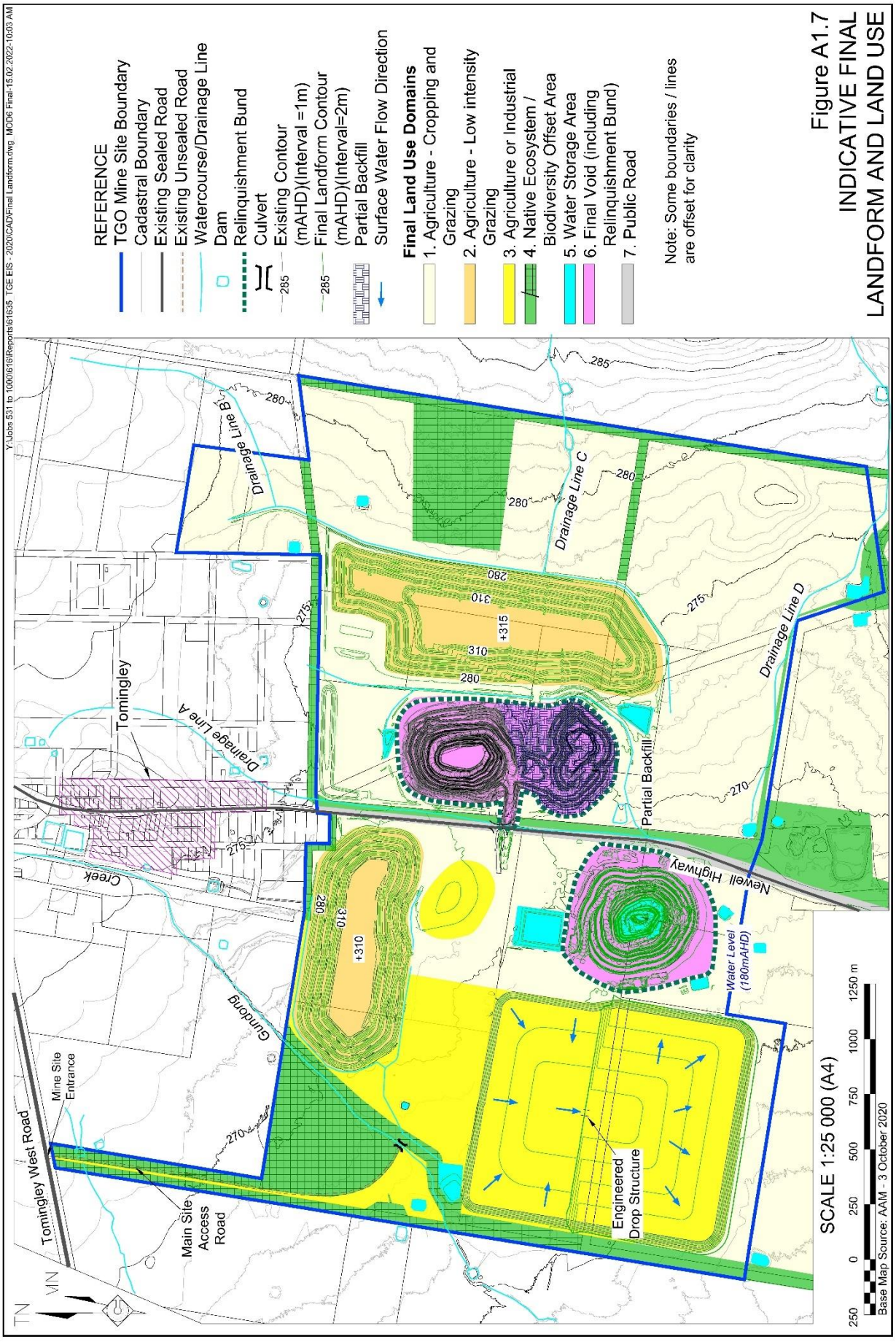


Figure A1.7
INDICATIVE FINAL
LANDFORM AND LAND USE
REFERENCE
TGO Mine Site Boundary
Cadastral Boundary
Existing Sealed Road
Existing Unsealed Road
Watercourse/Drainage Line
Dam
Relinquishment Bund
Culvert
Existing Contour (mAHD)(Interval =1m)
Final Landform Contour (mAHD)(Interval=2m)
Partial Backfill
Surface Water Flow Direction
Final Land Use Domains
1. Agriculture - Cropping and Grazing
2. Agriculture - Low intensity Grazing
3. Agriculture or Industrial
4. Native Ecosystem / Biodiversity Offset Area
5. Water Storage Area
6. Final Void (including Relinquishment Bund)
7. Public Road
Note: Some boundaries / lines are offset for clarity
Drainage Line B
Drainage Line C
Drainage Line D
Drainage Line A
Tomingley
Creek
Gundong
Newell Highway
Partial Backfill
Water Level (180mAHD)
Engineered Drop Structure
Mine Site Entrance
Tomingley West Road
Main Site Access Road
TN
MN
SCALE 1:25 000 (A4)
250 0 250 500 750 1000 1250 m
Base Map Source: AAM - 3 October 2020
Y:\Jobs 531 to 1000\616\Reports\61635 TGE EIS - 2020\CAD\Final Landform.dwg MOD6 Final-15.02.2022-10:03 AM

A1.10 REHABILITATION AND FINAL LAND USE

A1.10.1 REHABILITATION OBJECTIVES AND TARGETS

Figure A1.7 presents the final rehabilitated landform and land use for the TGO Mine Site. **Table A1.5** presents the approved rehabilitation objectives and targets for the TGO Mine Site. Further information is provided in the approved *Mining Operations Plan*.

Table A1.5
Rehabilitation Objectives and Targets

Feature	Objective	Target
Land Use	Provide for a combination of sustainable agriculture, light industrial / commercial and biodiversity conservation.	Rehabilitate Mine Site in accordance with **Figure A1.7**.
	Minimise adverse socio-economic outcomes following mine closure.	Consult with the community and government agencies in relation to the post-mining land use Rehabilitate the TGO Mine Site in accordance with **Figure A1.7** unless otherwise agreed.
Landform	Provide a low maintenance, geotechnically stable and safe, non-polluting landform and provides land suitable for the proposed final land use.	Geotechnical results show the landform is stable.
	Construct the final landform such that it is self-sustaining.	The final landform has maintenance requirements consistent with the agreed post mining land use(s). Rehabilitate the Mine Site in accordance with **Figure A1.7**.
	Provide rehabilitated woodland communities which adjoin conserved and improved native vegetation remnants to create a continuous corridor of grassy woodland vegetation across the Mine Site.	Monitoring to confirm that woodland vegetation is continuous.
Biodiversity	Maintain or improve the species diversity and habitat value of the Mining Lease.	Conserve at least 66.6ha of remnant native vegetation and establish at least an additional 61ha of native vegetation in accordance with the Biodiversity Offset Strategy.
Surface Infrastructure	Decommission and remove all surface infrastructure (unless required for a lawful post mining land use).	All surface infrastructure removed (unless required for a lawful post mining land use).
Final Voids	Ensure all final voids are safe, stable and secure.	Construct a safety bund around all open cut and install a suitable fence and lockable gate.
Other	Allow for the relinquishment of the Mining Lease and the return of the security lodged over the Mining Lease within a reasonable time after the end of the mine life.	Within 5 years of final rehabilitation.

A1.10.2 FINAL LANDFORM AND LAND USE

Figure A1.7 presents the final landform for the TGO Mine Site. In summary, the combined final landform would include the following.

- One fully backfilled open cut, namely Wyoming 3 Open Cut.
- One partially backfilled open cut, namely Caloma 2 Open Cut, bunded and fenced as required.

- Two bunded and fenced final voids, namely the Wyoming 1 and Caloma 1 Open Cuts.
- Two shaped and rehabilitated waste rock emplacements, namely Waste Rock Emplacements 2 and 3. Material contained within Waste Rock Emplacement 1 would be largely consumed during rehabilitation of the Residue Storage Facilities.
- A capped, free-draining integrated Residue Storage Facility consisting of:
  - a reshaped Residue Storage Facility 1 that would direct surface water north to south to an engineered drop structure constructed on the embankment between Residue Storage Facility 1 and 2; and
  - a reshaped Residue Storage Facility 2 that would direct surface water evenly across the surface of the Facility to be discharged to natural drainage via non-concentrated flow on the western, southern and eastern embankment of the Facility.

Figure A1.7 presents the indicative final land use for the TGO Mine Site. In summary, the anticipated final land use would include a mix of agricultural production and biodiversity conservation. Infrastructure such as hardstand areas, internal roads and water management infrastructure would be retained for final land use if required.

Appendix 2

RSF1 Stages 7-9 Concept Design Report

prepared by

GHD Pty Ltd

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Tomingley Gold Operations Pty Ltd

Residue Storage Facility

Stage 7-9 Concept Design

December 2019

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Appendices

1. Introduction

1.1 Purpose and Scope of this Report

GHD Pty Ltd (GHD) was engaged by Tomingley Gold Operations Pty Ltd (TGO) to undertake the concept design of Residue Storage Facility (RSF) Stage 9 Raise at Tomingley Gold Mine, located approximately 50 km southwest of Dubbo, NSW.

The RSF has recently been raised to Stage 6 RL 280.5 m. The RSF is currently approved to Stage 6 with a maximum elevation of RL 280.5 m (15 m high).

TGO has prepared an updated mine schedule for the approved mining operation. It is understood that the approval of RSF Stage 9 raise is a key factor to the viability of the continued development of the underground mine as further resource developing drilling is carried out at depth below the existing ore body and near mine. The construction of a new RSF is costly and would require a lengthy approval process due to increasing the sites environmental disturbance. Therefore, TGO is aiming to utilise the existing RSF with a proposed Stage 9 raise to store the remainder of the Life of Mine (LOM) residue production.

The RSF is an off-stream paddock style dam comprised of two cells with central decant ponds. The embankments have been raised predominantly using the upstream construction method, except Cell 2 eastern embankment which was raised by the downstream construction.

TGO has confirmed that upstream construction method is still the preferred method to raise the RSF embankments based on the comparison of buttress volumes verses storage capacity for centreline and upstream construction methods as summarised in Section 3.3

This report details the concept design of Stage 7 to 9 based on the total expected LOM tonnage identified by the updated mine schedule and includes a review of previous raise design parameters, design features of the proposed raise, stability analysis, incremental impact on seepage and groundwater, water balance update, tailings and water management plans in relations to the RSF closure, safe in design risk assessment and a bill of quantities for the proposed raise.

This report has been produced to assist TGO in their submission for the Mod 4 approval.

1.2 Assumptions and Scope Exclusions

The design and documentation assumptions include the following;

- The basis of design provided by TGO listed in section 2.1 is correct.
- Data provided by others, including (but not limited to) production records, surveys, geotechnical and monitoring data, is correct.

The scope of this design excludes;

- Review of hydrology and the required decant flood storage provisioning as it is unchanged since the last raise.

1.3 Limitations

This report: has been prepared by GHD for Tomingley Gold Operations Pty Ltd and may only be used and relied on by Tomingley Gold Operations Pty Ltd for the purpose agreed between GHD and the Tomingley Gold Operations Pty Ltd as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Tomingley Gold Operations Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Tomingley Gold Operations Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Design Basis and Criteria

2.1 Background

TGO produces approximately 1.1 Mt of process residue per year which is currently being deposited in the RSF. The current development concept allows for up to 1.5 Mt of process residue per year. The RSF lies to the south of the Plant Area and comprises two square shaped cells covering a total of 40.5 Ha as shown in Figure 2-1.

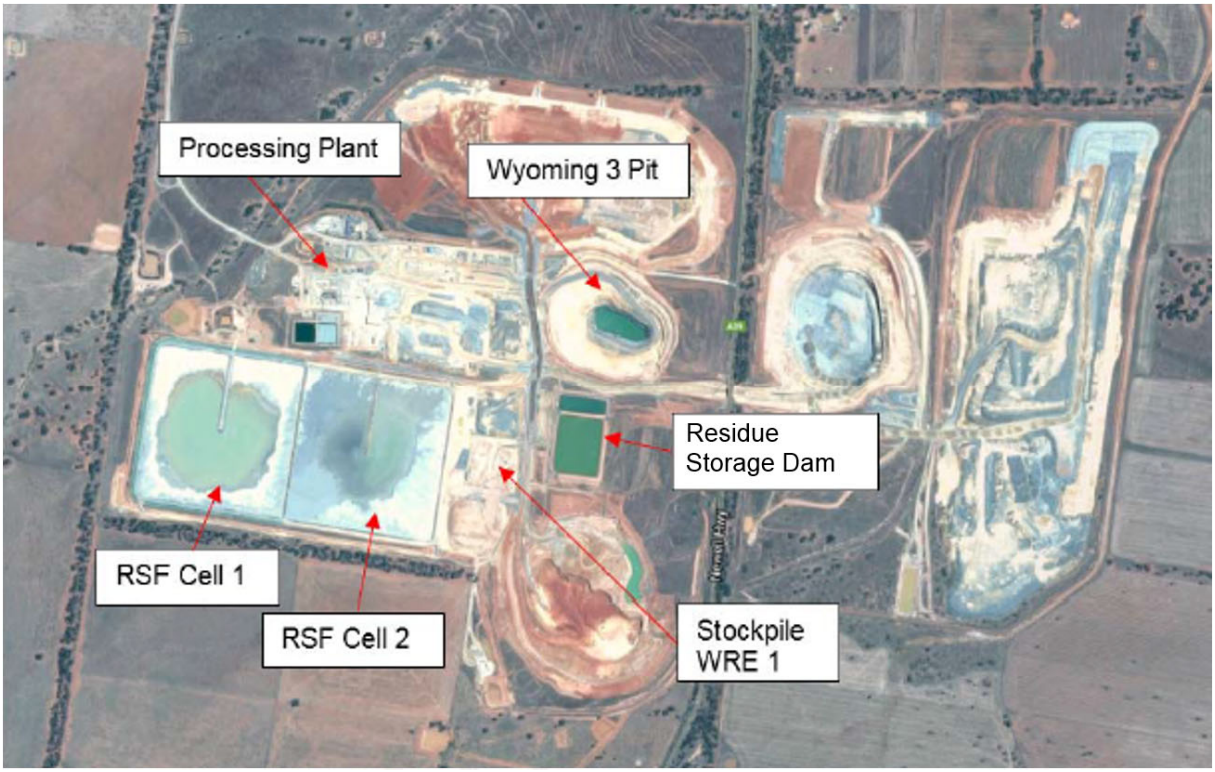

Figure 2-1 Site Layout

The Stage 1 starter dam of 2.0 to 5.5 m height was constructed in 2013 to RL 270.5 m to provide adequate storage capacity for the first 12 to 15 months of the operation. The RSF was subsequently raised primarily through upstream construction methods in 2 m raises in 2015, 2016, 2017, 2018 and to the current Stage 6 RL 280.5 m in 2019. The relevant design documents are listed as follows:

- Tomingley Gold Project, Residue Management, Design Report, Rev 1 (DEC, 2011);
- TGO RSF, Stage 2 Wall Raise Design Report, (PSM, 2015);
- TGO, Residue Storage Facility, Stage 3 Raise – Detailed Design (GHD, 2016); and
- TGO, Residue Storage Facility, Stage 4 Raise Detailed Design Report (GHD, 2017a).
- RSF Stability Update Post 2017 Investigations (GHD, 2017b).
- RSF Stage 5 Raise Design Preconstruction report (GHD, 2017c).
- RSF Stage 6 Raise Design Preconstruction report (GHD, 2019).

The RSF is designed to operate as a sub-aerial tailings deposition facility, discharging from the perimeter walls forming exposed beaches grading from the embankments towards the central ponds.

A rockfill underdrainage system, which is drained via pump wells, has been provided around the upstream toe to assist in maintaining a low phreatic surface within the residue under the critical upstream constructed foundation.

Each cell is equipped with a centrally located decant tower to enable water released from the residue, combined with collected rainwater from the RSF, to be returned to the process water dam for re-use in the mill where possible via pumps.

Historically, the operation has shown to have excess water in the RSF decant ponds during winter months as can be seen from the aerial photo in Figure 2-1. During these periods the pond has been allowed to encroach on the Stage 1 embankment which has resulted in softer tailings and difficult founding of the Stage 2 upstream raise. The Stage 2 raise has subsequently had longitudinal cracking due to settlement and some minor seepage on the downstream shell of the Stage 2 raise, where ponding on the wall has also occurred, particularly at Cell 2 where the Stage 2 embankment was traffic compacted only. Consequently, a filter was designed for Cell 2 northern and southern downstream embankments to manage the piping risk, this filter has been partially applied to a 120 m length of the Cell 2 south embankment which was still actively seeping during 2016, seepage is captured for return to the pond and flows are monitored.

Since then, buttresses have been built along the downstream toe of north and south walls of Cell 2 to the same height of Stage 5 crest level, which has covered the existing filter section. Monitoring has shown a trend in seepage reduction to the filter drain.

Buttresses have also been built along the downstream toe of Cell 1 to 1 m below the Stage 4 crest level. All buttresses have over-steepened batter slopes to maintain the access road along the toe of RSF and to minimise encroaching into sediment ponds. Although the placed buttress are sufficient to achieve the minimum factor of safety for Stage 5 embankments, the buttresses should be flattened to the design profile 3H:1V to achieve the minimum toe width as per Stage 5 design (GHD, 2017c) at the LOM of current open pits operation.

To reduce the need to store excess water on the RSF, the Residue Storage Dam (RSD), previously known as Wyoming Central Dam (WCD) has been upgraded and commissioned in August 2018 to provide 110 ML of excess process water storage to minimise the RSF supernatant ponds. This will assist in a tailings beach forming in the RSF in accordance with the design requirements which will subsequently improve tailings strength for futures raises and increase overall embankment stability.

TGO is putting the process plant on care and maintenance for a period of approximately 10 weeks from mid-December 2019 to allow sufficient underground (UG) ore to be delivered to the ROM to enable processing to recommence. Development of the underground workings commenced in January 2019.

The RSF closure concept envisions Cell 1 to be 2 m higher than Cell 2 to form a final beach profile grading from west of Cell 1 to east of Cell 2 to drain the surface water off the RSF to natural ground, away from the dam. This is further discussed in Section 7.

2.2 Consequence Category Review

The current RSF Consequence Category has been assessed as “Significant” in the design report titled “RSF Stage 5 Raise Detailed Design Report” (GHD, 2017c) for Dam Failure and Environmental Spill Consequence Categories in accordance with the ANCOLD Guidelines on the Consequence Categories for Dams (ANCOLD, 2012b).

For Dam Failure Consequence Category, it was considered that the residue is susceptible to flow in a dam break due to previous observations of seepage and water retention in the storage particularly through the winter months. The PAR (Population at Risk) was assessed to be <1 for

both Sunny Day and Flood Failure, given the daily monitoring schedule and contingency plans that are in place in the Dam Safety Emergency Plan (DSEP), the plant personnel would have adequate warning to reach a safe evacuation area in the event of a catastrophic failure.

The highest severity of damage and loss due to the dam failure was assessed as being 'Major' based on the impact on the business and the natural environment due to the release of tailings and contaminated water.

Based on a damage and loss level of 'Major' and a PAR of <1, the consequence category was determined to be 'Significant' for both Sunny Day and Flood failure scenarios.

The previous assessment undertaken for Stage 5 RSF, as summarised above, has been reviewed and considered still applicable to the Stage 9 RSF embankments although the flood wave would be slightly higher due to increase of tailings volume stored in the RSF. Given the RSD has now been commissioned to remove excess ponding from the RSF the 'Significant' consequence is still deemed appropriate even with slightly higher tailings volume stored.

The Environmental Spill Consequence Category has also been reviewed and conservatively assessed to be 'Significant' due to release of contaminated decant water stored in the RSF that would have a 'Major' impact on the environment with PAR <1.

The RSD (previously WCD) has been upgraded and commissioned in August 2018 to store excess water from the RSF to maintain the ponds as small as practicable, in attempt to increase the embankment stability and reduce piping risk overtime. However the residue is still susceptible to flow in a dam break due to it being at a high level of saturation or water trapped between deposition layers. It is therefore important to keep ponds as small as possible and allow sufficient drying time between each cycle to enable tailings to dry and consolidate in order to increase the tailings density and strength.

The buttresses have also been constructed along the downstream toe of RSF to increase the stability of the RSF to a minimum factor of safety of 1.1 for post liquefaction case assuming all tailings will liquefy under earthquake loading. Additional buttresses will be required for future raises, as discussed in Section 3.3.

2.3 Design Basis

The assumptions and requirements used as design basis supplied by TGO are presented in Table 2-1.

Table 2-1 Design Basis

Item	Design Basis
Production Schedule	Cease processing and enter care and maintenance, until underground mining planned to restart. UG Mining Operation; Life of Mine 3Mt, production rate of 125 t/hr or 0.55 Mtpa average per annum, processing 1 week on 1 week off.
Geochemistry	Residue, waste rock and clay construction materials sources are Non-Acid Forming (NAF).
Residue Deposition	Pumped as a slurry at 45-50% solids (current). Deposited from spigots on perimeter pipe from upstream crest. Rotation between Cell 1 and Cell 2 in 50/50 spilt from Stage 6 onwards.
Water Management	External excess decant storage of 110 ML at RSD.
Construction Material Hauling	The construction material will be obtained from existing stockpiles to the east of Cell 2 using an excavator and truck operation.
Closure	Embankments are progressively rehabilitated to reduce risk for erosion. On mine closure, residue proposed to be covered by placement of mine waste to form a water-shedding cover and growth medium, with a final profile to be determined by future closure design.

2.4 Design Criteria

The design criteria listed in Table 2-2 developed and agreed with TGO for the proposed lifts have been based on the following:

- Currently accepted practice for dam engineering in Australia.
- Australian National Committee on Large Dams (ANCOLD) Guidelines; and
- NSW Dam Safety Committee (DSC) guidelines and requirements.

Table 2-2 Stage 4 RSF Design Criteria

Item	Design Criteria
Dambreak Consequence Category (ANCOLD)	Significant
Environmental Spill Consequence Category (ANCOLD)	Significant
Decanting System	Maintain and raise existing decant towers with pumped decant to process water pond. Pump capacity: 1.92 ML/day

Item	Design Criteria
Spillway	The TGO RSF is designed for no spill, therefore no spillway has been provided resulting in a requirement to fully contain a PMF event without spill.
Decant Pond Requirements	Maintain at all times 1:10,000 year AEP flood event without the pond reaching the embankment wall.
Embankment Seismic Loading	Operating Basis Earthquake (OBE) = 1:475 year return period, PGA = 0.01g Maximum Credible Earthquake (MCE): PGA = 0.36g
Southern, Western & Northern Embankments	Upstream raise construction method. Batter Slopes of 3H:1V (North & West wall) 2.5H:1V (South wall) downstream and 1.5H:1V upstream. Access Roads of minimum 6 m wide, including safety bunds.
Eastern Embankment	Centreline raise construction method. Batter slopes of 3H:1V downstream and 1.5H:1V upstream. Access Roads of minimum 6 m wide, including safety bunds.
Decant Embankments	Centreline raise construction method. Batter slopes of 1.5H:1V downstream and upstream. Access Roads of minimum 6 m wide, including safety bunds.
Central Embankment	Upstream raise construction method. Batter slopes of 1.5H:1V downstream and upstream. Access Roads of minimum 6 m wide.

3. Stage 7 Raise Stability Analysis

3.1 Overview

RSF embankments require additional buttress for the future Stage 7 raise to meet the stability requirement for static and post liquefaction conditions. Historically the RSF cells have been raised by upstream construction except the Cell 2 eastern embankment, which reduces the storage area and storage capacity as the dam rises.

A cost benefit analysis was undertaken to compare the benefit of centreline and upstream raise geometry considering embankment fill costs verses tailings storage / rise rate.

The buttress volumes for each option for Stage 7 current LOM has been determined by the stability results, as described in the following section.

3.2 Stability Analysis

3.2.1 Method of Analysis

A high level stability analysis has been undertaken with the 2D Limit Equilibrium software package Slide 7.0, produced by Rocscience. Bishop's Simplified Method was selected to determine the factor of safety (FOS) against circular and Morgenstern-Price Method for non-circular (block) failures.

The phreatic surface has been drawn manually on each model based on the monitoring data of the new piezometers installed through Stage 4 embankment to the tailings at RL 268.5 m in November 2017. Three piezometers showed that the water level was approximately at RL 269.5 m as of July 2018. This is expected to increase slightly as the pond level increases.

Two sections have been analysed:

Cell 1 - section with waste rock beneath the Stage 2 embankment, as per as-constructed information;

Cell 2 – section without waste rock beneath Stage 2 embankment, no haul road or blanket filter was assumed downstream of the embankment (sections represents the northern wall, which is considered as most critical as the haul road and filter increase stability on the southern wall).

3.2.2 Load Cases

The following static loading cases have been modelled for both Cell 1 and Cell 2 based on the most critical cases identified during the Stage 5 stability assessment.

Load Case 1 - Long term normal loading (where porewater pressures in all materials have dissipated except the tailings), modelled as an effective strength analysis.

Load Case 2 - Post-liquefaction due to earthquake loading (liquefied tailings, undrained clay embankment and foundations) with normal operating water level;

Table 3-1 shows the static load cases that have been analysed and their corresponding required minimum FOS, as defined in the Australian National Committee on Large Dams (ANCOLD) *Guidelines on Tailings Dams* (May, 2012).

Table 3-1 Static Load Cases and Minimum FOS

Load Case	Description	Max. Taills RL (m)	Pond RL (m)	Failure Direction	Min. FOS
1	Static Normal	282	281	DS*	1.5
2	Post-liquefaction	282	281	DS	1.1

*DS = downstream

3.2.3 Material Properties

The material properties adopted for the buttress design, as listed in Table 3-2 are based on previous geotechnical investigations and embankment testings during Stage 5 construction.

Table 3-2 Adopted Material Parameters

Material	Unit Weight (kN/m^3)	Effective Strength		Undrained Strength (kPa)
		Friction Angle (°)	Cohesion (kPa)	
Clay Embankment (Note 1)	18.5	30	6	57
Waste Rock under Cell 1 Stage 2 embankment	22	40	0	-
Oxide / Fresh Waste (buttresses)	18	28 (Note 2)	0	-
Tailings	13	-	-	Note 3
Consolidated Tailings	14	-	-	Note 4
Liquefied Tailings	12	-	-	Note 5
In-situ Clay/ Saprolite	17	29	11	78 (Note 6)

Note 1: Effective and undrained shear strength were derived using lower quartile values obtained from four Consolidated Undrained laboratory triaxial tests undertaken in the 2016 investigation.

Note 2: Assumed 28 degrees friction angle for tipping oxide waste for buttress. The same strength has been adopted for fresh tipped waste which is conservative.

Note 3: Tailings at the surface (i.e. unconsolidated) were assumed to have an undrained strength of 6 kPa, based on 2017 CPT testing. Consolidated tailings were assumed to have an increase of 5 kPa/m with depth to a maximum strength of 30 kPa.

Note 4: Undrained shear strength of the tailings under Stage 2 embankment is assumed to have a minimum Su of 0 kPa at top and an increase of 4.3 kPa/m with depth to a maximum strength of 15 kPa.

Note 5: Vertical stress ratio = 0.03, minimum shear strength of 0 kPa.

Note 6: Based on Consolidated Undrained Triaxial tests undertaken on the foundation samples at Cell 1 in 2016.

3.2.4 Results

It is found that the post-liquefaction case is the most critical case that governs the size of the buttress for both cells. To achieve the minimum required factor of safety of 1.1 for this case, both upstream and centreline options require a minimum buttress toe of 18 m wide for both cells, to be constructed at 3H:1V slopes with benches to RL 278.5 m (except 17 m for Cell 1 upstream raise, benches to RL 279.0 m).

The buttress geometry has been summarised in Table 3-3.

It should be noted that this stability is conceptual and could be refined with future work in an attempt to reduce this footprint. The minimum geometry for Stage 7 buttress for both options are shown in Figure 3-1 to Figure 3-4.

Table 3-3 Buttress Sizes for Stage 7 Raise

Section	Cell 1		Cell 2	
Construction Method	Upstream	Centreline	Upstream	Centreline
Base Width (m)	17 m	18 m	18 m	18 m
Top Bench RL (m)	RL 279.0 m	RL 278.5 m	RL 278.5 m	RL 278.5 m
Batter Slope	3H:1V	3H:1V	3H:1V	3H:1V

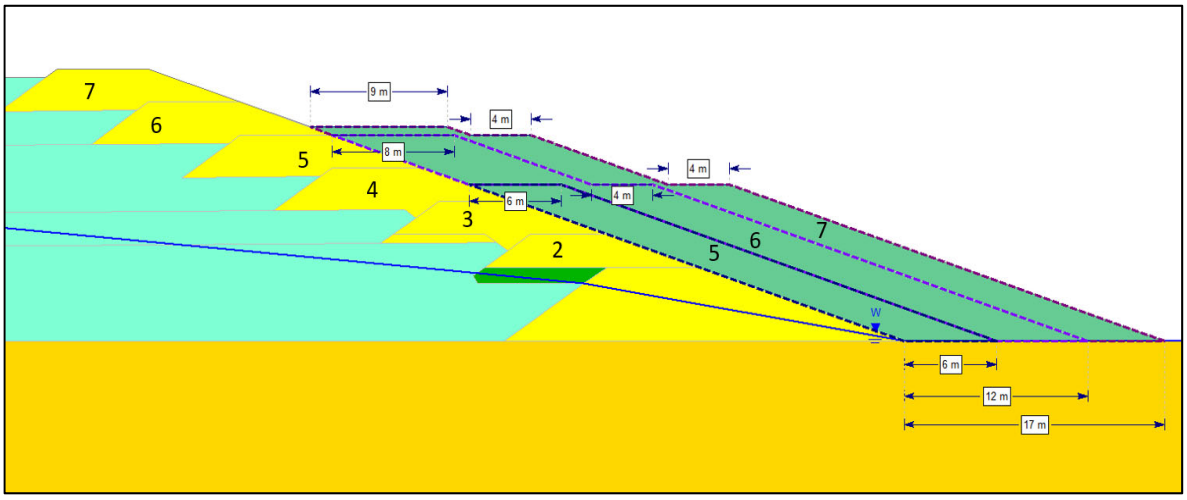

Figure 3-1 Cell 1 Stage 7 Buttress geometry: Upstream Raise

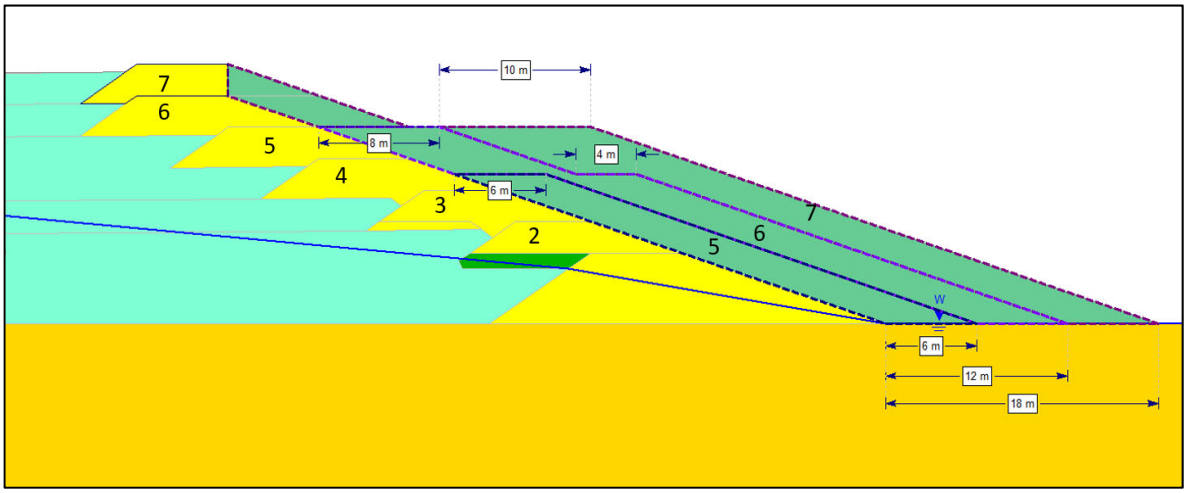

Figure 3-2 Cell 1 Stage 7 Buttress geometry: Centreline Raise

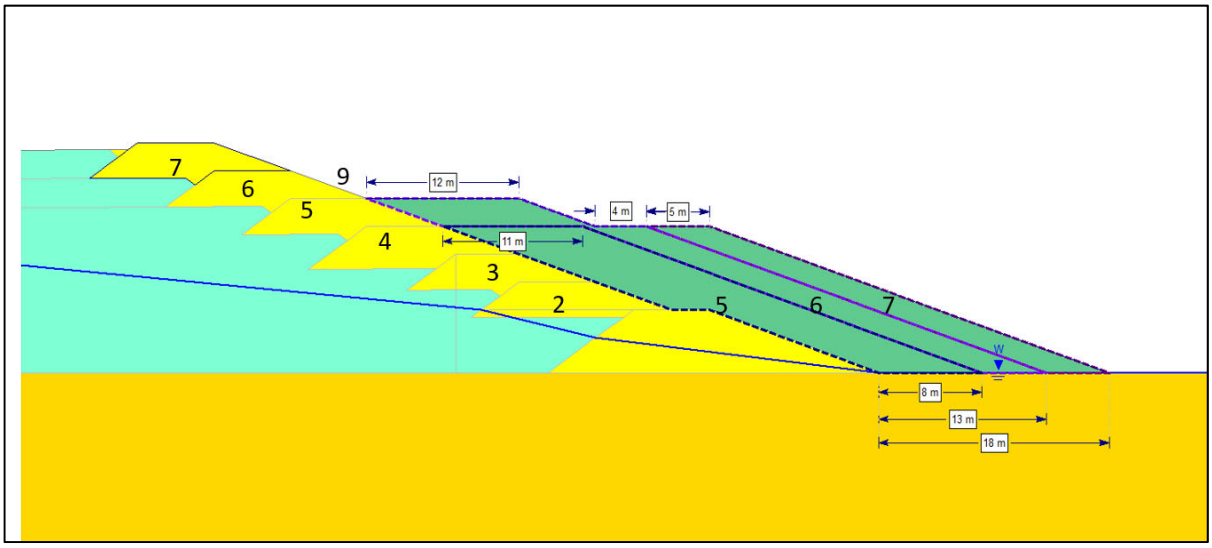

Figure 3-3 Cell 2 Stage 7 Buttress geometry: Upstream Raise

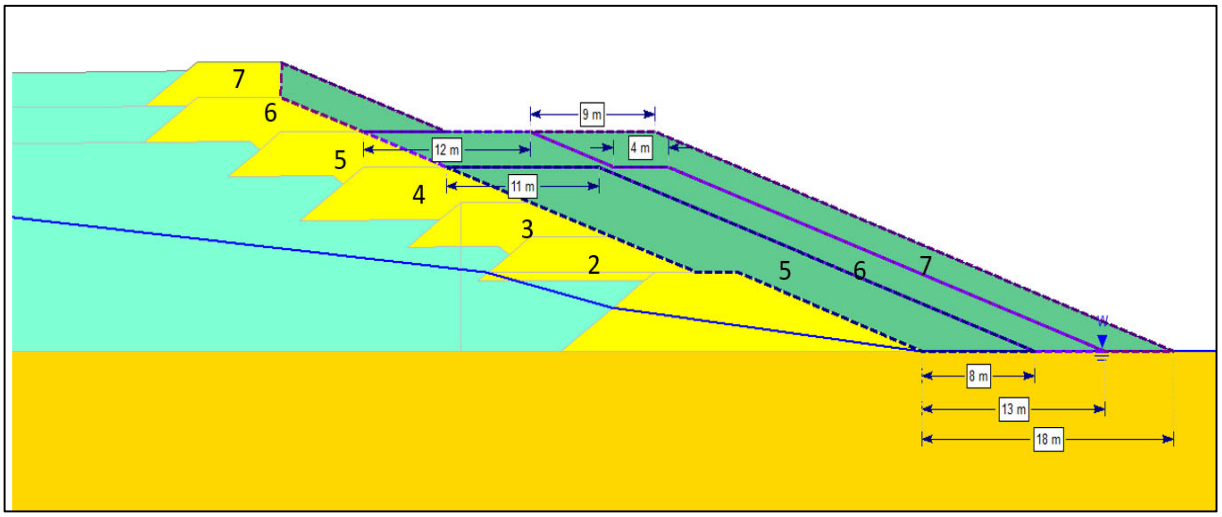

Figure 3-4 Cell 2 Stage 7 Buttress geometry: Centreline Raise

3.3 Options Comparison

The buttress volumes required for each option and storage volumes for Stage 7 raise has been summarised in Table 3-4. The buttress and storage volumes are based on the following assumptions:

- Buttress volumes are estimated based on the sectional area of one section from stability results for each cell excluding Stage 6 buttress. The area is then multiplied by the crest length of the embankment for respective cell.
- A buttress is not required for Cell 2 eastern embankment as it is proposed to be raised by centreline construction.
- The tailings storage capacity assumes the current tailings grade from perimeter to decant tower will be the same as when the cells are full as tailings fill to RL 278 m, i.e. 0.5 m below the dam crest. The storage volume is obtained by multiplying storage area and raise height.
- The storage areas for the upstream raise option are estimated by offsetting Stage 5 as-constructed upstream crest line as required for each future raise, assuming the central

embankment is raised by upstream construction into Cell 1 storage, and eastern embankment by centreline method.

- The storage areas for centreline raise option are estimated from Stage 5 as-constructed survey, assuming all embankments are being raised by centreline method, thus remain the same for all future raises.
- For comparison purposes, it is assumed that the tailings in Cell 2 is always 1 m below Cell 1, assuming discharge from the perimeter around the cell at a rotation of 50/50 split between Cell 1 and Cell 2. The deposition strategy to facilitate the closure arrangement is discussed further in Section 7.

Table 3-4 Centreline versus Upstream Raise Stage 7

Raise option	Centreline Raise Option			
	Buttress Volume (m^3)	Storage Capacity* (m^3)	Storage/ buttress ratio	Storage (months)
Centreline Raise	216,200	553,000	2.6	18
Upstream Raise	137,000	520,100	3.8	17
Difference	79,200	32,900	1.2	1

* Storage capacity does not include Stage 5/6 storage.

3.4 Discussions

Upon comparison of volumes in Table 3-4, the upstream raise option is considered preferable than the centreline raise as it was shown that the centreline raise option will require more buttress materials for each raise with slightly more storage capacity (additional 1 month) than the upstream raise option.

It is noted that the buttress size for Stage 7 is conceptual only and would be dependent on the post-liquefied tailings shear strength and foundation parameters as a deep seated failure through the foundation was one of the possible failure mechanisms based on the stability assessment. It is also noted that the buttress material was assumed to be oxide waste with lower strength as were used previously. The buttress size could reduce if stronger materials (fresh waste, or compacted fill) was used for future buttress work.

To confirm the buttress size required, it is recommended that:

- A more detailed foundation investigation be conducted to reassess the foundation conditions and strength by drilling boreholes and retrieve samples for triaxial testing;
- CPTu investigation within the tailings be undertaken at similar locations to previous investigations prior to raising the RSF to assess whether the tailings have improved in strength and reassess the liquefaction /strain weakening potential and post-liquefied shear strength.
- Continue to monitor pressures from piezometers to confirm the phreatic surface within tailings.

4. Stage 8/9 Raise Stability Analysis

4.1 Overview

A high level stability analysis has also been undertaken to investigate the feasibility of raising the RSF beyond Stage 7 to Stage 8/9.

The RSF embankments would require additional buttress for future Stage 8/9 raise to meet the stability requirement for static and post liquefaction conditions.

A cost benefit analysis was undertaken to compare the benefit of centreline and upstream raise geometry considering embankment fill costs verses tailings storage/rise rate for Stage 8/9

The buttress volumes for each option for Stage 8/9 has also been determined by the stability results, as described in the following section.

4.2 Stability Analysis

4.2.1 Method of Analysis

A high level stability analysis has been undertaken with the 2D Limit Equilibrium software package Slide 7.0, produced by Rocscience. Bishop's Simplified Method was selected to determine the factor of safety (FOS) against circular and Morgenstern-Price Method for non-circular (block) failures.

Two sections have been analysed:

Cell 1 - section with waste rock beneath the Stage 2 embankment, as per as-constructed information;

Cell 2 – section without waste rock beneath Stage 2 embankment, no haul road or blanket filter was assumed downstream of the embankment (sections represents the northern wall, which is considered as most critical as the haul road and filter increase stability on the southern wall).

The static loading cases analysed for the stability purposes have been described in section 3.2.2 of this report

4.2.2 Material Properties

The adopted material properties have been discussed in detail in section 3.2.3 of this report and has been listed in Table 3-2.

4.2.3 Results

Based on the stability analysis, to achieve the minimum required factor of safety of 1.1 for the post seismic case a minimum buttress toe of 26 m and 28 m will be required for the upstream raise construction option for Cell 1 and Cell 2 respectively. While, for the centreline raise option the minimum buttress toe of 28 m and 30 m will be required for Cell 1 and Cell 2 respectively with 3H:1V batter slope.

The buttress geometry has been summarised in Table 4-1.

Although, the RSF can be theoretically raised with the 3H:1V downstream batter slope, that bigger buttresses construction along the downstream toe is constrained by the mine lease boundary along the western and southern side of RSF. Therefore, raising RSF with 3H:1V batter slope requires the buttress to be placed against the fence along the southern area of RSF, leaving minimal to no room for drainage.

It should be noted that this stability is conceptual and could be refined with future work in an attempt to reduce this footprint.

The minimum required buttress geometry for the various stages are shown in Figure 4-1 to Figure 4-4.

Table 4-1 Buttress Sizes for Stage 9 Raise: 3H:1V batter

Section	Cell 1		Cell 2	
Construction Method	Upstream	Centreline	Upstream	Centreline
Base Width (m)	26 m	30 m	28 m	30 m
Top Bench RL (m)	RL 283.5 m	RL 280 m	RL 283.5 m	RL 280.5 m
Batter Slope	3H:1V	3H:1V	3H:1V	3H:1V

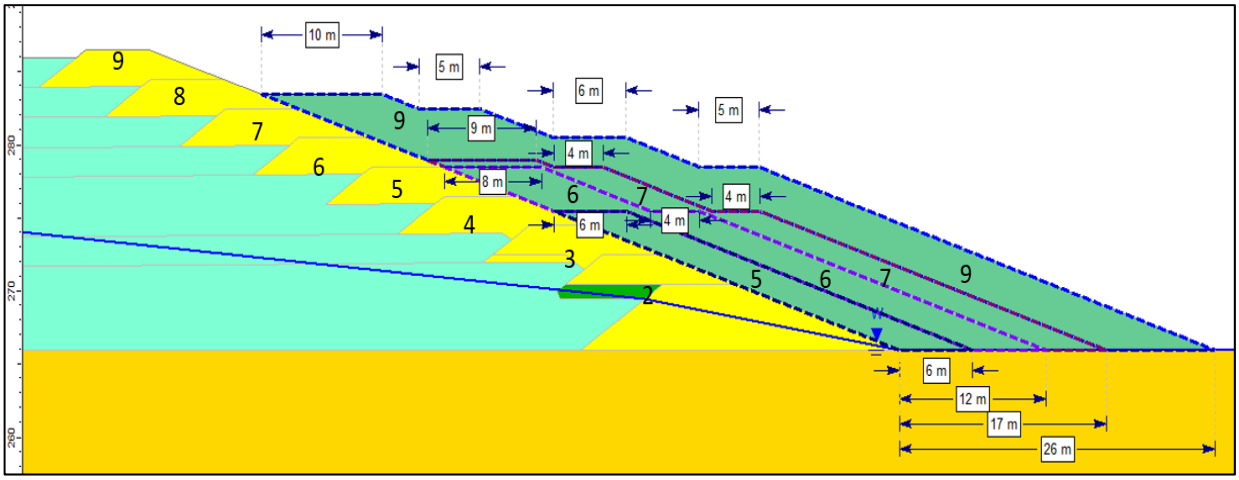

Figure 4-1 Cell 1 Upstream Raise Option

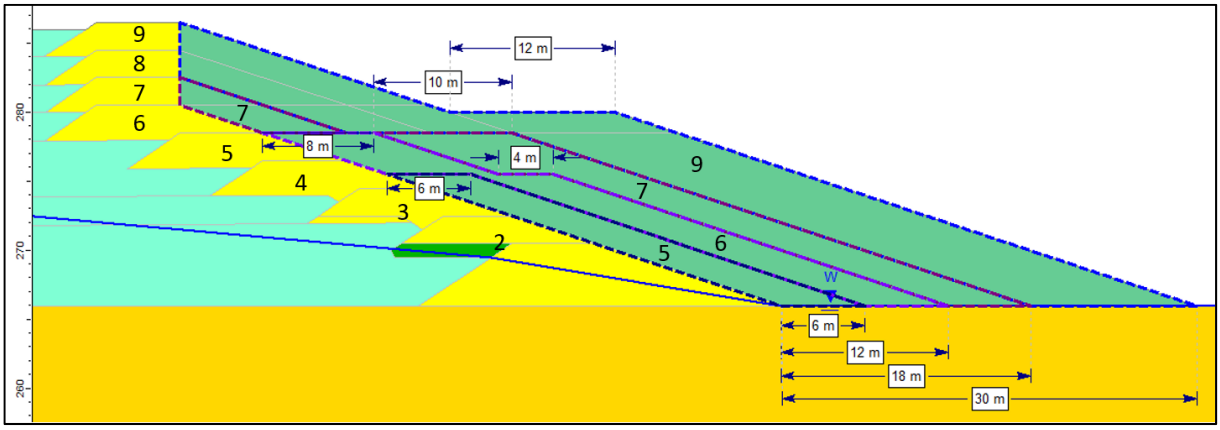

Figure 4-2 Cell 1 Centreline Raise Option

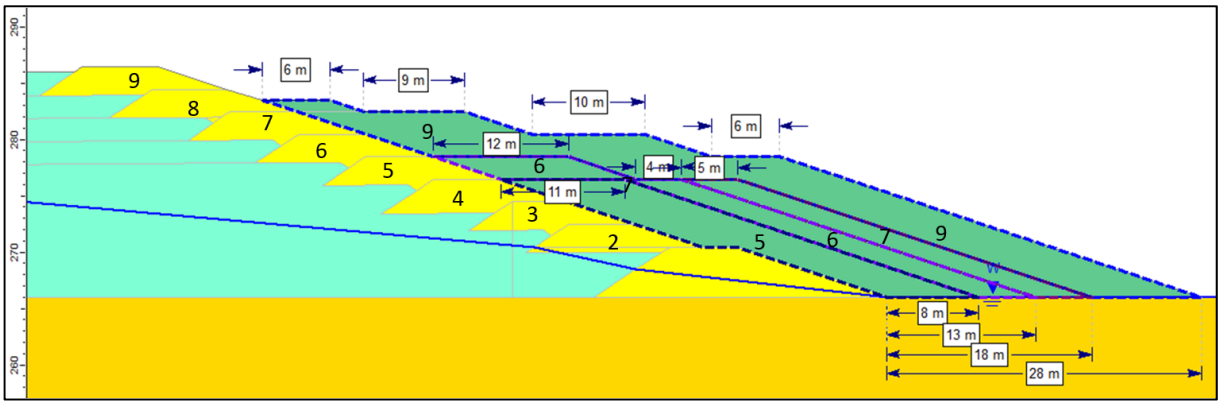

Figure 4-3 Cell 2 Upstream Raise Option

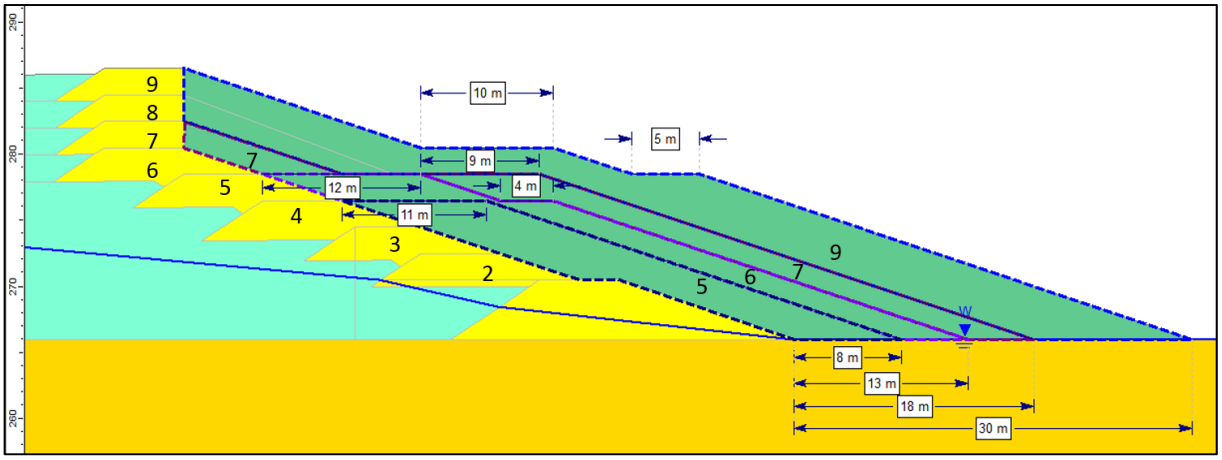

Figure 4-4 Cell 2 Centreline Raise Option

4.2.4 Buttress Sensitivity Analysis

Sensitivity analysis has been undertaken with a flatter downstream batter angle of 2.5H:1V for the preferred upstream raise option to check the possibility of reducing the minimum buttress toe width to 20 m and 22 m for Cell 1 and Cell 2 respectively

Based on the adopted material strength parameters, changing the batter slope to 2.5H:1V from 3H:1V reduces the factor of safety for both the normal loading case and post seismic case (see Figure 4-5) below the minimum requirements as described in Section 4.2.1. The results from the stability analysis for the upstream raise construction with varying buttress batter slope have been compared in Table 4-2.

Table 4-2 Buttress Stability Sensitivity Results

Buttress Grade	Long term Loading (Upstream Raise)		Post Seismic (Upstream Raise)	
	Cell 1	Cell 2	Cell 1	Cell 2
3H:1V	1.5	1.5	1.1	1.1
2.5H:1V	1.4	1.4	1.0	1.0

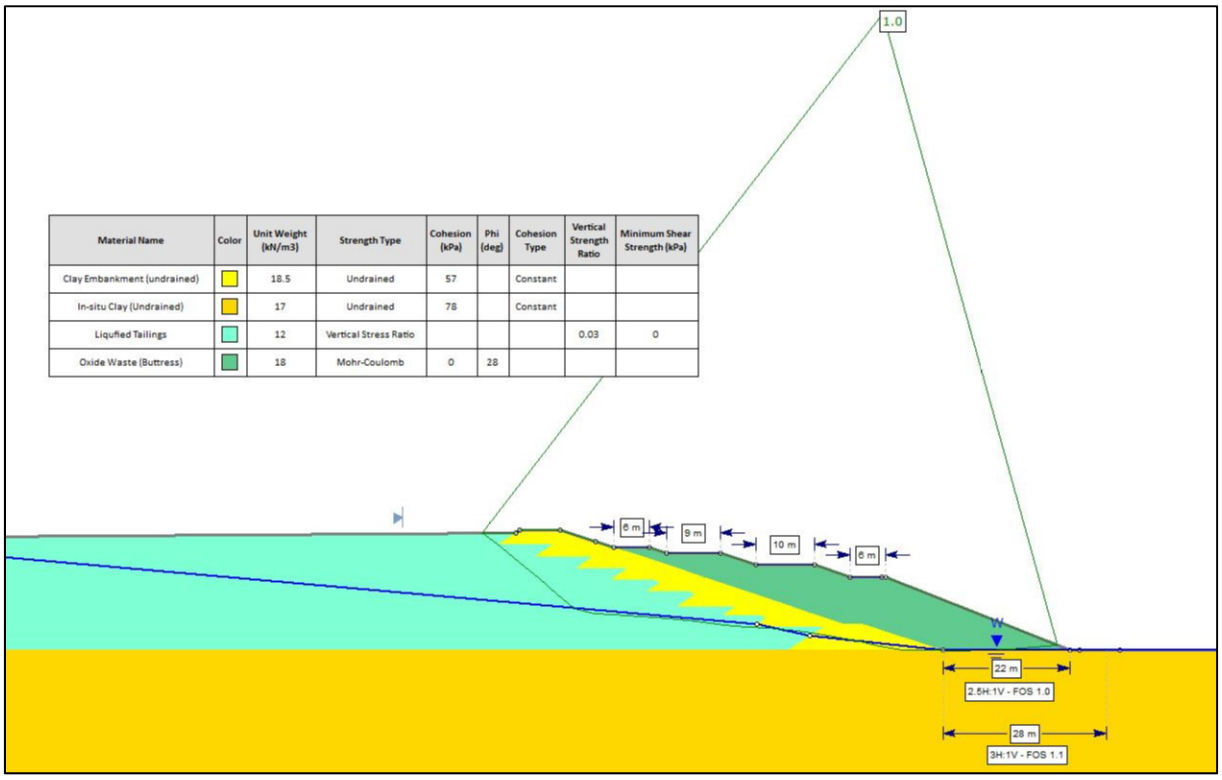

Figure 4-5 Upstream Construction Cell 1: Post Seismic Case with Fos of 1.0

It must be noted that conservative parameters were adopted for the stability analysis. Therefore, a sensitivity analysis has been undertaken to determine the improvements in the material strength which would be result in an acceptable factor of safety as summarised in Table 4-3.

The analysis shows that with a small improvement in material strengths of embankment, buttress or tailings could yield acceptable FOS at 2.5H:1V (see Figure 4-6).

It is proposed a 2.5H:1V slope is adopted for the South wall such that buttress toe offset from the lease boundary is maximised. A 3H:1V slope for the West and North walls is proposed where there is no boundary constraints.

Table 4-3 Material Parameters Sensitivity

Improved Parameters	Original Parameters			Improved Parameters		
	Friction Angle (°)	Cohesion (kPa)	Undrained Strength (kPa)	Friction Angle (°)	Cohesion (kPa)	Undrained Strength (kPa)
Clay Embankment	-	-	57	-	-	65
Oxide Waste	0	28	-	0	30	-

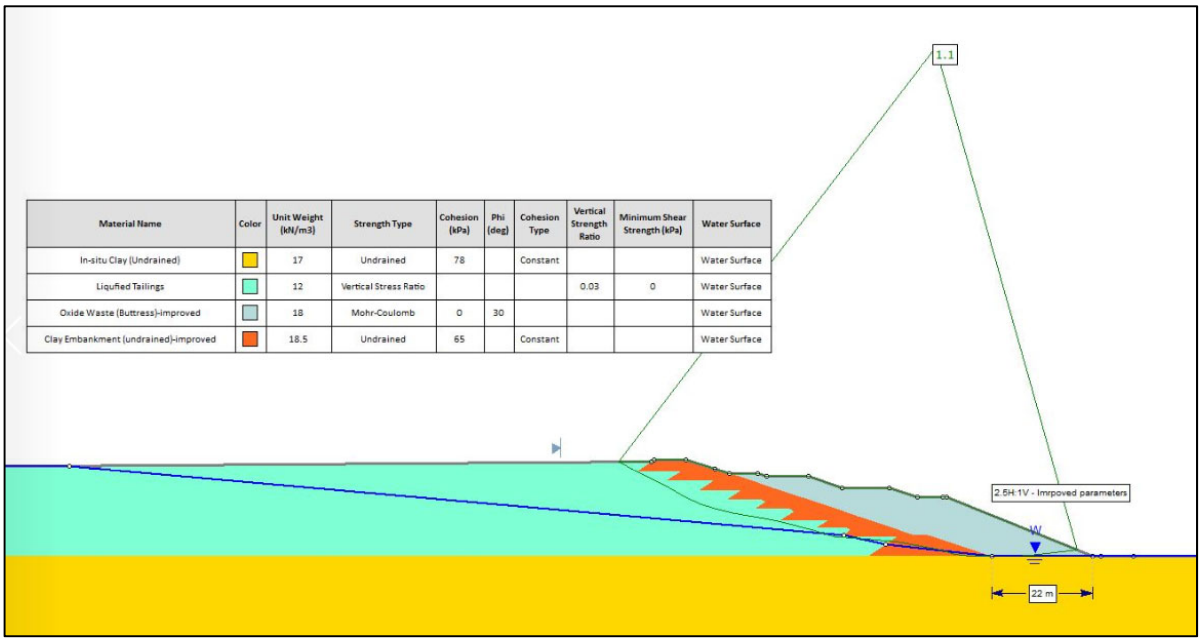

Figure 4-6 Upstream Construction Cell 1 with improved material strength: Post Seismic Case with Fos of 1.1

4.3 Options Comparison

The buttress volumes required for each option and storage volumes for Stage 9 has been summarised in Table 4-4. The buttress and storage volumes are based on the following assumptions:

- Buttress volumes are estimated based on the sectional area of one section from stability results for each cell including Stage 8 buttress. The area is then multiplied by the crest length of the embankment for respective cell. The volume excludes the embankment volume for each raise. A buttress is not required for Cell 2 eastern embankment as it is proposed to be raised by centreline construction.
- The tailings storage capacity assumes the current tailings grade from perimeter to decant tower will be the same as when the cells are full as tailings fill to RL 278 m, i.e. 0.5 m below the dam crest. The storage volume is obtained by multiplying storage area and raise height.
- The storage areas for the upstream raise option are estimated by offsetting Stage 5 as-constructed upstream crest line as required for each future raise, assuming the central embankment is raised by upstream construction into Cell 1 storage, and eastern embankment by centreline method.
- The storage areas for centreline raise option are estimated from Stage 5 as-constructed survey, assuming all embankments are being raised by centreline method, thus remain the same for all future raises.
- For comparison purposes, it is assumed that the tailings in Cell 2 is always 1 m below Cell 1, assuming discharge from the perimeter around the cell at a rotation of 50/50 split between Cell 1 and Cell 2. The deposition strategy to facilitate the closure arrangement is discussed further in Section 7.

Table 4-4 Centreline versus Upstream Raise Stage 9

Raise option	Buttress Volume (m3)#	Storage Capacity* (m3)	Storage/ buttress ratio	Storage (months)
Centreline Raise	530,000	1,105,900	2.1	35
Upstream Raise	461,700	978,800	2.1	31
Difference	68,300	127,100	-	4

* Storage capacity includes Stage 8 storage.

Incremental volume above Stage 7 buttress volume

4.4 Discussions

Upon comparison of volumes in Table 4-4, the upstream raise option is considered preferable than the centreline raise as it was shown that the centreline raise option will require more buttress materials for each raise with slightly more storage capacity (additional 4 months) than the upstream raise option.

It is noted that the buttress size for Stage 9 is conceptual only and would be dependent on the post-liquefied tailings shear strength and foundation parameters as a deep seated failure through the foundation was one of the possible failure mechanisms based on the stability assessment. As discussed in Section 4.2.4, the buttress material was assumed to be oxide waste with lower strength which was used in the previous analysis. However, sensitivity analysis proved that even a small improvement in the materials strength can yield the required minimum Fos for steeper batter slopes of 2.5H:1V and thereby reduces the required buttress volumes and the downstream toe width.

It is proposed a 2.5H:1V slope is adopted for the South wall such that buttress toe offset from the lease boundary is maximised. A 3H:1V slope for the West and North walls is proposed where there is no boundary constraints.

Therefore, to confirm the buttress size required, it is recommended that:

- A more detailed foundation investigation be conducted to reassess the foundation conditions and strength by drilling boreholes and retrieve samples for triaxial testing;
- CPTu investigation within the tailings be undertaken at similar locations to previous investigations prior to raising the RSF to assess whether the tailings have improved in strength and reassess the liquefaction /strain weakening potential and post-liquefied shear strength.
- Continue to monitor pressures from piezometers to confirm the phreatic surface within tailings.

5. Water Balance

A site water balance model has previously been prepared for TGO (GHD, 2017). The model was simulated from 1 July 2018 to 1 July 2022, with an initial inventory of process water volume of 50 ML and a mining water volume of about 800 ML. The water balance has been updated with the proposed production schedule with a nominal 1.1 Mtpa production continuing until March 2018 and nominal 0.55 Mtpa production on a week on – week off basis commencing in October 2019 and continuing until July 2022. All other model parameters and inputs were as documented in GHD (2017).

The range of total process and mining water inventory under various potential rainfall conditions are shown in Figure 5-1 and Figure 5-2, respectively.

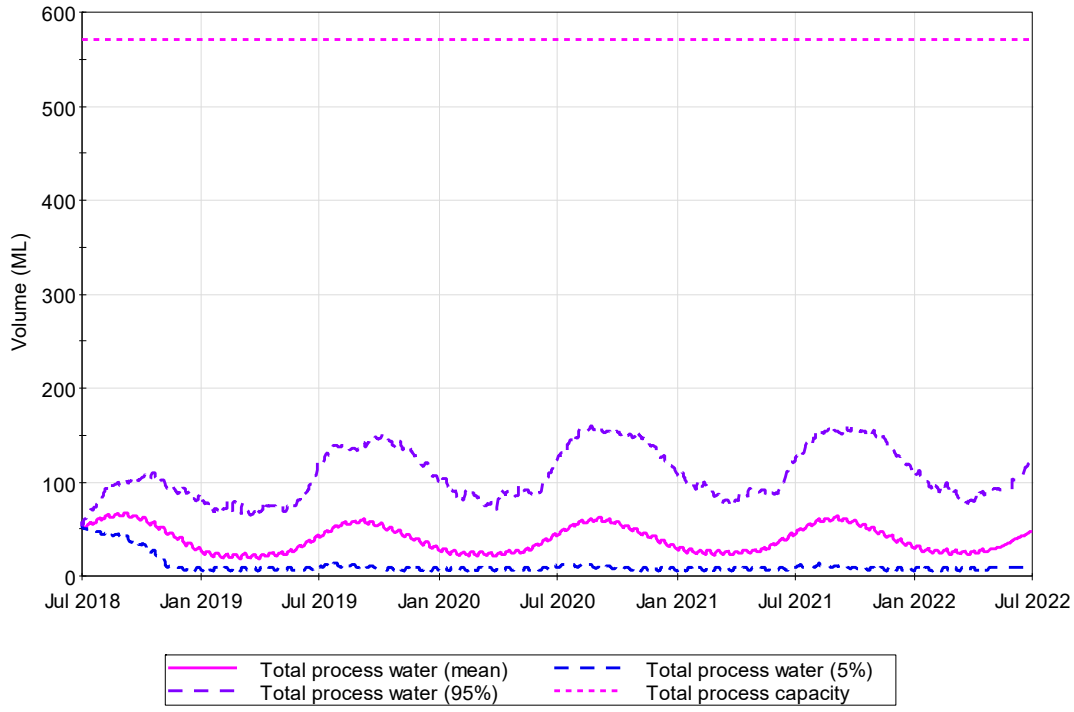

Figure 5-1 Total process water inventory

Figure 5-1 shows that process water inventory is likely continue to vary, potentially exceeding the 110 ML capacity of the recently commissioned RSD in above average rainfall conditions. However, the total process water inventory is not expected to exceed the combined physical water storage capacity of RSD and the RSF. Although the RSD provides a short term storage of process water during the winter months, due its relatively deep geometry (small surface area to volume ratio) compared to the RSF decant ponds, total evaporation is expected to be lower when it is in use. Therefore, depending on rainfall conditions and process water inventory, TGO should consider contingency measures to enhance the evaporation of process water from the inactive RSF beach, within operational and safety constraints. Measures may include blower or sprinkler type evaporators.

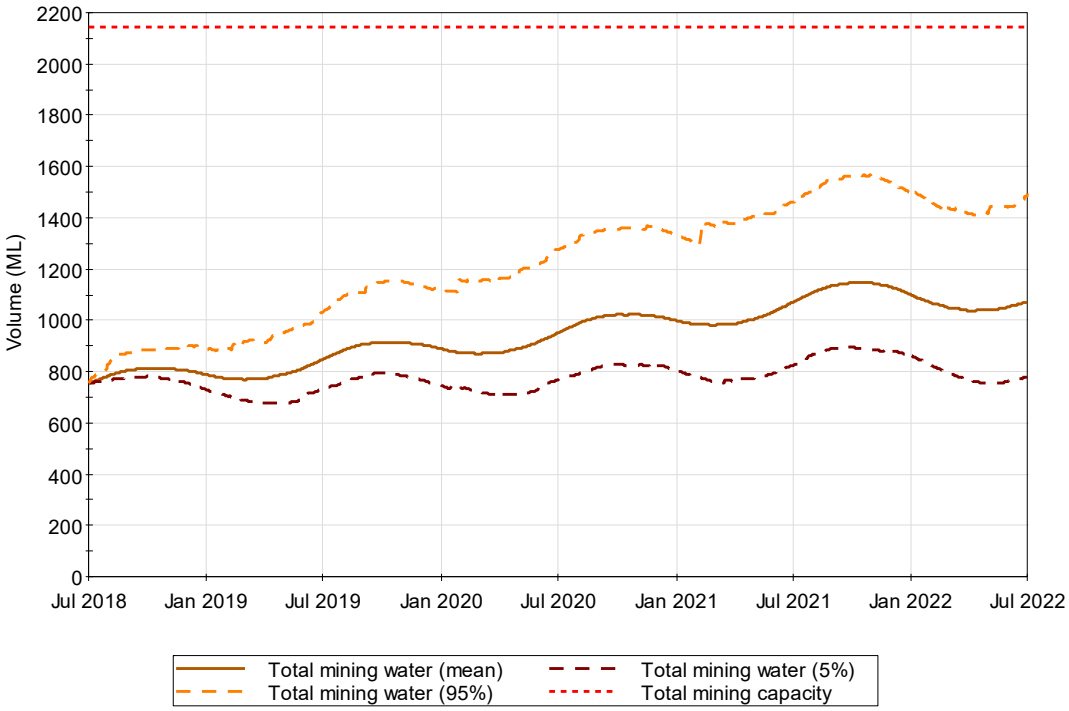

Figure 5-2 Total mining water inventory

Figure 5-2 shows that mining water inventory is likely to increase until 2022, corresponding to the peak in predicted groundwater inflows, however remains within the water storage capacity of the long term mining water storage, the Caloma One void.

The average annual water balance for year ending June 2020 is shown in Table 5-1.

Table 5-1 Average annual water balance

Water flow	1.1 Mtpa	0.55 Mtpa
Inputs		
Direct rainfall and catchment runoff	451	451
Supplied from Woodland borefield	529	254
Moisture in ore	55	27
Groundwater inflows	264	264
Total Inputs	1299	995
Outputs		
Evaporation	280	230
Dust suppression	250	250
Water retained in residue	493	239
Losses from rewetting of inactive beach	177	177
Total Outputs	1200	897
Change in Storage	99	99

Table 5-1 shows that both water inflows and outflows are expected to be lower with lower production rates and the increase in mining water storage is expected to remain unchanged. This indicates that process water inventory is unlikely to be significantly affected by the proposed reduction in production rate, as the main drivers of seasonal and annual variability in the water balance are rainfall and evaporation. As no increase in production is proposed, no reduction in water security is expected. As no change to catchment area or water storage capacity is proposed, no increase in risk of off-site discharge is expected.

6. Groundwater and Seepage Analysis

6.1 Local Hydrogeology

There are three distinct groundwater systems within the vicinity of TGO's mining leases, as identified by The Impax Group (2011):

- Shallow alluvium – discrete, shallow alluvium (less than 10-20 m deep) dissects the plains surrounding the mine site along creek flow paths. These aquifers are believed to be recharged from rainfall infiltration. Groundwater within these systems is of relatively good quality, however yields are relatively low and dependent on rainfall. Perched groundwater occurs within the shallow alluvium underlying the RSF, however it is generally not continuous across the mine site. Shallow groundwater appears to be more permanent along Gundong Creek to the northwest of the RSFs.
- Deep alluvium – up to 100 m deep and located approximately 10 km to the northwest and west of TGO. Groundwater yields are believed to be low and of poor quality. These systems may have some interaction with underlying bedrock however are believed to be primarily recharged from rainfall.
- Fractured rock – the area surrounding Tomingley is underlain by a confined saline groundwater system within the fractured sandstone, siltstone and volcanics at a depth of greater than 80 m. Groundwater yields range from 0-3 L/s, generally less than 1.5 L/s, and water quality is poor with high salinity (average electrical conductivity (EC) exceeds 20,000 µS/cm). Coffey (2007) investigated this groundwater system as a potential water supply for the mine and found it to be inadequate in terms of both yield and quality.

This assessment focuses on the incremental impact of the RSF Stage 9 raise on shallow groundwater underlying the RSF. Shallow groundwater is typically at a depth of less than 10 m below ground level (bgl). A groundwater contour plot for November 2017 (presented in GHD, 2018a) indicates shallow groundwater below the RSF is moving to the east away from Gundong Creek.

The hydraulic conductivity of the clay which comprises the foundation of the RSF is generally low to very low. Falling head tests on clayey strata between 1.55 and 42.5 m bgl at the RSF area indicate hydraulic conductivities of 0.0002 to 0.002 m/d or 2.3×10^{-8} to 1×10^{-9} m/s (DEC, 2011).

Groundwater usage is limited in the vicinity of the mine site. The closest active production bores (i.e. non test or monitoring bores), are over 3 km to the north of the mining lease area within shallow alluvium (GW034897, GW037395 and GW803148) with all reported yields less than 1.5 L/s. These bores are registered for stock and domestic, irrigation use and town water supply respectively.

6.2 Existing Seepage and Groundwater Impact

TGO undertakes monthly monitoring of shallow bores in the vicinity of the RSF (RSFMB01, RSFMB02, RSFMB03, RSFMB04, RSFMB05, RSFMB06, RSFMB07, RSFMB08, RSFMB09, RSFMB10 and RSFMB11). Monitoring ceased in early 2016 at RSFMB10. The RSF bores are generally located at the toe of the Stage 1 embankment.

GHD (2018a) carried out a review of monitoring data from these bores to identify impacts from the RSF. Groundwater level and quality data were assessed using a number of statistical and geochemical methods.

HARTT (Hydrograph Analysis: Rainfall and Time Trends) indicates statistically significant increasing time trends (independent of rainfall) in shallow groundwater level at bores RSFMB03, RSFMB04, RSFMB05, RSFMB07 and RSFMB08. However, analysis of groundwater chemistry did not find geochemical changes in shallow groundwater consistent with influence from residue decant water. It was concluded, based on this weight of evidence approach, that the increasing trends in groundwater levels around the RSF are not attributable to seepage from the RSF and are more likely attributable to one or more of the following:

- Recovery of groundwater levels following construction of the surface facilities area.
- The bulk mass of residue within the RSF resulting in compression of the underlying aquifer and increasing groundwater levels around the perimeter.
- Seepage from the sediment basins.

6.3 Analysis of Incremental Seepage and Groundwater Impact

Although seepage from the existing RSF has not been detected by the existing shallow groundwater monitoring bore network, a conceptual analysis of potential seepage has been undertaken to calculate the incremental change in seepage rate between approved conditions (Stage 6) and proposed conditions (Stage 9).

6.3.1 Methodology

The seepage analysis involved a one-dimensional calculation of vertical advective flow from the RSF decant pond into the underlying foundation. The calculation was based on the Darcy flow equation. For Stage 6 and Stage 9, the rates of seepage to shallow groundwater through the residue and through the residue and foundation were calculated. The conceptual analysis is shown schematically in Figure 6-1 and Figure 6-2.

The following inputs and assumptions were applied:

- For Stage 6, the decant pond water level was assumed to be managed at RL 279 m and 0.5 m deep, while for Stage 9 the decant pond water level was assumed to be managed at RL 285 m and 0.5 m deep.
- Maximum decant pond area of 2.56 ha (160 m x 160 m).
- The base of the residue was assumed to be RL 267.5 m.
- The residue has a permeability of 1 x 10^{-8} m/s (DEC, 2011).
- The influence of the embankment on seepage was not considered.
- Negligible water pressure at the base of the tailings.
- Foundation permeabilities of 1 x 10^{-8} m/s and 1 x 10^{-9} m/s were analysed (from DEC, 2011).
- Observed shallow groundwater level of RL 260 m for Stage 6 and RL 261.8 m for Stage 9.
- Seepage rates are calculated under steady state conditions.

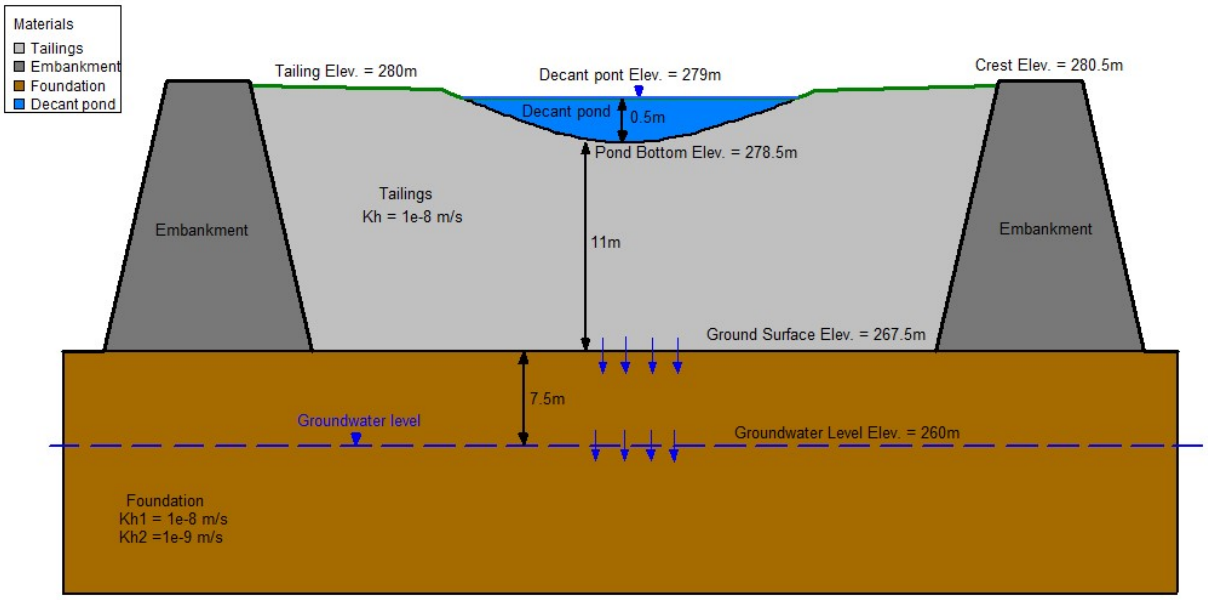

Figure 6-1 Conceptual seepage analysis through the residue and foundation – Stage 6

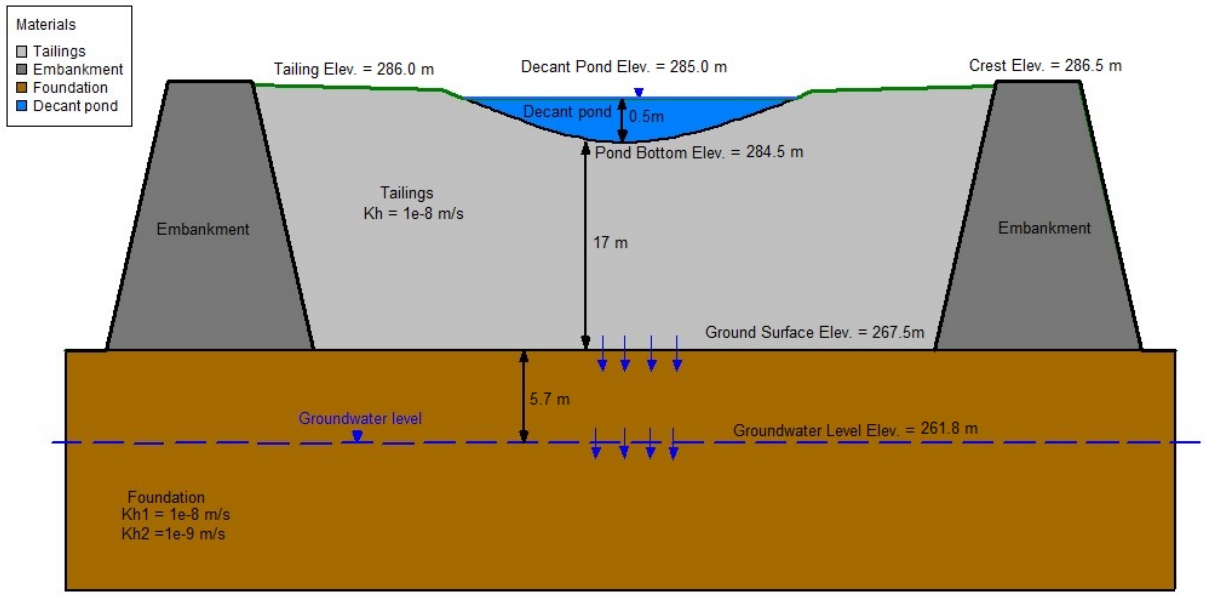

Figure 6-2 Conceptual seepage analysis through the residue and foundation - Stage 9

6.3.2 Results

The results of the seepage analysis are shown in Table 6-1. The analysis suggests negligible incremental change in seepage from the Stage 6 raise. In fact, the analysis suggests that there may be a slight reduction in the seepage rate due to an increased depth of tailings and increased distance between the decant pond and shallow groundwater.

Overall the analysis indicates negligible change in risk of impact to groundwater as a result of the Stage 9 raise to the RSF. Due to the assumptions and the analytical approach undertaken it is considered that the modelled seepage rates are sufficient for the purpose of comparing the

incremental change in seepage when considering the depth of residue and variations in foundation material.

Table 6-1 Stage 9 seepage analysis results

Flow properties	Stage 6		Stage 9	
	Calculated seepage volume (kL/d)	Seepage time (yrs)	Calculated seepage volume (kL/d)	Seepage time (yrs)
1st Scenario: Seepage through residue	23.1	33.4	22.8	52
2nd Scenario: Seepage to shallow groundwater through residue and foundation with K1	22.7	57.1	22.6	70
3rd Scenario: Seepage to shallow groundwater through residue and foundation with K2	4.9	265.7	6.9	230

6.4 Monitoring program

The existing monitoring network has not detected any seepage from the RSF at this point in time. This is consistent with the seepage analysis which predicts it would take up to 200 years for seepage (if any) to reach shallow groundwater.

Since there is not expected to be any increase in the risk of impact to groundwater as a result of the Stage 9 raise, it is considered that the existing monitoring network is sufficient and that monitoring should continue in accordance with the existing program.

7. Tailings and Water Management

7.1 During Operation

Figure 7-1 shows the storage capacity and schedule for future raises of RSF, as summarised in Table 7-1.

The schedule timing is based on the following assumptions, in an attempt to achieve the final closure beach profile (refer to Section 7.3):

- Total tailings production of approx. 3 Mt with an annual production rate of 0.55 Mtpa.
- Tailings deposition is based on 50/50 split between Cell 1 and Cell 2.

Table 7-1 also includes the cumulative storage capacity of the RSF from Stage 1 onwards and remaining Stage 5 storage was estimated by adding the remaining capacity provided by TGO based on the survey undertaken on 6th September 2018 (which was approximately 326 kt and 594 kt for Cell 1 and Cell 2 respectively) and the tailings deposited in Cell 1 (70 days) and Cell 2 (16 days) prior to the survey date.

The tailings density has been assumed to be 1.4 t/m^3, this should be confirmed by undertaking tailings reconciliation annually to check the remaining storage and update project schedule to plan for future raises.

Table 7-1 Schedule and Estimated Timing

Schedule	Incremental Storage (t)	Additional Cumulative Storage (Mt)	LOM Cumulative Storage (Mt)
Cell 1 / Cell 2 combined for Stage 1 / Stage 2 (approved)	2.23		2.23
Cell 1 Stage 3 raise (approved)	0.54		2.78
Cell 2 Stage 3 raise (approved)	0.53		3.31
Cell 1 Stage 4 raise (approved)	0.54		3.86
Cell 2 Stage 4 raise (approved)	0.53		4.39
Cell 1 Stage 5 Raise (approved)	0.52		4.91
Cell 2 Stage 5 Raise (approved)	0.64		5.55
Cell 1 Stage 6 Raise (approved)	0.50		6.05
Cell 2 Stage 6 Raise (approved)	0.52		6.57
Cell 1 Stage 7 Raise	0.47	0.47	7.04
Cell 2 Stage 7 Raise	0.51	0.98	7.55
Cell 1 Stage 8 Raise	0.45	1.43	8.00
Cell 2 Stage 8 Raise	0.50	1.93	8.50
Cell 1 Stage 9 Raise	0.43	2.36	8.93

As discussed in Section 5, the water balance showed that even with a lower production rate for future underground mining, the RSD is needed to provide short term storage of process water during the winter months. In above average rainfall conditions, it is predicted that RSF will have a larger pond.

Following the Stage 6 construction the tailings deposition strategy will be maintained at 50/50 split with a production rate of 45,800 t /month. The 1 week on/ 1 week off production schedule is beneficial to the RSF because the pond can be maintained more easily as the excess water can be removed during the off production period via pumping either to RSD (if not full already) or to one of the unfilled open pits (in an emergency situation).

Due to the constraint of the mine lease boundary, based on the preliminary stability assessment and resultant buttress footprint, the RSF can only be lifted to Stage 9, which could provide additional storage of 2.35 Mt following Stage 6 construction/filling. The RSF could potentially be raised further if higher strength materials can be used for the buttress construction, or the foundation and/or tailings are found to be stronger than the current estimates, as discussed in Section 3.4.

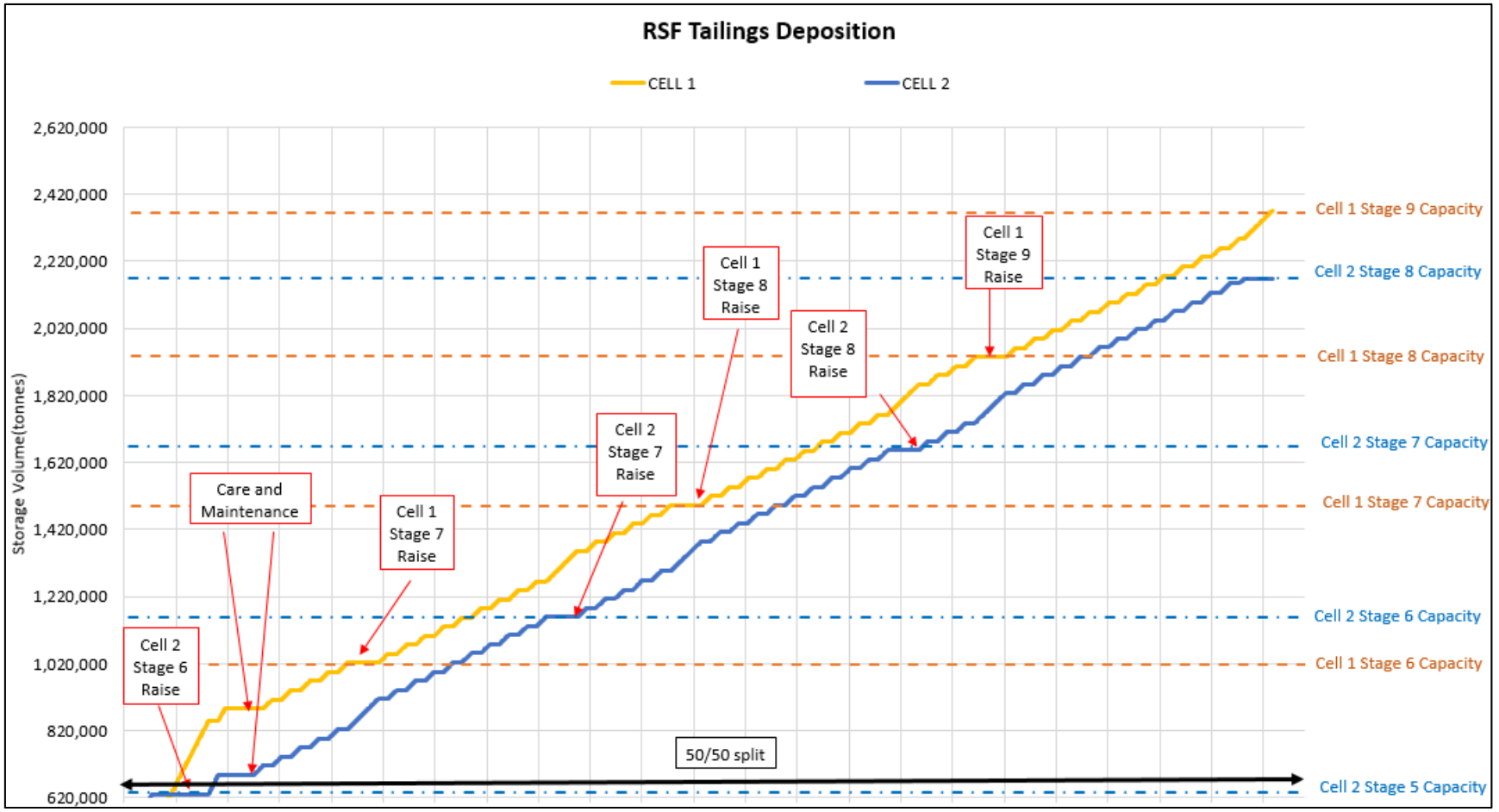

Figure 7-1 RSF Tailings Deposition Schedule

7.2 Final Stage before Closure

The closure plan for the RSF is to have a dry cover with a central drain sloping from the west to east, diverting the runoff from the RSF to the natural ground into perimeter drain before release offsite.

This requires Cell 1 (including the central embankment) to be constructed 2.0 m higher than Cell 2. The final closure beach profile can be achieved by either:

- Option 1: Tailings deposition from the perimeter as per current tailings deposition strategy and reshape the beach to the final profile upon closure; OR
- Option 2: Change deposition strategy to discharge tailings only from the western perimeter of both cells on final filling to form final beach profile grading to the east of Cell 2.

Option 1

The tailings and water management plan will remain the same as current strategy.

The RSF cells will be able to store a 1:100 AEP flood within the 50 m beach boundary, a 10,000 AEP 72hr rainfall of 460 mm up to the maximum tailings level (i.e. 0.5 m below the crest) and PMP of 966 mm up to the crest.

Option 2

It is estimated that the deposition strategy will need to be changed at least 8 months before the closure to form the desirable profile to minimise earthworks to reshape the beach later. Changing the deposition strategy will push the pond towards the Cell 1 central embankment and Cell 2 eastern embankment, as shown in Figure 7-2.

It is noted that changing the deposition strategy to this arrangement will reduce the tailings storage capacity by approximately 20%, as predicted by the tailings beach modelling software Muck3D.

Although this means the total flood storage capacity will increase for the PMF, it does not have the beach protection against the embankment like Option 1. Should a large inflow occur, water would be ponded against the central embankment and Cell 2 eastern embankment during normal operation, which can store approximately 6 ML before reaching the southern and northern embankments. This would increase piping risk if the supernatant ponds are not managed properly in the final filling stage. This risk could be managed with sufficient pumping capacity to RSD assuming RSD was empty to receive inflows at the commencement of the change in deposition plan.

The production schedule of 1 week on/ 1 week off provides additional time to drawdown the pond at the end of deposition week to ensure the pond is always kept low and away from the northern and southern embankments.

The decant embankment in both cells can be raised with a slope to the crest of the last raise or decommissioned after the pond is moved to the new /final location. A sump will be constructed in the tailings, where the excess water will be pumped by floating pontoon and returned to the process plant or RSD via pipeline laid along the central embankment and eastern embankment as shown in Figure 7-2.

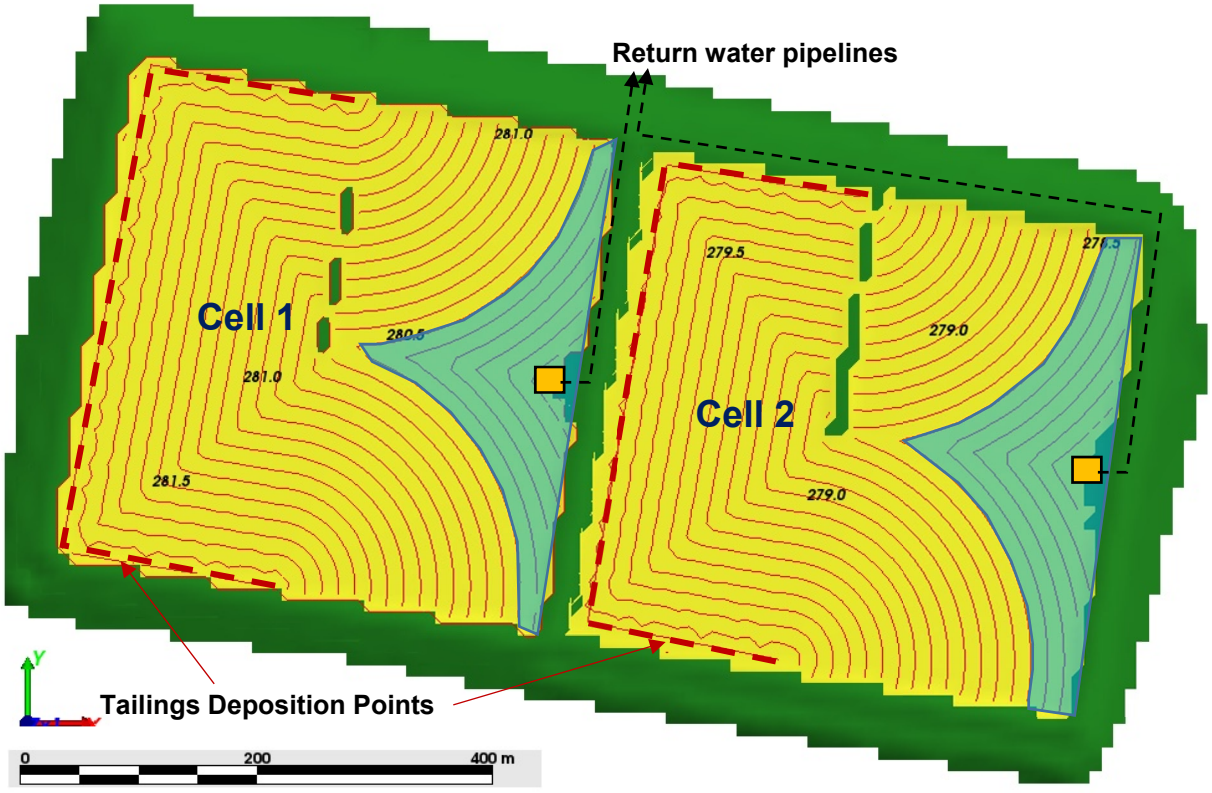

Figure 7-2 Option 2 Tailings Beach Profile (Muck3D)

The central embankment then becomes a critical structure at the final stage, as it will not have tailings on the downstream side to support it as per previous stages. It is noted that the central embankment has been assumed to be raised by upstream construction into Cell 1 storage, hence reducing the storage area of Cell 1 as it is being raised progressively. This will increase the rate of rise of Cell 1 and increase piping failure risk of the central embankment as it is founded on tailings only, especially at the final stage of filling when the decant water will be ponded against it.

The central embankment can be raised by centreline construction to maintain the rate of rise of Cell 1, designed to retain water for the final stage, with wider embankment/ buttress if required to increase the stability. This would require removal of pipework for the raise and would not enable deposition from the common wall during the raise, however this is expected to be feasible with detailed tailings management planning.

Ponding against eastern embankment is considered as acceptable, as it has been raised by downstream construction and future raises proposed as centreline.

7.2.1 Conclusion

Option 2 deposition would reduce post closure earthworks for the final landform, however this option does pose some operational difficulties. Therefore, it is proposed to continue with Option 1 deposition arrangement.

7.3 Closure

Upon closure, all decant water will be evaporated off the RSF. All RSF decant structures will be decommissioned, backfilled and all pipework removed.

For Option 1, waste rock will be pushed into the soft tailings in the middle of the cells in the decant pond area to increase trafficability and the tailings will be regraded to the profile as shown in Figure 7-3, facilitating drainage from west to east. Similarly for Option 2, the waste

rock will be pushed into the soft tailings in the decant pond area near the central and eastern embankments and regrade beach profile, although the earthworks will be less than Option 1.

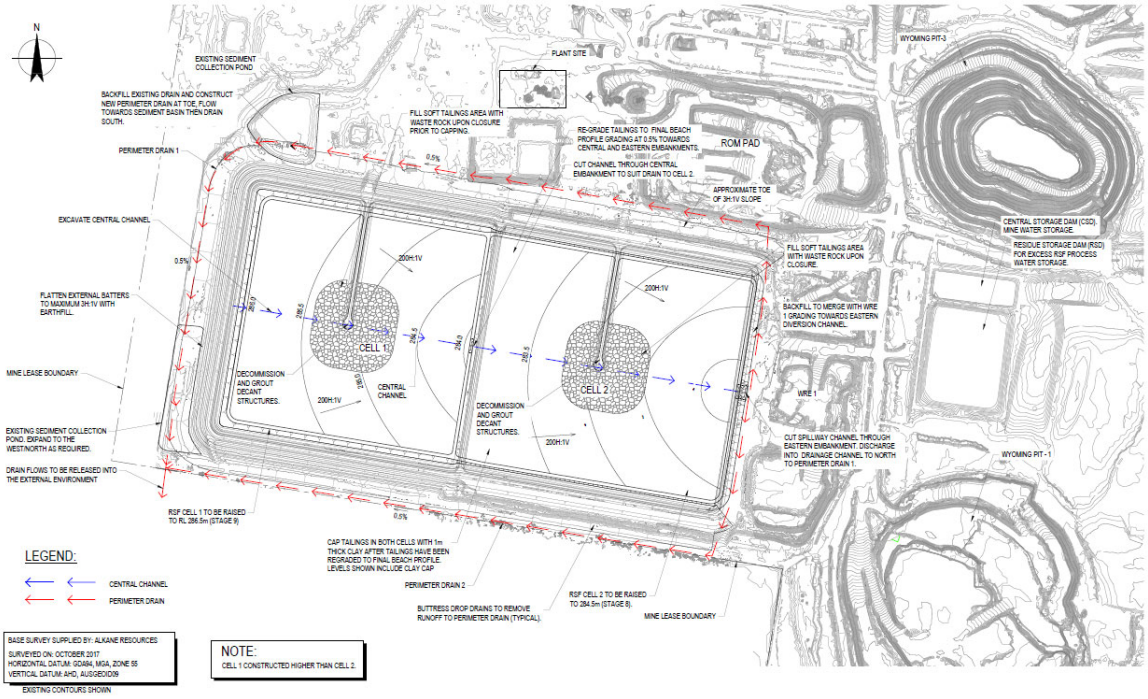

Figure 7-3 Closure Plan (Figure 05 in Appendix A)

Tailings will then be capped with a 1 m clay layer to reduce infiltration, minimise dusting and provide a surface for rehabilitation. The upstream slopes should be flattened to 3H:1V as part of the capping earthworks. Any oversteepened buttress should be flattened to make long term stable slopes. It is noted that post capping the western area will be filled to the same level of the crest. Some areas will need to be overfilled to account for settlement.

A channel will be cut through the central embankment to facilitate drainage to a central channel grading at 0.5% to the Cell 2 eastern wall. Another channel will be cut through the eastern embankment, where a drain will take flows either to the north along WRE1 with an engineered drop structure to natural ground feeding perimeter drain 1 cut along the toe of northern and western embankment, or to the south merge with the perimeter drain 2 cut along the toe of southern embankment of RSF to the sediment pond then discharge offsite.

External RSF batters will be flattened to 3H:1V on the North/East/West and 2.5H:1V on the South wall and spread with topsoil and seeded for revegetation.

8. Bill of Quantities

A high level volume estimate for the materials required for the embankment and buttress for the raise of Stage 7 to Stage 9 is summarised in Table 8-1.

It is noted that the Stage 5 buttress has been overbuilt in some locations, particularly along Cell 2 southern embankment. The buttress volumes are the additional material required to construct to the minimum buttress profile as per the typical sections shown on Figure 03 in Appendix A.

It is assumed that all embankments will be raised by upstream construction, except Cell 2 eastern embankment and decant embankments which will be raised by centreline construction.

Table 8-1 Bill of Quantities

Item	Cell 1	Cell 2	Total
Stage 6 Embankment	47,000	42,400	*89,400*
Stage 6 Buttress	44,600	22,200	*66,800*
Subtotal (Stage 6)	*91,600*	*64,600*	*156,200*
Stage 7 Embankment	47,000	47,500*	*94,500*
Stage 7 Buttress	89,100	42,000*	*131,100*
Subtotal (Stage 7)	*136,100*	*89,500*	*225,600*
Stage 8 Embankment	*47,000*	52,500	99,500
Stage 9 Embankment	*47,000*	58,000	105,000
Stage 8/9 Buttress	*275,000*	191,500	466,500
Subtotal (Stage 9)	*369,000*	*302,000*	*670,500*
Total[#]	*596,700*	*456,100*	*1,052,800*

Note:

* Cell 2 Stage 9 Raise is not required based on LOM tonnage and closure arrangement.

[#] All volumes shown are bulk embankment fill and exclude pavement material, safety bund and decant tower rockfill.

9. Safety in Design

Safety in design is a strategy aimed at preventing injuries by considering hazards as early as possible in the planning and design process, enhancing safety through choices in the design process. A safety in design approach considers the safety of those who construct, operate, maintain, clean, repair and demolish an asset (includes building, structure, plant or equipment). Parties involved in the planning and design stage of a project are in a position to reduce the risks that arise during the life cycle of the asset and have a legal requirement to do so.

At each design stage “designers” can make a significant contribution by identifying and eliminating hazards, and reducing likely risks from hazards where elimination is not possible. Often the most cost effective and practical approach is to avoid introducing a hazard to the workplace in the first place, by eliminating hazards at the design stage.

The definition of “designer” not only affects the actual designer but also those who are connected with the design (e.g. during construction), including parties where the end product is to be used, or could reasonably be expected to be used, as, or at a workplace (e.g. during end use, inspection, operation, cleaning, maintenance and demolition). Furthermore, the “designer” must ensure, so far as is reasonably practicable, that the plant, substance or structure is designed to minimise risks to the health and safety of workers where the design is for the purposes of a workplace.

It is therefore reasonable to consider the wider practical definition of “designer” to include:

- Design professionals
- Head contractors, project managers, clients, end- users and workers
- Quantity surveyors, insurers, quality assurance staff, work safety professionals and ergonomics practitioners
- Suppliers including manufacturers, importers, those who hire plant, constructors, installers and trades and maintenance people

GHD has been engaged to provide design services described in this report. As such GHD has undertaken a component of the designer’s role in this project. In this role GHD has identified and mitigated a number of potential risks within the limitations of our scope, in consultation with other members of the design team.

During the detailed design phase a Safety in Design review was carried out by GHD. A number of design improvements were identified to eliminate hazards and improve overall safety. GHD have prepared a summary of the risks identified and mitigation measures adopted or recommended. This risk register is attached as Appendix C. The construction risks are not included in the risk register as they are not the focus points for this concept design, but the same risks are documented in a GHD Letter titled “RSF Stage 5 Raise Safety in Design” (GHD, 2018b).

Some residual risks, both safety and design related have been identified in the risk register. Proposed mitigation measures and responsible parties for implementing these are also identified.

10. Concluding Statement

Summary findings and recommendations for RSF Stage 9 Concept Design are as follows:

- The upstream raise method is preferable to the centreline raise method based on the buttress volume verses storage capacity comparisons.
- The stability assessment shows that it is feasible to raise the RSF to Stage 9.
- Further geotechnical investigations such as CPTu and foundation investigations are recommended to be undertaken during the detailed design stage to confirm the required buttress size.
- The storage capacity review shows that the proposed LOM requires Cell 1 to be constructed to Stage 9 and Cell 2 to Stage 8 to form the closure landform.
- The water balance shows that there is negligible negative impact to the mining and process water inventory as the mine will still have adequate water with a reduced throughput. Lower decant pond levels than current are expected in the RSF due to the reduced tonnage and availability of RSD to store excess process water.
- The groundwater review shows that there is negligible change in impacts to groundwater as a result of the Stage 9 raise to the RSF. The current groundwater and seepage monitoring programme is considered appropriate.
- The closure landform presented in Section 7.3 aims to safely remove surface water from the RSF. The two options to achieve the final landform through the last year of deposition are presented in Section 7.2 and are both considered feasible. Continuing the current deposition arrangement as per Option 1 is proposed.
- Stage 9 should proceed based on the above findings noting that particular risks identified for the project can be mitigated to appropriate levels and utilisation of the current RSF footprint offers significant environmental benefits compared to development of a new site and associated footprint.

11. References

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GHD (2017b) Memorandum for Tomingley Gold Operations, RSF Stability Update Post 2017 Investigations, GHD Pty Ltd, April 2017

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GHD (2018a) Processing Plant, Groundwater Data Review, Rev 0, January 2018

GHd (2018b) RSF Stage 5 Raise Safety in Design, Letter 3218646-29385, GHD Pty Ltd, June 2018

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PSM (2015) TGO RSF, Stage 2 Wall Raise Design Report, Pells Sullivan Meynink, January 2015

Appendices

Appendix A – Concept Design Drawings

N

LEGEND:

RETURN WATER PIPELINE

TAILINGS PIPELINE

EXISTING SEDIMENT COLLECTION POND

PROCESS & RAW WATER DAMS

PLANT SITE

TAILINGS PIPELINES

RETURN WATER PIPELINE

ROM PAD

WYOMING PIT-3

TAILINGS PIPELINE AND SPIGOTS.

RETURN WATER PIPELINE

MERGE BUTTRESS TO WRE 1

MINE LEASE BOUNDARY

CELL 1 DECANT CAUSEWAY

CELL 2 DECANT CAUSEWAY

CELL 1

CELL 2

285.0

284.5

284.0

284.0

284.5

285.0

283.0

282.5

282.0

282.0

282.5

283.0

CENTRAL STORAGE DAM (CSD). MINE WATER STORAGE.

RESIDUE STORAGE DAM (RSD) FOR EXCESS RSF PROCESS WATER STORAGE.

WRE 1

EXISTING SEDIMENT COLLECTION POND. EXPAND TO THE WEST / NORTH AS REQUIRED.

CELL 2 CENTRAL EMBANKMENT. REFER TO FIGURE 4 FOR TYPICAL SECTION.

WYOMING PIT - 1

CELL 2 STAGE 8 EASTERN WALL. REFER TO FIGURE 4 FOR TYPICAL SECTION.

CELL 1 TO BE RAISED TO STAGE 9 CREST RL 286.5m

CELL 1 STAGE 9 BUTTRESS. REFER TO FIGURE 3 FOR TYPICAL SECTION.

LOCALISED WIDENING OF CAUSEWAY TO ENABLE TURNING OF LIGHT VEHICLES.

TAILINGS PIPELINE AND SPIGOTS.

MINE LEASE BOUNDARY

CELL 2 TO BE RAISED TO STAGE 8 CREST RL 284.5m.

CELL 2 STAGE 9 BUTTRESS. REFER TO FIGURE 3 FOR TYPICAL SECTION.

MERGE BUTTRESS TO WRE 1

BASE SURVEY SUPPLIED BY: ALKANE RESOURCES

SURVEYED ON: OCTOBER 2017
HORIZONTAL DATUM: GDA94, MGA, ZONE 55
VERTICAL DATUM: AHD, AUSGEOID09

EXISTING CONTOURS SHOWN

0 50 100 150m

SCALE 1:5000 AT ORIGINAL SIZE

TOMINGLEY GOLD OPERATIONS PTY LTD
RSF STAGE 9 CONCEPT DESIGN

TAILINGS DEPOSITION PLAN OPTION 1

Job Number 32-18962
Revision A
Date SEP 2018

Figure 01

2 Salamanca Square Hobart TAS 7000 Australia **T** 61 3 6210 0600 **F** 61 3 6210 0601 **E** hbamail@ghd.com **W** www.ghd.com

Plot Date: 10 December 2019 - 2:25 PM Plotted by: Victoria Jenkins Cad File No: G:\32\18962\CADD\Drawings\32-18962-FIG01.dwg

N

LEGEND:

RETURN WATER PIPELINE

TAILINGS PIPELINE

MINE LEASE BOUNDARY

EXISTING SEDIMENT COLLECTION POND

PROCESS & RAW WATER DAMS

PLANT SITE

TAILINGS PIPELINE AND SPIGOTS. DISCHARGE FROM WESTERN HALF PERIMETER ONLY.

ROM PAD

WYOMING PIT-3

TAILINGS PIPELINE AND SPIGOTS. DISCHARGE FROM WESTERN HALF PERIMETER ONLY.

MERGE BUTTRESS TO WRE 1

CENTRAL STORAGE DAM (CSD). MINE WATER STORAGE.

CELL 2 DECANT CAUSEWAY

CELL 1 DECANT CAUSEWAY

RETURN WATER PIPELINE

RESIDUE STORAGE DAM (RSD) FOR EXCESS RSF PROCESS WATER STORAGE.

285.0

284.5

284.0

283.5

283.0

283.0

282.5

282.0

281.0

CELL 1

CELL 2

WRE 1

EXISTING SEDIMENT COLLECTION POND. EXPAND TO THE WEST / NORTH AS REQUIRED.

CELL 2 CENTRAL EMBANKMENT. REFER TO FIGURE 4 FOR TYPICAL SECTION.

WYOMING PIT - 1

CELL 2 STAGE 8 EASTERN WALL. REFER TO FIGURE 4 FOR TYPICAL SECTION.

CELL 1 TO BE RAISED TO STAGE 9 CREST RL 286.5m

CELL 1 STAGE 9 BUTTRESS. REFER TO FIGURE 3 FOR TYPICAL SECTION.

TEMPORARY SUMP IN TAILINGS WITH FLOATING PONTOON AND RETURN WATER PIPELINE

CELL 2 TO BE RAISED TO STAGE 8 CREST RL 284.5m.

MERGE BUTTRESS TO WRE 1

CELL 2 STAGE 8 BUTTRESS. REFER TO FIGURE 3 FOR TYPICAL SECTION.

MINE LEASE BOUNDARY

TEMPORARY SUMP IN TAILINGS WITH FLOATING PONTOON AND RETURN WATER PIPELINE

BASE SURVEY SUPPLIED BY: ALKANE RESOURCES

SURVEYED ON: OCTOBER 2017
HORIZONTAL DATUM: GDA94, MGA, ZONE 55
VERTICAL DATUM: AHD, AUSGEOID09

EXISTING CONTOURS SHOWN

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SCALE 1:5000 AT ORIGINAL SIZE

GHD

TOMINGLEY GOLD OPERATIONS PTY LTD
RSF STAGE 9 CONCEPT DESIGN

TAILINGS DEPOSITION PLAN OPTION 2

Job Number 32-18962
Revision A
Date SEP 2018

Figure 02

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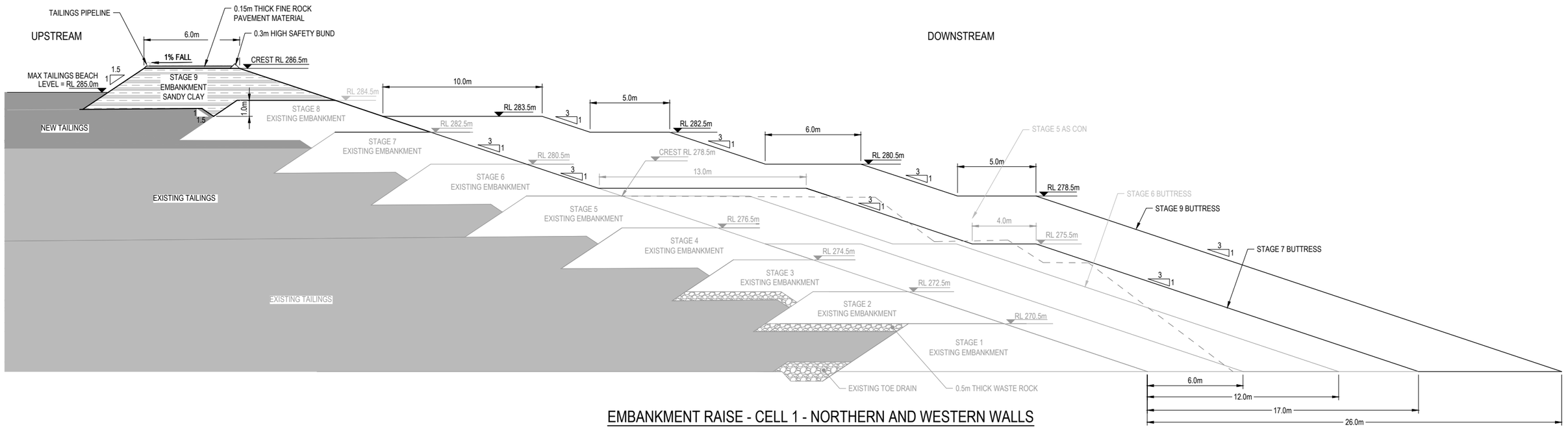
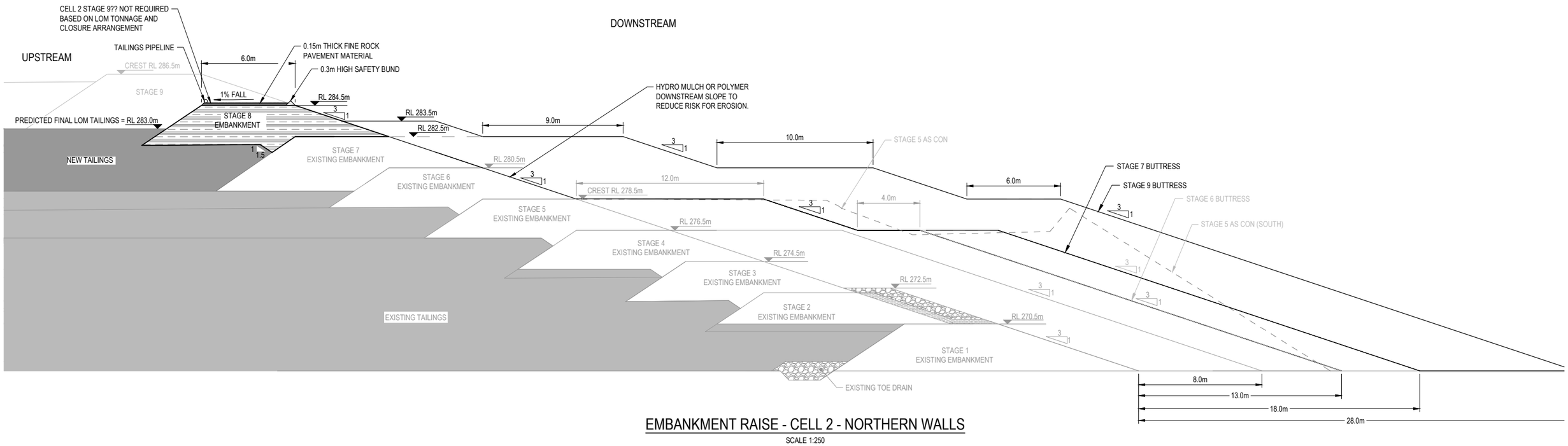
Plot Date: 12 December 2019 - 1:35 PM Plotted by: Victoria Jenkins Cad File No: G:\32\18962\CADD\Drawings\32-18962-FIG02.dwg



EMBANKMENT RAISE - CELL 1 - NORTHERN AND WESTERN WALLS

SCALE 1:250



EMBANKMENT RAISE - CELL 2 - NORTHERN WALLS

SCALE 1:250

0 2.5 5.0 7.5m

SCALE 1:250 AT ORIGINAL SIZE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
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E hbamail@ghd.com **W** www.ghd.com

TOMINGLEY GOLD OPERATIONS PTY LTD
RSF STAGE 9 CONCEPT DESIGN
TYPICAL SECTIONS - SHEET 1 OF 3

Job Number	32-18962
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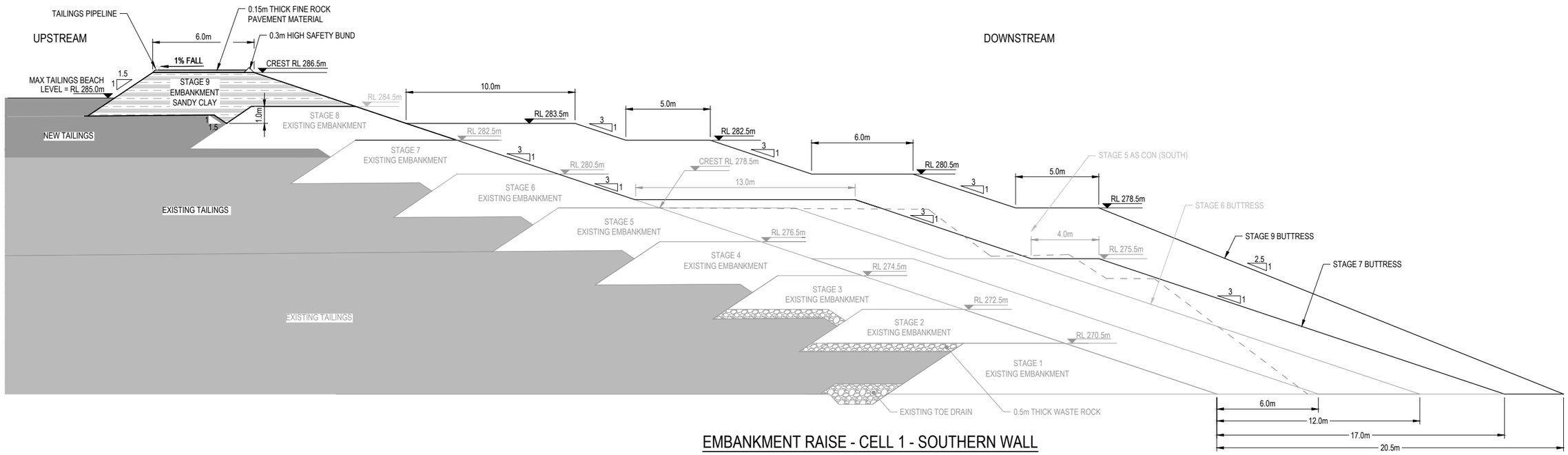
Date	SEPT 2018

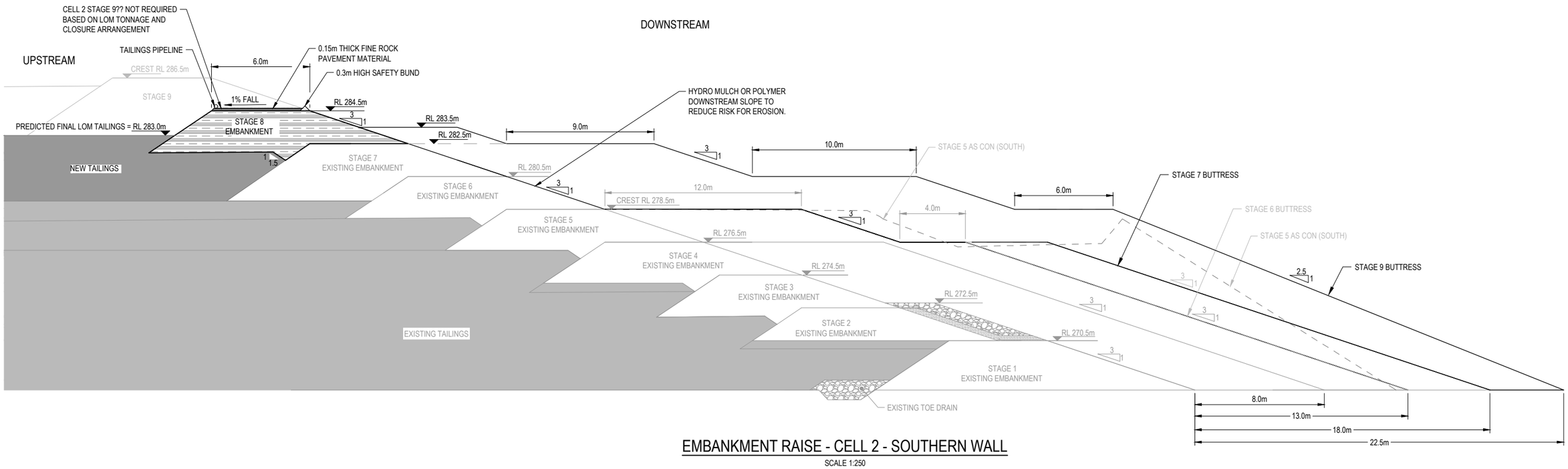
Figure 03

Plot Date: 17 December 2019 - 8:01 AM Plotted by: Manan Abrol Cad File No: N:\AU\hobart\Projects\32\18962\CADD\Drawings\32-18962-FIG03.dwg



EMBANKMENT RAISE - CELL 1 - SOUTHERN WALL

SCALE 1:250



EMBANKMENT RAISE - CELL 2 - SOUTHERN WALL

SCALE 1:250

0 2.5 5.0 7.5m

SCALE 1:250 AT ORIGINAL SIZE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 **F** 61 3 6210 0601
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TOMINGLEY GOLD OPERATIONS PTY LTD
RSF STAGE 9 CONCEPT DESIGN
TYPICAL SECTIONS - SHEET 2 OF 3

Job Number	32-18962
Revision	A
Date	SEPT 2018

Figure 04

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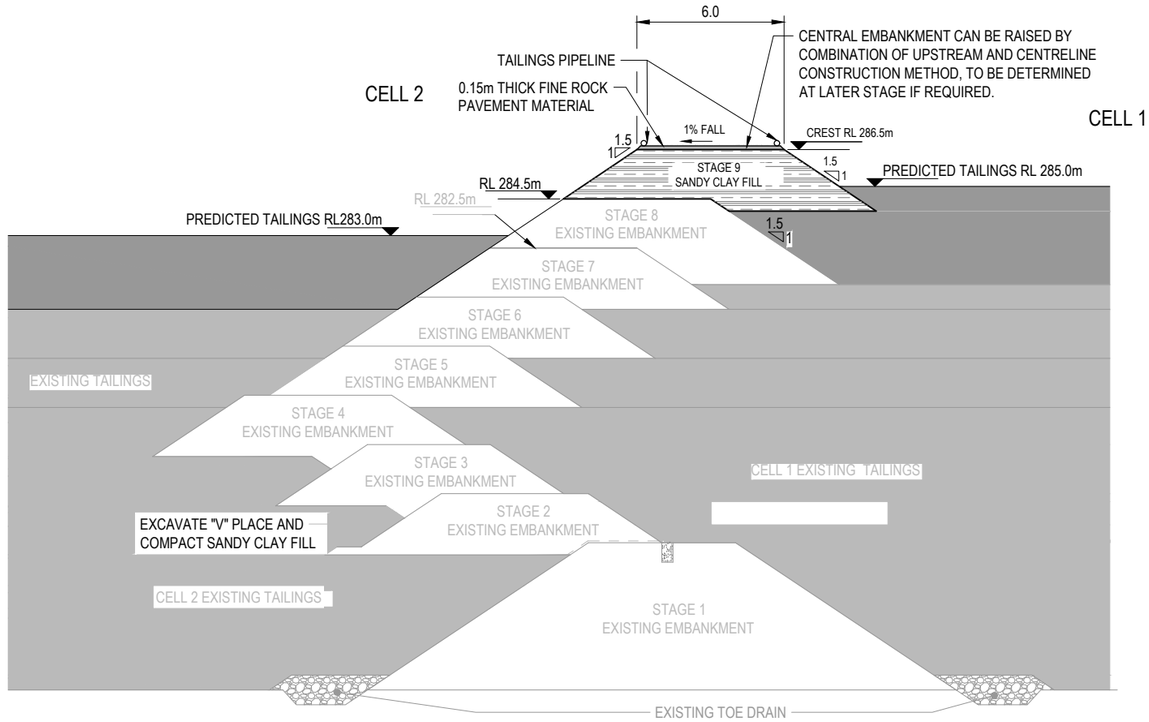
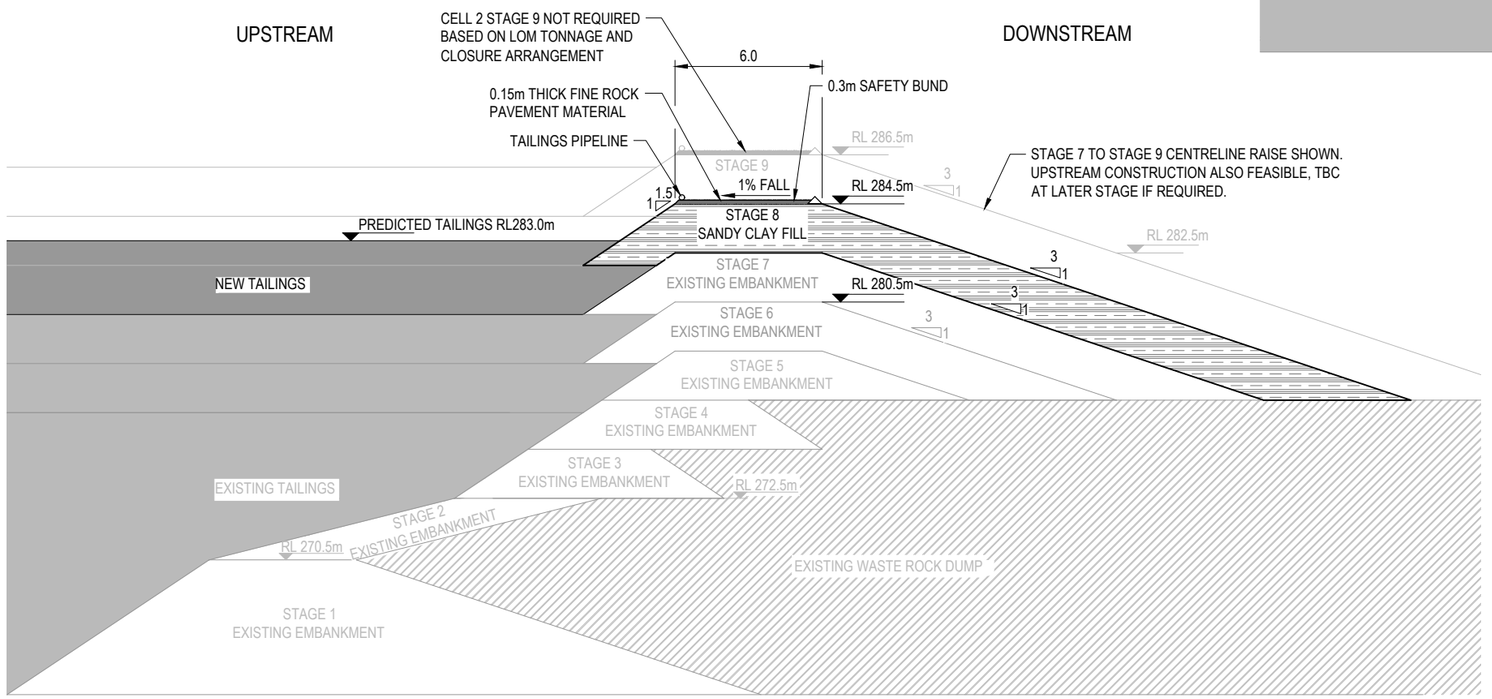


CENTRAL EMBANKMENT

SCALE 1:250



CELL 2 EASTERN WALL

SCALE 1:250

0 2.5 5.0 7.5m

SCALE 1:250 AT ORIGINAL SIZE

2 Salamanca Square Hobart TAS 7000 Australia
GPO Box 667 Hobart TAS 7001
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TYPICAL SECTIONS - SHEET 3 OF 3

Job Number	32-18962
Revision	A
Date	SEP 2018

Figure 05

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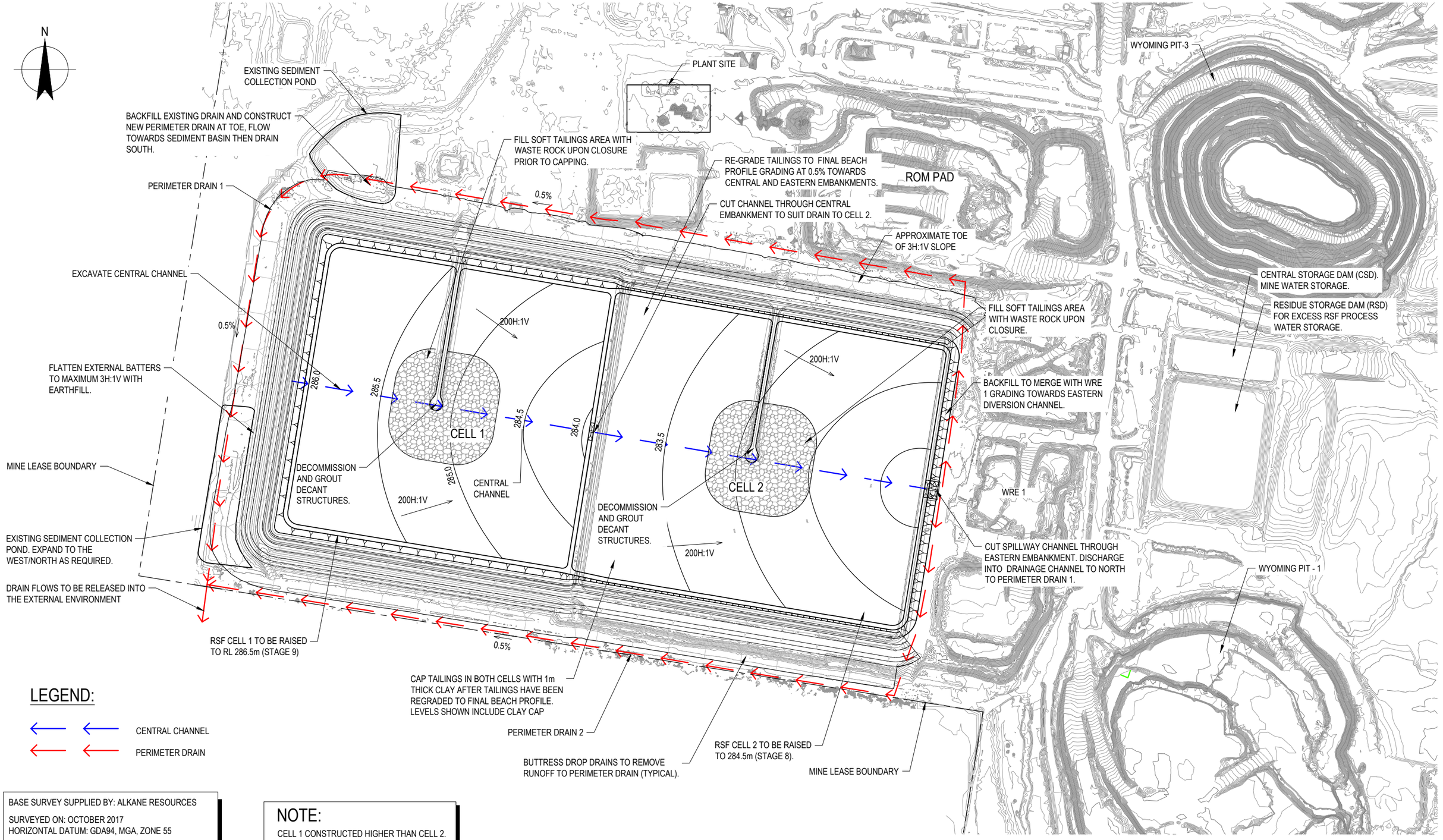

LEGEND:

CENTRAL CHANNEL

PERIMETER DRAIN

BASE SURVEY SUPPLIED BY: ALKANE RESOURCES

SURVEYED ON: OCTOBER 2017
HORIZONTAL DATUM: GDA94, MGA, ZONE 55
VERTICAL DATUM: AHD, AUSGEOID09

EXISTING CONTOURS SHOWN

NOTE:
CELL 1 CONSTRUCTED HIGHER THAN CELL 2.

0 50 100 150m
SCALE 1:5000 AT ORIGINAL SIZE

TOMINGLEY GOLD OPERATIONS PTY LTD
RSF STAGE 9 CONCEPT DESIGN

CLOSURE PLAN AT LOM

Job Number 32-18962
Revision A
Date SEP 2018

Figure 06

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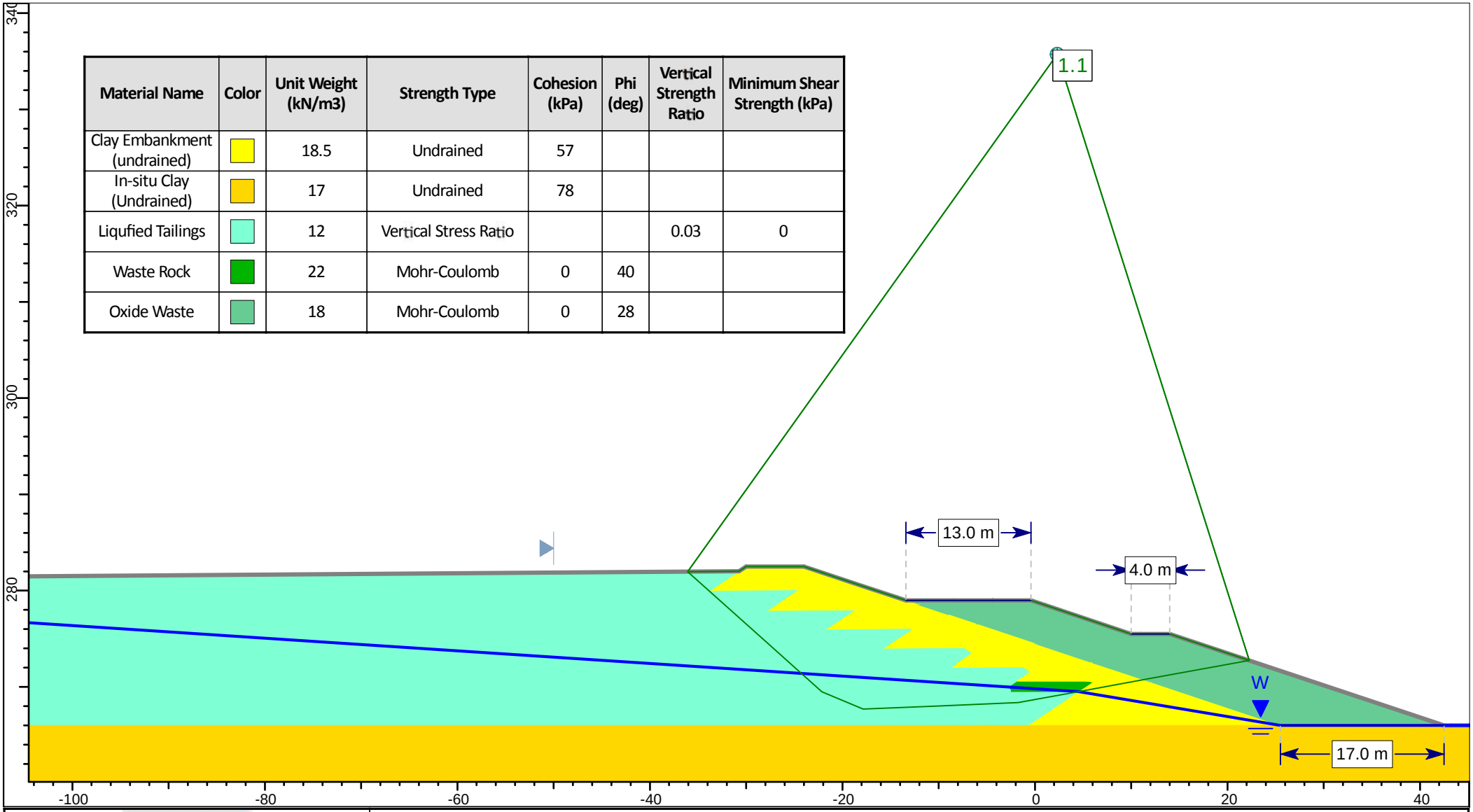
Plot Date: 10 December 2019 - 2:28 PM Plotted by: Victoria Jenkins Cad File No: G:\32\18962\CADD\Drawings\32-18962-FIG06.dwg

Appendix B – Stability Analysis

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (kPa)
Clay Embankment (undrained)		18.5	Undrained	57			
In-situ Clay (Undrained)		17	Undrained	78			
Liqufied Tailings		12	Vertical Stress Ratio			0.03	0
Waste Rock		22	Mohr-Coulomb	0	40		
Oxide Waste		18	Mohr-Coulomb	0	28		



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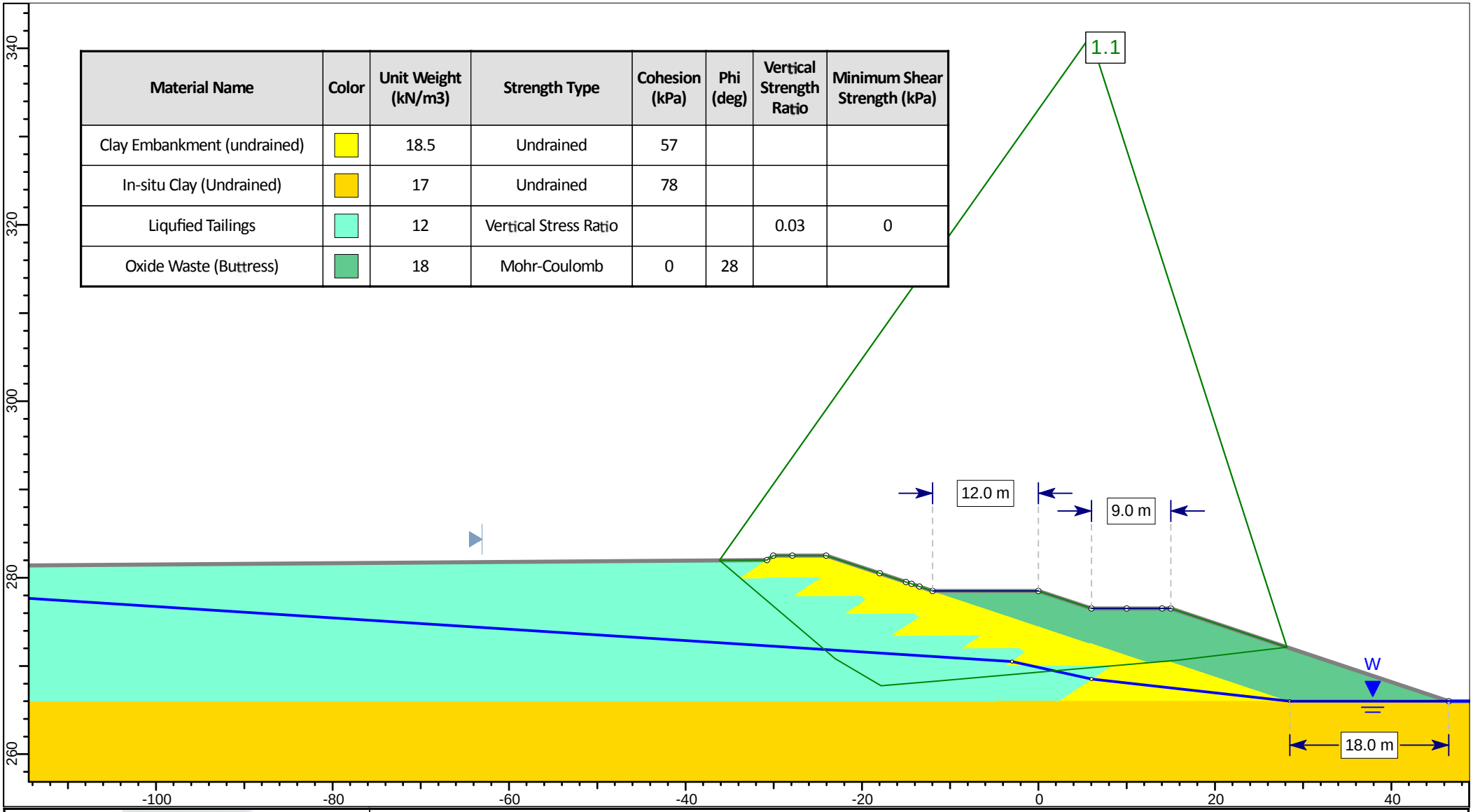
SLIDEINTERPRET 7.021

Project	TGO RSF - Stage 7 Raise Concept
Analysis Description	Stability Analysis - Cell 1
Drawn By	MA/CCJ
Scale	1:550
File Name	Cell 1 Stage 7 Upstream.slmd
Date	28/08/2018

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (kPa)
Clay Embankment (undrained)		18.5	Undrained	57			
In-situ Clay (Undrained)		17	Undrained	78			
Liqufied Tailings		12	Vertical Stress Ratio			0.03	0
Oxide Waste (Buttress)		18	Mohr-Coulomb	0	28		



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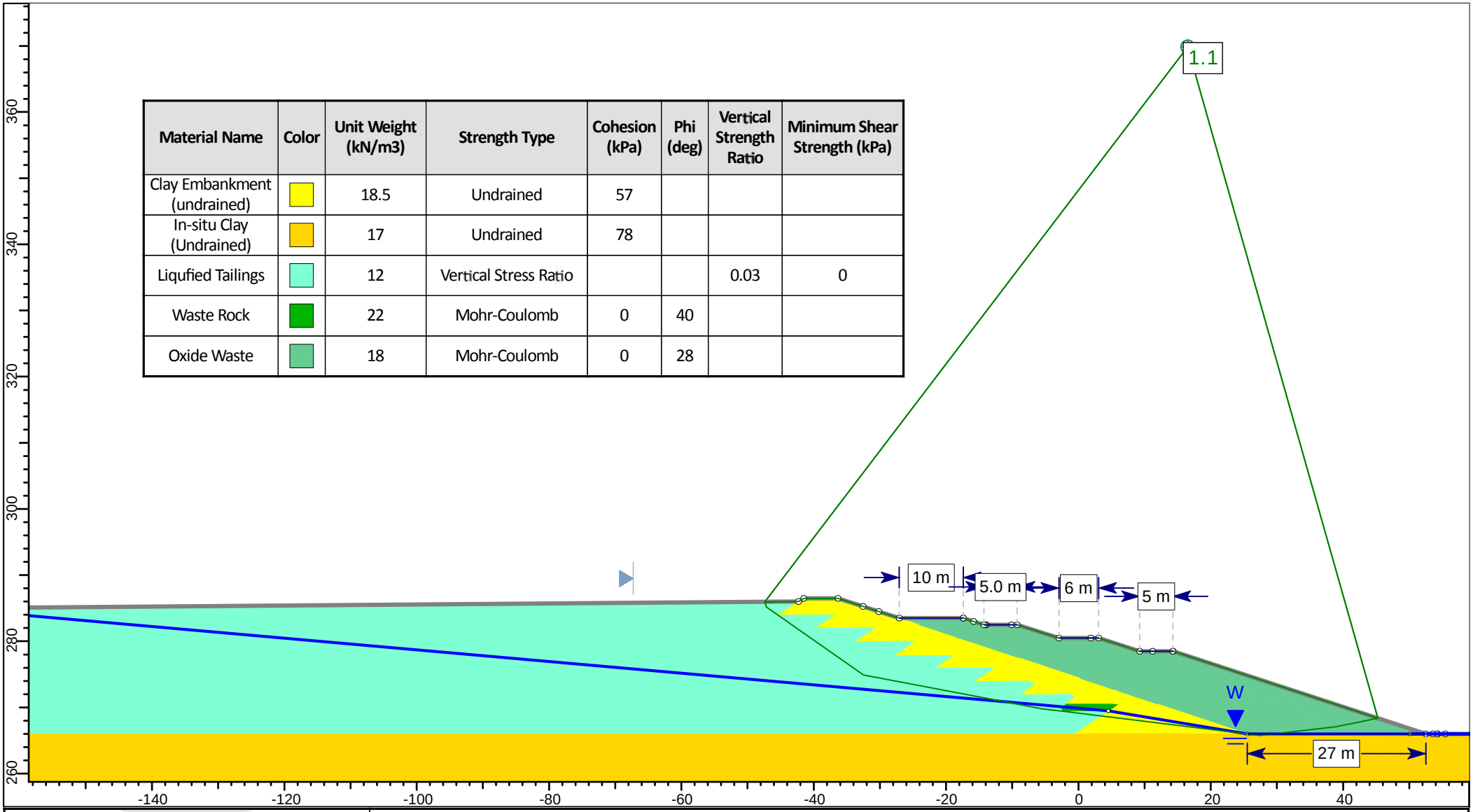
SLIDEINTERPRET 7.021

Project	TGO RSF - Stage 7 Raise Concept
Analysis Description	Stability Analysis - Cell 2
Drawn By	MA/CCJ
Scale	1:600
Date	28/09/2018
File Name	Cell 2 Stage 7 Upstream.slmd

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (kPa)
Clay Embankment (undrained)		18.5	Undrained	57			
In-situ Clay (Undrained)		17	Undrained	78			
Liqufied Tailings		12	Vertical Stress Ratio			0.03	0
Waste Rock		22	Mohr-Coulomb	0	40		
Oxide Waste		18	Mohr-Coulomb	0	28		



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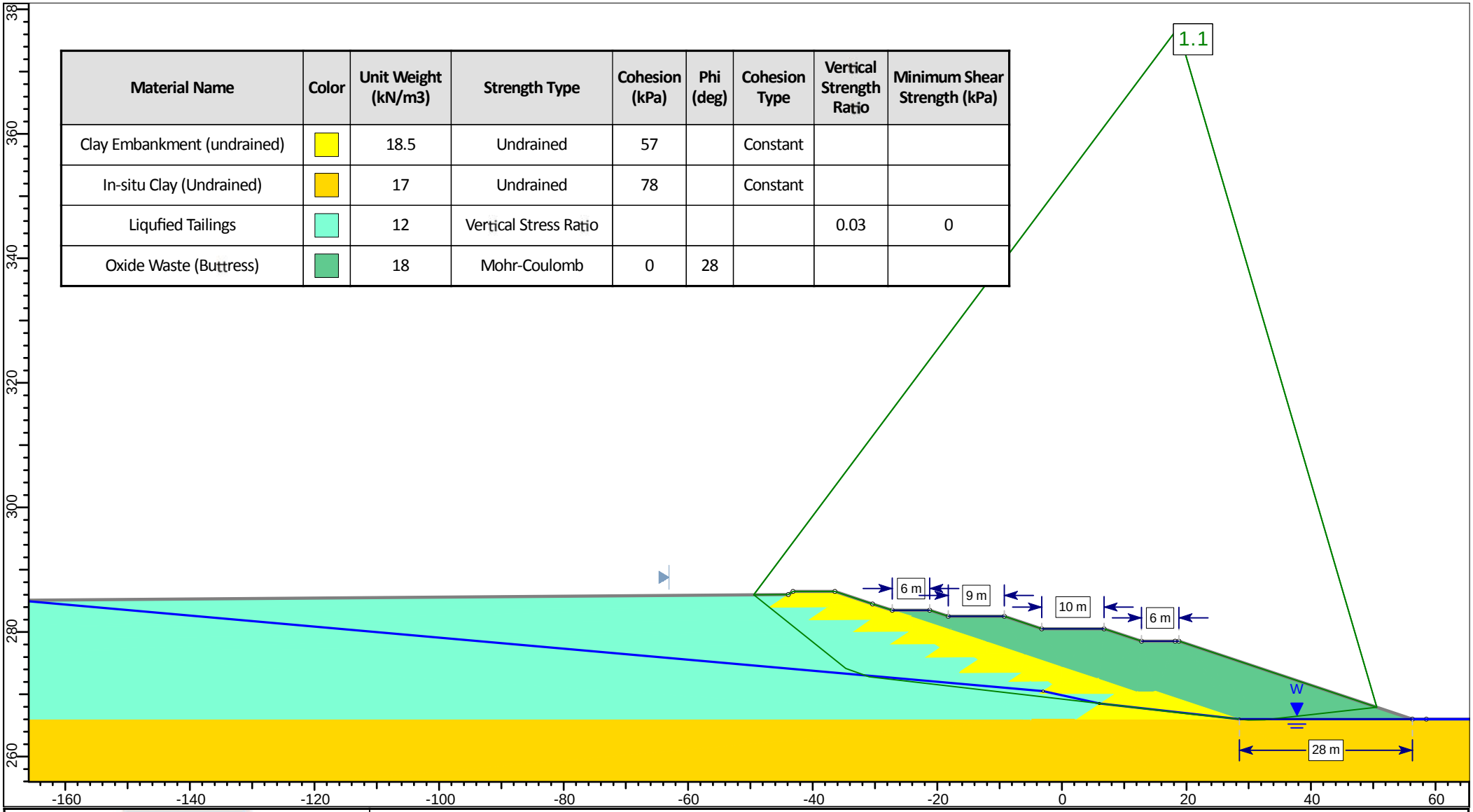
SLIDEINTERPRET 7.021

Project	TGO RSF - Stage 7 Raise Concept		
Analysis Description	Stability Analysis - Cell 1		
Drawn By	MA/CCJ	Scale	1:800
Date	28/08/2018	File Name	Cell 1 Stage 9 Upstream.slmd

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Vertical Strength Ratio	Minimum Shear Strength (kPa)
Clay Embankment (undrained)		18.5	Undrained	57		Constant		
In-situ Clay (Undrained)		17	Undrained	78		Constant		
Liqufied Tailings		12	Vertical Stress Ratio				0.03	0
Oxide Waste (Buttress)		18	Mohr-Coulomb	0	28			



SLIDEINTERPRET 7.021

Project	TGO RSF - Stage 7 Raise Concept
Analysis Description	Stability Analysis - Cell 2
Drawn By	MA/CCJ
Scale	1:850
Date	28/08/2018
File Name	Cell 2 Stage 9 Upstream.slmd

Appendix C – Risk Register

Risk Assessment (PRELIMINARY)

Notes: *Designs with significant quantities of dangerous goods may require detailed risk assessments under Dangerous Goods or Major Hazard legislation
* Most industrial processes will require an industry specific assessment, e.g. HAZOP and/or Quantitative Risk Assessment for facilities that have chemical or high-pressure processes under Dangerous Goods or Major Hazard legislation.

Design Life Cycle:	Investigation and Design	Setup, Construction and Commissioning	Operation	Maintenance	Closure	Date Prepared: 3/09/18	**Revision No:**	Rev A	
Job Name:	RSF Stage 7 Raise Concept Design	**Job No:**	3218962	**Client:**	Tomingley Gold Mine Pty Ltd				
People involved in Risk Assessment:	Chia Chia Jong/ Rob Longey								

Design Ref	Design Life Cycle Stage	Hazards What could cause injury or ill health, damage to property or damage to the environment	Risk What could go wrong and what might happen as a result	Existing Control Measures	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Residual Risk Rating			Person Responsible
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
	Investigation and Design	**Inaccurate assumptions relating to hydraulic properties (embankment and tailings), seepage behaviour and phreatic surface**	Inadequate embankment stability as a result of higher than anticipated phreatic surface.	Phreatic surface based on intepreted data collected from five piezometers installed in tailings to monitor phreatic surface through the critical section (below Stage 2 embankment). RSF to be raised using sandy clay or clayey sand materials. Tailings beach designed to be min. 100 m away from the upstream face to lower phreatic surface. Maintain decant pond as low as possible by pumping water to WCD or back to process plant. The seepage & groundwater has been reviewed and showed negligible incremental impact.	**E**	**2**	**Significant**	- Ongoing monitoring of piezometers in embankment and foundation to inspect seepage behaviour as the tailings beach rises. - Ongoing review of design assumptions using "observational approach" during detailed design of each embankment raise including provision for additional stabilisation or drainage if required to maintain acceptable embankment stability. - Review of design by independent peer reviewer.	**E**	**1**	**Moderate**	TGO
	Investigation and Design	**Inaccurate assumptions relating to foundation, tailings and embankment material strength properties and loading conditions**	Incorrect design assumptions relating to loading conditions or material properties relating to foundation conditions (i.e. low strength foundation zone, liquefaction potential), resulted in inadequate buttressing leading to TSF failure.	Material properties have been reviewed based on previous geotechnical investigations (2016/2017) and recent embankment testing during Stage 5 construction. Loading conditions assessed in accordance with ANCOLD Guidelines on Tailings Dams (2012) as appropriate for RSF concept design including post-seismic case using post-liquefied strength for tailings.	**E**	**2**	**Significant**	- Geotechnical investigation is recommended to verify foundation and tailings strength and confirm buttress size required for future raise. - Adequate engineering supervision during foundation tailings excavations. - Review of design by independent peer reviewer.	**E**	**1**	**Moderate**	TGO
	Investigation and Design	**Upstream raise of central embankment**	Piping failure of central embankment as founded on tailings with potential water ponding on this wall at final filling (Option 2), reduced storage area of Cell 1 hence higher rate of rise.		**E**	**2**	**Significant**	- Central embankment to be designed to be take water load in detailed design. - Consider central embankment to be raised by centreline construction. - Pond can be managed better with 1 week on/ 1 week off production schedule.	**C**	**2**	***Low***	TGO
	Setup, Construction and Commissioning	**Time delays in design/construction**	Any delay will result in delay of production and financial implications	RSF deposition and construction schedule was produced based on production schedule provided by TGO.	**D**	**2**	**Moderate**	- Undertake tailings reconciliation to confirm settled tailings density annually to check storage capacity and forecast for the next raise. - Ongoing review of project schedule. - Proactive management to ensure tasks are completed on time. - Time construction to maximise production during summer weather to minimise contractor delays.	**C**	**2**	***Low***	TGO
	Operation	**Rising piezometric pressures**	Instability of the RSF as a result of rising phreatic surface.	Vibrating wire piezometers were installed post Stage 4 raise to monitor pore pressures within the embankments.	**E**	**2**	**Significant**	- Ongoing monitoring of piezometers in embankment and foundation to inspect seepage behaviour as the tailings beach rises. - TGO to follow RSF Trigger Action Response Plan (TARP) and contact dam designer to investigate cause.	**E**	**1**	**Moderate**	TGO

Design Ref	Design Life Cycle Stage	Hazards What could cause injury or ill health, damage to property or damage to the environment	Risk What could go wrong and what might happen as a result	Existing Control Measures	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Residual Risk Rating			Person Responsible
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
	Operation	**Poor tailings management practices**	Target tailings densities are not achieved resulting in TSF filling quicker than anticipated. Reduced freeboard and flood storage leading to increased risk of uncontrolled spill.	Regular reviews of tailings management during periodic inspections. Instrumentation (i.e. piezometers, movement monitoring, tailings beach indicators) installed to enable monitoring.	**C**	**3**	**Moderate**	- Undertake tailings reconciliation to check tailings settled density and review filling schedule and design flood storage allowance.	**C**	**2**	***Low***	TGO
	Operation	**Change of tailings depostion strategy to 75/25 split between Cell 1 and Cell 2 to suit closure arrangement**	Higher rate of rise in Cell 1, reduce drying time, resulting in lower beach density and strength.	Tailings deposition strategy has been reviewed and found that with 1 week on/1 week off production schedule, Cell 1 will have similar rate of rise, longer drying time. Revert back to 50/50 split when tailings in Cell 1 are 2m above Cell 2 in Nov 2020.	**C**	**3**	**Moderate**	- Monitor TSF fill rate during operation. - Undertake CPT testing to verify tailings strength and update stability assessment.	**C**	**2**	***Low***	TGO
	Operation	**Change of tailings deposition strategy to discharge only from western half perimeter to form final closure beach profile (Option 2)**	Water ponding against central embankment and Cell 2 eastern embankment. Water to rise up against northern and southern embankments leading to piping failure.	Cell 2 eastern embankment is considered stable as it has been raised by downstream construction.	**E**	**2**	**Significant**	- Central embankment to be designed to be take water load in detailed design. - Pond can be managed better with 1 week on/ 1 week off production schedule.	**C**	**2**	***Low***	TGO
	Operation	**TSF fills quicker than anticipated**	Production is greater than anticipated or tailings density is less than anticipated. Raise schedule must be bought forward. Production must be slowed or halted.	Regular reviews of tailings management during routine operator and periodic engineering inspections.	**C**	**3**	**Moderate**	- Monitor TSF fill rate during operation. - Undertake tailings reconcilitation to confirm settled tailings density annually to check storage capacity and forecast for the next raise. - Contingency for bringing forward future raises.	**C**	**2**	***Low***	TGO
	Operation	**High decant pond level**	Potential for piping failure of TSF embankment due to increased hydraulic gradients. Reduced flood storage, increase risk of overtopping.	RSD (WCD) has been upgraded and commissioned in August 2018 to enable dewatering of RSF to keep the decant pond as low as practicable. Filters were constructed to collect seepage in Cell 2. Production schedule of 1 week on/ 1 week off provides additional time to pump excess water out and control the pond.	**D**	**2**	**Moderate**	- Undertake regular routine and intermediate surveillance inspections during operation to keep decant pond as low as practicable. - Instrumentation (i.e. piezometers, movement monitoring) to enable monitoring. - Regular reviews of piezometer data to validate assumptions made in determining phreatic surface in stability models.	**D**	**1**	**Moderate**	TGO
	Operation	**Decant pump failure**	Unable to supply water to process plant. Production must be slowed /halted. Large decant pond reducing flood storage, increase risk of overtopping.	Based on the previous hydrological investigations , RSF has estimated to have a capacity to store 217 ML of water up to embankment crest without overtopping . Water can be sourced from open pits or water dams on site. Production on 1 week on/ 1 week off schedule, gives more time to dewater RSF.	**B**	**3**	**Low**	- Undertake regular routine inspection to ensure decant pond is kept as low as practicable. - Regular servicing of pump. - Consider backup options for pump and power supply	**B**	**2**	***Negligible***	TGO
	Operation	**Severe earthquake**	Foundation liquefaction or cyclic softening. Loss of strength of embankment material. Deformation or failure of embankment leads to loss of tailings/decant water.	Embankment materials to be compacted to design specification hence loss of strength is not expected. Freeboard allowance of 0.5m adopted to accommodate anticipated crest settlement during an earthquake. Post-seismic stability was undertaken and buttresses had been constructed to stabilise RSF.	**D**	**1**	**Moderate**	- Geotechnical investigation is recommended to verify foundation and tailings strength and confirm buttress size required for future raise. - Seismic assessment to verify design assumptions and seismic monitoring.	**D**	**1**	**Moderate**	TGO
	Operation	**Extreme flood event**	Overtopping of embankment, resulting in uncontrolled release of water and tailings causing significant environmental damage and economic losses.	RSF can store 1:10,000 AEP of flood event without the pond reaching the embankment wall (Option 1) . External excess water storage of 110ML at WCD.	**E**	**2**	**Significant**	- Undertake regular routine inspection to ensure decant pond is kept as low as practicable. - OMS & DSEP regularly reviewed and updated if required.	**E**	**2**	**Significant**	TGO
	Operation	**Tailings delivery and decant pipe**	Failure of tailings delivery pipeline or decant pipeline results in erosion of embankment /contamination of site requiring remedial works	Tails pipe bunds. Natural foundation soils are low permebaility to minimise leakage to ground. Routine shift inspection. Flow meter alarms.	**C**	**2**	**Low**	- Routine inspections of tailings and decant pipelines to ensure they are in good condition.	**B**	**1**	***Negligible***	TGO
	Operation	**Vehicle driving on dam crest /along tailings pipelines**	Vehicle drives off crest road into TSF storage/ down downstream batter. Vehicle damages the tailings pipelines.	It has been proposed to have safety bund on downstream side of crest road and ramps similar to Stage 5 raise. Suitable crest width designed for LV access. Tails pipe on upstream side acts as partial deflector upstream batter. If pipe is removed this is for raise when beach is high/dry (ie;low rollover risk)	**D**	**3**	**Significant**	- Vehicle safety provisions must be considered on completion of construction to ensure they are adequate.	**D**	**2**	**Moderate**	TGO

Design Ref	Design Life Cycle Stage	Hazards What could cause injury or ill health, damage to property or damage to the environment	Risk What could go wrong and what might happen as a result	Existing Control Measures	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Residual Risk Rating			Person Responsible
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
	Operation	**Poor operational management**	Dam safety issues are not observed leading to unsafe conditions	Instrumentations have been installed for monitoring purposes.	**C**	**2**	**Low**	- Daily monitoring by appropriately trained staff - OMS & DSEP regularly reviewed and updated if required - Annual inspections undertaken by consultant dams' engineer	**C**	**2**	***Low***	TGO
	Closure	**Tailings dusting**	Wind blown tails in Care & Maintenance / closure period	TGO had previously reviewed and considered spray on polymer product to stabilise tails should C&M phase occur. Inspections / monitoring during C&M.	**C**	**2**	**Low**	-Longer term closure period capping is an option	**C**	**1**	***Low***	TGO
	Closure	**Mine closure plan not able to be executed**	Dam safety issues are not observed leading to unsafe conditions		**C**	**3**	**Moderate**	Future capping / landform design. -Trial of capping	**C**	**2**	***Low***	TGO

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Rev0	CC.Jong	R.Longey		R.Longey		04/10/18
Rev 1	M.Abrol	R.Longey		R.Longey		26/08/19
Rev 2	B.Gepilano	R.Longey		R.Longey		27/09/19
Rev 3	M.Abrol	R.Longey		R.Longey		13/12/2019
Rev 4	M.Abrol	R.Longey		R.Longey		17/12/2019

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Appendix 3

Preconditions to the Granting of Approval and Mandatory Matters for Consideration

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Table A3.1
Preconditions to the Granting of Approval

Statutory Reference	Pre-condition	Relevance	Modification Report Section
Environmental Planning and Assessment Act 1979			
4.55(2)	A consent authority may, … modify the consent if (a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	As a former Part 3A Project and in accordance with Clause 3BA(6)(a) of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*, the relevant reference point for the "substantially the same development" comparison is the last Section 75W modification, namely MOD3. The Proposed Modification would be substantially the same as the MOD3 Project for the following reasons. • The TGO Mine would continue to be an open cut and underground mine with a Carbon in Leach processing plant producing gold doré. • The Proposed Modification would not result in an intensification of the approved activities. • The Proposed Modification would not result in any additional disturbance to land within the TGO Mine Site. • The Proposed Modification would not result in any change to the total area of the TGO Mine Site. • The use of a modified Residue Storage Facility is generally consistent with the continued operation of a mine such as the approved TGO Mine and would not be a significant alteration or radical transform of the approved TGO Mine.	
	(b) it has consulted with the relevant [government authorities]	This is a matter for the Department of Planning and Environment.	
	(c) it has notified the application in accordance with— i) the regulations, if the regulations so require, or ii) [not relevant]	This is a matter for the Department of Planning and Environment.	
	(d) it has considered any submissions made …	This is a matter for the Department of Planning and Environment, however, the Applicant anticipates preparing a Submissions Report to provide a response to any submissions received.	

Table A3.1 (Cont'd)
Pre-conditions to Granting Approval

Statutory Reference	Pre-condition	Relevance	Modification Report Section
Biodiversity Conservation Act 2016 (BC Act)			
Section 7.14	If the Minister for Planning is of the opinion that proposed SSD is likely to have serious or irreversible impacts on biodiversity values, the Minister: (a) is required to take those impacts into consideration, and (b) is required to determine whether there are any additional and appropriate measures that will minimise those impacts if consent or approval is granted.	Nil. No additional land would be disturbed.	NA
Narromine Local Environmental Plan 2011 (Narromine LEP)			
Clause 2.3(2)	**Zone objectives and Land Use Table** The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	Not applicable. The application is to modify MP 09_0155 and is not an application for development consent.	NA
Clause 6.1(3)	**Earthworks** Before granting development consent for earthworks (or for development involving ancillary earthworks), the consent authority must consider the following matters: (a) the likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development,	Nil. No additional land would be disturbed.	NA
	(b) the effect of the proposed development on the likely future use or redevelopment of the land,	Nil. The Proposed Modification would not alter any future use of the land.	NA
	(c) the quality of the fill or the soil to be excavated, or both,	Nil. The Proposed Modification would not require fill or soil.	NA
	(d) the effect of the proposed development on the existing and likely amenity of adjoining properties,	Potential amenity impacts associated with Proposed Modification have been addressed.	6.4
	(e) the source of any fill material and the destination of any excavated material,	Nil. The Proposed Modification would not require fill or generate spoil.	NA
	(f) the likelihood of disturbing relics,	Nil. No additional land would be disturbed.	NA
	(g) the proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area,	Nil. No additional land would be disturbed.	NA

Table A3.1 (Cont'd)
Pre-conditions to Granting Approval

Statutory Reference	Pre-condition	Relevance	Modification Report Section
Narromine Local Environmental Plan 2011 (Narromine LEP) (Cont'd)			
Clause 6.1(3) (Cont'd)	(h) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.	Potential impacts of the Proposed Modification have been addressed through design.	3.3
	Stormwater Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development— (a) is designed to maximise the use of water permeable surfaces on the land, having regard to the soil characteristics affecting on-site infiltration of water, and (b) includes, if practicable, on-site stormwater retention for use as an alternative supply to mains water, groundwater or river water, and (c) avoids any significant impacts of stormwater runoff on adjoining downstream properties, native bushland and receiving waters, or if that impact cannot be reasonably avoided, minimises and mitigates the impact.	Nil. The Proposed Modification would not alter water management practices within the TGO Mine Site.	NA
Clause 6.4(3) and (4)	**Terrestrial Biodiversity** Before determining a development application for development on land to which this clause applies, the consent authority must consider whether or not the development— (a) is likely to have any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and (b) is likely to have any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and (c) has any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and (d) is likely to have any adverse impact on the habitat elements providing connectivity on the land.	Nil. No additional land would be disturbed and the Proposed Modification would not result in activities that are not already undertaken within the TGO Mine Site.	NA
	Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that— (a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or	Nil. The Proposed Modification would be located within the existing Residue Storage Facility 1 footprint.	NA

Table A3.1 (Cont'd)
Pre-conditions to Granting Approval

Statutory Reference	Pre-condition	Relevance	Modification Report Section
Narromine Local Environmental Plan 2011 (Narromine LEP) (Cont'd)			
Clause 6.4(3) and (4) (Cont'd)	(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or (c) if that impact cannot be minimised—the development will be managed to mitigate that impact.		
Clause 6.5(3)	**Riparian land and watercourses** Before determining a development application to carry out development on land to which this clause applies, the consent authority must consider whether or not the development— (a) is likely to have any adverse impact on the following— (i) the water quality and flows within the watercourse, (ii) aquatic and riparian species, habitats and ecosystems of the watercourse, (iii) the stability of the bed and banks of the watercourse, (iv) the free passage of fish and other aquatic organisms within or along the watercourse, (v) any future rehabilitation of the watercourse and its riparian areas, and (b) is likely to increase water extraction from the watercourse.	Nil. The Proposed Modification would not alter water management practices within the TGO Mine Site.	NA
Clause 6.8(3)	**Essential services** Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the proposed development are available or that adequate arrangements have been made to make them available when required— (a) the supply of water, (b) the supply of electricity, (c) the disposal and management of sewage, (d) stormwater drainage or on-site conservation, (e) suitable road access.	Nil. The Proposed Modification would not impact on essential services.	NA

Table A3.1 (Cont'd)
Pre-conditions to Granting Approval

Statutory Reference	Pre-condition	Relevance	Modification Report Section
State Environmental Planning Policy (Resources and Energy) 2021 (Resources and Energy SEPP)			
Clause 2.16	Consent authority must be satisfied that consideration is given to development standards on particular matters related to mining that, if complied with, prevents the consent authority from requiring more onerous standards for those matters.	Nil. The Proposed Modification would not result in changes to the environmental aspects relevant to the non-discretionary standards.	N/A
Clause 2.17	Consent authority must • consider the existing used and approved uses of land in the vicinity of the development, whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development and any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses • evaluate and compare the respective public benefits of the development and the land uses • evaluate any measures proposed by the applicant to avoid or minimise any incompatibility	The existing and approved use of the TGO Mine Site is Mining. The Proposed Modification is consistent with that use. Surrounding land uses include residential and rural land uses and the TGO Mine has co-existed with those uses since 2013. The Proposed Modification would allow the current levels of employment to be maintained, resulting in an extension of the existing public benefit arising from the development. Section 3 and 6 present measures proposed to avoid or minimise any incompatibility.	3 and 6
Clause 2.18	Consent authority must be satisfied that proper consideration is given to any applicable provisions of the voluntary land acquisition and mitigation policy	Nil. The Proposed Modification would not result in changes to the environmental aspects relevant to the voluntary land acquisition and mitigation policy	NA
Clause 2.19	Consent authority must be satisfied that proper consideration is given to; • the existing uses and approved uses of land in the vicinity of the development, and • whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and • any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery and, evaluation of the respective public benefits of the development and the uses, extraction and recovery	Clause 2.19 is not relevant on the basis that the TGO Mine has already been approved and as such the compatibility of the TGO Mine with other mining, petroleum production or extractive industry has already been considered.	NA

Table A3.1 (Cont'd)
Pre-conditions to Granting Approval

Statutory Reference	Pre-condition	Relevance	Modification Report Section
State Environmental Planning Policy (Resources and Energy) 2021 (Resources and Energy SEPP)			
Clause 2.20	Consent authority must consider whether or not impacts on significant water resources and threatened species and biodiversity are avoided or minimised and that greenhouse gas emissions are minimised to the greatest extent practicable	Nil. The Proposed Modification would not alter water management practices within the TGO Mine Site.	NA
Clause 2.21	Consent authority must consider whether the Project will be carried out in such a way as to optimise the efficiency of recovery of minerals and to minimise the creation of waste in association with the extraction, recovery or processing of minerals.	The Proposed Modification would be consistent with the existing land uses and would ensure the uninterrupted mining operations within the TGO Mine Site.	1.4
Clause 2.22	Consent authority consider whether the Proposal is subject to any conditions that; require all or some of the transport of materials to not be by public road, limit or preclude truck movements and/or require the preparation of a code of conduct for the transport of materials on public roads.	Nil. The Proposed Modification would not alter off-site transportation operations.	N/A
Clause 2.23	Consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.	The Proposed Modification would not materially alter the scale or nature of the final landform nor the rehabilitation required.	NA

Table A3.2
Mandatory Matters for Consideration

Statutory Reference	Mandatory Consideration		Modification Report Section
Considerations under the EP&A Act			
Section 1.3	Relevant objects of the Act: • to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The Proposed Modification would promote the social and economic welfare of the community by permitting extraction of a known, State-owned resource, with the associated economic benefits to the community and State. These benefits would be achieved without additional adverse significant social or environmental impacts.	NA
	• to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	Section 7.5.2 addresses matters relevant to Ecologically Sustainable Development.	7.5.2
	• to promote the orderly and economic use and development of land,	The Proposed Modification would be undertaken in an orderly way to maximise the economic benefit to the community and State while minimising other adverse outcomes.	NA
	• to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The Proposed Modification would not result in significant adverse environmental outcomes. Section 6 presents a detailed analysis of the key environmental aspects that may be affected by the Proposed Modification.	NA
	• to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	Nil. No additional land would be disturbed.	NA
	• to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	This is a matter for Department of Planning and Environment.	NA
	• to provide increased opportunity for community participation in environmental planning and assessment.	This is a matter for Department of Planning and Environment.	NA
Section 4.15	• Relevant environmental planning instruments.	See **Table A3.1.**	**Table A3.1**
	• Proposed planning instrument	Nil. No additional planning instruments are proposed.	NA
	• Development Control Plan	In accordance with Clause 12.10(a) of the *State Environmental Planning Policy (Planning Systems) 2021*, development control plans are not relevant to SSD applications.	NA

Table A3.2 (Cont'd)
Mandatory Matters for Consideration

Statutory Reference	Mandatory Consideration		Modification Report Section
Considerations under the EP&A Act (Cont'd)			
	• Any planning agreement.	A Planning Agreement exists between the Applicant and Narromine Shire Council, including the following terms. Recurring payments are subject to CPI increases from 2012/2013. All payments continue until 31/12/2025. • Community contribution..... $53,750pa • Road maintenance ..... $45,000pa • Council environmental expertise ..... $20,000pa • Water supply study..... $30,000 to $50,000 • Raw water for Tomingley village ..... 2MLpa • Transfer water infrastructure at end of life	NA
	• The EP&A Regulation	The Regulations have been considered throughout this document.	Entire document
	• The likely impacts of the development, including environmental impacts on both the natural and built environment, and social and economic impacts in the locality.	Section 6 presents an assessment of relevant impacts on the natural and built environment and social and economic impacts.	6 (generally)
	• The suitability of the site for the development.	Stage 9 Cell 2 would be constructed within the footprint of the existing Residue Storage Facility 1 and the site is suitable for the Proposed Modification.	NA
	• Any submissions made in accordance with the EP&A Act or the regulations.	This is a matter for Department of Planning and Environment, however, the Applicant anticipates preparing a *Submissions Report* following completion of the exhibition period.	NA
	• The public interest.	This is addressed in Section 7.9. In summary, however, the Applicant contends that the Proposed Modification is in the public interest.	7.9

Table A3.2 (Cont'd)
Mandatory Matters for Consideration

Statutory Reference	Mandatory Consideration		Modification Report Section
Considerations under the EP&A Act (Cont'd)			
Section 4.55(2)	A consent authority may, … modify the consent if (a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and	As a former Part 3A Project and in accordance with Clause 3BA(6)(a) of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*, the relevant reference point for the "substantially the same development" comparison is the last Section 75W modification, namely MOD3. The Proposed Modification would be substantially the same as the MOD3 Project for the following reasons. • The TGO Mine would continue to be an open cut and underground mine with a Carbon in Leach processing plant producing gold doré. • The Proposed Modification would not result in an intensification of the approved activities. • The Proposed Modification would not result in any additional disturbance to land within the TGO Mine Site. • The Proposed Modification would not result in any change to the total area of the TGO Mine Site. The use of a modified Residue Storage Facility is generally consistent with the continued operation of a mine such as the approved TGO Mine and would not be a significant alteration or radical transform of the approved TGO Mine.	NA
	(b) it has consulted with the relevant [government authorities]	This is a matter for the Department of Planning and Environment.	NA
	(c) it has notified the application in accordance with— i) the regulations, if the regulations so require, or ii) [not relevant]	This is a matter for the Department of Planning and Environment.	NA
	(d) it has considered any submissions made …	This is a matter for the Department of Planning and Environment, however, the Applicant anticipates preparing a Submissions Report to provide a response to any submissions received.	NA

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