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

Tomingley Gold Project

Modification Report – MOD 5

Major Project Application
No. PA 09_0155





Prepared in December 2020 by R.W. CORKERY & CO. PTY. LIMITED

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Modification Report – MOD 5

Major Project Application No. PA 09_0155

Prepared for:

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LIST OF ACRONYMS

ABS	Australian Bureau of Statistics
ACHAR	Aboriginal Cultural Heritage Assessment Report
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANCOLD	Australian National Committee on Large Dams
ASC	Australian Soil Classification
AREA	AREA Environmental Consultants and Communication Pty Ltd
AQIA	Air Quality Impact Assessment
AWS	Automated Weather Station
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOA	Biodiversity Offset Area
DECCW	Department of Environment, Climate Change and Water
DPIE	Department of Planning, Industry and Environment
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
ESD	Ecologically Sustainable Development
GHD	GHD Pty Ltd
INP	*Industrial Noise Policy*
LALC	Local Aboriginal Land Council
LEP	Local Environment Plan
LLS Act	*NSW Local Land Services Act 2013*

MAC	Muller Acoustic Consulting Pty Ltd
MOP	Mining Operations Plan
NAG	Noise Assessment Group
NCST	National Committee on Soil and Terrain
NPI	*Noise Policy for Industry 2017*
OEH	Office of Environment and Heritage
PA	Project Approval
PEL	Pacific Environment Limited
PCT	Plant Community Type
PMF	Probable Maximum Flood
POEO Act	*Protection of Environment Operations Act 1997*
RMP	Residue Management Plan
ROM	Run-of-Mine
RSF	Residue Storage Facility
RUSLE	Revised Universal Soil Loss Equation
RWC	R.W. Corkery & Co. Pty Limited
SAR	San Antonio and Roswell
SEPP	State Environmental Planning Policy
SLR	SLR Consulting Australia Pty Ltd
SSD	State Significant Development
SSM	Sustainable Soils Management Pty Ltd
TEC	Threatened Ecological Community
TGO	Tomingley Gold Operations
TSP	Total Suspended Particles
WRE	Waste Rock Emplacement

EXECUTIVE SUMMARY

Introduction

This *Modification Report* has been prepared by RW Corkery & Co. Pty. Limited on behalf of Tomingley Gold Operations Pty Ltd (the Proponent) to support the application for a fifth modification to development consent MP09_0155 for the Tomingley Gold Mine (the Proposed Modification).

The Tomingley Gold Mine (the Mine) is located immediately to the south of the village of Tomingley in central western NSW (see **Figure ES1**).

This application is being made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* and the Minister for Planning and Public Spaces is the consent authority. The Proponent contends that the Proposed Modification complies with all preconditions for granting approval, including being substantially the same as the development approved under MOD 3 (when the consent was transitioned from a Part 3A approval to a State Significant Development (SSD) by a notice published in the NSW Government Gazette on 31 August 2018).

This summary introduces the Proponent, provides relevant background to the Proposed Modification and presents an overview of the design of the Proposed Modification's operational safeguards and predicted additional impacts on the surrounding environment.

The Proponent

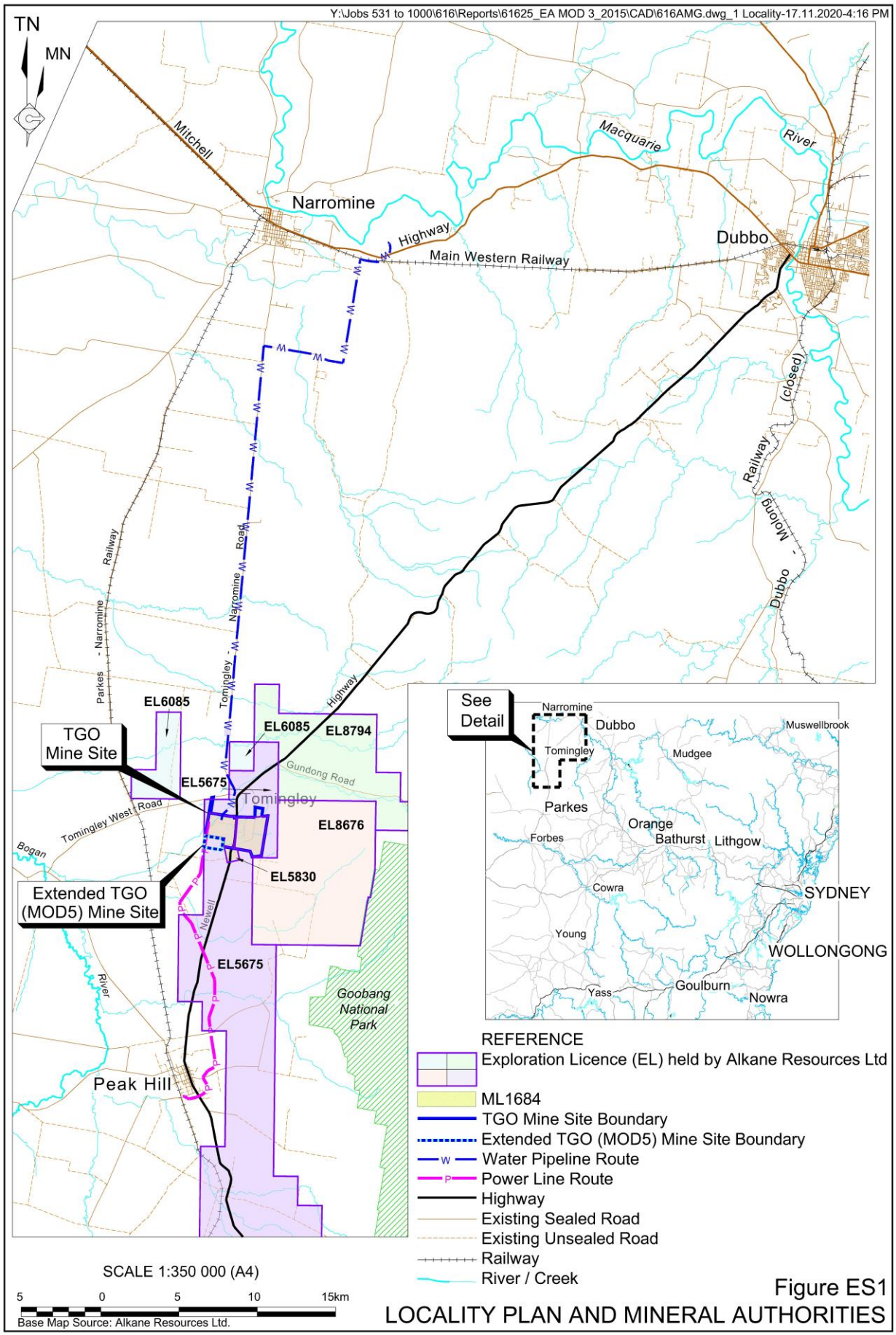
Tomingley Gold Operations Pty Ltd (the Proponent), is a wholly owned subsidiary of Alkane Resources Limited (Alkane). Alkane is an Australian Securities Exchange listed exploration and mining company managed by a highly experienced board and senior management team.

In addition to operating the Tomingley Gold Mine, Alkane is also active in the exploration for gold and a range of other minerals on tenements within NSW.

Overview of the Approved Activities

Activities approved under MP09_0155, as modified, include the following (**Figure ES2**). Mining operations may be undertaken until 31 December 2022.

- Establishment of infrastructure required for the Mine.
- Extraction of waste rock and ore from four open cut areas, with underground operations approved under three of the open cuts.
- Construction of three out-of-pit waste rock emplacements and one in-pit emplacement.
- Construction and use of a processing plant to process up to 1.5 million tonnes per annum (Mtpa) .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TN
MN
Mitchell
Macquarie
River
Narromine
Highway
Dubbo
Main Western Railway
Railway (closed)
Molong - Dubbo
Railway
Narromine - Parkes
Narromine Road
Tomingley - Highway
EL6085
EL6085
EL8794
TGO Mine Site
EL5675
Tomingley
Gundong Road
Tomingley West Road
EL8676
Bogan
EL5830
Extended TGO (MOD5) Mine Site
Newell
EL5675
River
Goobang National Park
Peak Hill
See Detail
Narromine
Dubbo
Muswellbrook
Tomingley
Mudgee
Parkes
Orange
Forbes
Bathurst
Lithgow
Cowra
SYDNEY
Young
WOLLONGONG
Yass
Goulburn
Nowra
REFERENCE
Exploration Licence (EL) held by Alkane Resources Ltd
ML1684
TGO Mine Site Boundary
Extended TGO (MOD5) Mine Site Boundary
Water Pipeline Route
Power Line Route
Highway
Existing Sealed Road
Existing Unsealed Road
Railway
River / Creek
SCALE 1:350 000 (A4)
5 0 5 10 15km
Base Map Source: Alkane Resources Ltd.
Figure ES1
LOCALITY PLAN AND MINERAL AUTHORITIES

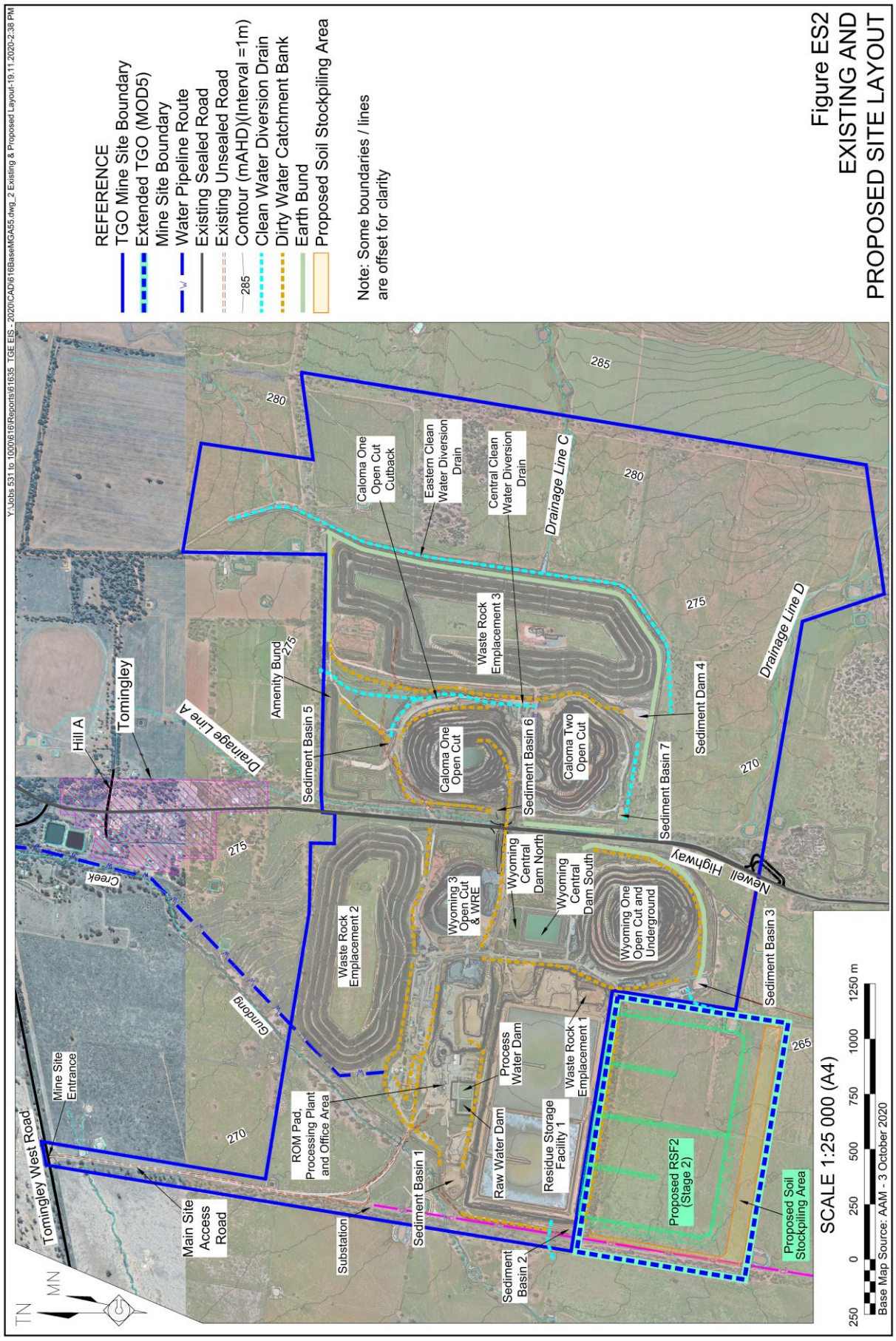


Figure ES2
EXISTING AND
PROPOSED SITE LAYOUT
REFERENCE
TGO Mine Site Boundary
Extended TGO (MOD5)
Mine Site Boundary
Water Pipeline Route
Existing Sealed Road
Existing Unsealed Road
Contour (mAHD)(Interval =1m)
Clean Water Diversion Drain
Dirty Water Catchment Bank
Earth Bund
Proposed Soil Stockpiling Area
Note: Some boundaries / lines are offset for clarity
Y:\Jobs 531 to 1000\616\Reports\61635_TGE EIS - 2020\CAD\616BaseMGA55.dwg_2 Existing & Proposed Layout-19.11.2020-2:38 PM
Tomingley West Road
Mine Site Entrance
Main Site Access Road
Substation
Sediment Basin 1
Sediment Basin 2
ROM Pad, Processing Plant and Office Area
Raw Water Dam
Process Water Dam
Residue Storage Facility 1
Waste Rock Emplacement 1
Waste Rock Emplacement 2
Proposed RSF2 (Stage 2)
Proposed Soil Stockpiling Area
Wyoming 3 Open Cut & WRE
Wyoming Central Dam North
Wyoming Central Dam South
Wyoming One Open Cut and Underground
Sediment Basin 3
Newell Highway
Sediment Basin 7
Sediment Dam 4
Caloma One Open Cut
Caloma Two Open Cut
Sediment Basin 6
Waste Rock Emplacement 3
Caloma One Open Cut Cutback
Eastern Clean Water Diversion Drain
Central Clean Water Diversion Drain
Drainage Line C
Drainage Line D
Drainage Line A
Amenity Bund
Sediment Basin 5
Hill A
Tomingley
Creek
Gundong
TN
MN
SCALE 1:25 000 (A4)
250 0 250 500 750 1000 1250 m
Base Map Source: AAM - 3 October 2020

- Construction and use of a residue storage facility (RSF1) with a maximum elevation of 286.5m AHD and an approximate storage capacity of 8.93Mt of residue.
- Construction and use of ancillary infrastructure, including, haul roads, an underpass under the Newell Highway, an office, water management structures, electrical, telecommunication and other infrastructure.

Overview of the Proposed Modification

The Proposed Modification seeks consent for the following (**Figure ES2**).

- Construction and use of Stages 1 and 2 of second residue storage facility, namely RSF2.
- An extension of Mine Life from 31 December 2022 to 31 December 2025.
- Extension of the TGO Mine Site boundary to incorporate RSF2.
- Use of Caloma 2 for backfilling operations.

No other changes to the approved Mine are proposed.

Proposed RSF2

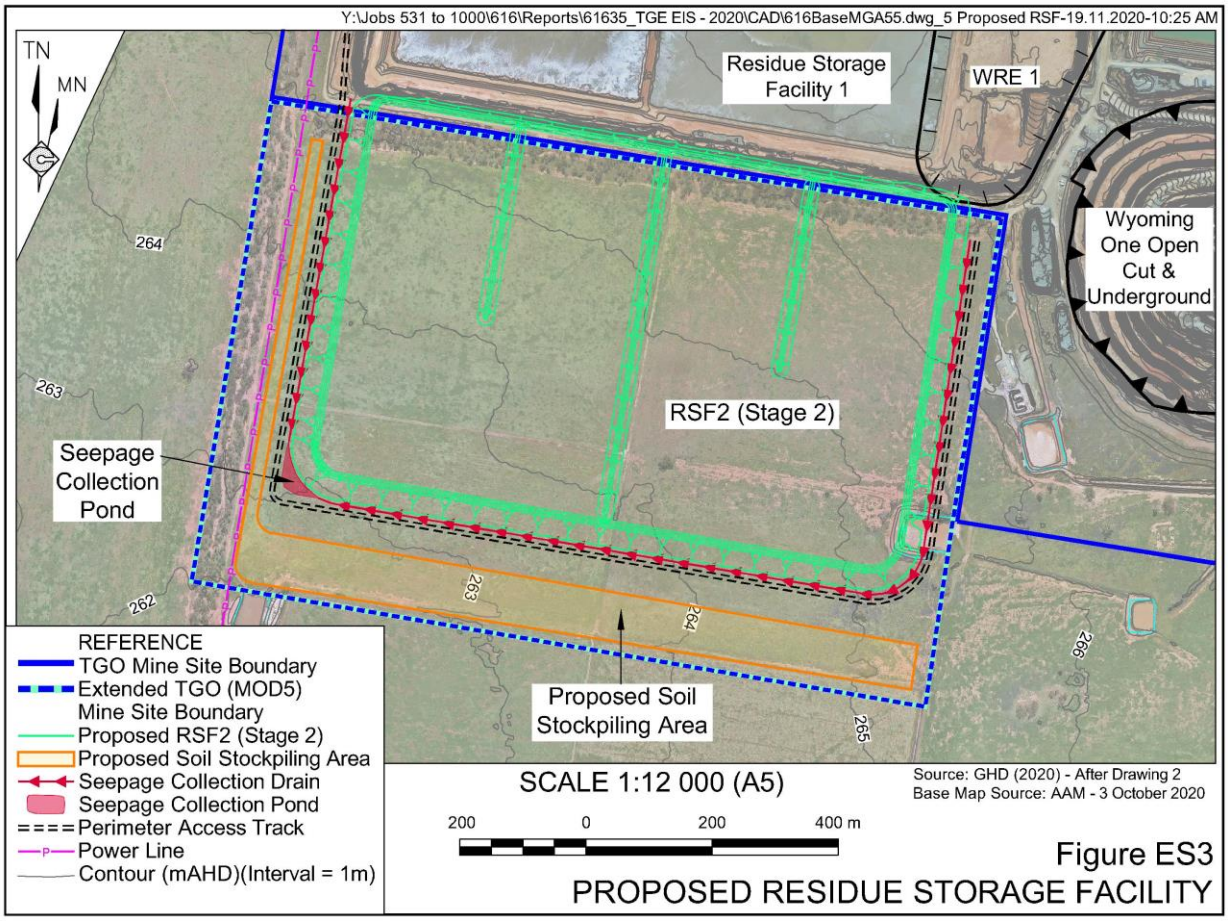
The Proponent proposes to construct a second Residue Storage Facility, namely RSF2, immediately to the south of the existing RSF1 (**Figure ES3**). RSF2 has been designed in accordance with all relevant design guidelines and criterial and would be constructed in two stages. The facility would have the following design criteria.

- Maximum crest elevation .....272.0m AHD
- Maximum elevation of residue .....271.3m AHD
- Slope of outer face (except northern embankment).....1:3 (V:H)
- Proposed disturbance area (Stage 2).....64.3ha
- Cumulative maximum capacity 4.5Mt
- Liner material.....minimum 1m compacted clay
- Liner permeability ..... maximum 1 x 10^{-9}m/s
- Residue deposition .....Perimeter discharge
- Decant system..... current central decant towers

RSF2 would be constructed using locally sourced materials and would built using upstream or centre line lift techniques.

Extension of the TGO Mine Site

The proposed RFS2 would be constructed to the south of the approved TGO Mine Site and would, as a result, require an extension of the TGO Mine Site.



Extension of Mine Life

The Proponent has identified additional resources that would support mining operations beyond the currently approved life of Mine. As a result, the Proponent proposes to extend the approved life of the mine by three years to 31 December 2025.

Partial Backfilling of Caloma 2 Open Cut

The Proponent proposes to place waste rock from the Caloma 1 cut back into the completed Caloma 2 Open Cut.

Consultation

The Proponent has undertaken consultation with a wide range of government agencies as part of preparation of this *Modification* Report. All relevant matters raised by those agencies have been addressed in this document

The Proponent has also consulted extensively with the community. No substantial issues of concern have been raised in relation to the Proposed Modification.

Environmental Safeguards and Impacts

- Biodiversity – The Proposed Modification would result in the disturbance of an additional approximately 85ha of land adjacent to RSF1. As a result of the increased disturbance area, the proponent would retire the following ecosystem credits through payment into the Biodiversity Conservation Trust.
  - 103 credits for PCT82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion.
  - 49 credits for PCT201 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion.

  No species credit species were identified within the extended TGO Mine Site.
- Noise – the Proposed Modification would result in minor increases in noise emissions associated with the construction phase RSF2, however, the Project would continue to satisfy the relevant noise criteria at all assessed receivers and for each noise assessment group under standard meteorological. In addition, MAC (2020) notes that the predicated noise levels are within +5dB of the proposed very noise enhancing conditions and, thus, are also compliant.
- Air Quality – the Proposed Modification would have a negligible impact on air quality surrounding the TGO Mine Site for the following reasons.
  - The Proposed Modification would result in a negligible additional 1.4% emission of particulate material when compared with the approved MOD3 development.
  - The Proposed Modification would result in a negligible change in particulate matter received at surrounding residences.
- Soils – the Proposed Modification would result in disturbance of poorly drained soils with an average Land and Soil Capability Class of 6, or low capability land with very high limitations for high impact agricultural land uses. However, the soil materials are suitable for stripping and stockpiling and, assuming that appropriate amelioration measures are implemented, the Land and Soil Capability Class of the final RSF2 landform is likely to be Class 4 or moderate land capability land.
- Heritage – there were no Aboriginal or historical heritage sites identified within the extended TGO Mine Site and no heritage-related impacts are anticipated.
- Surface water – the Proposed Modification would not result in substantial changes to the approved water management system within the TGO Mine Site, nor would the existing risk of discharge of contaminated water be increased.
- Groundwater – the existing RSF1 is not resulting in adverse impacts to shallow groundwater in the immediate vicinity of the Residue Storage Facility and the Proposed Modification is not expected to increase the risk of such an event occurring.

- Visual amenity - the RSF2 would not be result in an unacceptable change to the visual amenity from publicly accessible vantage points surrounding the extended TGO Mine Site because it would be 14.5m lower than the immediately adjacent RSF1. Furthermore, the closest residence to RSF2 would be located at a distance of approximately 1.4km from the facility.

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

Project Evaluation and Justification

The Proposed Modification has been evaluated and justified principally through consideration of its potential impacts on the environment and potential benefits to the local and wider community.

Through an assessment of key environmental issues, as well as the consideration of the principles of ecologically sustainable development, the evaluation has found that, with the implementation of the proposed operational controls, safeguards and/or mitigation measures, the residual risk posed by each possible environmental incident or impact has either been reduced from its original level or deemed an acceptable risk.

Further, the design of the Proposed Modification has addressed each of the sustainable development principles, and on balance, it is concluded that the Proposed Modification achieves a sustainable outcome for the local and wider environment.

Conclusion

The Proposed Modification has been, to the extent feasible, designed to address all issues raised by the local community and all levels of government, as well as the principles of ecologically sustainable development. The Proposed Modification provides for the continuation of operations at the Tomingley Gold Mine, allowing ongoing employment and maintaining stimulus to the local economies of Tomingley and the wider Narromine LGA.

In light of the conclusions included throughout this *Modification Report*, it is assessed that the Proposed Modification could be constructed and operated in a manner that would satisfy all relevant statutory goals and criteria, environmental objectives and reasonable community expectations.

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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 Proponent) to support the application to modify development consent MP 09_0155 for the Tomingley Gold Mine (the Proposed Modification). The Tomingley Gold Mine (the Mine) is located immediately to the south of the village of Tomingley in central western NSW (see **Figure 1**). The Mine is operated by Tomingley Gold Operations Pty Ltd, a wholly owned subsidiary of Alkane Resources Ltd (Alkane). MP 09_0155 applies to and the Mine operates within an area referred to for the purposes of this document as the TGO Mine Site (**Figure 2**).

PA 09_0155 has been modified four 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 an increase the capacity of Residue Storage Facility 1 (RSF1) and a commensurate increase in the height and aerial extent of the facility.

The Proposed Modification seeks consent for the following.

- Construction and use of Stages 1 and 2 of RSF2.
- An extension of Mine Life from 31 December 2022 to 31 December 2025.
- Extension of the TGO Mine Site boundary to incorporate RSF2.
- Use of Caloma 2 for backfilling operations.

No other changes to the approved Mine are proposed.

The application to modify PA 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 draft document *Preparing a Modification Report* published by the NSW Department of Planning, Industry and Environment dated June 2019 and addresses matters listed in correspondence from the Department of Planning, Industry and Environment received on 22 October 2020, as well as from other agencies (see Section 5.1).

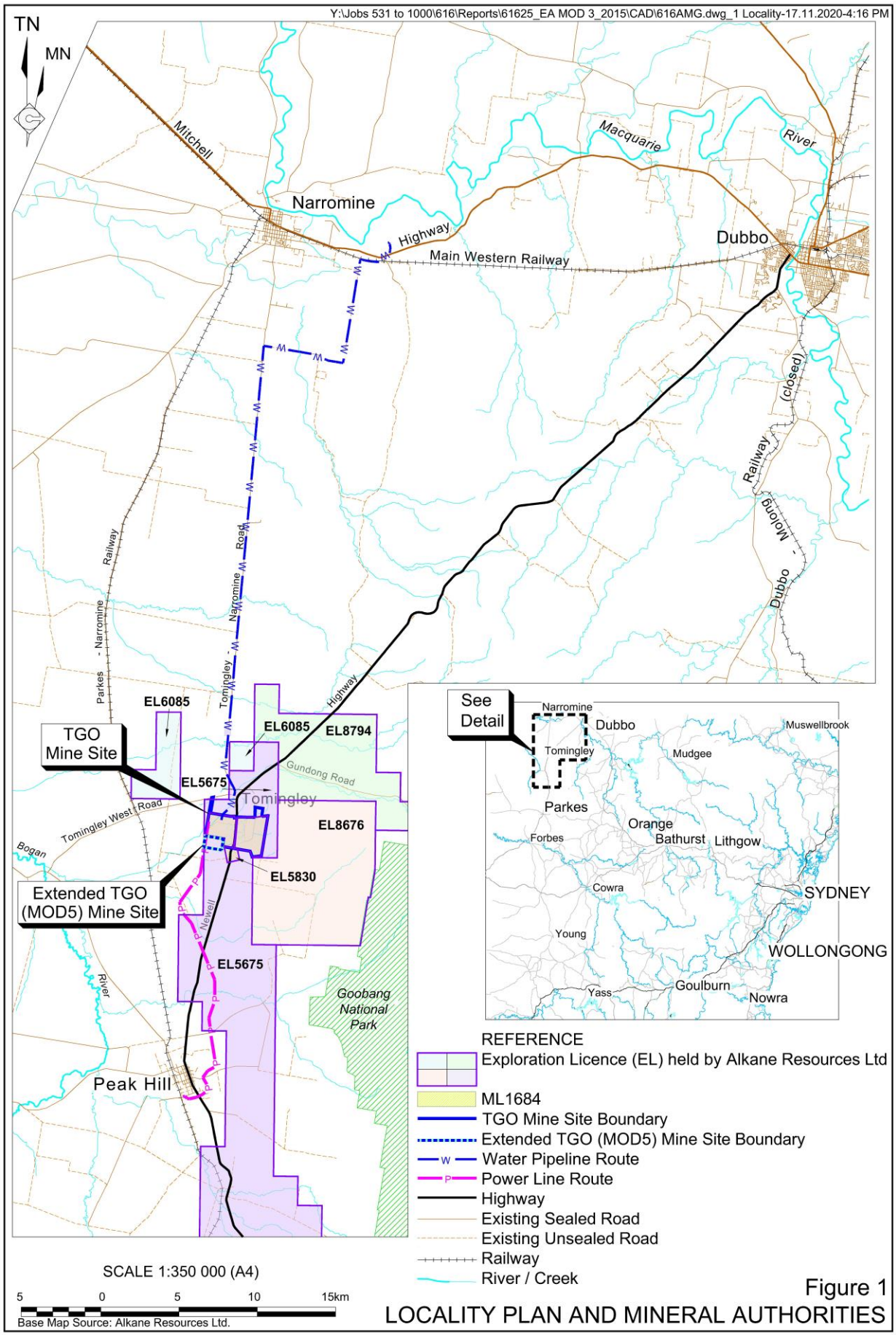
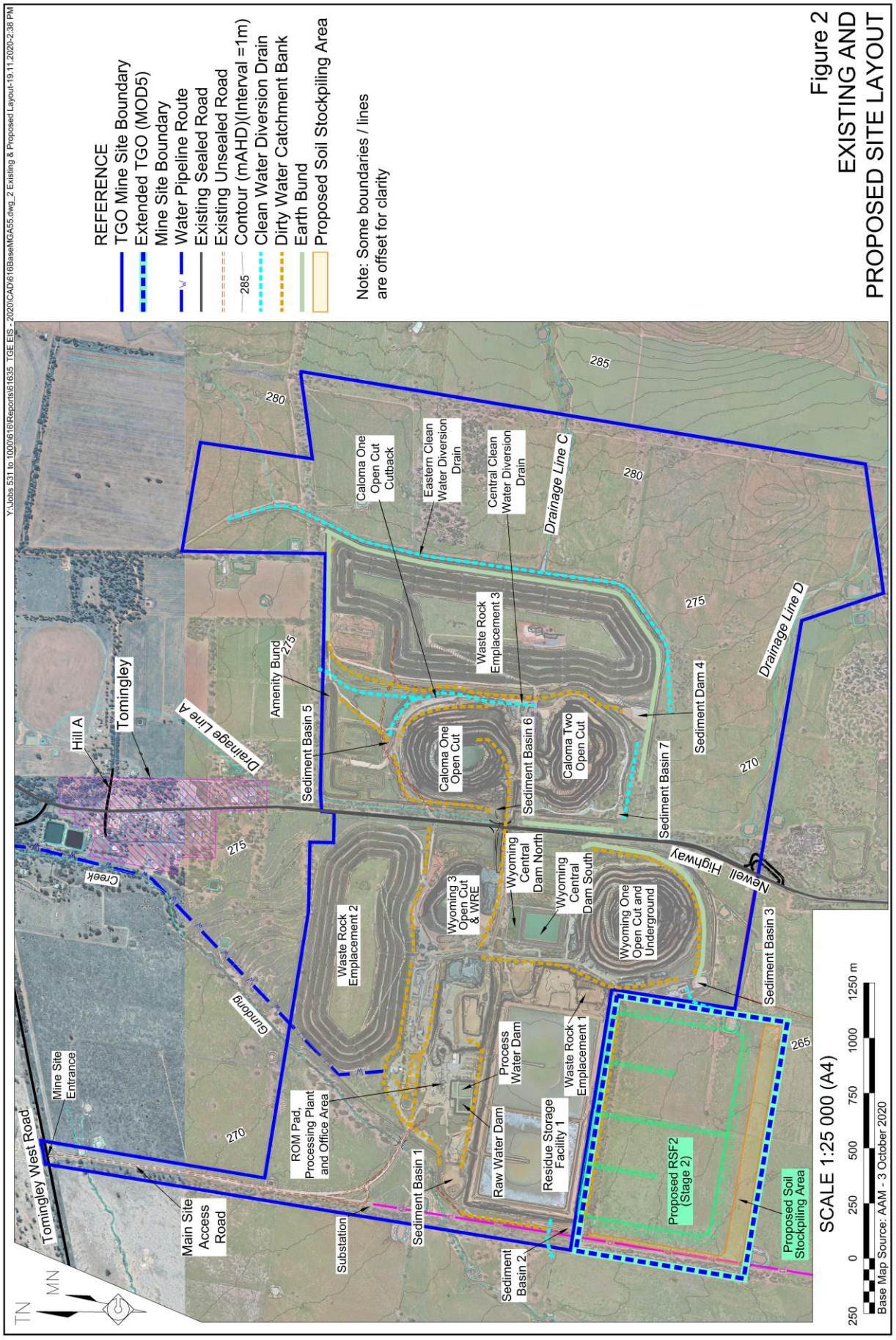


Figure 1
LOCALITY PLAN AND MINERAL AUTHORITIES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Caloma Two Open Cut
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Tomingley
Drainage Line A
Creek
Newell Highway
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Proposed Soil Stockpiling Area
Main Site Access Road
Substation
Sediment Basin 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

1.2 BACKGROUND

1.2.1 Approved Activities

Activities approved under MP09_0155, as modified, include the following (**Figure 2**). Mining operations may be undertaken until 31 December 2022.

- Establishment of infrastructure required for the Mine, including a water supply pipeline, an underpass beneath the Newell Highway, and revegetated amenity bunds.
- Extraction of waste rock and ore from four open cut areas, namely:
  - Caloma 1 and 2 Open Cuts; and
  - Wyoming 1 and 3 Open Cuts.
- Extraction of waste rock and ore from the Wyoming 1 and Caloma 1 and 2 underground mines.
- Construction of three out-of-pit waste rock emplacements, namely Waste Rock Emplacements 1, 2 and 3, and one in-pit emplacement, namely the Wyoming 3 Open Cut.
- Construction and use of various haul roads, a run-of-mine (ROM) pad and associated stockpiles.
- Construction and use of a processing plant to process up to 1.5Mtpa, incorporating a crushing and grinding circuit, a standard carbon-in-leach processing plant, site offices, workshops, ablutions facilities, stores, car parking, and associated infrastructure.
- Construction and use of a residue storage facility (RSF1) to Stage 9, Cell 1, with a maximum elevation of 286.5m AHD and an approximate storage capacity of 8.93Mt of residue.
- Construction and use of ancillary infrastructure, including:
  - an office and associated infrastructure;
  - surface water management structures;
  - a water pipeline from a licensed bore 7km east of Narromine;
  - electrical, telecommunication and other infrastructure; and
  - ancillary infrastructure.

1.2.2 Operation of the Mine

Construction of the Mine commenced in February 2013 with open cut mining commencing in November 2013. The initial phase of open cut mining was completed in January 2019. During 2019, the Proponent processed previously stockpiled low-grade ore, with the processing plant placed into care and maintenance from between December 2019 and February 2020.

Underground development from a portal in the Wyoming 1 Open Cut commenced in January 2019, with ore production from stopes under the Wyoming 1 Open Cut commencing in December 2019. The Proponent continues to mine underground at Wyoming 1 and is currently developing an underground drive to Caloma 2, with the first underground ore from that deposit expected in the first half of 2021.

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

Processing operations recommenced in February 2020, initially on a reduced roster before full production was resumed in May 2020.

Finally, the Proponent commenced construction of Stage 7 of RSF1 in July 2020, with initial residue placement expected in November 2020.

Table 1 presents the publicly available production figures for the Mine for each financial year to June 2020. In summary, approximately 6.61Mt of ore was processed between the commencement of mining operations and 30 June 2020. The maximum annual rate of processing was 1.14Mt in 2015, less than the approved maximum rate of processing of 1.5Mtpa.

Table 1
Previous Production Statistics

Production	Units	Financial Year ending 30 June							Total
		2014	2015	2016	2017	2018	2019	2020	
Waste mined	bcm	4 635 684	5 730 661	6 199 820	7 679 110	3 165 414	657 647	50 473	28 118 809
Ore mined	t	545 550	1 286 291	1 285 454	1 222 868	1 589 811	400 187	355 879	6 686 040
Ore milled	t	359 096	1 140 704	1 096 105	1 087 983	1 092 602	998 703	838 743	6 613 936
Source: Alkane Resources Ltd – June Quarterly Reports for each financial year									

1.2.3 Proposed Tomingley Gold Extension Project

In addition to the approved operations at Tomingley Gold Operations, the Proponent has identified a number of exploration prospects located to the south of the TGO Mine Site. The Proponent has been actively exploring the identified prospects, including in particular the San Antonio and Roswell (SAR) deposits. The information presented in this subsection is provided for information only. This application does not seek approval for the Tomingley Gold Extension Project. A separate application will be prepared for that Project in due course.

Inferred Mineral Resource estimates have been released for the SAR deposits as follows.

- Roswell 7.02Mt grading 1.97g/t (445 000oz)
- San Antonio 7.92Mt grading 1.78g/t (453 000oz)

Resources drilling is ongoing, with updated resource and reserve estimates to be released once available.

The Proponent anticipates that the proposed operations, based on work undertaken to date, would include the following (**Figure 3**).

- A single open cut (the SAR Open Cut) approximately 1.7km long, 700m wide and up to 310m deep, to be mined in stages, indicatively from south to north.
- Underground development under each open cut stage, with two or more portals located in the initial stage of the open cut. Mining operations, both open cut and underground, would be undertaken for a period of up to 10 years.
- Placement of waste rock into two or more out-of-pit or in-pit waste rock emplacements.
- Realignment of the Newell Highway, including:
  - re-establishment of the existing overtaking lanes;
  - construction of intersections for Back Tomingley West Road, the realigned Kyalite Road and McNivens Lane; and
  - installation of under road drainage to ensure safe passage of surface water flows.
- Realignment of Kyalite Road, including a grade separated underpass to separate mine and non-mine vehicles. An alternative route for Kyalite Road re-entering the Newell Highway within the Tomingley village is also under investigation.
- Construction and use of the following infrastructure.
  - A haul road from the SAR Open Cut to the TGO Mine Site.
  - Water management infrastructure, including clean water diversions and dirty and mine water containment structures.
  - An open cut infrastructure area.
  - A magazine and explosives store.
  - Realigned infrastructure, including powerlines and communications infrastructure.

In addition, the following modifications would be required within the TGO Mine Site to accommodate the Project.

- Importation of SAR Open Cut waste rock and backfilling of the Caloma 1 and 2 Open Cuts.
- Importation of ore from the SAR Open Cut for processing using the existing TGO processing Plant at a maximum rate of up to 1.5Mtpa for a period of approximately 10 years, with the resulting residue placed into the approved RSF1 (pending remaining capacity) and the proposed RSF2, including Stages 1 and 2 included in this Proposed Modification and Stages 3 to 9 to be included in a subsequent application.

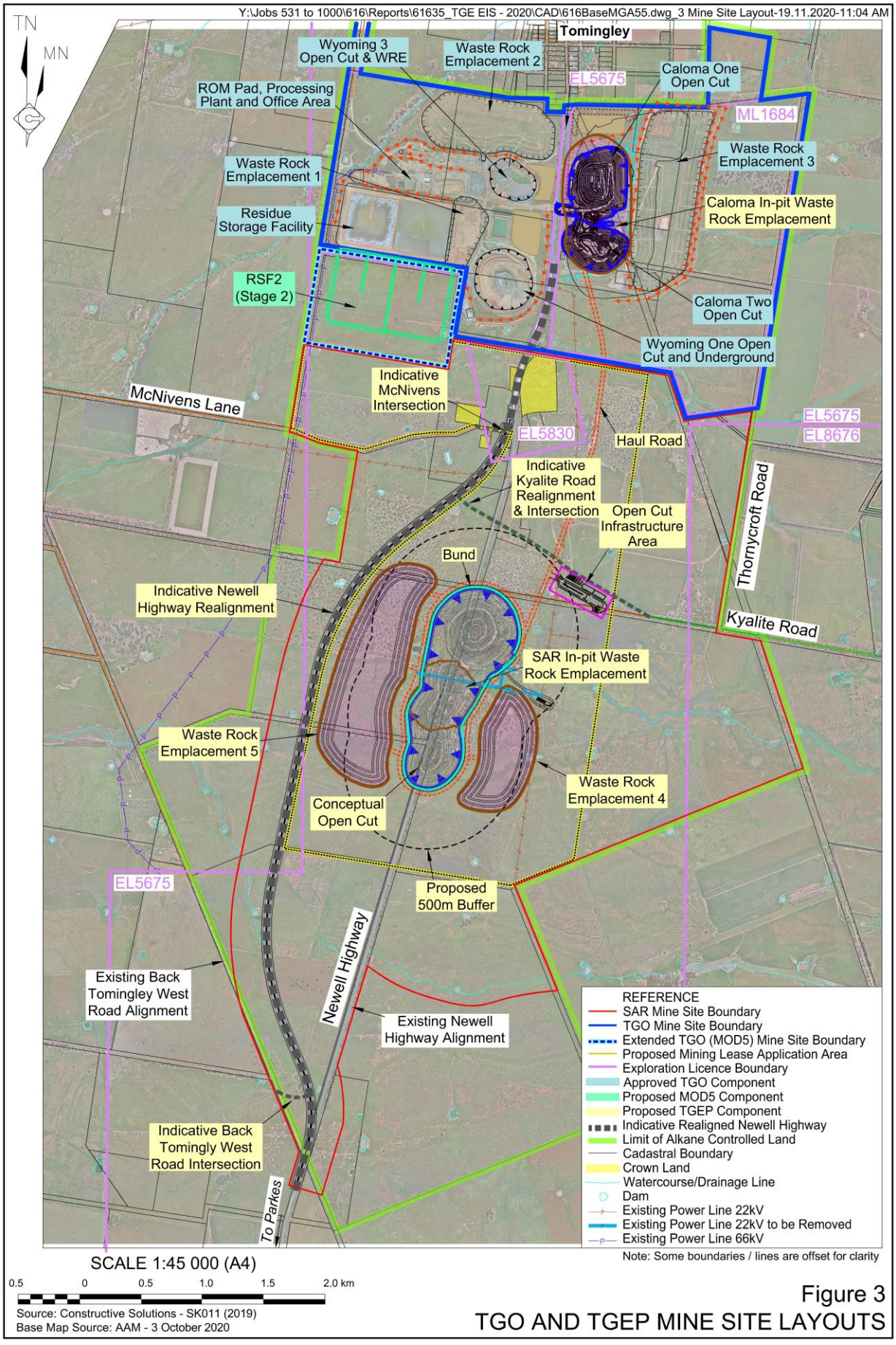


Figure 3
TGO AND TGEP MINE SITE LAYOUTS

- Incorporation of one or more additional water supply bores in the vicinity of the existing water supply pipeline. The bore(s) would be located within Zone 6 of the Lower Macquarie Groundwater aquifer.
- Additional Biodiversity Offset Areas (BOAs) in the form of Stewardship sites would be established across the Proponent's landholding.

The Proponent anticipates that MP09_0155 would be relinquished following granting of any development consent for the Tomingley Gold Extension Project. The Tomingley Gold Extension Project application is currently in progress, with submission of the application anticipated in 2021.

1.3 NEED FOR THE MODIFICATION

1.3.1 Introduction

The Proponent is seeking consent to:

- increase the residue storage capacity of Tomingley Gold Operations through the construction of the initial stages of a second Residue Storage Facility, together with the associated extension of the approved TGO Mine Site; and
- extend the life of the Mine by three years.

In order to justify the Proposed Modification, the Proponent must, amongst other matters, demonstrate the need for the proposed activities by demonstrating:

- that there is adequate known resources and reserves, as well as exploration potential, to justify mining operations until 31 December 2025; and
- that the currently approved RSF1 does not have adequate capacity to cater for planned mining operations over the proposed extended life of the Mine.

As identified in Section 1.2.3, the Proponent is currently preparing an application for development consent for the Tomingley Gold Extension Project which would, following granting of consent for that application, replace MP09_0155.

1.3.2 Mineral Resources, Ore Reserves and Mine Schedule

Tables 2 and **3** present the Mineral Resources and Ore Reserves[1] Statement for the Tomingley Gold Operations at 30 June 2020. In summary, approximately 3.0Mt of Ore Reserves and 9.4Mt of Mineral Resources remain within the TGO Mine Site.

[1] The JORC Code (2012) defines Mineral Resources and Ore Reserves as follows.
- A 'Mineral Resource' is a concentration or occurrence of solid material of economic interest in or on the Earth's crust [with] reasonable prospects for eventual economic extraction.
- An "Ore Reserve" is the economically mineable part of a … Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted.

Table 2
TGO Mineral Resources at 30 June 2020

	Measured		Indicated		Inferred		Total	
	Tonnes (kt)	Grade (g/t Au)	Tonnes (kt)	Grade (g/t Au)	Tonnes (kt)	Grade (g/t Au)	Tonnes (kt)	Grade (g/t Au)
Open Pittable Resources (cut-off 0.50g/t Au)								
Wyoming One	624	1.8	428	1.3	107	0.7	1,159	1.5
Wyoming Three	86	2	16	1.3	33	1.4	135	1.7
Caloma	879	1.6	1,016	1.2	824	1.2	2,719	1.3
Caloma Two	64	2.3	812	2	26	1.4	902	2
Sub Total	**1 653**	**1.6**	**2 272**	**1.6**	**990**	**1.2**	**4 915**	**1.5**
Underground Resources (cut-off 1.3g/t Au)								
Wyoming One	664	2.8	1,390	2.9	427	2.8	2,481	2.9
Wyoming Three	46	2.2	24	2	20	1.9	90	2.1
Caloma	158	2.6	129	2	465	1.9	752	2
Caloma Two	-	0	785	2.4	426	2	1,211	2.3
Sub Total	**868**	**2.8**	**2,328**	**2.7**	**1,338**	**2.2**	**4,534**	**2.6**
TOTAL	**2 521**	**1.8**	**4 600**	**2.2**	**2 328**	**1.5**	**9 449**	**1.9**

Source: Alkane Resources Ltd – 2020 Annual Report

Table 3
TGO Ore Reserves at 30 June 2020

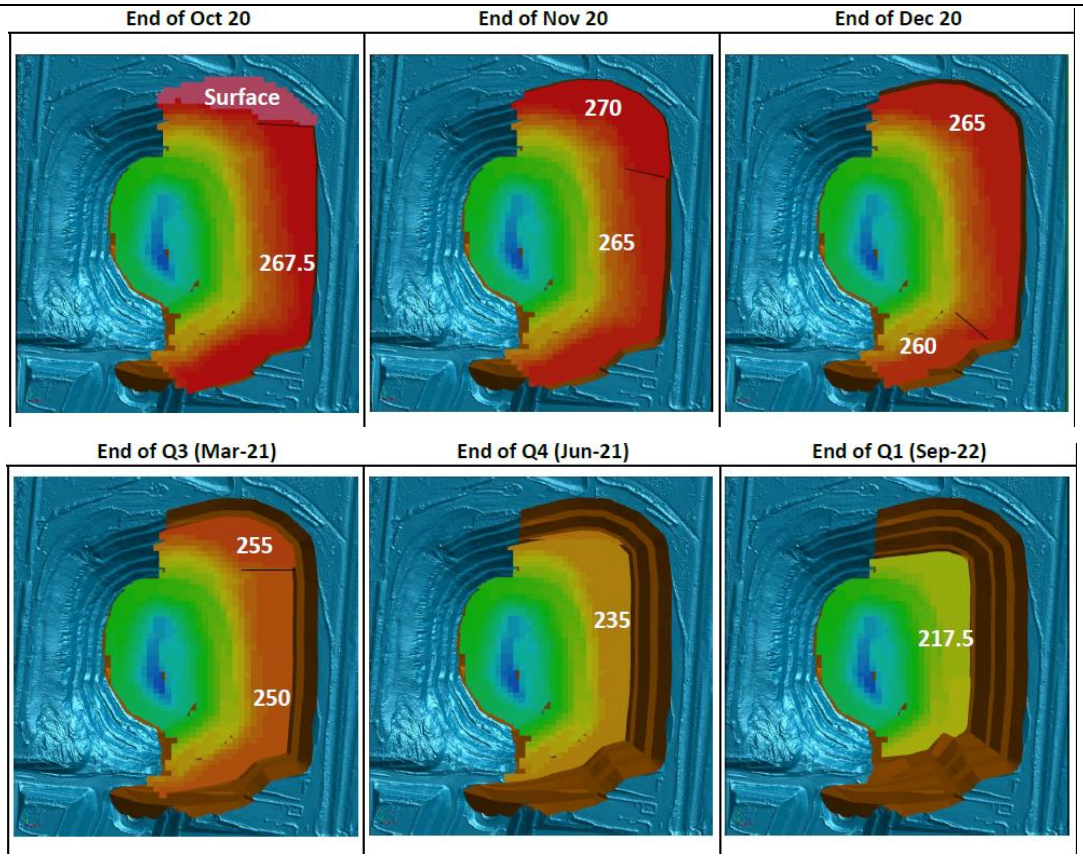
	Proved		Probable		Total	
	Tonnes (kt)	Grade (g/t Au)	Tonnes (kt)	Grade (g/t Au)	Tonnes (kt)	Grade (g/t Au)
Open Pittable Reserves (cut-off 0.50g/t Au)[1]						
Wyoming One	0	0	0	0	0	0
Wyoming Three	0	0	0	0	0	0
Caloma	450	1.7	119	1.2	569	1.6
Caloma Two	0	0	0	0	0	0
Stockpiles	207	0.8	0	0	207	0.8
Sub Total	**657**	**1.1**	**119**	**1.2**	**776**	**1.4**
Underground Reserves (cut-off 1.3g/t Au)						
TGO underground	573	1.9	1 618	2	2 191	2
Sub Total	**573**	**1.9**	**1 618**	**2**	**2 191**	**2**
TOTAL	**1 230**	**1.8**	**1 737**	**1.9**	**2 967**	**1.8**

Note 1: The Proponent has recently lowered to open cut cut-off to 0.4g/t Au. This is likely to increase the material that would be classified as ore, and consequently the material that would be mined and processed.

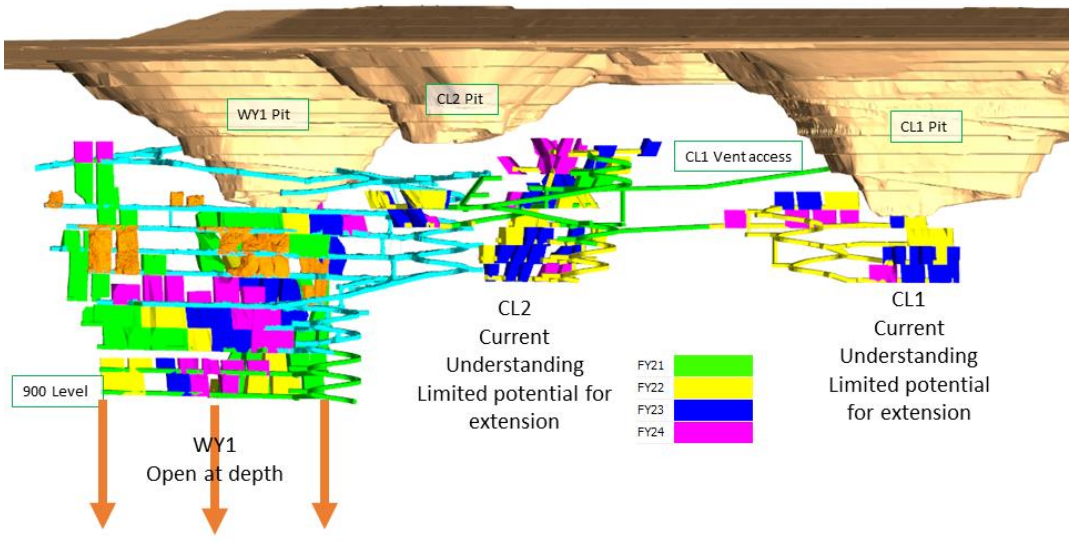
Source: Alkane Resources Ltd – 2020 Annual Report

Table 4 presents the current mine production schedule for the Mine. It is noted that given the current historically high gold price, the Proponent is investigating measures to further increase production rates and that this schedule may be revised upwards. **Figure 4** presents an isometric view of the mining planning schedule used to generate the production schedule presented in **Table 4**. Notwithstanding the current high gold prices, the Proponent has determined that there

is no potential for open cuttable ore underneath the Caloma 2 Open Cut and that remaining resources in the vicinity of that open cut are amenable to underground mining. Similarly, with the exception of previously identified ore within the approved Caloma 1 cut back, there is no known open cuttable ore associated with Wyoming 1 or Caloma 1 Open Cuts, with mining using underground mining methods to continue.



Open Cut Mine Schedule



Underground Mine Schedule

Source: Tomingley Gold Operations Pty Ltd

Figure 4
Mine Planning Schedule

Table 4
TGO Life of Mine Mining Schedule

Quarter	Open Cut Mining (t)	Underground Mining (t)	Total (t)
Dec-20	-	190 000	190 000
Mar-21	2 000	208 000	210 000
Jun-21	10 000	211 000	220 000
Sep-21	28 000	212 000	241 000
Dec-21	43 000	212 000	255 000
Mar-22	62 000	211 000	273 000
Jun-22	95 000	211 000	306 000
Sep-22	118 000	211 000	330 000
Dec-22	122 000	212 000	334 000
Mar-23	97 000	210 000	307 000
Jun-23	-	212 000	212 000
Sep-23	-	203 000	203 000
Dec-23	-	163 000	163 000
Mar-24	-	161 000	161 000
Jun-24	-	72 000	72 000
Total	**577 000**	**2 709 000**	**3 287 000**

Source: Tomingley Gold Operations Pty Ltd – revised mine schedule dated September 2020.

Based on known ore within the TGO Mine Site mining operations could continue to at least the June 2024 quarter, with approximately 3.3Mt of ore to be mined over this period. However, the based on the Proponent's previous record of converting Mineral Resources to Ore Reserves (see Section 1.3 of RWC (2020)), the current combined mineral inventory within the TGO Mine Site of approximately 12.4Mt and the recent reduction in the open cut cut-of grade from 0.5g/t Au to 0.4g/t Au, it is highly likely, even if production rates are revised upwards, that adequate reserves will exist to permit mining operations to continue until the proposed end of Mine life of 31 December 2025.

1.3.3 Remaining RSF1 Storage Capacity

The approved capacity of RSF1 is approximately 8.93Mt of residue. **Table 5** presents the capacity of Stages 7 to 9 of RSF1, together with the anticipated residue placement commencement and completion dates. In summary, RSF1 Stage 7 to Stage 9 (Cell 1) has a design capacity of approximately 1.95Mt and is expected to be full by February 2022. By contrast, the current mining schedule indicates that a minimum of 3.3Mt ore is available to be mined should adequate capacity be available to store the residue and adequate time be available to mine the resource. This would produce a minimum of 3.3Mt of residue that would require storage, a minimum 1.35Mt more than the remaining capacity of RSF2.

1.3.4 Extension of TGO Mine Site

As described in Section 1.4.3, the Proponent investigated a number of alternative locations for RSF2 and rejected each in favour of the proposed location. In order to construct RSF2 in the proposed location, the TGO Mine Site will be required to be extended. The land on which the TGO Mine Site is to be extended is currently owned by M. McNiven, however, the Proponent has purchased that land, with settlement due on 1 February 2021. A new Mining Lease will be required for ancillary activities.

1.3.5 Remaining Wyoming 3 Storage Capacity

The Proponent has sought and obtained development consent for placement of waste rock into the Wyoming 3 Open Cut under MOD3 (RWC, 2015 and **Appendix 1**). RWC (2015) also implies that waste rock would also be placed into "other" open cuts. For the avoidance of doubt, the Proposed Modification seeks development consent for placement of waste rock into the Caloma 2 Open Cut. The following addresses the capacity constraints within the Wyoming 3 Open Cut that make this necessary.

Since receipt of consent for that activity, the Proponent has placed approximately 2.5Mm^3 of material into the open cut, with approximately 1.2Mm^3 of remaining capacity. The Proponent anticipates that approximately 0.7Mm^3 of material from the ROM Pad, as well as additional material from other sections of the TGO Mine Site would be required to be placed within Wyoming 3 Open Cut during final rehabilitation. As a result, limited capacity remains within Wyoming 3 Open Cut to accept additional waste rock.

Table 5
RSF1 Capacity and Filling Schedule

Construction Activity	Incremental Storage (Mt)[1]	Residue Deposition[2]	
		Anticipated Commencement	Anticipated Completion
Stage 7 Cell 1	0.38	Jul 2020	Oct 2020
Stage 7 Cell 2	0.44	Nov 2020	Jan 2021
Stage 8 Cell 1	0.36	May 2021	Aug 2021
Stage 8 Cell 2	0.43	Sep 2021	Nov 2021
Stage 9 Cell 1	0.34	Nov 2021	Feb 2022
Total	**1.95**		

Note 1: Source - GHD (2019) – After Table 7-1
Note 2: Source - Tomingley Gold Operations Pty Ltd – revised residue schedule dated October 2020.

With the recommencement of mining operations within Caloma 1 Open Cut in October 2020, additional waste rock is being generated. The Proponent anticipates that over the life of that operation that approximately 6.3Mt or 2.8 million bank or *in situ* cubic meters of waste rock would be produced. The Proponent anticipates that approximately 0.4Mm^3 of waste rock would be required for construction of Stages 1 and 2 of RSF2, with that material to be temporarily stored within WRE1 until required. The remaining waste rock will be required to be stored elsewhere. As WRE2 and WRE3 have now been rehabilitated, and consistent with the Resources Regulator policy to maximise backfilling of existing voids, the Proponent proposes to place waste rock into the completed Caloma 2 Open Cut.

Finally, prior to recommencing open cut operations within the Caloma 1 cut back, the Proponent was storing surface water that accumulated within the dirty water catchments within the TGO Mine Site in the Caloma 1 Open Cut. In order to permit mining operations, that water was required to be removed and has been transferred to the Wyoming 3 Open Cut. That water is gradually being used for mining-related purposes, however, its presence in Wyoming 3 Open Cut would preclude use of the open cut for placement of waste rock.

1.4 ALTERNATIVES CONSIDERED

1.4.1 Introduction

In preparing the Proposed Modification, the Proponent considered a range of alternatives. This section presents an overview of the alternatives considered and rejected during the planning phase of the Proposed Modification.

1.4.2 Alternate Residue Storage Facility Location

GHD undertook an options assessment for potential locations for RFS2 within the TGO Mine Site. In summary, two options were assessed as follows.

- Option 1 – proposed location immediately to the south of and integrated with RSF1.
- Option 2 – a standalone, turkey's nest style facility to the south of WRE3.

Option 2 was considered to be less optimal than Option 1 for the following reasons.

- Additional pumping distance required for residue transfer from the processing plant and for return of decant water.
- Option 2 would require approximately 25% to 30% more material to construct the embankments than Option 1 because of the ability of Option 1 to utilise the existing RSF1 southern embankment. This would result in additional costs and disturbance of land.
- Option 2 would require additional decant water storage facilities, whereas Option 1 could utilise the existing Wyoming Central Dam storage.

In light of the above, the Proponent elected to proceed with Option 1.

1.4.3 Alternate Residue Storage Facility Footprint

The Proponent considered a smaller Residue Storage Facility footprint. In particular, the Proponent considered constructing one cell only, with the single cell option required to be constructed to Stage 4 rather than the proposed Stage 2. However, the Proponent notes that a vertical rate of rise of the residue of approximately 2m per year is required to achieve suitable settling and geotechnical stability of the residue. At an average and maximum rate of production

of 1Mtpa and 1.5Mtpa and a settled density of 1.4t/m^3, approximately 715 000m^3 and 1 070 000m^3 of capacity per year respectively is required. In order to achieve the required 2m per year rate of rise, approximately 36ha and 54ha of residue deposition area is required.

The one cell Residue Storage Facility option would have a residue deposition area of approximately 30ha, too small for the anticipated average residue production rate and substantially too small for the approved maximum rate of production.

In addition, the Proponent notes that a one cell Residue Storage Facility does not provide for the required rotation of residue placement required to achieve suitable settlement and geotechnical stability of the residue.

As a result, the one cell Residue Storage Facility option was rejected.

1.4.4 No Extension of the TGO Mine Site

The Proponent considered not extending the TGO Mine Site to accommodate RSF2, however, this would have resulted in Mine-related infrastructure outside of the approved TGO Mine Site boundary, an outcome that was considered by the Proponent to be unacceptable.

1.4.5 No Extension of the Mine Life

The Proponent considered not extending the life of the Mine, relying rather on the application for development consent for the Tomingley Gold Extension Project to replace and extend the life of the currently approved Tomingley Gold Operations. However, the Proponent felt that assuming that the Tomingley Gold Extension Project application would be submitted, assessed and approved by 31 December 2022 posed an unacceptable risk to the continuation of mining operations should delays in the application process be experienced.

1.4.6 Alternate Waste Rock Emplacement Locations

The Proponent considered alternate locations for placing waste rock generated by the Caloma 1 cut back. Options considered, and the reasons that each was rejected, included the following.

- Placement into WRE3 – this waste rock emplacement is approved to receive additional waste rock at the northern end of the emplacement. However, the Proponent has determined that access for fully laden haul trucks may pose a safety risk. The emplacement has been rehabilitated and the Proponent felt that it would be inappropriate to disturb the rehabilitated areas. This location would also result in noise emissions that while approved, were likely to be seen by the community as less than ideal.
- Placement into Wyoming 3 Open Cut – the Proponent considered placing waste rock into this open cut, however, as discussed in Section 1.3.4, limited capacity remains in that open cut and additional storage would have been required anyway.

Finally, the Proponent is currently storing surface water within the Wyoming 3 Open Cut that is unable to be discharged pending use for mining-related purposes. Placement of waste rock withing that open cut would displace necessary water storage capacity.

- Construction of an additional waste rock emplacement – this option would have resulted in disturbance of additional land, with the resulting additional environmental impacts. In addition, limited areas within the existing surface water management area would be available, resulting in the need for substantial modification to surface water diversion structures. Finally, any new waste rock emplacement would require transportation of waste rock much greater distances than required for placement within the Caloma 2 Open Cut, resulting in additional greenhouse gas emissions and costs.

As a result, each of the above alternatives were rejected.

2. DESCRIPTION OF THE MODIFICATION

2.1 OVERVIEW OF THE PROPOSED MODIFICATION

The Proposed Modification seeks consent for the following. **Figure 3** presents the proposed layout of RSF2 and the extended TGO Mine Site Boundary.

- Construction and use of Stages 1 and 2 of RSF2.
- An extension of Mine Life from 31 December 2022 to 31 December 2025.
- Extension of the TGO Mine Site boundary to incorporate RSF2.
- Use of Caloma 2 for backfilling operations.

No other changes to the approved Mine are proposed.

Appendix 1 presents a detailed comparison of the Project as originally approved, the changes associated with each of the subsequent modifications, the currently approved Project and the Proposed Modification.

2.2 RESIDUE STORAGE FACILITY

2.2.1 Introduction

A concept design for RSF2 has been prepared by GHD, with the resulting report referred to hereafter as GHD (2020). A copy of that report is presented as **Appendix 2**. It is noted that, consistent with industry practice, that report presents a conceptual design for the Residue Storage Facility for Stages 1 to 9. Development consent is sought for Stages 1 and 2 and the conceptual design for Stages 3 to 9 is presented in this document for information only. GHD (2020) also presents two options for embankment construction, namely upstream and centreline lift options (see Section 2.2.3). For the purposes of this application, the Proponent has assumed centreline lifts as this option would disturb a larger area and require additional material movements. Should upstream lifts methods be used, the anticipated environmental impacts would be reduced.

The Proponent would complete the detailed design following the granting of development consent for the Proposed Modification. 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 (ANCOLD), the Dams Safety NSW and currently accepted practice for Australian tailings storage facility engineering.

This section presents a description of the current, approved Residue Storage Facility, as well as the modified Facility.

2.2.2 Existing RSF1 Design

Figure 2 presents the layout of the existing RSF1. In summary the design criteria for the approved facility are as follows.

- Final Stage ..... Stage 9 (Cell 1)
- Maximum crest elevation .....286.5m AHD

- Maximum elevation of residue ..... 286.0m AHD
- Crest width, including safety bund 6m
- Slope of outer face ..... 1:3 (V:H) (northern and western walls)
  ..... 1:2.5 (V:H) (southern walls)
- Slope of inner face ..... 1:1.5(V:H)
- Cumulative maximum capacity ..... approximately 8.93Mt
- Dam Break Consequence Category (ANCOLD)..... Significant
- Environmental Spill Consequence Category (ANCOLD)..... Significant
- Decant system..... maintain current central decant towers
- Decant pond capacity.....1:10 000-year AEP flood event
- Spillway not required, designed for no spill

MOD4, approved in May 2020, sought approval for construction of Stages 7 to Stage 9 (Cell 1) of RSF1, with residue placement into Stage 7 commencing in July 2020.

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 utilises the existing WRE1.

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 Mine to date.

2.2.3 Design of RSF2

GHD (2020) presents the conceptual design for RSF2 Stages 1 to 9. Development consent is sought for Stages 1 and 2 only. The Proponent anticipates seeing development consent for Stages 3 to 9 of RSF2, likely as a component of the Tomingley Gold Extension Project.

GHD (2020) have prepared the conceptual RSF2 design based on the following.

- ANCOLD Guidelines on Tailings Dams (2019) and related guidelines.
- Relevant International Commission on Large Dams Guidelines.
- Dam Safety NSW Guidelines.
- NSW Environmental Protection Authority, Tailings Dam Liner Policy Letter (2016).

In summary, the RSF2 Stages 1 and 2 would have the following design criteria (**Figures 5** to **8**).

- Maximum crest elevation ..... 272.0m AHD
- Maximum elevation of residue ..... 271.3m AHD
- Crest width, including safety bund 7m
- Slope of outer face (except northern embankment)..... 1:3 (V:H)
- Slope of inner face ..... 1:2 (V:H)
- Proposed disturbance area (Stage 2)..... 64.3ha
- Cumulative maximum volume ..... 3.2Mm^3
- Assumed residue density ..... 1.4t/m^3
- Design capacity (Stage 1) 2.9Mt
- Design capacity (Stage 1 and 2) 4.5Mt
- Liner material..... minimum 1m compacted clay
- Liner permeability ..... maximum 1 x 10^{-9}m/s
- Residue deposition ..... Perimeter discharge
- Decant system..... current central decant towers
- Dambreak Consequence Category (ANCOLD) ..... Significant
- Environmental Spill Consequence Category (ANCOLD)..... Low
- Decant pond capacity..... 1:10 000-year AEP flood event

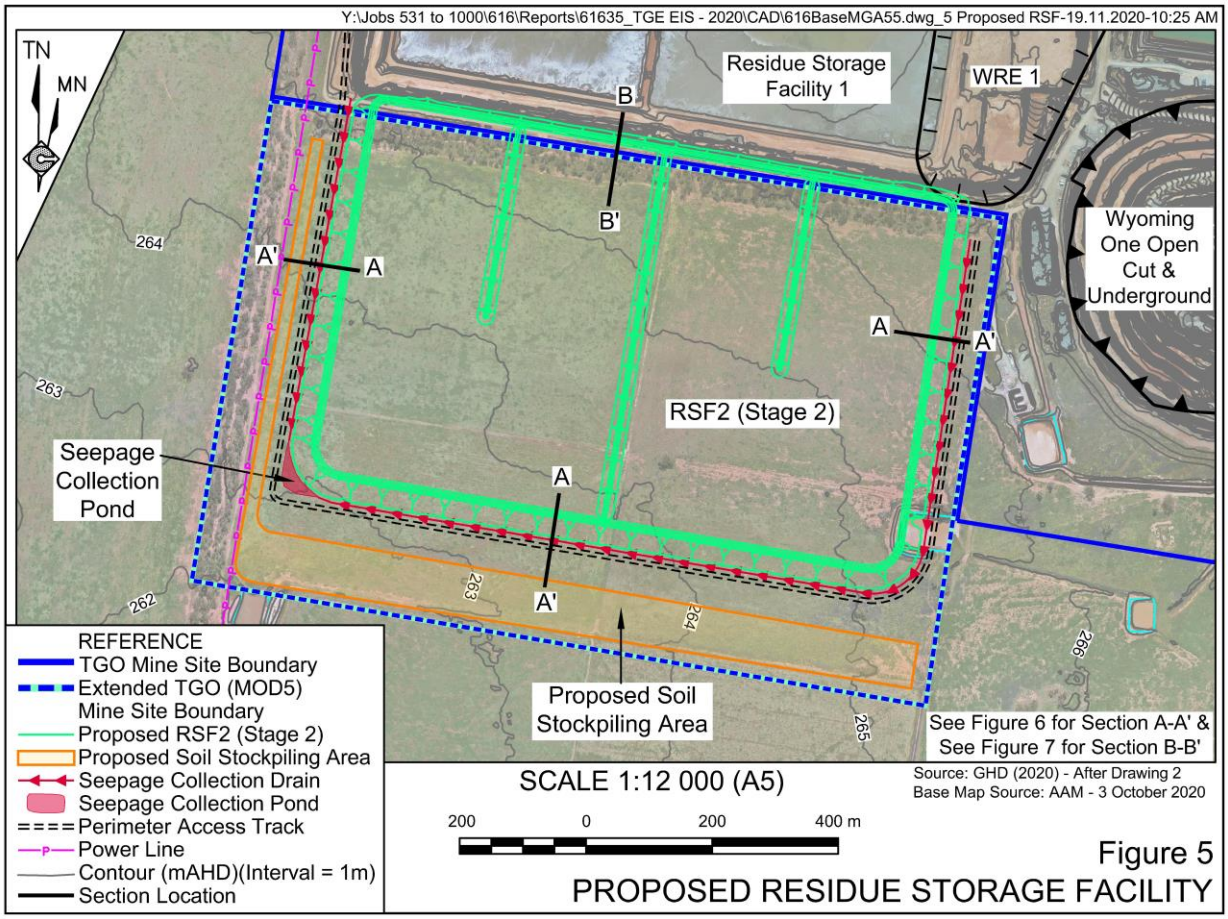


Figure 5
PROPOSED RESIDUE STORAGE FACILITY

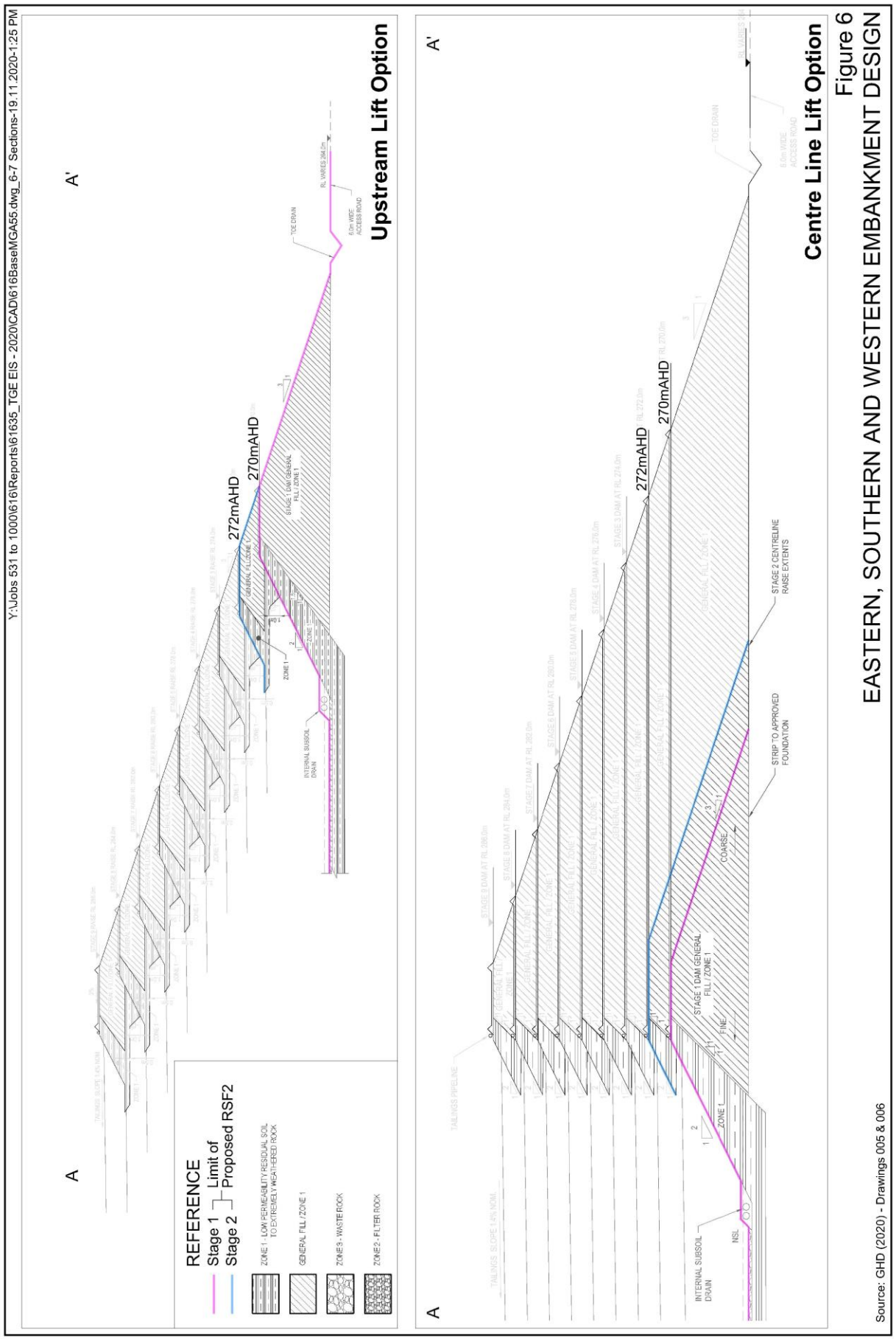


Figure 6
EASTERN, SOUTHERN AND WESTERN EMBANKMENT DESIGN

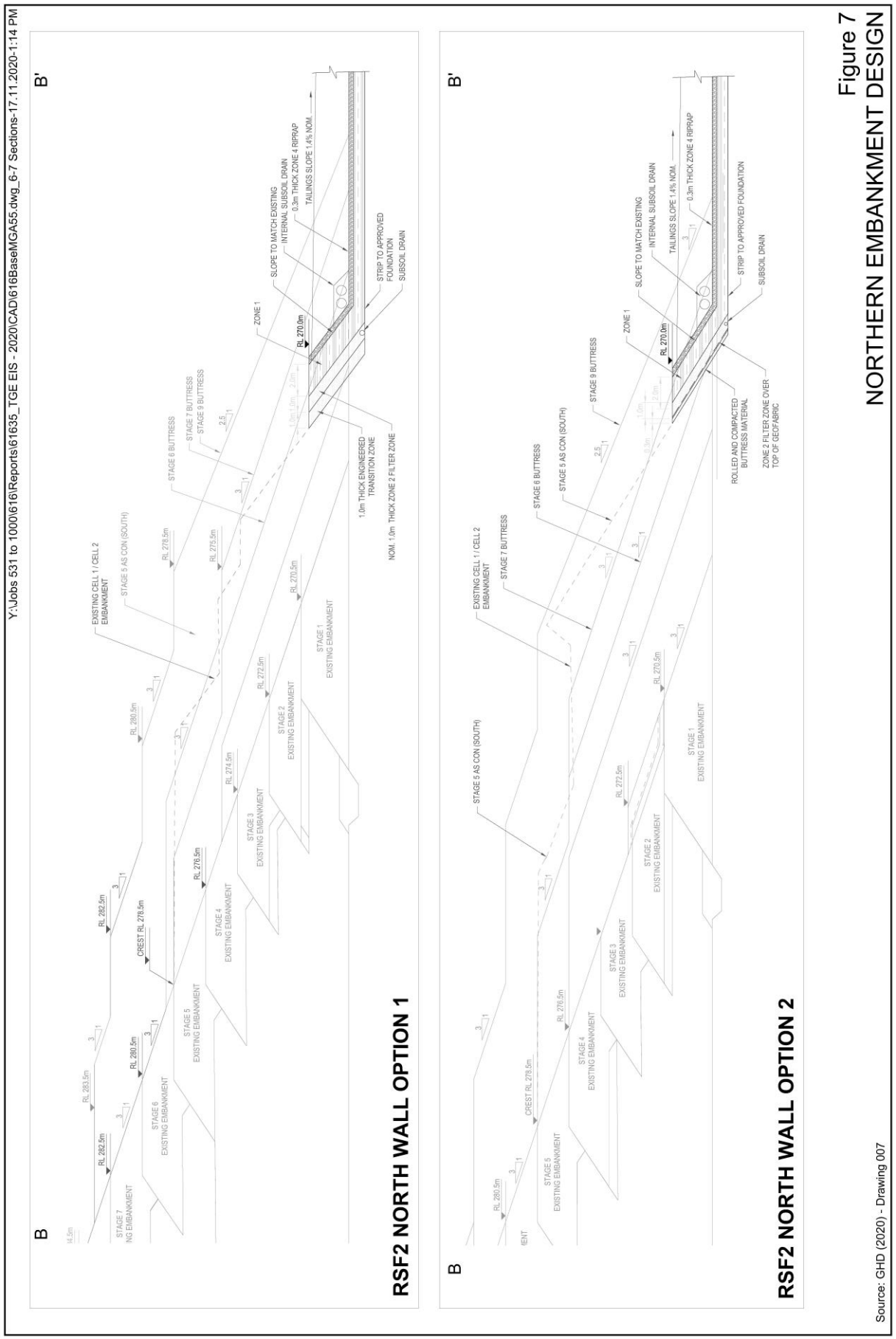


Figure 7
NORTHERN EMBANKMENT DESIGN

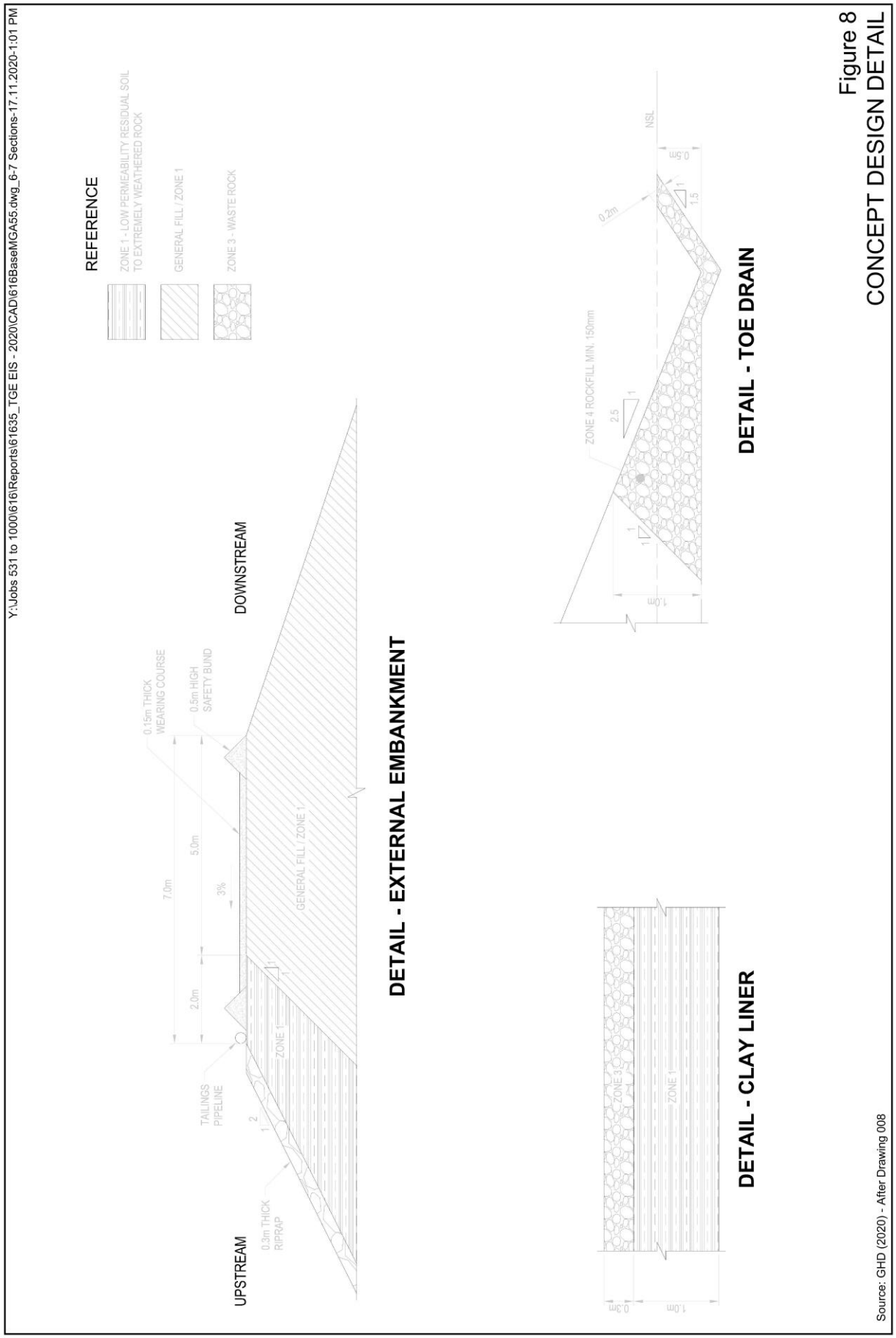


Figure 8
CONCEPT DESIGN DETAIL

The proposed Residue Storage Facility would be constructed in two stages, comprising an initial starter stage followed by Stage 2. As identified in Section 1.3.3, the remaining known mining inventory for within the TGO Mine Site is 3.3Mt. With all ore mined becoming residue following removal of the contained gold and a remaining capacity within RSF1 of 1.95Mt, a minimum of 1.35Mt of additional residue storage capacity is required. In addition to the known mining inventory, the Proponent anticipates identifying additional resources at depth below the Wyoming 1 underground mine (see Section 1.3.2). As a result, it is likely that substantially more than 1.35Mt of residue would be produced. GHD (2020) identify that Stage 1 of RSF2 would contain approximately 2.94Mt of residue. In the unlikely event that the growth in the mining inventory is less than 1.59Mt, the Proponent would only construct Stage 1 of RSF2.

GHD (2020) state that the concept design caters for either:

- upstream lifts, whereby the embankment for the subsequent Stage is constructed on the surface of the residue emplaced during the previous Stage; or
- centre line lifts, whereby the crest of the embankment of the subsequent stage is constructed directly over the crest of the previous stage, with additional buttressing material required.

The final design option selected will depend on the strength of the placed tailings, with upstream lifts requiring greater strength of the tailings than centre line lifts. For the purposes of this document, centreline lifts have been assumed because of the greater disturbance area and material movements required compared to upstream lifts. Should upstream lifts be constructed, actual environmental impacts will be less than those assessed.

Figures 6 to **8** presents the proposed designs of the embankments for RSF2. In summary, the eastern, southern and western embankments would comprise two zones as follows (**Figures 6** and **8**).

- an inner/upstream, low permeability zone (Zone 1 - Liner): and
- an outer/downstream zone (Zone 1 – General Fill).

Zone 1 – General Fill material would provide the geotechnical strength for the embankments, while the Zone 1 – Liner material would ensure the required permeability of the embankment.

Figure 6 presents both the upstream and downstream lift design options for the embankments.

The northern embankment of RSF2 would utilise the existing RFS1 southern embankment. This arrangement would have the following advantages.

- Reduced requirement for embankment material and a reduced disturbance area compared with a standalone option for RSF2.
- Additional buttressing for the southern embankment of RSF1, and visa versa.
- Improved final landform options for the combined RSF1 and RSF2 on mine closure.

Prior to commencing construction of the northern RSF2 embankment, the southern embankment of RSF1 would be prepared to ensure suitable foundation for the RSF2 embankment. GHD (2020) identify two options for preparing the RFS1 southern embankment as follows (**Figure 7**).

- Option 1 – retaining the existing batter slope and placing a layer of engineered fill against the existing buttress.
- Option 2 – battering of the RSF1 buttress to a nominal slope of 1:3 (V:H) following by rolling and compacting and covering with geofabric.

The detailed design would determine the most appropriate option and would also ensure that preparation operations do not adversely impact on the stability of the RSF1 southern embankment.

Finally, RSF2 would include a perimeter drain and 6m wide access track, seepage collection pond and a network of monitoring bores (**Figures 6** and **8**).

2.2.4 Construction of RSF2

2.2.4.1 Supervision and Certification of Construction

The construction of RSF2 would be supervised by a suitably qualified and accredited engineer.

Prior to commissioning of RSF2, the supervising engineer would certify that the facility has been constructed in accordance with the detailed design and all relevant guidelines and other requirements, including testing of materials used to ensure that they are fit for purpose. In particular, the Zone 1 materials would be tested to ensure that they comply with the required 1×10^{-9}m/s permeability requirements.

2.2.4.2 Geotechnical Assessment

GHD (2020) note that geotechnical assessments for RSF2 are in progress and that the results of those assessments will be used to inform the detailed design of the facility. However, based on information obtained for RSF1, the foundation material for RSF2 are anticipated to be as follows.

- Surface materials (up to 5m deep) comprise low permeability sandy clay
- Deeper deposits (5m to 15m) generally consist of a stiff gravelly clay
- At depth (below 15m) is a stiff weathered siltstone

GHD (2020) note that the gravelly clay material (below 5m depth) would likely form the foundation for the Residue Storage Facility embankments.

2.2.4.3 Construction Materials

GHD (2020) identify four classes of construction material as follows.

- Zone 1 General Fill - low permeability material, nominally 5m thick which would be placed on the inner/upstream side of the RSF2 embankment. This material would likely consist of low permeability sandy clay sourced from within the footprint of RSF2

- Zone 1 Liner – a 1m thick zone of in-situ material which would be ripped and recompacted to form a low permeability layer of 1 x 10^{-9}m/s minimum across the foundation of RSF2 to limit seepage during both operation and closure of the facility
- Zone 2 Filter Material – limited volumes to be used as between the RSF2 northern embankment and the existing RSF1. This material would be crushed and screened hard rock, likely manufactured on site using existing waste rock and mobile crushing equipment. Alternatively, that material may be imported to site from a commercial source.
- Zone 3 Waste Rock – This material would be used to protect the Zone 1 Liner material prior to covering with tailings.

2.2.4.4 Construction Operations

The Proponent would initially remove vegetation from the proposed RSF2 footprint generally in accordance with the procedures identified in RWC (2011) as follows.

- All hollow bearing trees would be inspected prior to removal and any nesting or roosting fauna would be encouraged to escape or would be relocated as required.
- Seed would be harvested prior to clearing where practicable.
- Larger vegetation would be removed using a bulldozer with its blade positioned just above the surface.
- Tree trunks would be retained for use in rehabilitation activities. Smaller vegetation would be mulched and similarly used for rehabilitation activities.
- Ground cover vegetation would be removed with the topsoil to maximise the retention of the seed bank and nutrients within the soil, as well as to minimise opportunities for erosion and dust lift-off between removal of the larger vegetation and soil stripping.

Sustainable Soils Management (SSM) prepared the soils and land capability assessment for the Proposed Modification (see Section 6.5). Soil would be removed in accordance with the recommendations of SSM as follows.

- Strip topsoil soil within the proposed RSF2 footprint to a depth of approximately 15cm.
- Spread 5t/ha of gypsum on the underlying subsoil and strip a further 45cm of subsoil.
- Ensure that soil the soil is neither pulverised (reduced to dust) nor compacted during stripping and stockpiling operations.
- Stockpile the topsoil no more than 2m high and the subsoil no more than 3m high.

Following removal of vegetation and soil, the Proponent would commence construction of Stage 1 of RSF2 by stripping material within the footprint of the embankments and basin of the facility to expose the underlying foundation material. Stripped material would be stockpiled within the disturbance footprint, with construction to be undertaken sequentially to allow storage of the excavated material.

The foundations of the embankments would be constructed in accordance with the detailed design, with key trenches and perimeter drains to be installed.

The basin of the facility would be lined with an engineered clay liner to achieve a maximum permeability of 1 x 10^{-9}m/s **(Figure 8**). The clay liner would be constructed using *in situ* material that would be ripped, watered and compacted, likely in multiple passes to achieve the required permeability. The permeability of the liner would be tested prior to covering with approximately 300mm of Zone 3 General Fill to protect the liner and facilitate drainage.

The Stage 1 embankments would indicatively be constructed as shown in **Figure 8**, from material sourced from within the RSF2 footprint. The inner face of the Zone 1 Liner material would also be covered with approximately 300mm of Zone 3 Waste Rock to protect the liner.

Stage 2 of the facility would be constructed as Stage 1 approaches capacity, likely 2 years following commissioning of Stage1, using either upstream or centre line lifts. Similarly to Stage 1, Stage 2 construction would be supervised and certified by a suitably qualified and accredited engineer.

2.2.5 Operation of RSF2

Prior to the commissioning of RSF2, a detailed Residue Management Plan (RMP) would be developed to document all elements associated with the deposition and storage of residue within RSF2. In summary, however, the Proponent would deposit residue into each cell of RSF2 via perimeter discharge, with discharge locations varied regularly to permit optimum distribution and settling of the residue. Perimeter discharge would result in an inward sloping surface, with the decant water accumulating in the centre of each cell. The accumulated water would be pumped from the facility to the Process Water Dam or the Wyoming Central Dam South (see Section 3.2.7). Excess surface water would not, under normal operating conditions, be stored within the facility.

2.2.6 Water Storage Capacity

Notwithstanding the above, during period of extreme rainfall, additional water may accumulate withing RSF2. GHD (2020) note that the minimum water storage capacity for tailings dams as follows.

- Minimum wet season water storage allowance ..... 1:10 AEP[2] wet season runoff
- Minimum extreme storm storage ..... 1:1 000 AEP, 72 hour flood event
- Contingency freeboard..... 300mm
- Emergency spillway design capacity ..... 1:1 000 AEP flood event (with sufficient freeboard for wave run-up during a 1:10 AEP wind event)

[2] AEP = Annual Exceedance Probability defined by the Australian Bureau of Meteorology as "The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year."

GHD (2020) however note that as Tomingley Gold Operations is a nil discharge site the criterion for storage of storm events has been increased to 1:10 000 AEP, 72-hour flood event within the residue beach area. In addition to this, RSF2 has been designed to contain the probable maximum flood (PMF) event with an additional 300mm freeboard.

GHD (2020) undertook an assessment of anticipated storage requirements under a range of storm events using the Very Rare to Extreme Flood Estimation methodology (ARR, 2016). **Table 6** presents the results of that analysis. In summary, a minimum storage capacity of 254ML is required to store a 1:10 000 year AEP rainfall event. GHD (2020) state that the proposed design of RSF2 complies with this requirement.

Table 6
Water Storage Requirements for Storm Events

AEP (years)	1:100	1:1 000	1:2 000	1:10,000	1:200 000	PMP
Design Rainfall (mm)	192	310	347	470	676	996
Storage Volume (ML)	103	167	187	254	365	538
Source: GHD (2020) – After Table 5-1						

2.2.7 Water Balance Analysis

GHD (2020) undertook an analysis of the water balance for the Residue Storage Facility under mean, as well as 5th and 95th percentile rainfall conditions. The results of that analysis are presented in Section 8 of GHD (2020). In summary, GHD (2020) 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.

2.2.8 Seepage Analysis

GHD (2020) also undertook an analysis of expected seepage from RSF2. The results of those assessments are presented in Section 9 GHD (2020). The following presents an overview of that analysis.

Three aquifers exist in the vicinity of the Residue Storage Facility as follows.

- Shallow alluvium, typically associated with creeks and water courses. Where groundwater in encountered, it is typically less than 10 metres below ground level (mbgl).
- Deep alluvium, typically up to 100m deep overlying the basement bedrock.
- Fractured rock aquifer, typically below 80m deep and characterised by low yields and poor-quality groundwater. Where groundwater in encountered, it is typically at an elevation of less than 190m AHD.

GHD (2020) state that falling head tests on clayey strata between 1.55mbgl and 42.5mbgl within RFS1 indicate permeabilities of between 2.3 x 10^{-8}m/s to 1 x 10^{-9}m/s.

GHD (2020) undertook a one-dimensional calculation of vertical advective flow from the decant pond to the underlying foundation of RSF2. Three scenarios were modelled as follows.

1. Seepage to shallow strata through the residue and clay liner only.
2. Seepage to regional groundwater through the residue, clay liner and high permeability foundation (assuming a permeability of 1×10^{-8}m/s).
3. Seepage to regional groundwater through the residue, clay liner and low permeability foundation (assuming a permeability of 1×10^{-9}m/s).

Table 7 presents the results of that analysis. In summary, GHD (2020) state that RSF2 poses a low risk of seepage of RSF decant water through the clay liner and foundation throughout the life of the facility, with risks further reduced following closure.

Table 7
Results of Seepage Analysis

Scenario	Stage 1		Stage 2	
	Calculated seepage volume (kL/d)	**Seepage time (years)**	**Calculated seepage volume (kL/d)**	**Seepage time (years)**
Scenario 1	1.6	39	1.9	46
Scenario 2	3.5	145	3.5	151
Scenario 3	0.5	1067	0.5	1074
Source: GHD (2020) – After Table 9.1				

2.2.9 Monitoring

In order to ensure that potential adverse groundwater impacts associated with RFS2 are appropriately monitored, the Proponent proposes to construct monitoring bores around the eastern, southern and western perimeter of the facility at approximately 250m centres. The location of these bores would be determined during the detailed design phase and would be documented in the *Water Management Plan* to be revised following receipt of development consent.

2.3 EXTENSION OF THE TGO MINE SITE

Figure 9 presents the proposed extension of the TGO Mine Site. In summary, two lots, would be added to the TGO Mine Site as follows.

- Lot 156, DP7755093.
- Lot 1623, DP1178801.

Table 8 presents all land titles within the existing and Extended TGO Mine Site. The Extended TGO Mine Site extends approximately 25m into EL8173, held by Sandfire Resources Limited. The Proponent will consult with that Company in relation to the Proposed Modification and any Mining Lease Application will not include land within EL8173.

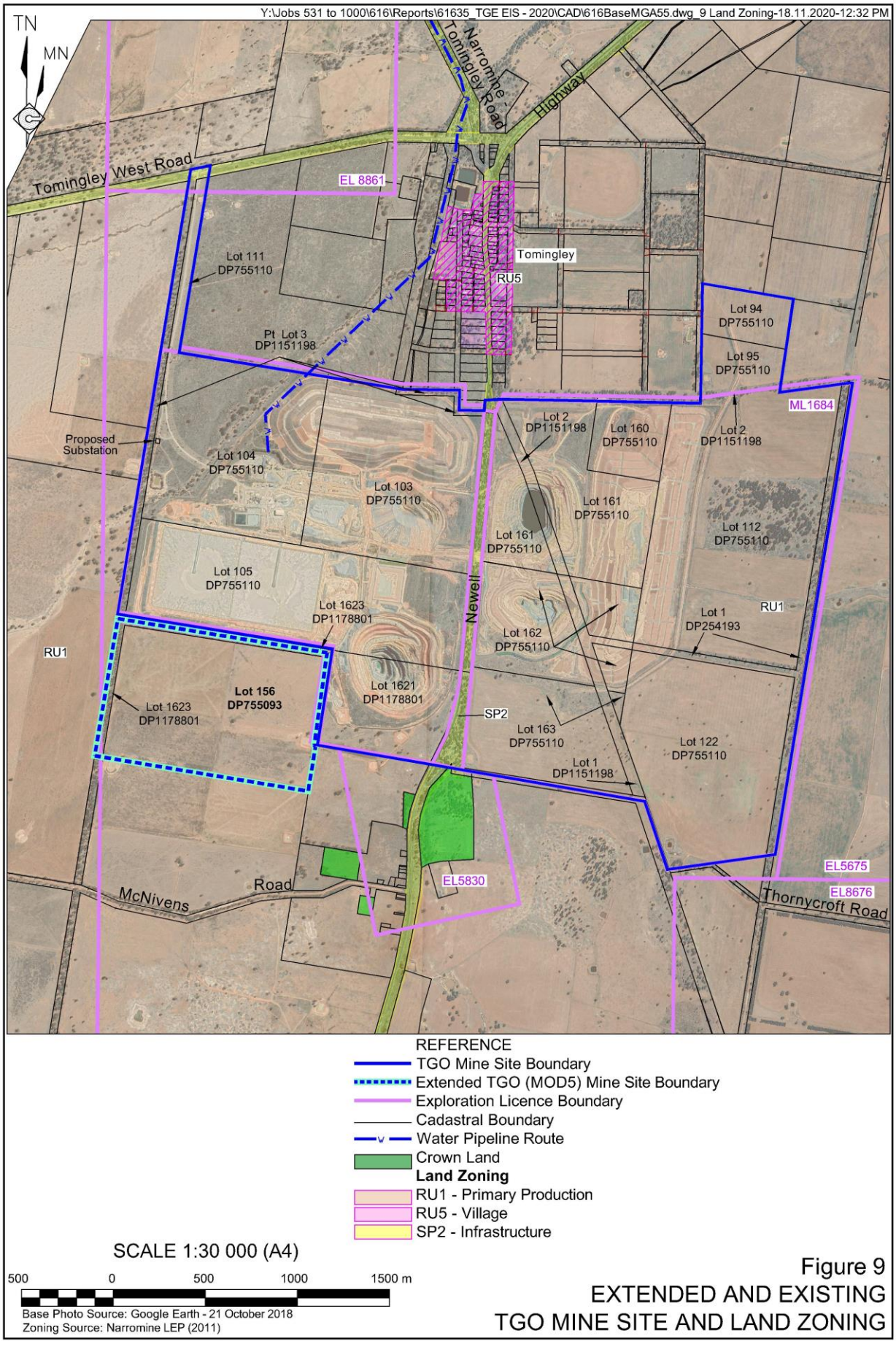


Figure 9
EXTENDED AND EXISTING
TGO MINE SITE AND LAND ZONING

Table 8
Existing and Extended TGO Mine Site Land Titles

Lot	DP	Lot	DP	Lot	DP
TGO Mine Site					
1	254193*	111	755110*	163	755110
1621	1178801	112	755110	1	1151198*
94	755110	122	755110*	2	1151198*
95	755110	160	755110	3	1151198
103	755110	161	755110	156	7755093
104	755110	162	755110	1623	1178801*
105	755110				
Road Reserve associated with Newell Highway Crown roads (unnamed)					
Water Pipeline Route					
185	43458	70	755110	104	755110
A	380855	74	755110	111	755110
7003	1032703	81	755110	18	755119
7002	1032703				
Road Reserves associated with the Mitchell Highway, Webb's Siding Road, Dappo Road, Bootles Road, Pinedene Road, Narromine-Tomingley Road and Tomingley West Road and the easement for the Main Western Railway. Crown roads (unnamed)					
Note: * Indicates part lot.					

2.4 EXTENSION OF MINE LIFE

As indicated in Section 1.3.2, the Proponent anticipates that adequate Ore Reserves and Mineral Resources exist within the TGO Mine Site to permit mining operations to continue for a further three years after the approved end of Mine Life, namely until the end of 2025. Consequently, approval is sought for an extension of the approved life of the Mine to 31 December 2025.

It is noted that mining operations could, based on the known mineral inventory of approximately 12.4Mt, continue beyond 2025. However, as the Proponent anticipates that the Tomingley Gold Extension Project will have been approved by that date, approval is sought to extend the life of the mine until the end of 2025 only. In the event that the Tomingley Gold Extension Project has not been approved by that date, a further application to modify MP09_0155 would be made at that time.

2.5 PARTIAL BACKFILLING OF CALOMA 2 OPEN CUT

As indicated in Section 1.3.4, additional storage for waste rock is required to cater for material to be generated from the Caloma 1 cut back. As WRE2 and WRE3 have been rehabilitated and the Wyoming 3 Open Cut has limited capacity to accept additional waste, the Proponent proposes to place waste rock from the Caloma 1 cut back into the Caloma 2 Open Cut.

Waste rock from the Caloma 1 cut back would be transported to the Caloma 2 Open Cut via internal haul roads. The haul road between the Caloma 1 and 2 Open Cut remains within the open cut footprint, with the saddle between the open cuts at approximately 240m AHD, or 30m below the natural land surface.

Waste rock would then be unloaded either at a tip head at approximately 240m AHD or at a lower elevation depending on operation and / or geotechnical requirements. Placed waste rock would then be pushed into the Caloma 2 Open Cut void using a bulldozer using the same procedures used at Wyoming 3 Open Cut.

The Proponent anticipates placing between 2.5Mm^3 and 3.0Mm^3 of waste rock into the Caloma Open Cut, with the final volume of placed material dependent on the actual volume of waste rock within the Caloma 1 cut back and final swell factors for the placed material. The estimated capacity of the Caloma 2 Open Cut is approximately 5.6Mm^3. As a result, the proposed back filling operations would fill approximately half of the available void.

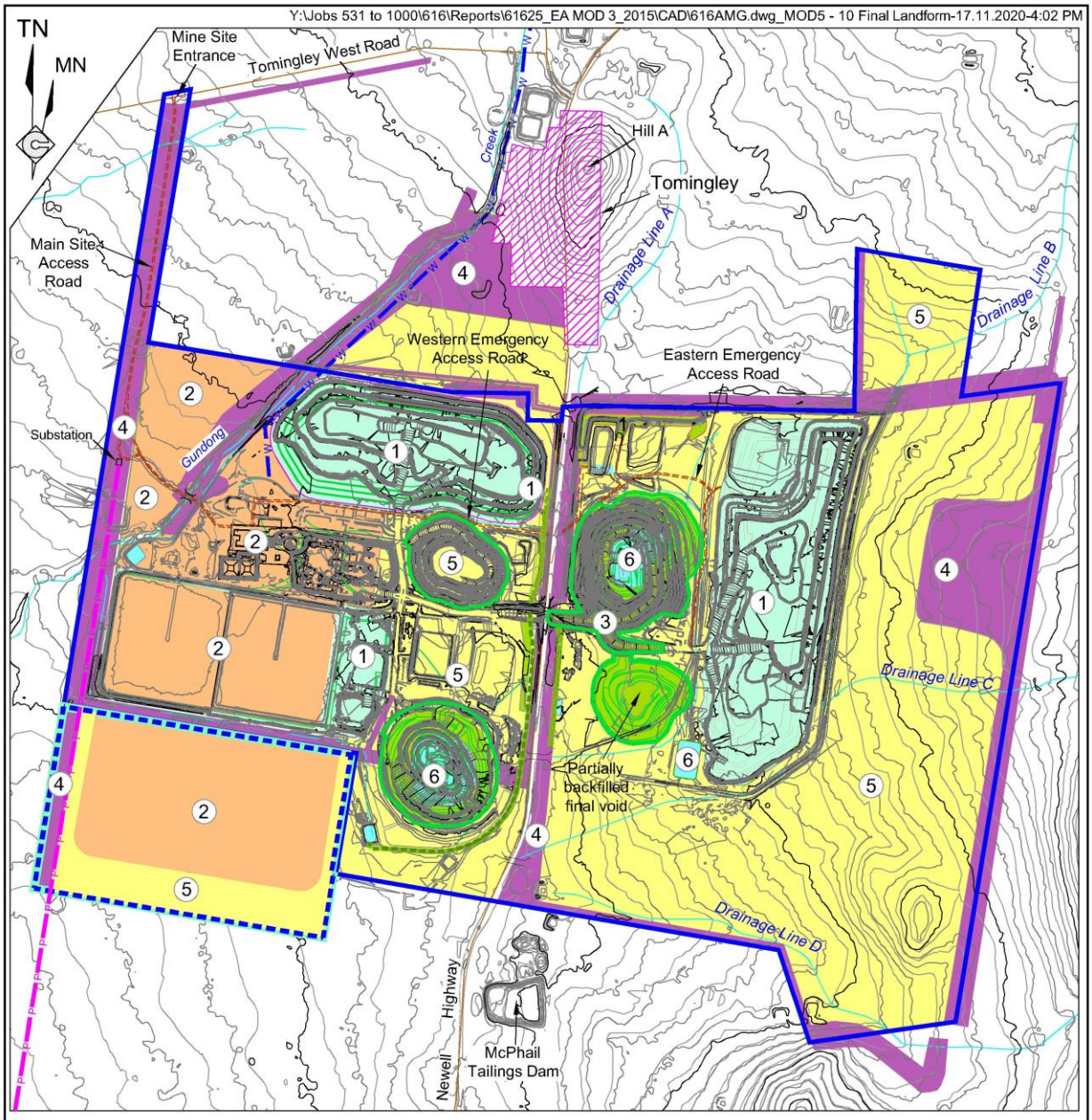
Finally, as noted in Section 1.3.2, the Proponent has determined that no open cuttable ore remains within the Caloma 2 Open Cut, with all remaining ore to be extracted using underground mining methods. As a result, the proposed backfilling operations would not sterilise remaining resources.

2.6 SITE DECOMMISSIONING AND REHABILITATION

Decommissioning of RSF2 would be broadly consistent with Section 2.14 of RWC (2011) and Section 2.4 of RWC (2020). **Figure 10** presents the overarching TGO Mine Site final landform and land use. A comprehensive closure design will be prepared during the detailed design phase for the facility.

Notwithstanding the above, the following procedures would be implemented during decommissioning and rehabilitation of RSF2.

- 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 residue surface would be regraded to permit surface water on the final landform to flow from west to east.
- Channels would be cut through the central and eastern embankments to permit surface water on the final landform to flow from Cell 1 to Cell 2 and then to a perimeter drain. Surface water from RSF1 would not be permitted to flow to RSF2.
- A perimeter drain would be established to direct water from the final landform of RSF2 to natural ground level, then to the south of the facility and to a suitable storage.
- The shaped upper surface of the facility would be capped indicatively with
  - a layer of waste rock to form a trafficable layer over the residue;
  - a low permeability layer, conceptually comprising a 600mm thick clay layer; and
  - a suitable growth medium to permit establishment of a grassland consistent with that proposed for RSF1.
- Consistent with the approved 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.



REFERENCE

- TGO Mine Site Boundary
- Extended TGO (MOD5) Mine Site Boundary
- Water Pipeline Route
- Powerline Route
- Road / Track
- Existing Sealed Road
- Existing Contour (m AHD)(Interval = 1m)
- Proposed Contour (m AHD)(Interval = 10m)
- Amenity Bund
- Watercourse
- Culvert

Rehabilitation Strategy

1. Revegetated with Inland Grey Box/Fuzzy Box, Woodland Trees, Shrubs and Grass Species (with final land use of Native Vegetation Conservation)
2. Revegetated using Pasture Grass Species (with final land use to be determined, Sustainable Agriculture or other Commercial use)
3. No Revegetation. Native Trees and Shrubs Expected to Revegetate (with final land use of Native Vegetation Conservation)
4. Native Vegetation Establishment and Protection (with final land use of Native Vegetation Conservation)
5. Return to Sustainable Agriculture
6. Water Storage

SCALE 1:27 000 (A4)

250 0 250 500 750 1000 1250 m

Alkane Resources Ltd.

Figure 10
MODIFIED FINAL LANDFORM AND LAND USE

3. STRATEGIC CONTEXT

3.1 STRATEGIC PLANS

3.1.1 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 disturb approximately 82.7ha of land that is currently used for agricultural operations, primarily grazing with intermittent cropping. The Proposed Modification would use that land for residue storage, thereby permitting the continued operation of the Mine. While the Proposed Modification would result in lost agricultural productivity, the proposed land use would result in a higher value use of that land for the life of the Mine.

- Direction 6: Expand education and training opportunities

  The Proposed Modification would permit the Proponent to continue for an additional three years to employ apprentices and trainees and contribute to training programs for the local community, including the Aboriginal community through its partnership with the Peak Hill local Aboriginal community.

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

  The Proponent has a long history of working with the Peak Hill Aboriginal community to promote training and business opportunities. That approach would continue for the extended life of the Mine.

- Direction 8: Sustainably manage mineral resources.

  The Proposed Modification would ensure that capacity constraints within the Residue Storage Facility do not limit the Proponent's ability to continue to operate the Mine to gain the maximum benefit from the identified resources within the TGO Mine Site.

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 be consistent with the following Directions.

- Direction 13: Protect and manage environmental assets

The Proposed Modification would result in disturbance of the following plant vegetation community types.

- PCT82 in moderate condition 3.09ha
- PCT201 in moderate condition 1.35ha
- Cleared vegetation 80.72ha

The Biodiversity Development Assessment Report (BDAR) (see section 6.2) determined that the following ecosystem credits would be required to offset the above plant community types.

- PCT82 .....103 credits
- PCT201 .....49 credits

In order to offset unavoidable biodiversity impacts, the Proponent would retire the required biodiversity credits through either purchasing the credits on the open market or paying into the Biodiversity Conservation Trust. In this way, the Proposed Modification is consistent with this Direction.

- Direction 14: Manage and conserve water resources for the Environment

  RSF2 would be constructed in a manner that would ensure that the facility would comply with all safety and pollution control standards and requirements and a detailed and comprehensive monitoring program would be implemented to monitor and detect any adverse water-related impacts before they become an issue, thereby minimising impacts to water resources within and surrounding the TGO Mine Site.

- Direction 16: Respect and protect Aboriginal heritage assets

  The Proposed Modification would not result in disturbance of 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, with the exception of an extension of time during which the Mine would operate, 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 other 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 continued operation of the Mine at least until 31 December 2025. This would help support the small villages and towns surrounding the TGO Mine Site, including Tomingley, Peak Hill and Narromine, and provide additional economic activity in those communities.

- Direction 24: Collaborate and partner with Aboriginal communities.

  The Proponent has a long history of collaborating with the Peak Hill Aboriginal community. The Proposed Modification would provide the resources for that ongoing collaboration to continue for a further three years.

3.1.2 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 Proponent 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 continued operation of the Mine at least until 31 December 2025. This would be consistent with each of Actions identified under this Principle.

Principle 3 - Protecting and enhancing our environment

The Proposed Modification has been the subject of a detailed environmental assessment summarised in this document and would result in the following impacts. Additional information is provided in Section 6 of this document.

- Disturbance of approximately 4.44ha of PCT82 and PCT201 (see Sections 3.1.1 and 6.2). In order to offset these unavoidable biodiversity impacts, the Proponent would retire the required biodiversity credits through either purchasing the credits on the open market or paying into the Biodiversity Conservation Trust. In this way, the Proposed Modification is consistent with this Principle.

- Additional noise and dust sources located closer to Residence R6 than has been the case for the approved Mine. However, the anticipated noise and dust levels at this Residence, and at all surrounding residences, would remain below the relevant assessment criteria.
- The soils assessment determined that approximately 60cm of soil should be stripped and with suitable amelioration, the final land capability may indeed be higher than the existing land capability.

The Proposed Modification would not result in additional heritage, surface water, groundwater, visual amenity or other impacts. As a result, the Proposed Modification would be consistent with Actions 3.1, 3.2 and 3.3 of the Plan.

3.2 COMMUNITY VIEWS

Section 5.2 provides an overview of the community engagement that has been undertaken by the Proponent and Alkane in relation to the Mine, the Proposed Modification and associated activities. In summary, no issue or concerns have been received in relation to the Proposed Modification.

3.3 ECONOMIC AND SOCIAL TRENDS

The Australian Bureau of Statistics (ABS, 2019) provided a range of data in relation to economic and social trends within the Dubbo Statistical Area. This area includes the towns of Narromine, Dubbo, Wellington, Gilgandra and Coonabarabran, as well as the village of Tomingley. That data identifies the following economic and social trends surrounding the TGO Mine Site.

- Industry - agriculture is an important industry employing 10.8% of the workforce in 2016, down from 11.3% in 2011. Mining, while employing 1.1% of the workforce in 2016, up from 0.9% in 2011 is an important and growing contributor to the economy. As a result, the Proposed Modification, particularly the extended life of the Mine, would continue to support the local economy through the provision of jobs in this important industry.
- Income – the median income, excluding welfare payments, within the Dubbo Statistical Area was $44,078 in 2016. This compares with substantially higher salaries paid by the Proponent to its workers, the majority of whom live locally. As a result, the Proposed Modification would extend the time that the Proponent is able to support the local economy through the provision of wages and other benefits.

Anecdotally, the Proponent understands that despite the end of the drought, challenging agricultural conditions of past years are continuing to have a significant impact on rural communities surrounding the TGO Mine Site, including reduced employment, consumption and economic activity and the associated social impacts that entails. The Proposed Modification would ensure that the Proponent is able to continue to employ local workers and contribute to a

local, diverse economy for an additional three years. Should the Proponent cease to operate the mine when the currently approved Residue Storage Facility is at capacity or that the currently approved end of Mine life, there would be substantial economic and social disruption.

3.4 ENVIRONMENTAL TRENDS

The Proponent notes that the recent end of the drought has resulted in substantial improvement in the health of the surrounding environment. The Proposed Modification would not result in significant environmental impacts and those impacts that would occur would be within relevant criteria and, in the case of biodiversity-related impacts, would be offset in accordance with the relevant requirements. Section 6 includes additional information in relation to the anticipated biodiversity-related impacts.

3.5 STRATEGIC SUPPORT FOR THE PROJECT

In light of the above, the Proponent contends that there is strong strategic support for the continued operation of the Mine and, therefore, for the Proposed Modification.

4. STATUTORY CONTEXT

4.1 POWER TO GRANT APPROVAL

At the time of the approval of PA 09_0155, State Environmental Planning Policy (Major Development 2005) identified the Mine as a Major Project for which project approval under Part 3A of the EP&A Act was required. On 31 August 2018, the Mine was transitioned to a State Significant Development by a notice published in the NSW Government Gazette. As a result, this application is therefore made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*. Section 4.5 addresses the matters that the consent authority is required to take into consideration under that Section.

4.2 CONSENT AUTHORITY

In accordance with Clause 8A(1) of the *State Environmental Planning Policy (State and Regional Development) 2011* if any of the following criteria are exceeded the consent authority is the Independent Planning Commission.

- Narromine Shire Council provides a submission objecting to the application.
- Objections are received from 25 persons or more.
- The Proponent has disclosed a reportable political donation of $1,000 or more.

In the event that none of the above criteria are exceeded, the Minister for Planning and Public Spaces is the consent authority. The Proponent understands that in these circumstances, the Minister has delegated their powers to determine the application to a senior officer of the Department of Planning, Industry and Environment.

4.3 PERMISSIBILITY

The TGO Mine Site lies within land zoned RU 1 – Primary Production or, for those section of the TGO Mine Site within the Newell Highway road reserve, SP2 Infrastructure, under the *Narromine Local Environment Plan 2011* ("Narromine LEP").

All land that would be disturbed by the Proposed Modification is zoned RU1. Open cut mining is permissible with consent within that zone. Underground mining is permissible in accordance with Clause 7(1)(a) of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

RSF2 would be considered to be ancillary to open cut mining and is therefore permissible with consent within the proposed extended TGO Mine Site boundary.

4.4 OTHER APPROVALS

Table 9 presents the existing approvals held for the Mine and identifies where modifications to those approvals would be required or where new approvals would be necessary.

Table 9
Existing and Additional Approvals

Approval	Modification/ New Approval Required?	Justification/ Comment
EPL20169	Modification	A modification would be required to extend the premises to which the licence applies and to include additional monitoring locations.
ML1684	New Approval	A new Mining Lease for an Ancillary Mining Activity will be required for the proposed extended TGO Mine Site. An amended MOP will be required prior to commencing RSF2.
Groundwater 80BL24528 – 80BL24532, 80BL620426 (monitoring bores)	New Approvals	Additional monitoring bores will be required for RFS2. These bores will be required to be licenced under the *Water Management Act 2000.*
Controlled Works Approval (boundary diversion structure) 80CW809661	No	No changes to the approved diversion.
Water Supply Works and Water Use Approval 80CA719513 / WAL 35321 (Upper Bogan River Water Source – 22ML/year)	No	No changes to the proposed water supply system.
Groundwater Works Approval 80WA705442 (Lower Macquarie Zone 6 Groundwater Source)	No	No changes to the proposed water supply system.
Water Access Licence WAL20270 (1 000ML/year)	No	No changes to the proposed water supply system.
Water Access Licence WAL28643 (NSW Murray Darling Basin Fractured Rock Aquifer) (220ML/year)	No	No changes to the proposed mining operations.
Notification of Dangerous Goods NDG200150	No	No changes to chemical or reagent practices.

4.5 PRE-CONDITIONS TO GRANTING APPROVAL

Table 10 presents the pre-conditions that apply to the Proposed Modification.

4.6 MANDATORY MATTERS FOR CONSIDERATION

Table 11 presents the mandatory matters for consideration that apply to the Proposed Modification.

Table 10
Preconditions to the Granting of Approval

Section/ Clause	Precondition	Relevance
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 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 extension of the TGO Mine Site by approximately 89ha, and as a result the area to which MP09_0155 applies, represents approximately 11% of the approved 778ha TGO Mine Site. The proposed extension would not materially alter or radically transform the approved mine. • The proposed extension of the life of the mine by 3 years from the MOD3 approved life of 12.5 years (July 2012 to December 2022) would not materially alter or radically transform the approved mine. • The use of a second Residue Storage Facility is generally consistent with the continued operation of a mine such as the approved Mine and would not be a significant alteration or radical transform of the approved Mine.
	(b) it has consulted with the relevant [government authorities]	This is a matter for the Department of Planning, Industry 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, Industry and Environment
	(d) it has considered any submissions made …	This is a matter for the Department of Planning, Industry and Environment, however, the Proponent anticipates preparing a Submissions Report to provide a response to any submissions received.

Table 11
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
Environmental Planning and Assessment Act 1979		
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
	• to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	Section 7.1 addresses matters relevant to Ecologically Sustainable Development
	• 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.
	• 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.
4.15	Relevant environmental planning instruments	See Mining SEPP, Koala SEPP and Narromine LEP below
	Relevant development control plans	In accordance with Clause 11(a) of the *State Environmental Planning Policy (State and Regional Development) 2011*, development control plans are not relevant to SSD applications.

Table 11 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
Environmental Planning and Assessment Act 1979 (Cont'd)		
4.15 (Cont'd)	Any planning agreement	A Planning Agreement exists between the Proponent and Narromine Shire Council, including the following terms. Recurring payments are subject to CPI increases from 2013/2013. All payments continue until 31/12/2022. The • 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 The Proponent proposes to amend the Planning Agreement in consultation with Narromine Shire Council to extend the life of the agreement without materially changing the other terms of the agreement.
4.15 (Cont'd)	The regulations	The Regulations have been considered throughout this document.
	The likely impacts of that development, including environmental impacts on both the natural and built environments, 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.
	The suitability of the site for the development,	The TGO Mine Site is an approved Mine and is suitable for the development.
	Any submissions made in accordance with this Act or the regulations,	This is a matter for Department of Planning, Industry and Environment, however, the Proponent anticipates preparing a *Submissions Report* following completion of the exhibition period.
	The public interest.	This is addressed in Section 7.7. In summary, however, the Proponent contends that the Proposed Modification is in the public interest

Table 11 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007		
12AB	**Non-discretionary development standards for mining** Cumulative noise level. The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings	The Noise Assessment (see Section 6.3) determined that anticipated noise emissions would be less than the relevant criteria.
	Cumulative air quality level. The development does not result in a cumulative annual average level greater than 30µg/m^3 of PM_{10} for private dwellings.	The Air Quality Assessment (see Section 6.4) determined that the anticipated PM_{10} annual average concentration would be less than the relevant criterion.
	Non-discretionary development standards for mining Cumulative noise level. The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings	The Noise Assessment (see Section 6.3) determined that anticipated noise emissions would be less than the relevant criteria.
	Cumulative air quality level. The development does not result in a cumulative annual average level greater than 30µg/m^3 of PM_{10} for private dwellings.	The Air Quality Assessment (see Section 6.4) determined that the anticipated PM_{10} annual average concentration would be less than the relevant criterion.
	Airblast overpressure. Airblast overpressure caused by the development does not exceed: (a) 120 dB (Lin Peak) at any time, and (b) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.	The Proposed Modification would not alter blasting operations

Table 11 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Cont'd)		
12AB (Cont'd)	Ground vibration. Ground vibration caused by the development does not exceed: (a) 10mm/sec (peak particle velocity) at any time, and (b) 5mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months, measured at any private dwelling or sensitive receiver.	The Proposed Modification would not alter blasting operations
	Aquifer interference. Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table.	No significant changes to the approved groundwater and aquifer interference impacts are anticipated
12	Consideration is given to: • the existing uses and approved uses of land in the vicinity of the development;	The existing and approved use of the TGO Mine Site is Mining. The Proposed Modification is consistent with that use. The extended TGO Mine Site is agricultural land which the Proponent has agreed to purchase, with settlement scheduled for 1 February 2021. Surrounding land uses include residential and rural land uses and the Mine has co-existed with those uses since 2013.
	• the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and	Section 6 presents an assessment of relevant impacts on the natural and built environment and social and economic impacts surrounding the TGO Mine Site. The Proposed Modification would not significantly impact on those land uses.
	• any ways in which the development may be incompatible with any of those existing, approved or preferred land uses.	The Proposed Modification would not be inconsistent with existing land use within the TGO Mine Site and would therefore not be incompatible with surrounding land uses.

Table 11 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Cont'd)		
12 (Cont'd)	The respective public benefits of the development and the existing, approved or preferred land uses are evaluated and compared.	The Proposed Modification would permit the continued operation of the Mine for a further three years, resulting in an extension of the existing public benefit arising from the development. The proposed extension of Mine life and the TGO Mine Site would, with the exception of the temporary loss of approximately 80.72ha of grazing land, not adversely impact on the public benefit associated with the surrounding uses.
	Measures proposed to avoid or minimise any incompatibility are considered.	Section 2 and 6 present measures proposed to avoid or minimise any incompatibility.
13	Consideration is given to whether the development is likely to have a significant impact on current or future mining, petroleum production or extractive industry and ways in which the development may be incompatible. Measures taken by the Proponent to avoid or minimise any incompatibility are considered. The public benefits of the development and any existing or approved mining, petroleum production or extractive industry must be evaluated and compared.	Clause 13 is not considered relevant on the basis that the Mine has already been approved and as such the compatibility of the Mine with other mining, petroleum production or extractive industry has already been considered. Furthermore, the Proponent has considered the mineral perspectivity of the proposed RSF2 footprint and is satisfied that the Proposed Modification would not sterilise resources.
14	Consideration is given to ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure: • impacts on significant water resources, including surface and groundwater resources, are avoided or minimised;	Sections 6.7 and 6.8 address matters related to surface water and groundwater respectively.
	• impacts on threatened species and biodiversity are avoided or minimised; and	Section 6.2 addresses matters related to biodiversity.
	• greenhouse gas emissions are minimised and an assessment of the greenhouse gas emissions (including downstream emissions) of the development is provided.	The Proposed Modification would not materially alter the Mine's greenhouse gas emissions
15	The efficiency of resource recovery, including the reuse or recycling of material and minimisation of the creation of waste, is considered	The Proposed Modification would ensure that the maximum benefit is obtained from a State-owned resource within the approved life of the Mine.

Table 11 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Cont'd)		
16	The following transport-related issues are considered. • The transport of some or all of the materials from the site by means other than public road. • Limitation of the number of truck movements that occur on roads within residential areas or roads near to schools. The preparation of a code of conduct for the transportation of materials on public roads.	The Proposed Modification would not change or impact on transport-related matters.
17	The rehabilitation of the land affected by the development is considered including: • the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated; • the appropriate management of development generated waste; • remediation of any soil contaminated by the development; and	The Proposed Modification would result in an additional Residue Storage Facility that would be required to be rehabilitated. Section 3.7 presents a description of the proposed final landform, land use and rehabilitation of the facility. The Proposed Modification would not result in generation of waste, require remediation of contaminated soil or jeopardise public safety.
	• the steps to be taken to ensure that the state of the land does not jeopardize public safety, while being rehabilitated or at the completion of rehabilitation.	
State Environmental Planning Policy (Koala Habitat Protection) 2019		
5	Land to which the Policy applies	The Narromine Local Government Area is identified in Schedule 1 of the SEPP. However, as State Significant Development, the SEPP is not relevant
9	Development assessment process—no approved koala plan of management for land	The BDAR (see Section 6.2) determined that the Extended TGO Mine Site does not include Koala.

Table 11 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
Narromine Local Environmental Plan 2011		
6.4	**Terrestrial Biodiversity** (3) 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	Section 6.2 addresses matters related to biodiversity. The Proposed Modification would result in disturbance of the following plant vegetation community types. • PCT82 in moderate condition.....3.09ha • PCT201 in moderate condition .....1.35ha • Cleared vegetation .....80.72ha The Biodiversity Development Assessment Report (BDAR) (see section 6.2) determined that the following ecosystem credits would be required to offset the above plant community types. • PCT82 .....103 credits • PCT201 .....49 credits
	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.	
	(4) 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	In order to offset unavoidable biodiversity impacts, the Proponent would retire the required biodiversity credits through either purchasing the credits on the open market or paying into the Biodiversity Conservation Trust. In this way, the Proposed Modification is consistent with this Direction.
	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.	

Table 11 (Cont'd)
Mandatory Maters for Consideration

Section/ Clause	Matter for Consideration	Relevance/Comment
Biodiversity Conservation Act 2016		
7.14(2)	The Minister for Planning, when determining in accordance with the Environmental Planning and Assessment Act 1979 any such application, is to take into consideration under that Act the likely impact of the proposed development on biodiversity values as assessed in the biodiversity development assessment report. The Minister for Planning may (but is not required to) further consider under that Act the likely impact of the proposed development on biodiversity values	An assessment of Biodiversity impacts is presented in Section 6.2.

5. ENGAGEMENT

5.1 GOVERNMENT AGENCY CONSULTATION

Department of Planning, Industry and Environment

The Proponent consulted with Department of Planning, Industry and Environment (DPIE) during preparation of this Modification Report. In particular, a Letter Report outlining the Proposed Modification was provided on 12 October 2020 via the Planning Portal with a request for a Scoping Meeting. This was followed by a videoconference with the Department on 20 October 2020 during which the Proponent provided the Department with a briefing on the proposed activities and a range of matters to be addressed in the Modification Report were discussed.

Formal correspondence from the Department was received on 22 October 2020 requesting the information presented in **Table 12** be included in this Modification Report.

Table 12
DPIE Requested Information

Requested information	Where addressed
Clear and detailed justification of the need for RSF2 and its proposed footprint, including	
• more information about annual volumes of tailings;	Section 1.3.3
• the available mineral resources and how they were estimated; and	Section 1.3.2
• alternatives that were considered to avoid or minimise impacts.	Section 1.4
Information about:	
• the required water licences; and	Section 4.4
• proposed clean water diversion.	NA
A table summarising previous modifications to the original project approval and the proposed modification, outlining clearly the changes made to the project	Appendix 1
Detailed consideration of the matters in Section 4.15 of the EP&A Act, including the objects of the Act, permissibility and relevant statutory planning instruments, such as the Mining SEPP.	Section 4.6

Other Government Agencies

Following receipt of a request from the Department of Planning, Industry and Environment for the Proponent was to manage consultation with the relevant government agencies, a copy of the Letter Report dated 12 October was sent to the following agencies on 16 October 2020, with a request for agency feedback in relation to matters to be addressed in this document by 30 October 2020. **Table 13** presents a summary of the requirements of each of the agencies that responded and where each matter has been addressed.

- Biodiversity, Conservation and Sciences Division
- DPIE – Water
- Natural Resources Access Regulator

- Environment Protection Authority
- Heritage NSW
- Mining, Exploration and Geoscience
- Resources Regulator
- Transport for NSW
- Narromine Shire Council

Table 13
Agency Requested Information

Requested information	Where addressed
Biodiversity, Conservation and Sciences Division (20 October 2020)	
• Biodiversity impacts related to the proposed modification are to be assessed in accordance with Section 7.9 of the Biodiversity Conservation Act 2017 the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), *Biodiversity Conservation Regulation 2017* (s6.8) and *Biodiversity Assessment Method.*	6.2
• The EA must map the following features relevant to water and soils including: – Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map). – Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method). – Wetlands as described in s4.2 of the Biodiversity Assessment Method. – Groundwater. – Groundwater dependent ecosystems. – Proposed intake and discharge locations.	Appendix 3
• The EA must describe background conditions for any water resource likely to be affected by the modification, including existing surface and groundwater.	6.7 and 6.8
• The EA must assess the impacts of the modification on water quality.	6.7 and 6.8
• The EA must assess the impact of the modification on hydrology.	6.7
• The EA must address flooding.	6.7
Environment Protection Authority (30 October 2020)	
• The modification report must include an air quality assessment carried out in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2016).	Appendix 5
• The modification report must detail emission control techniques and practices that will be employed at the site and identify how the proposed control techniques and practices will meet the requirements of the POEO Act, Clean Air Regulation and associated air quality limits or guideline criteria.	6.4.3
• The modification report must assess the following noise and vibration aspects of the proposed development. – Construction noise. – Operational noise. – Road traffic noise. – Vibration and blasting.	Appendix 4 6.3.4 6.11

Table 13 (Cont'd)
Agency Requested Information

Requested information	Where addressed
Environment Protection Authority (30 October 2020) (Cont'd)	
• The modification report must assess: – Waste – Chemicals and hazardous materials – Radiation	6.11
• The modification report must demonstrate how the proposed development will meet the requirements of section 120 of the Protection of the Environment Operations Act 1997.	6.7 and 6.8
• The modification report must include a water balance for the development.	Appendix 2 2.2.7
• If the proposed development intends to discharge waters to the environment, the modification report must demonstrate how the discharge(s) will be managed in terms of water quantity, quality and frequency of discharge and include an impact assessment of the discharge on the receiving environment.	Not Applicable
• The modification report must describe how stormwater will be managed in all phases of the project, including details of how stormwater and runoff will be managed to minimise pollution.	2.2.6 6.7
• The modification report must describe any water quality monitoring programs to be carried out at the TGO Mine Site	2.2.9
Heritage NSW (29 October 2020)	
• The assessment must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in an Aboriginal Cultural Heritage Assessment Report (ACHAR). The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigation in NSW (OEH 2010), and be guided by the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales (DECCW 2011).	Appendix 7
• Consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.	Appendix 7 6.6.2
• Impacts on Aboriginal cultural heritage values are to be assessed and documented in the ACHAR.	Appendix 7 6.6.5
• The assessment of Aboriginal cultural heritage values must include a surface survey undertaken by a qualified archaeologist.	Appendix 7 6.6.5
• The ACHAR must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the project to formulate appropriate measures to manage unforeseen impacts.	Appendix 7 6.6.4
• The ACHAR must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.	Appendix 7 6.6.4

Table 13 (Cont'd)
Agency Requested Information

Requested information	Where addressed
Resources Regulator (4 November 2020)	
Post-mining land use (Proponent's Note: Post mining land use described and approved under the original Project Approval.) (a) Identification and assessment of post-mining land use options; (b) Identification and justification of the preferred post-mining land use outcome(s), including a discussion of how the final land use(s) are aligned with relevant local and regional strategic land use objectives;	2.6 Approved MOP
Rehabilitation objectives and domains Proponent's Note: Rehabilitation objectives and domains are set out in the approved MOP.) (c) Inclusion of a set of project rehabilitation objectives and completion criteria that clearly define the outcomes required to achieve the post-mining land use for each domain. Completion criteria should be specific, measurable, achievable, realistic and time-bound. If necessary, objective criteria may be presented as ranges;	Approved MOP
Rehabilitation Methodology (d) Details regarding the rehabilitation methods for disturbed areas and expected time frames for each stage of the rehabilitation process;	2.6 Approved MOP
Conceptual Final Landform Design (e) Inclusion of a drawing at an appropriate scale identifying key attributes of the final landform, including final landform contours and the location of the proposed final land use(s);	Figure 10
Monitoring and Research (f) Outlining the monitoring programs that will be implemented to assess how rehabilitation is trending towards the nominated land use objectives and completion criteria; (g) Details of the process for triggering intervention and adaptive management measures to address potential adverse results as well as continuously improve rehabilitation practices; (h) Outlining any proposed rehabilitation research programs and trials, including their objectives. This should include details of how the outcomes of research are considered as part of the ongoing review and improvement of rehabilitation practices;	Approved MOP
Post-closure maintenance (i) Description of how post-rehabilitation areas will be actively managed and maintained in accordance with the intended land use(s) in order to demonstrate progress towards meeting the rehabilitation objectives and completion criteria in a timely manner;	Approved MOP
Barriers or limitations to effective rehabilitation (j) Identification and description of those aspects of the site or operations that may present barriers or limitations to effective rehabilitation, including: (i) evaluation of the likely effectiveness of the proposed rehabilitation techniques against the rehabilitation objectives and completion criteria; (ii) an assessment and life of mine management strategy of the potential for geochemical constraints to rehabilitation (e.g. acid rock drainage, spontaneous combustion etc.), particularly associated with the management of overburden/interburden and reject material; (iii) the processes that will be implemented throughout the mine life to identify and appropriately manage geochemical risks that may affect the ability to achieve sustainable rehabilitation outcomes;	Approved MOP

Table 13 (Cont'd)
Agency Requested Information

Page 4 of 4

Requested information	Where addressed
Resources Regulator (4 November 2020)	
(iv) a life of mine tailings management strategy, which details measures to be implemented to avoid the exposure of tailings material that may cause environmental risk, as well as promote geotechnical stability of the rehabilitated landform; and (v) existing and surrounding landforms (showing contours and slopes) and how similar characteristics can be incorporated into the post-mining final landform design. This should include an evaluation of how key geomorphological characteristics evident in stable landforms	Approved MOP
Narromine Shire Council (4 November 2020)	
Clarification regarding any requirement for subdivision of land associated with the modification and this purchase is sought. Is this proposed to be progressed outside the mine approvals processes?	No subdivision required for the Proposed Modification

In addition, **Table 14** presents a log of consultation undertaken by the Proponent in relation to the Proposed Modification.

Table 14
MOD5 Consultation Log

Date	Agency	Consultation Method	Matters Addressed
24/9/2020	Environment Protection Authority, Narromine Shire Council, Biodiversity, Conservation and Sciences Division and Department of Planning, Industry and Environment	Site Tour	Discussion about MOD5 and TGEP generally
20/10/2020	Department of Planning, Industry and Environment	Videoconference	Briefing on MOD5
21/10/2020	Peak Hill LALC	Telephone	Discussion about MOD5 and TGEP generally
4/11/2020	Narromine Shire Council	Telephone	The Proponent explained purpose of MOD5 application
9/11/2020	The Honourable John Barilaro MP	Face to Face	Discussion about MOD5 and TGEP generally

5.2 COMMUNITY CONSULTATION

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

- Community newsletters[3]
- Community Newsletters 18 to 23 were released in February, August and November 2019 and March June and August 2020. 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.
- Community Newsletter 24 was released on 9 November 2020 and addressed matters particular to the Proposed Modification.
- Community Consultative Committee[4]

  The Community Consultative Committee met and discussed Tomingley Gold Extension Project and/or the Proposed Modification in February and May 2019 and February, June, August, September, October and November 2020. The Committee expressed general support for the applications and is assisting the Proponent with its consultation strategy and providing community feedback as required.
- Face to face meetings.

  The Proponent has met face to face with surrounding landholders on at least 56 occasions between 1 January 2020 and 4 November 2020. Discussions addressed a range of matters, including Tomingley Gold Extension Project and the Proposed Modification. During these meetings, no concerns or issues with the Proposed Modification were raised.
- Ad-hoc community engagement.

  Throughout 2019 and in early 2020, the Proponent and Alkane have engaged with the community through a range of ad-hoc meetings and interactions, including the following where representatives spent several hours on each occasion fielding questions from the public.

  – 27 April 2019 – Tomingley Picnic Races (sponsored by Alkane).
  – 25 May 2019 – Dubbo Show.

  The Proponent and Alkane also met with residents of Tomingley and surrounds at various public events and social occasions.

  No concerns or issues with Tomingley Gold Extension Project or the Proposed Modification were raised during these interactions.

[3] Community newsletters are available at http://www.alkane.com.au/projects/tomingley-gold-operations/community-resources/tgo-community-newsletter/
[4] CCC meeting minutes are available at https://www.alkane.com.au/projects/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. The assessment includes a description of the proposed design and/or operational safeguards that are proposed to be implemented and an assessment of the level of impact the Proposed Modification may have after implementation of those safeguards.

This Section also presents those environmental aspects that would not be impacted by the Proposed Modification and a justification for why that is the case.

6.2 BIODIVERSITY

6.2.1 Introduction

The *Biodiversity Development Assessment Report* (BDAR) was completed by AREA Environmental Consultants and Communication Pty Limited. The BDAR, referred to hereafter as AREA (2020) is presented as **Appendix 3**. This subsection presents an overview of the results of that assessment.

The BDAR was prepared in accordance with the *Biodiversity Assessment Method* (BAM) by Addy Watson, GradDip. CapVertMan, GradCert Social Impact. BEnvSc, BAM accredited assessor (BAAS19066), Principal Environment and Community Consultant with AREA.

6.2.2 Local Setting and Environmental Performance

6.2.2.1 Regional setting and Database Search Results

The Proposed Modification is entirely within the Darling Riverine Plains Bioregion and Bogan-Macquarie subregion, approximately 5km from the boundary with the NSW South Western Slopes Bioregion, Lower Slopes and Inland Slopes (**Figure 11**).

There are no mapped rivers, streams or wetlands within the TGO Mine Site. Gundong Creek lies approximately 375m to the northwest of the TGO Mine Site at its closest point. The Bureau of Meteorology has mapped no Groundwater Dependent Ecosystems (aquatic, terrestrial or subterranean) within 1 500m of the TGO Mine Site.

The DPIE eSPADE spatial viewer provided mapped soil and geology information as part of the assessment. This mapping indicated the following.

- No acid sulfate soil risk.
- Sodosal and chromosol soil.
- Soil pH between 5.6 and 6.
- High erosion hazard (data point within 1 550m).

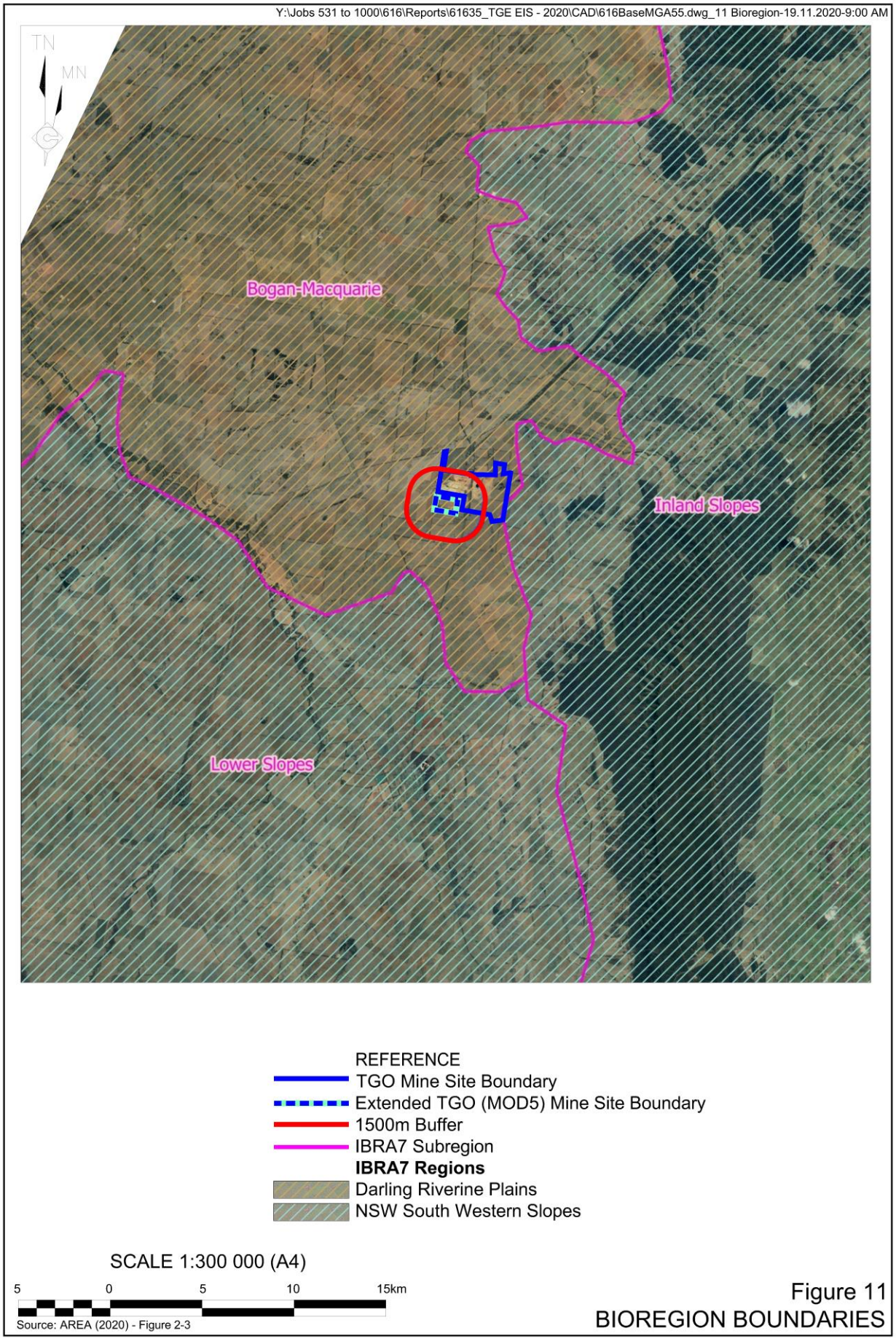


Figure 11
BIOREGION BOUNDARIES

There were no other areas of other geological significance or soil hazards identified or known within the TGO Mine Site.

6.2.2.2 Plant Community Types

AREA (2020) undertook an assessment of the majority of the Extended TGO Mine Site, referred to hereafter as the Biodiversity Study Area.

Section 6.2.4 presents a detailed description of the plant community type assessment, however, AREA (2020) identified two Plant Community Types (PCTs) including the following (**Figure 12**).

- PCT82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion. This PCT has been further subdivided into two zones as follows.
  - Zone 1 – includes established trees and limited shrubs and an established native grass ground cover. This zone is a fenced tree line that has been subjected to grazing but not cropping.
  - Zone 2 – includes no trees or shrubs with a groundcover of native and non-native species. This zone is a cleared, grazing paddock that is cropped every 5 to 10 years.
- PCT201 - Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion.

PCT201 is consistent with the definition of a Threatened Ecological Community (TEC) listed as Endangered under the *Biodiversity Conservation Act 2016* (BC Act), namely Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions (Part).

6.2.3 Management and Mitigation Measures

The Proponent would continue to implement the following biodiversity-related management and mitigation measures.

- Continue to implement the approved *Biodiversity Management Plan* (BMP) for the life of the Mine. That plan would be reviewed following receipt of development consent and, if required, it would be revised.
- Ensure all construction staff working on the proposal are inducted on the following.
  - site environmental procedures, namely vegetation management, sediment and erosion control, protective fencing, noxious weeds, hygiene protocols and ethical procedures for handling fauna displaced on the TGO Mine Site;
  - what to do in case of an environmental emergency (chemical spills, fire, injured fauna);

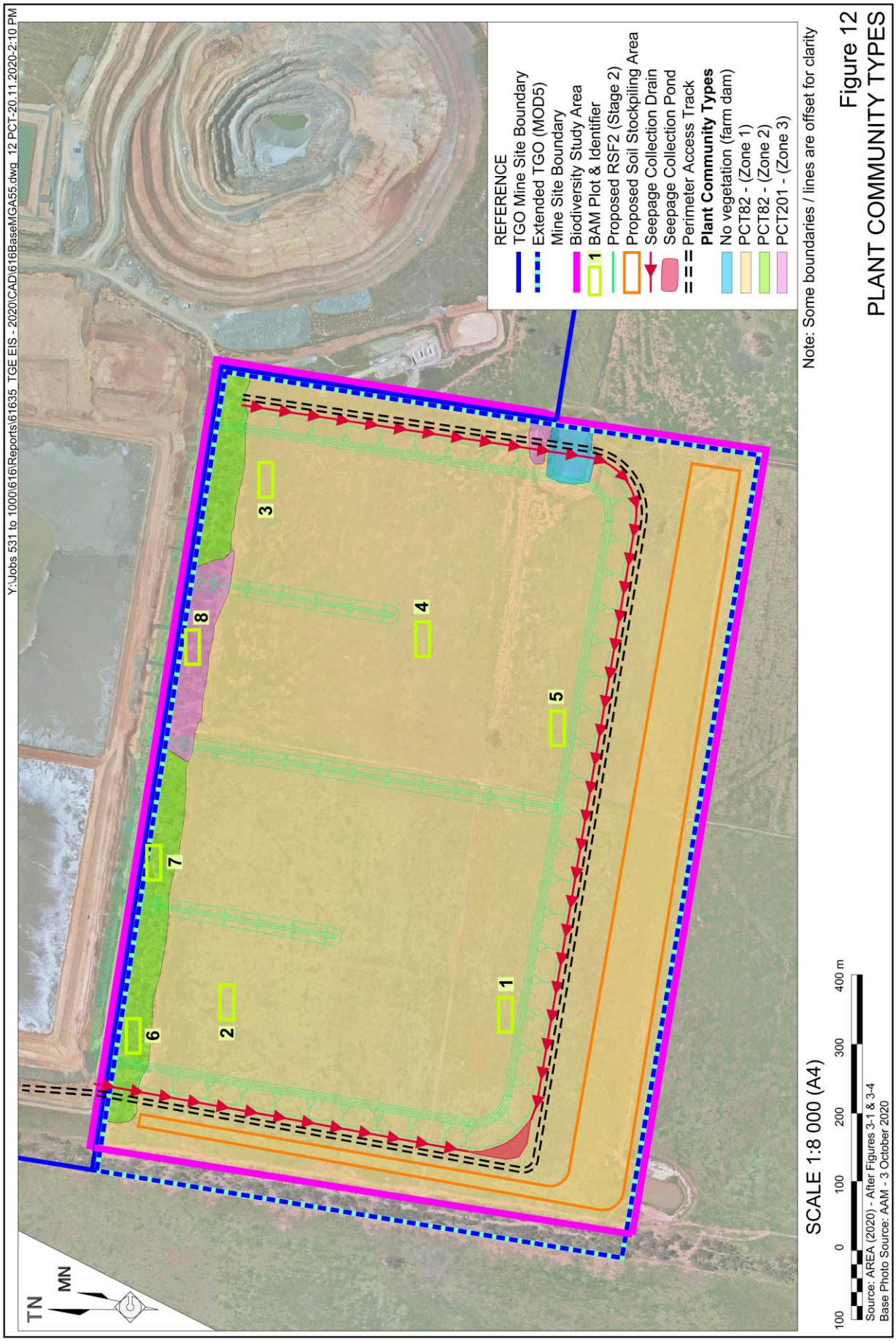


Figure 12
PLANT COMMUNITY TYPES

  - key contacts in case of environmental emergency; and
  - how to reduce the risk of vehicle strike to fauna.

- Locate temporary infrastructure (set down areas, access tracks etc.) in existing cleared areas away from vegetation to minimise vegetation removal and indirect effects.
- Accurately and clearly mark out the limits of clearing (where appropriate) and the vegetation to be retained outside of the development site.
- Undertake regular inspections to ensure all retained vegetation/fauna habitat is clearly marked and that fencing is in place, where appropriate.
- Avoid clearing native vegetation in Spring.
- Implement staged habitat removal to allow fauna to vacate if present. Habitat trees should be felled carefully using equipment that allows habitat trees to be lowered to the ground with minimal impact and hollows inspected. Respond to fauna detected during the clearing process.
- Salvage and relocate tree hollows from trees cleared as part of the proposal.

6.2.4 Assessment of Impacts

6.2.4.1 Introduction

AREA (2020) was prepared to assess the potential biodiversity impacts associated with the Proposed Modification and addresses requirements of the following legislative frameworks.

- NSW Environmental Planning and Assessment Act 1979 (EP&A Act);
- NSW Biodiversity Conservation Act 2016 (BC Act);
- NSW Local Land Services Act 2013 (LLS Act); and
- Koala Habitat Protection State Environmental Planning Policy (Koala SEPP).

The following subsections provide a summary of the assessment methodology and results for native vegetation and threatened species. For the purposes of this assessment, AREA (2020) assumed that the full Biodiversity Study Area would be disturbed.

6.2.4.2 Native Vegetation

Native vegetation surveys were completed consistent with the *Biodiversity Assessment Methodology 2020* (BAM) on 14 and 15 October 2020.

Eight 20m x 20m in 20m x 50m nested plots were assessed in accordance with BAM (2020) (**Figure 12**). The assessment observed and recorded characteristics of each plot including species composition and abundance for each layer (including upper/canopy, mid-storey/shrub stratum, and groundcover/ orbs and grasses). The number of species and height of all flora observed the percentage groundcover and signs of disturbance were recorded.

The assessment identified three vegetation zones within the proposed disturbance area, namely.

- Zone 1 – PCT82 – Grazed, Moderate condition
- Zone 2 – PCT82 – Cleared, Poor condition
- Zone 3 – PCT201 – Grazed, Moderate condition (**Figure 12**).

Vegetation integrity scores were determined based on the BAM (2020) and are grouped by vegetation zone (**Table 15)**. In summary, cleared sections of PCT82 recorded a "poor" condition, while non-cleared but previously grazed areas within the northern and western tree lines recorded "moderate" condition.

Table 15
Vegetation Integrity Scores

Zone	BAM item number	PCT ID	Condition	Area (ha)	Composition condition score	Structure condition score	Function condition score	Vegetation integrity (VI) score
1	1	82	Grazed_mod	3.09	70.4	59.2	71.7	66.9
2	2	82	Cleared_poor	80.72	42.6	5.9	15	15.5
3	3	201	Grazed_mod	1.35	83.8	64	70.6	72.4
Source: AREA (2020) – Table 6-1.								

Subsequently, the BAM Calculator was used to determine the ecosystem credit requirements for proposed disturbance within the Biodiversity Study Area (**Table 16**).

Table 16
Ecosystem Credit Summary

Zone	BAM item number	Matter requiring offsetting	Vegetation integrity loss	Area	Sensitivity to Potential Gain	Number of credits
1	1	PCT82	66.9	3.1	High Sensitivity to Potential Gain	103
2	2	PCT82	15.5	80.7	High Sensitivity to Potential Gain	0
3	3	PCT201	72.4	1.4	High Sensitivity to Potential Gain	49
					Total	**152**

AREA (2020) determined that the Proposed Modification would not result in Serious and Irreversible Impact on PCT201 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion.

6.2.4.3 Threatened Species (excluding Koala)

Threatened species surveys were carried out within and surrounding the Biodiversity Study Area in June, September and October 2020. Surveys included search transect, diurnal hollow observation and bird searches, baited camera traps and nocturnal frog surveys. Ultrasonic bat recording was conducted immediately adjacent to the development site in December 2019.

No species credit species were identified by the assessment.

6.2.4.4 Koala

AREA (2020) note the following in relation to Koala within the Biodiversity Study Area.

- The area is not identified as important habitat.
- There is not a resident local population of Koalas present.
- The development site is adjacent to a major regional highway and surrounded by long operational rural activities both increasing the risk of mortality by vehicle strike or dog attack.

Three species of Koala habitat trees listed in the Koala SEPP occur within the Biodiversity Study Area, namely White Cypress Pine, Grey Box and Fuzzy Box. These trees would be removed by the Proposed Modification.

AREA (2020) determined that Koala are not present within the Biodiversity Study Area.

In addition, as the Proposed Modification is State Significant the Koala SEPP does not apply.

6.2.4.5 Biodiversity Offsets

Table 16 presents the ecosystem credits required for the Proposed Modification. No species credits are required. The Proponent would retire the required credits through a payment into the Biodiversity Conservation Trust.

6.3 NOISE

6.3.1 Introduction

The Noise Assessment Report was completed by Muller Acoustic Consulting Pty Ltd (MAC). The assessment, referred to hereafter as MAC (2020) and presented as **Appendix 4**, was prepared with reference to the *NSW Environment Protection Authority, Noise Policy for Industry (NPI) 2017* and builds on prior noise assessments completed for the original Project Approval (SLR, 2011) and MOD3 (MAC, 2015). This subsection presents an overview of the results of that assessment.

6.3.2 Local Setting and Environmental Performance

The TGO Mine Site is located immediately south of the village of Tomingley. As a result, numerous residences occur immediately to the north of the TGO Mine Site. Within the agricultural land to the east, south and west of the TGO Mine Site, residences are more widely spaced. The closest residence to the Extended TGO Mine Site is Residence R6, which is located approximately 1.7km from the existing TGO Mine Site and approximately 1.1km from the Extended TGO Mine Site boundary **(Figure 13**).

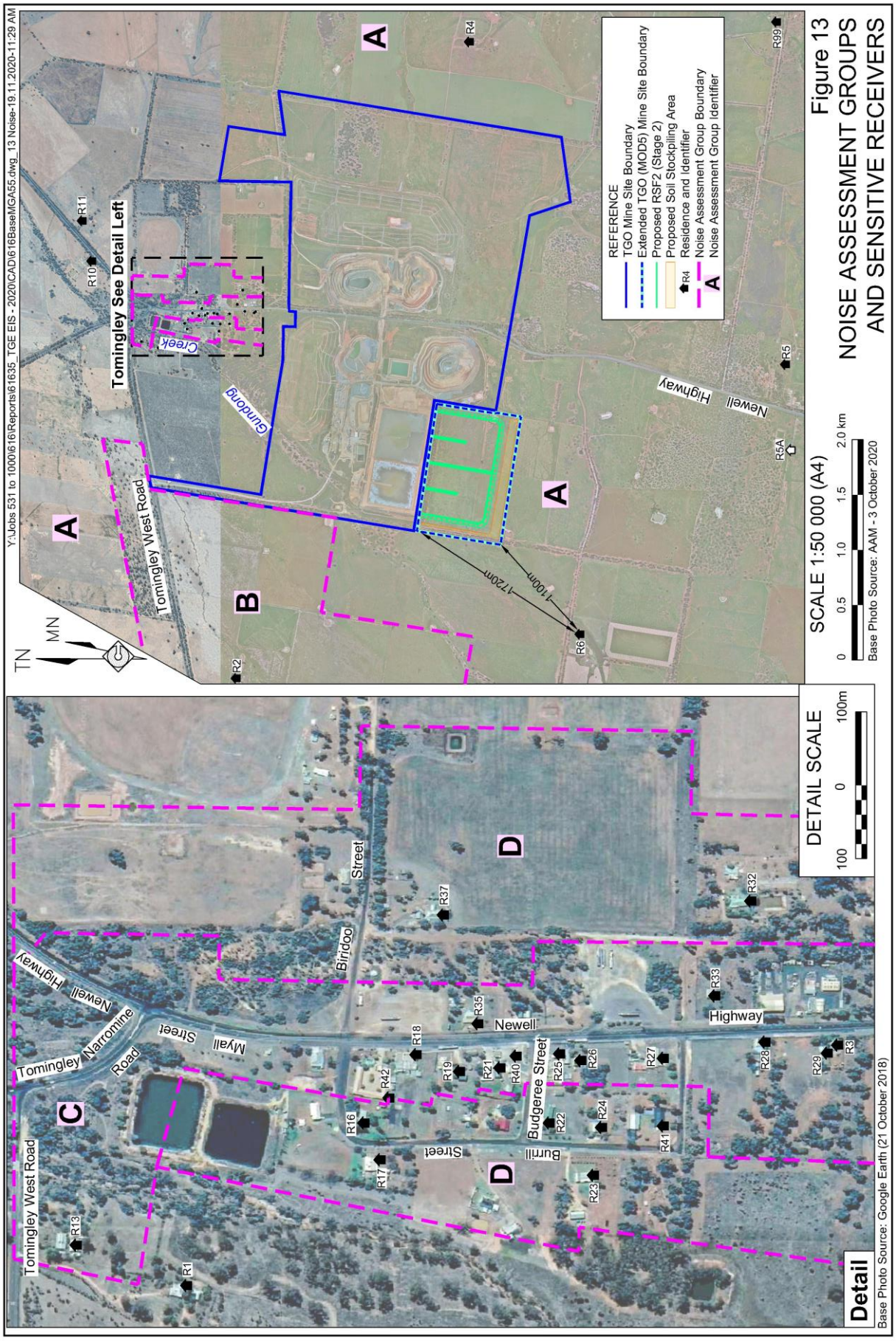


Figure 13
NOISE ASSESSMENT GROUPS AND SENSITIVE RECEIVERS
SCALE 1:50 000 (A4)
0 0.5 1.0 1.5 2.0 km
Base Photo Source: AAM - 3 October 2020
REFERENCE
TGO Mine Site Boundary
Extended TGO (MOD5) Mine Site Boundary
Proposed RSF2 (Stage 2)
Proposed Soil Stockpiling Area
Residence and Identifier
Noise Assessment Group Boundary
Noise Assessment Group Identifier
Tomingley See Detail Left
Tomingley West Road
Gundong
Creek
Newell Highway
1100m
1720m
TN
MN
A
B
C
D
R1
R2
R3
R4
R5
R5A
R6
R10
R11
R13
R16
R17
R18
R19
R21
R22
R23
R24
R25
R26
R27
R28
R29
R32
R33
R35
R37
R40
R41
R42
R99
DETAIL SCALE
100 0 100m
Detail
Base Photo Source: Google Earth (21 October 2018)
Tomingley West Road
Tomingley Narromine Road
Myall Street
Newell Highway
Biridoo Street
Budgeree Street
Burrill Street
Newell
Highway

SLR (2011) identified four noise assessment groups (NAGs) surrounding the TGO Mine Site, which have been adopted MAC (2020). The NAGs are as follows (**Figure 13**).

- NAG A: ambient noise influenced by both local roads and Newell Highway (Residences R1, R4, R5, R6, R8, R9, R10, R11 and R12).
- NAG B: rural setting with minimal traffic noise influence (Residence R2).
- NAG C: ambient noise highly elevated due to Newell Highway (Residences R3, R13, R18, R19, R21, R24, R25, R26, R27, R28, R29, R33, R35 and R40).
- NAG D: ambient noise elevated due to Newell Highway (Residences R16, R22, R17, R23, R32 and R37).

Table 17 presents the noise compliance criteria identified in Table 2A of Condition 3A of Schedule 3 of MP09_0155 (the MP09_0155 Criteria).

Table 17
MP09_0155 Noise Compliance Criteria

Noise Assessment Group	Receivers	Day	Evening	Night	
		dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{1(1min)}$
NAG A	All Receivers	35	35	35	45
NAG B	All Receivers	36	35	35	45
NAG C	All Receivers	45	35	35	45
NAG D	All Receivers	43	38	36	45
All other residential receivers		35	35	35	45

The Proponent has engaged Muller Acoustic Consulting (MAC) to undertake monthly noise monitoring. MAC advise that there have been no non-compliances with the relevant compliance criteria since April 2016 when MAC commenced monitoring.

6.3.3 Management and Mitigation Measures

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

- Continue to implement the approved *Noise Management Plan*. That plan would be reviewed following receipt of development consent and, if required, it would be revised.
- Utilise frequency modulated reversing alarms on all mobile equipment.
- Continue to monitor real-time noise levels at various locations surrounding the TGO Mine Site.
- 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.
- Where possible, equipment will be reconfigured or progressively stood down in the event of exceeding real-time noise monitoring data or with the onset of a temperature inversion.

- Operational controls will be further triggered for noise management in the event of a noise complaint.
- Ensure that all personnel are inducted prior to work at the TGO Mine Site, including in regards to noise impacts.

6.3.4 Assessment of Impacts

6.3.4.1 Assessment Criteria

The NPI was released by the Environment Protection Authority in 2017. That document replaced the former Industrial Noise Policy (INP). The principal difference between the policies is a change in the default rating background noise level for the daytime period (7:00am to 6:00m) from 30dB $LA_{90(daytime)}$ in the INP to 35dB $LA_{90(daytime)}$ in the NPI. This results in the minimum applicable Project Intrusiveness Noise Level or assessment criteria increasing from 35dB $LA_{eq(15min)}$ under the INP to 40dB $LA_{eq(15min)}$ under the NPI.

Table 18 presents the NPI noise criteria the Mine determined in compliance with the NPI.

Table 18
Noise Assessment Criteria

Noise Assessment Group	Receivers	Day[1]	Evening[1]	Night[1]	
		dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	dB $LA_{1(1min)}$
Assessment meteorological conditions[2]					
NAG A	All receivers	35/40[4]	35	35	45
NAG B	All receivers	36/40[4]	35	35	45
NAG C	All receivers	45	35	35	45
NAG D	All receivers	43	38	36	45
All other residential receivers		35/40[4]	35	35	45
Very enhancing[3]					
NAG A	All receivers	45	40	40	N/A
NAG B	All receivers	45	40	40	N/A
NAG C	All receivers	50	40	40	N/A
NAG D	All receivers	48	43	41	N/A
All other residential receivers		45	35	40	N/A

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.
Note 2: Standard meteorological conditions (Daytime and Evening) and noise enhancing meteorological conditions (night time) as per Table 2 of MAC (2020).
Note 3: All other meteorological conditions.
Note 4: MP09_0155 Criteria / Noise Policy for Industry Criteria

Source: MAC (2020) – Table 3

6.3.4.2 Modelling Scenarios

The modelling scenarios adopted in the assessment were representative of noise emissions from current operations and for the Proposed Modification operations as follows (**Figures 14** to **16)**.

- Scenario 1 - Current Operations, comprising all approved operations.

- Scenario 2 - RSF2 – Stage 2a – Bulk Earthworks, comprising construction of the Stage 2 embankment approximately 6m above the natural ground surface.
- Scenario 3 - RSF2 – Stage 2b – Final Trim, comprising the final shaping of the Stage 2 embankment, approximately 6m above the natural ground surface.

It is noted that noise emissions associated with the modelled scenarios would only occur for the construction period for each of Stages 1 and 2, likely to be 6 months and 3 months respectively. At other times, noise emissions from RSF2 would be negligible.

Each scenario was modelled using iNoise (Version 2020.0) noise modelling software. iNoise utilises a three-dimensional digital terrain map, combined with relevant noise source data, ground type, attenuation barriers and atmospheric information to predict noise levels at potentially affected receivers.

6.3.4.3 Assessment Results

Table 19 present the results of the noise assessment for the closest receivers. **Figures 14** to **16** present noise contours for all receivers. In summary, the Proposed Modification would satisfy the existing compliance criteria and NPI noise compliance criteria at all assessed receivers under standard meteorological. In addition, MAC (2020) notes that the predicated noise levels are within +5dB of the proposed very noise enhancing conditions and, thus, are also compliant under those conditions also.

Table 19
Predicted Operational Noise Levels

Receiver	NAG	Scenario 1 - Current Operations	Scenario 2 - RSF2 Stage 2a – Bulk Earthworks	Scenario 3 - RSF2 Stage 2b – Final Trim	Day Criteria dB LAeq(15min)	
					MP09_0155 Criteria	NPI Criteria
R2	B	27	34	<30	36	40
R4	A	26	32	<30	35	40
R6	A	27	35	31	35	40
R29	C	34	36	35	45	45
Source: MAC (2020) – After Table 7						

Finally, the Proponent notes that the proposed placement of waste rock into the Caloma 2 Open Cut would not result in additional noise-related impacts for the following reasons.

- The approved mine permits transportation of waste rock to the Wyoming 3 Open Cut via haul roads located at the natural surface.
- The proposed placement of waste rock into the Caloma 2 Open Cut would require a shorter haul distance and the haul truck would remain approximately 30m below natural surface.

As a result, placement of waste rock into the Caloma 2 Open Cut would likely result in a reduction in noise emissions.

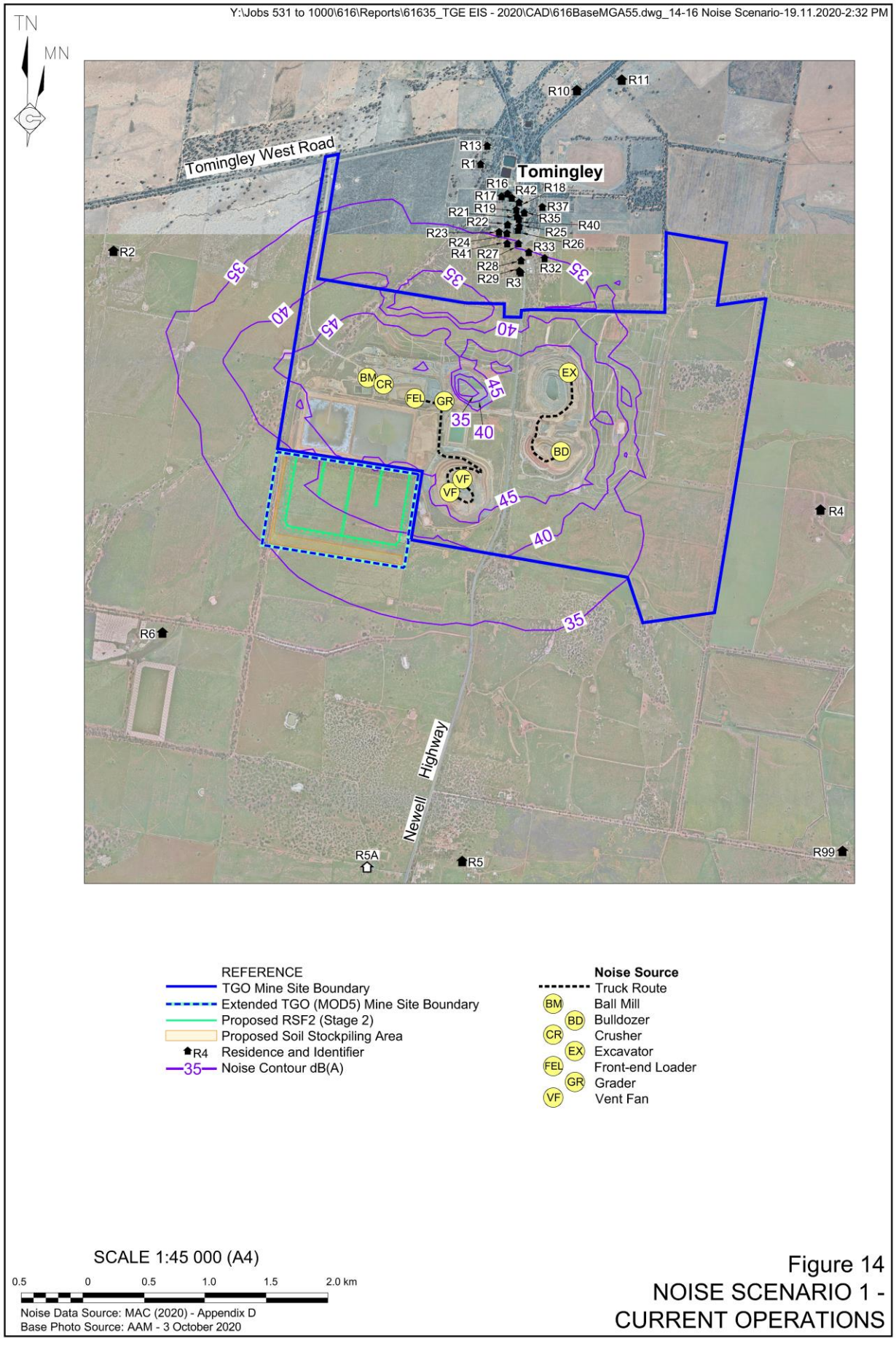


Figure 14
NOISE SCENARIO 1 - CURRENT OPERATIONS

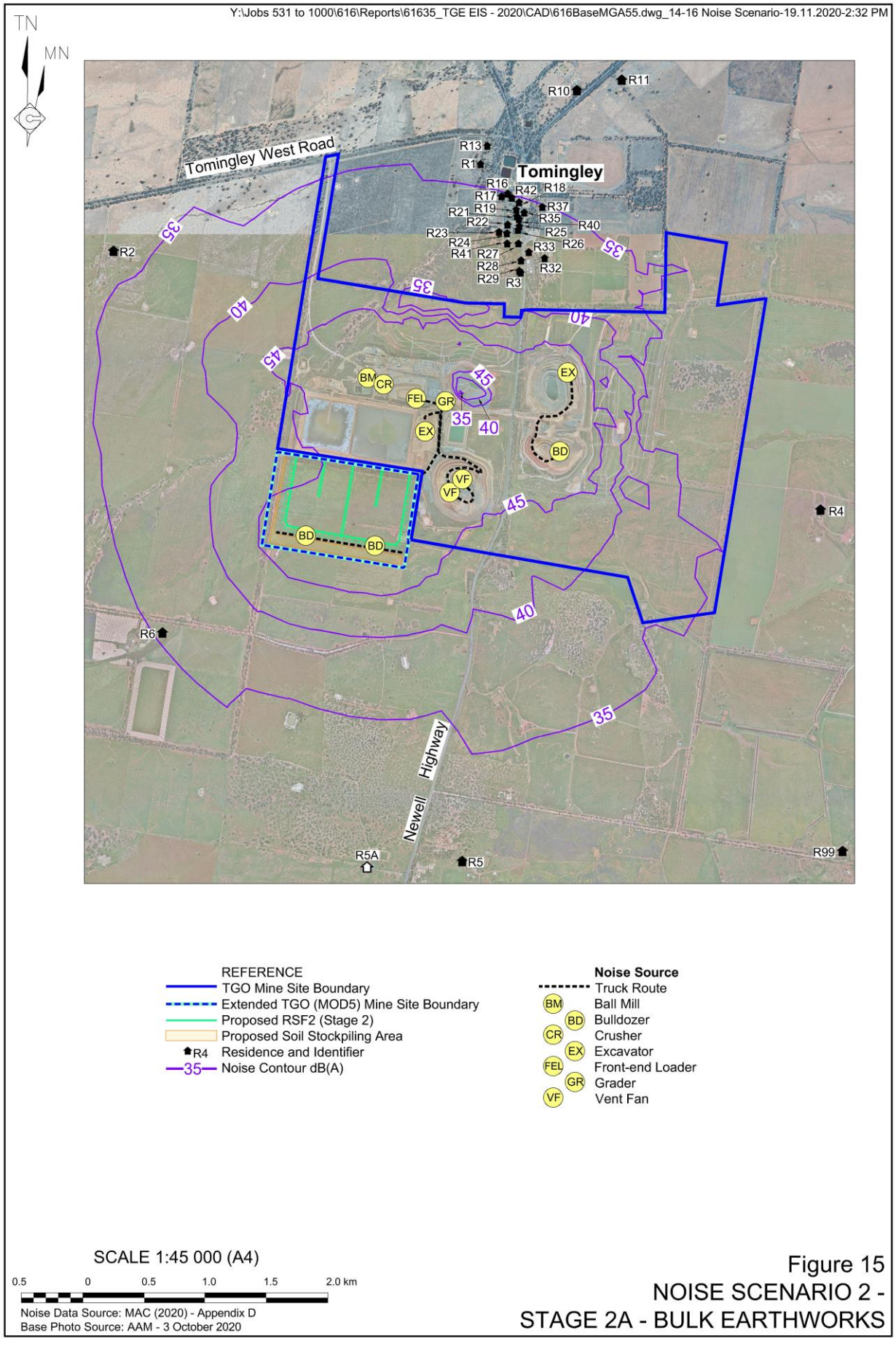


Figure 15
NOISE SCENARIO 2 -
STAGE 2A - BULK EARTHWORKS

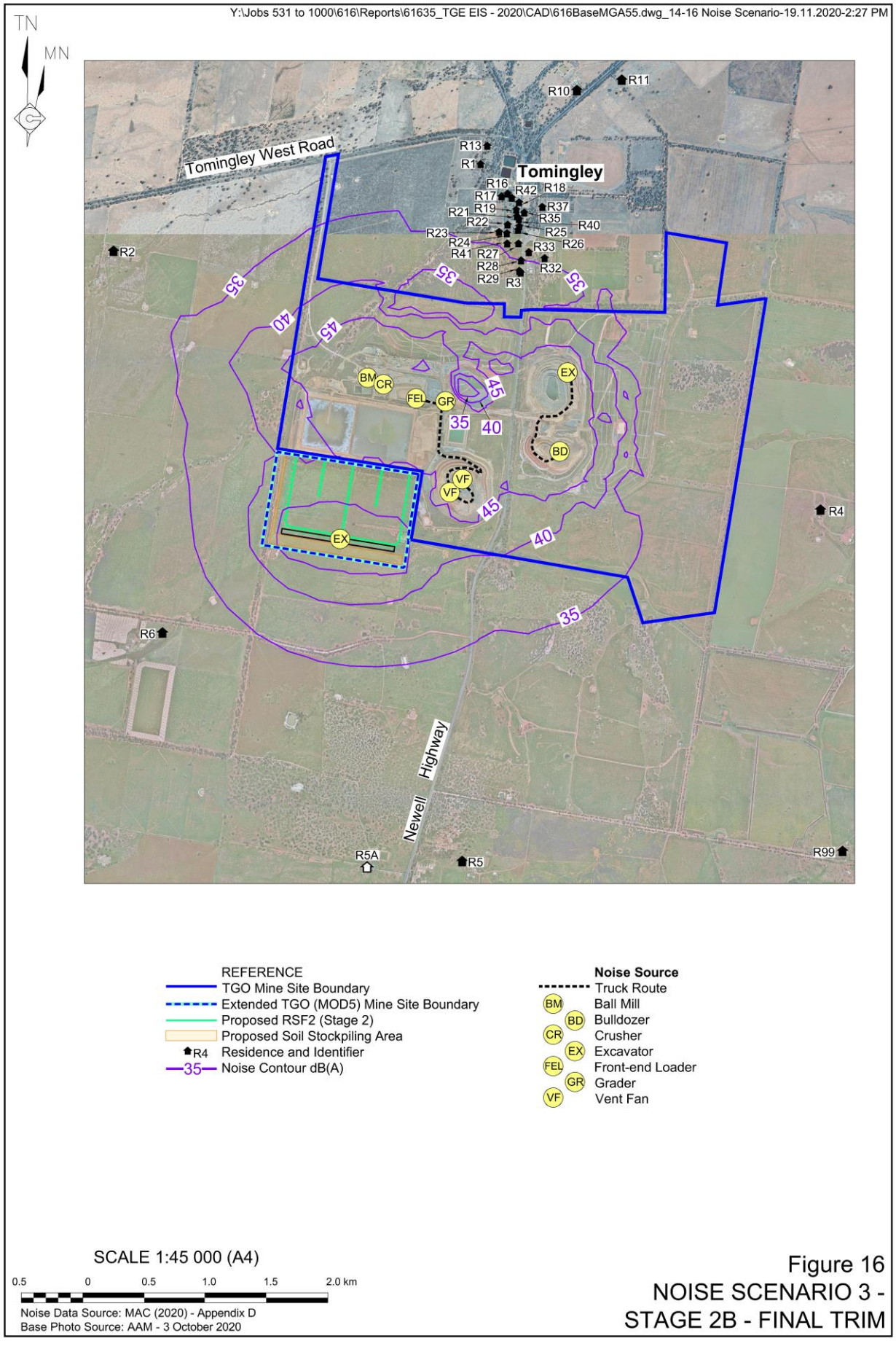


Figure 16
NOISE SCENARIO 3 -
STAGE 2B - FINAL TRIM

6.4 AIR QUALITY AND GREENHOUSE GAS

6.4.1 Introduction

The Air Quality Impact Assessment (AQIA) was completed by Northstar Air Quality Pty Ltd (Northstar). The AQIA, referred to hereafter as Northstar (2020) is presented as **Appendix 5**. This subsection presents an overview of the results of that assessment.

The AQIA was prepared in accordance with the *Approved Methods for the Modelling and Assessment of Air Quality in NSW*, NSW EPA, 2017 and takes into account the *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments*.

6.4.2 Local Setting and Environmental Performance

Air quality parameters, including ambient concentrations of TSP, PM_{10} and the rate of dust deposition are measured at the TGO Mine Site by the Proponent, with measurements available for the period May 2014 to June 2020. These measurements, along with data from the TGO Mine Site Automated Weather Station (AWS) were used by Northstar (2020), with the exception of measurements from 2018 and 2019 calendar years, which were been materially impacted by drought and bushfire events and thus have been excluded from use in the assessment.

The Proponent has a strong history of compliance with the air quality criteria specified in the Project Approval, with only one exceedance of the 24 Hour PM_{10} Criterion, in February 2016, being attributable to operations at the TGO Mine Site.

6.4.3 Management and Mitigation Measures

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

- Continue to implement the approved *Air Quality Management Plan*. That plan would be reviewed following receipt of development consent and, if required, it would be revised.
- Disturb only the minimum area necessary.
- Shape soil stockpiles and rehabilitate completed sections as soon as practical.
- Use water carts to minimise windblown and traffic dust.
- Delineate haul roads.
- Rehabilitate roads as soon as practicable once they are no longer in use.
- Limit the development of minor roads.
- Monitor weather forecast to assist in planning construction activities.

- Include in the TGO Mine Site induction the following information.
  - the requirement to keep to designated haul roads and not develop minor roads;
  - to notify a supervisor if wind-blown dust is observed; and
  - to call for the water cart if the potential for windblown dust is identified.

6.4.4 Assessment of Impacts

6.4.4.1 Introduction

Northstar (2020) undertook the assessment of air quality-related impacts using two methodologies as follows.

- An assessment of incremental change in emissions based on previous air quality assessments undertaken in 2011 for the original application for Project Approval (PEL, 2011) and in 2015 for MOD3 (PEL, 2015).
- An assessment of the spatial change in emissions associated with the proposed construction of Stage 1 of RSF2.

6.4.4.2 Assessment Criteria

Table 20 presents the air quality assessment/compliance criteria for the Mine based on Condition 17 of Schedule 3 of MO09_0155 and the NSW Environment Protection Authority assessment criteria.

Table 20
Air Quality Assessment Criteria

Pollutant	Averaging Period	Criterion	
		MP09_0155 Criterion[1]	EPA Criterion[2]
TSP	Annual	90µg/m^3	
PM_{10}	Annual	30µg/m^3	25µg/m^3
	24-hour	50µg/m^3	
$PM_{2.5}$	Annual	-	8µg/m^3
	24-hour	-	25µg/m^3
Deposited dust	Annual	2g/m^2/month – project alone	
		4g/m^2/month – cumulative	

Note 1: Source - Condition 17 of Schedule 3 of MO09_0155
Note 2: Northstar (2020) - Table 18

6.4.4.3 Assessment of Incremental Change in Emissions

Northstar (2020) replicated the AQIA methodology used by PEL (2015) when assessing the MOD3 application. In summary, Northstar (2020) have reviewed the likely incremental change in total suspended particulates (TSP) emissions between the original AQIA (PEL, 2011), the MOD3 AQIA (PEL, 2015) and the Proposed Modification.

Table 21 presents the result of that assessment. Northstar (2020) state that the anticipated increase in annual TSP emissions associated with the Proposed Modification when compared to the original AQIA is approximately 12.3 %, with an increase of only 1.4% from the MOD3 assessment. It is noted that for the purposes of this application, it is the MOD3 Project that forms the basis for comparison. Northstar (2020) state that incremental change in TSP emissions below 20% is unlikely to result in a material change to the conclusions of the original AQIA.

Table 21
Comparison of TSP Emissions

Page 1 of 2

Activity	TSP Emissions ($kg \cdot yr^{-1}$)		
	Original AQIA	MOD 3	MOD 5
Waste - Drilling	66 050	37 170	37 170
Waste - Blasting	15 775	20	20
Waste - Excavator loading Waste to haul truck	3 977	1 649	1 649
Waste - Hauling from Caloma 1 OC to WRE3	69 137	22 745	22 745
Waste - Hauling from Wyoming 1 OC to WRE1	4 749	6 203	6 203
Waste - Hauling from Wyoming 3 OC to WRE2	15 922	310	310
Waste - Hauling from Caloma 2 OC to WRE3		5 686	5 686
Waste - Emplacing at WRE3	1 790	589	589
Waste - Emplacing at WRE1	676	883	883
Waste - Emplacing at WRE2	1 511	29	29
Waste- Emplacing at WRE3		147	147
Waste- Dozers on Waste	36 640	24 131	24 131
ORE- Drilling	928	700	700
ORE- Blasting	589		-
ORE - Dozers ripping/pushing/clean-up	109 963	282 439	282 439
ORE - Excavators/FELs loading open pit ore to trucks	106 550	105 955	105 955
ORE - Hauling open pit ore from Caloma 1 to ROM pad	12 352	9 748	9 748
ORE - Hauling open pit ore from Wyoming 1 to ROM pad	6 575	20 604	20 604
ORE- Hauling open pit ore from Wyoming 3 to ROM pad	5 689	266	266
ORE- Hauling open pit ore from Caloma 2 to ROM pad		2 437	2 437
ORE - Unloading ROM to ROM stockpiles	355	353	353
ORE- FEL unloading ROM from stockpiles to ROM bin	355	353	353
ORE- Primary Crushing	24 135	24 000	24 000
ORE - Conveying to Screen Building	46	46	46
ORE - Unloading ore from conveyor to Screen Building	355	353	353
ORE - Screening	1 508	1 500	1 500
ORE - Conveying oversized material to Crushing Building	46	46	46
ORE - Unloading oversized ore from conveyor to Crushing Building	101	101	101
ORE - Secondary Crushing	68 784	68 400	68 400
ORE - Conveying oversized material to Screen Building	46	46	46
ORE - Conveying undersized material to Surge Bin	27	27	27
ORE - Unloading undersized ore from conveyor to Surge Bin	5	5	5

Table 21 (Cont'd)
Comparison of TSP Emissions

Activity	TSP Emissions (kg·yr^{-1})		
	Original AQIA	MOD 3	MOD 5
ORE - Conveying undersized material from Surge Bin to ball mill	44	44	44
ORE - Unloading undersized ore from conveyor to ball mill	18	18	18
REHAB - Dozers on rehab	3 861	3 861	3 861
WE - Waste dump areas	223 730	230 901	230 901
WE - Residue Storage	51 824	51 824	51 824
WE - Open pit	198 677	225 663	225 663
WE - ROM stockpiles	1 402	27 349	27 349
Grading roads	86 264	86 264	86 264
Stage 1 RSF2 Construction (6 months) (A)	-	-	29 961
Total	1 120 456	**1 242 865**	1 272 827
Change (%) from original	**-**	**10.9**	**12.3**

Note: (A) Stage 1 construction assessed given that emissions would be greater than in Stage 2. Stage 1 and Stage 2 construction not anticipated to occur in the same calendar year and not concurrently.

6.4.4.4 Assessment of the Spatial Change in Emissions

While the Proposed Modification would not result in substantial changes in the quantum of emissions of particulates, the location of emission sources would vary. Given that activities associated with the Proposed Modification would be closer to certain receptors, a focussed dispersion modelling exercise was undertaken by Northstar (2020) to quantify any potential impacts using the TAMP, CALMET and CALPUFF modelling software.

Table 22 presents the assessment of incremental (Proposed Modification alone) impacts. The results indicate that annual average incremental concentrations at all receptors are anticipated to be insignificant with all annual average concentration <1.5 % of the relevant criteria. Short-term impacts are also demonstrated to be minor with 24-hour PM_{10} concentrations predicted to be ≤6 %, and $PM_{2.5}$ predicted to <3 % of the relevant criteria

Table 23 presents the assessment of cumulative (Proposed Modification plus measured background dust levels for 2017) impact. The cumulative assessment determined the following.

- Annual average TSP, PM_{10} and dust deposition criteria are anticipated to be achieved.
- One additional, but marginal, exceedance may occur at a location in Tomingley village (R23). However, given the magnitude of that exceedance (< 0.1 µg/m^3), it is not likely to result in any measurable change at that receptor. Further, the AQIA does not take into account all management and mitigation measures and, as a result, the exceedance would not be likely to occur should all the adopted management and mitigation measures be implemented.

Table 22
Incremental Model Predictions of Proposed Modification

Receptor	Annual average µg/m³				Maximum 24-hour µg/m³	
	TSP	PM_{10}	$PM_{2.5}$	Dust Deposition	PM_{10}	$PM_{2.5}$
Criterion	**90**	**25**	**8**	**2**	**50**	**25**
Maximum	0.5	0.2	<0.1	<0.1	3.0	0.7
R1	0.3	0.1	<0.1	<0.1	2.5	0.5
R3	0.3	0.1	<0.1	<0.1	2.8	0.6
R4	0.1	<0.1	<0.1	<0.1	1.7	0.4
R5*	0.1	<0.1	<0.1	<0.1	1.0	0.2
R6	0.5	0.2	<0.1	<0.1	2.4	0.5
R8	0.1	<0.1	<0.1	<0.1	2.0	0.4
R9	0.2	0.1	<0.1	<0.1	1.9	0.4
R10	0.1	<0.1	<0.1	<0.1	1.6	0.3
R11	0.1	<0.1	<0.1	<0.1	1.3	0.3
R12	0.1	<0.1	<0.1	<0.1	0.7	0.2
R13	0.3	0.1	<0.1	<0.1	2.3	0.5
R16	0.2	0.1	<0.1	<0.1	2.5	0.5
R17	0.3	0.1	<0.1	<0.1	2.5	0.5
R18	0.2	0.1	<0.1	<0.1	2.5	0.6
R19	0.2	0.1	<0.1	<0.1	2.6	0.6
R21	0.2	0.1	<0.1	<0.1	2.7	0.6
R22	0.3	0.1	<0.1	<0.1	2.8	0.6
R23	0.3	0.1	<0.1	<0.1	3.0	0.7
R24	0.3	0.1	<0.1	<0.1	3.0	0.6
R25	0.2	0.1	<0.1	<0.1	2.8	0.6
R27	0.3	0.1	<0.1	<0.1	2.8	0.6
R28	0.3	0.1	<0.1	<0.1	2.8	0.6
R29	0.3	0.1	<0.1	<0.1	2.8	0.6
R32	0.2	0.1	<0.1	<0.1	2.2	0.5
R33	0.2	0.1	<0.1	<0.1	2.6	0.6
R35	0.2	0.1	<0.1	<0.1	2.6	0.6
R37	0.2	0.1	<0.1	<0.1	2.3	0.5
R40	0.2	0.1	<0.1	<0.1	2.7	0.6
R43	0.1	<0.1	<0.1	<0.1	0.8	0.2
R44	<0.1	<0.1	<0.1	<0.1	0.4	0.1
R45	0.1	<0.1	<0.1	<0.1	1.3	0.3
R46	0.1	<0.1	<0.1	<0.1	1.3	0.3
R47	<0.1	<0.1	<0.1	<0.1	0.6	0.1
R60	<0.1	<0.1	<0.1	<0.1	0.8	0.2
R61	<0.1	<0.1	<0.1	<0.1	0.8	0.2

Table 22 (Cont'd)
Incremental Model Predictions of Proposed Modification

Receptor	Annual average µg/m³				Maximum 24-hour µg/m³	
	TSP	PM_{10}	$PM_{2.5}$	Dust Deposition	PM_{10}	$PM_{2.5}$
Criterion	**90**	**25**	**8**	**2**	**50**	**25**
R62	<0.1	<0.1	<0.1	<0.1	0.9	0.2
R63	<0.1	<0.1	<0.1	<0.1	0.2	0.1
R64	<0.1	<0.1	<0.1	<0.1	0.3	0.1
R65	0.3	0.1	<0.1	<0.1	2.8	0.6
R66	0.3	0.1	<0.1	<0.1	2.7	0.6
Source: Northstar (2020) – after Table 18						

Table 23
Cumulative Annual Average Model Predictions of Proposed Modification

Receptor	Annual average µg/m³		
	TSP	PM_{10}	Dust Deposition (background from DDG5)
Criterion	**90**	**25**	**4**
Maximum	47.3	20.1	<1.8
R1	47.1	20.0	<1.8
R3	47.1	20.0	<1.8
R4	46.9	19.9	<1.8
R5*	46.9	19.9	<1.8
R6	47.3	20.1	<1.8
R8	46.9	19.9	<1.8
R9	47.0	20.0	<1.8
R10	46.9	19.9	<1.8
R11	46.9	19.9	<1.8
R12	46.9	19.9	<1.8
R13	47.1	20.0	<1.8
R16	47.0	20.0	<1.8
R17	47.1	20.0	<1.8
R18	47.0	20.0	<1.8
R19	47.0	20.0	<1.8
R21	47.0	20.0	<1.8
R22	47.1	20.0	<1.8
R23	47.1	20.0	<1.8
R24	47.1	20.0	<1.8
R25	47.0	20.0	<1.8
R27	47.1	20.0	<1.8
R28	47.1	20.0	<1.8
R29	47.1	20.0	<1.8
R32	47.0	20.0	<1.8
R33	47.0	20.0	<1.8

Table 23 (Cont'd)
Cumulative Annual Average Model Predictions of Proposed Modification

Receptor	Annual average µg/m³		
	TSP	PM_{10}	Dust Deposition (background from DDG5)
Criterion	**90**	**25**	**4**
R35	47.0	20.0	<1.8
R37	47.0	20.0	<1.8
R40	47.0	20.0	<1.8
R43	46.9	19.9	<1.8
R44	46.8	19.9	<1.8
R45	46.9	19.9	<1.8
R46*	46.9	19.9	<1.8
R47	46.8	19.9	<1.8
R60	46.8	19.9	<1.8
R61	46.8	19.9	<1.8
R62	46.8	19.9	<1.8
R63	46.8	19.9	<1.8
R64	46.8	19.9	<1.8
R65	47.1	20.0	<1.8
R66	47.1	20.0	<1.8
Source: Northstar (2020) – After Table 19			

The AQIA demonstrated that the spatial change in emissions, as a result of the Proposed Modification, would not cause any additional adverse impacts at the closest receptor to the TGO Mine Site, residence R6 (Table 6.8). This indicates that the level of emissions controls, and the scale of activities proposed is appropriate and can be managed in a manner as to not result in any adverse impacts.

Finally, the Proponent notes transportation of waste rock to the Caloma 2 Open Cut rather than the Wyoming 3 Open Cut was not assessed by Northstar (2020). However, the Proponent contends that the proposed placement of waste rock into the Caloma 2 Open Cut would result in reduced particulate matter-related impacts for the following reasons.

- The approved mine permits transportation of waste rock to the Wyoming 3 Open Cut via haul roads located at the natural surface.
- The proposed placement of waste rock into the Caloma 2 Open Cut would require a shorter haul distance and the haul truck would remain approximately 30m below natural surface.

As a result, placement of waste rock into the Caloma 2 Open Cut would likely result in a reduction in dust emissions.

6.4.4.5 Greenhouse Gas Assessment

The Proposed Modification would not alter the production rate or rate of emissions of greenhouse gasses. As a result, associated greenhouse gas impacts would be negligible.

6.5 SOILS AND LAND CAPABILITY

6.5.1 Introduction

This subsection of the Modification Report has been prepared by Sustainable Soils Management (SSM). SSM prepared the application for the Site Verification Certificate for the Proposed Modification. The following presents an assessment of the soil and land capability of the Extended TGO Mine Site.

6.5.2 Local Setting and Environmental Performance

6.5.2.1 Introduction

The Extended TGO Mine Site is a relatively level stagnant alluvial plain with no bedrock outcrops. There are, however, are small outcrops of Ordovician-Silurian Cotton Formation with have low-angled footslopes of sandstone and siltstone with quartz veins to the east and the southwest of the TGO Mine Site (Sherwin, 1996). Further to the east is the Harvey Ranges, the main range of the Lachlan Fold Belt in Goobang National Park which rises to over 700m elevation.

The Extended TGO Mine Site is covered in Mesozoic alluvium and colluvium derived from the geological complex of the Harvey Ranges to the east. This has been covered with Quaternary to recent alluvium which has been partially stripped in places. It is likely that the small Ordovician outcrops to the east and southwest of the Extended TGO Mine Site were once covered in this colluvial fill material. The combined depth of the various alluvia range from <1m to in excess of 60m over vertically dipping volcanic complexes in the region (Roach, 2007; Sherwin, 1996).

The flat, stagnant nature of the plain reflects original sediment sources in the fold belt, as well as some aeolian additions. Landform elements in the Extended TGO Mine Site include shallow (<1m deep) broad drainage depressions and plains.

Most of the Extended TGO Mine Site has been extensively cleared and is grazing land with occasional cropping, with a strip of native vegetation along the western and northern boundary.

6.5.2.2 Land Shape and Hydrology

The Revised Universal Soil Loss Equation (RUSLE) is used in agriculture and in *Managing Urban Stormwater* (Landcom, 2004) to estimate potential soil loss from water erosion. The Land Shape factor uses inputs of slope length and steepness to estimate the contribution of land shape to erosion potential. Land shape values range from 0.04 to more than 50 (Landcom, 2004).

Land shape values across the Extended TGO Mine Site were calculated a 5m pixel digital elevation model downloaded from NSW spatial Services. The value was less than 0.1, an indication that land shape would not contribute greatly to water erosion.

The Strahler stream order is essentially a count of the maximum number of tributaries above a reach of stream. The TGO Mine Site receives runoff in the form of overland from approximately 1 500ha to the east of the Newell Highway. This water flows across the TGO Mine Site as a broad sheet rather than being concentrated in a defined channel.

6.5.2.3 Soil Sampling and Mapping

Mapping Scale

SSM determined that the scale of mapping required to adequately assess the soil and land capability of the Extended TGO Mine Site is 1:25 000. Provisional 1:25 000 soil mapping units were established using Roach's (2007) regolith mapping units, in consideration with a ground EM survey (scale approximately 1:20,000).

Site Sampling and Soil Description

A square grid of 1 soil observation per 23ha aligned with Gundong Creek was established across the Extended TGO Mine Site for a total of five sampling sites (**Figure 17**). Individual grid locations were adjusted so that they did not fall into the middle of drainage lines. All sites had full detailed soil profile descriptions as per Isbell and NCST (2016) and NCST (2009) and were sampled for laboratory analysis. Soil profile descriptions are given in **Appendix 6.**

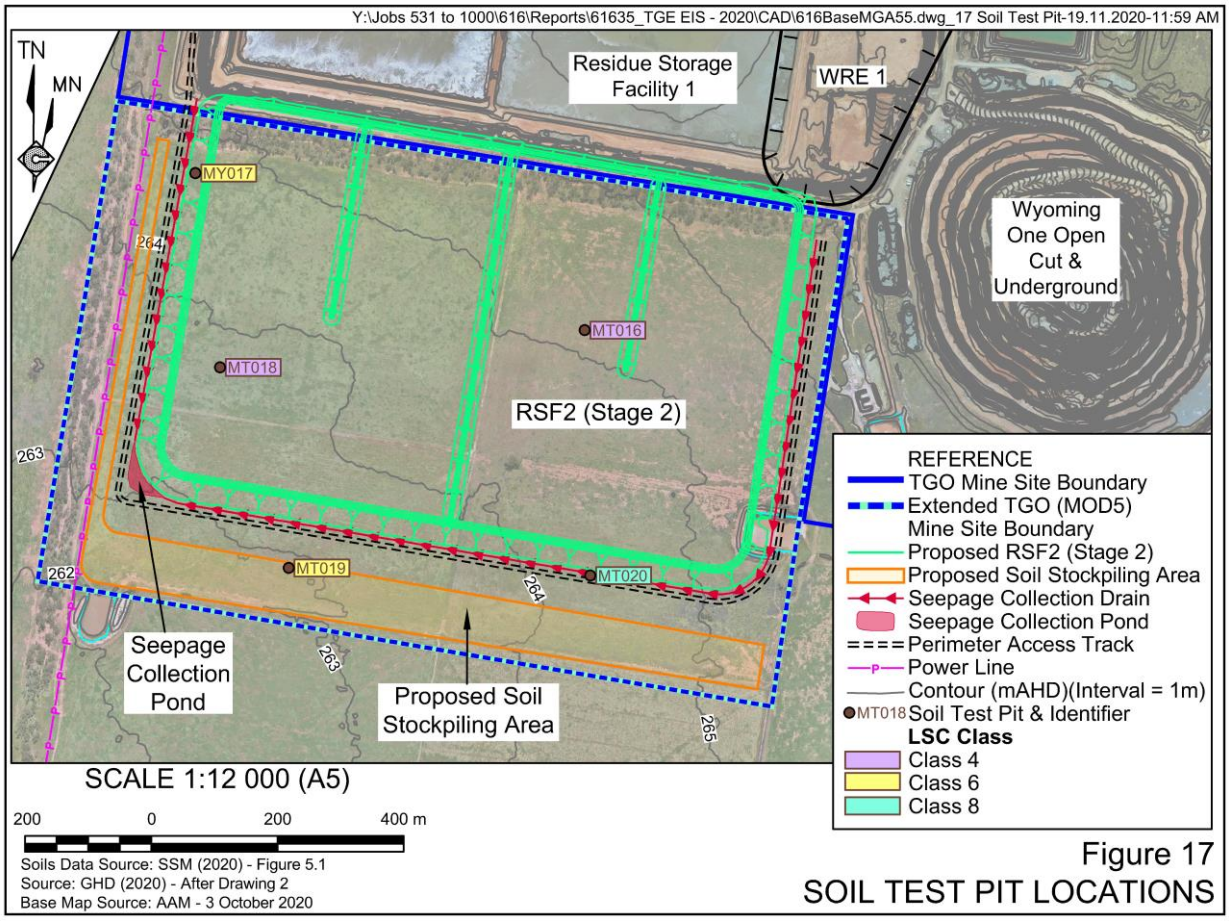


Figure 17
SOIL TEST PIT LOCATIONS

All sites were excavated to a minimum of 1.2m depth (or refusal) using a small excavator. The location of each test pit was recorded using a hand-held GPS with a position accuracy of approximately 5m.

Field data that were recorded for each of the five sampling test sites (**Appendix 6**) included:

- Soil test pit observations and information: GPS location, nature of exposure, slope, slope measurement method, aspect, site morphology, slope morphology, landform element, aspect, microrelief type, microrelief depth, microrelief extent, lithology, lithology identification method, rock outcrop, current land use, predevelopment vegetation community, growth form, ground cover percentage, current land use, site disturbance, current surface condition, predicted dry surface condition and predicted wet surface condition.
- Detailed soil profile observations for each horizon: lower depth, moisture content, grade of pedality, fabric, size and shape of dominant and subdominant peds. Type, amount, distribution, orientation, weathering and size of coarse fragments. Type, amount, strength, form and size of segregations. Moist colour of all horizons. Type, abundance, colour and contrast of mottles, field texture. Field tests for pH, effervescence to dilute hydrochloric acid, slaking, dispersion, EC1:5 for selected horizons and boundary distinctness.
- Overall soil profile observation: effective rooting depth, profile permeability, profile drainage, base of observations, substrate.
- Photographs of site and soil profile.

Soil field data for median clay content for each horizon was calculated using NCST (2009), (pp 164 to 165). These data were processed into depth increments of 0cm to 5cm, 5 cm to 15cm, 15cm to 30cm, 30cm to 60cm and 60cm to 100cm using the Equal Area Quadratic Spline program, Spline Tool (Jacquier and Seaton, 2012). These data were later used in conjunction with laboratory data to calculate ECe and Sum of Bases for each lab sample. Using a spline is an effective way of objectively matching soil horizon data of variable thickness to soil incremental data (Banks *et al*., 2020).

Laboratory Analysis

Laboratory analysis of soil samples was undertaken to assist in the identification of soil associations.

Soil samples were collected from the sampling depths of 0cm to 5cm, 5cm to 15cm, 15cm to 30cm, 30cm to 60cm and 60cm to 100cm for all sampling sites, unless the depth range covered the boundary between the A and B horizons of duplex profiles. In duplex profiles where a sample range covered the A to B horizon boundary, the depth range was shortened and only one horizon was sampled.

Samples from the five sites were submitted to the NATA and ASPAC accredited Incitec Pivot Laboratories for analysis (**Appendix 6**). Soil chemical properties are required for classifying soil in accordance with the Australian Soil Classification (ASC) were measured for all soil samples analysed. The soil chemical properties were pH in water and $CaCl_2$; exchangeable cations of Ca, Mg, K, Na and Al; EC1:5; and Cl. In addition, all samples were tested for NO^{3-} and $NH^{4-}N$.

Topsoil (0cm to 5cm and 5cm to 15cm) samples were subjected to further testing including organic carbon %, sulphate, Colwell P, P buffer index, and the trace elements Zn, Cu, Fe, Mn and B. Individual testing methods are given with the data in **Appendix 6**.

6.5.2.4 Soil Classification

All full soil profiles were classified according to Isbell and NCST (2016). Using both field and laboratory data each soil pit was allocated to ASC order; ASC suborder; ASC Great Group; ASC Subgroup; ASC Family properties of topsoil thickness; gravel and texture; subsoil texture; and soil depth.

A single Sodosol soil mapping unit covered the entire Extended TGO Mine Site. The mapping unit is dominated by imperfectly to moderately well drained Red Sodosols with a single occurrence of a Red Chromosol (**Figure 18**). At the time of profile description and sampling the soils of this unit were wet and had highly dilatant topsoils. Any small areas of aeolian dust in this landscape were very thin (<5 cm) and these did not appear to have an impact on soil properties. The Sodosols in this unit had impeded drainage, low wet bearing strength and sodicity in upper subsoils which further impedes profile permeability.

6.5.2.5 Soil and Land Capability Classification

The Land and Soil Capability assessment classifies land into one of eight land and soil capability classes. These classes give an indication of the intensity of use the land can withstand without suffering land and soil degradation (**Table 24**).

The Land and Soil Capability classes of the Extended TGO Mine Site were assessed in accordance with the *Land and Soil Capability Assessment Scheme – Second Approximation* (OEH, 2012).

The land and soil capability assessment scheme is a two-step process. The first step is to assess the Land and Soil Capability based on each of eight individual hazards (water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement) at each of the five sites assessed. For each of these hazards, the area around each site was assigned a Land and Soil Capability class from 1 (least hazard) to 8 (greatest). The final Land and Soil Capability for each site was determined by the highest class assigned to any hazard for that site (**Figure 19**).

The assessment of Land and Soil Capability classes for the Extended TGO Mine Site was based on data collected during the field survey, laboratory analysis of soil samples and is supplemented with information collected during the desktop assessment.

The five sites assessed were in Land and Soil Capability classes 4 to 8 (**Figure 17**). This resulted in an average LSC of 6 for the Sodosol Mapping Unit within the Extended TGO Mine Site.

No site assessed had a Land and Soil Capability rating better than class 4 (**Figure 20**). Waterlogging was the only hazard with an LSC class more than 4.

Australian Soil Classification	Poorly drained very deep Hypocalcic Mottled-Subnatric Red Sodosol.
Other Soil Types in Landscape	Red Chromosol
All Soil Test Pits in Landscape	MT 016, 017, 018, 019, 020.

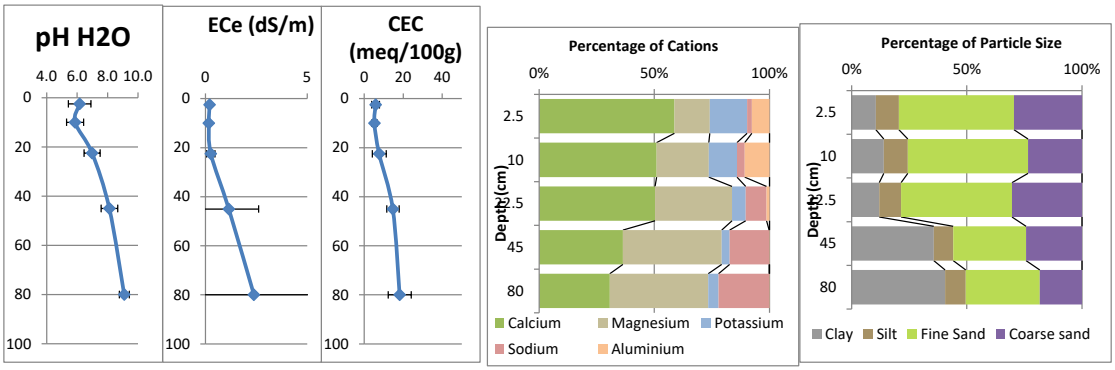


Figure 18
Representative Soil Test Pit Profile, Chemistry and Particle Size

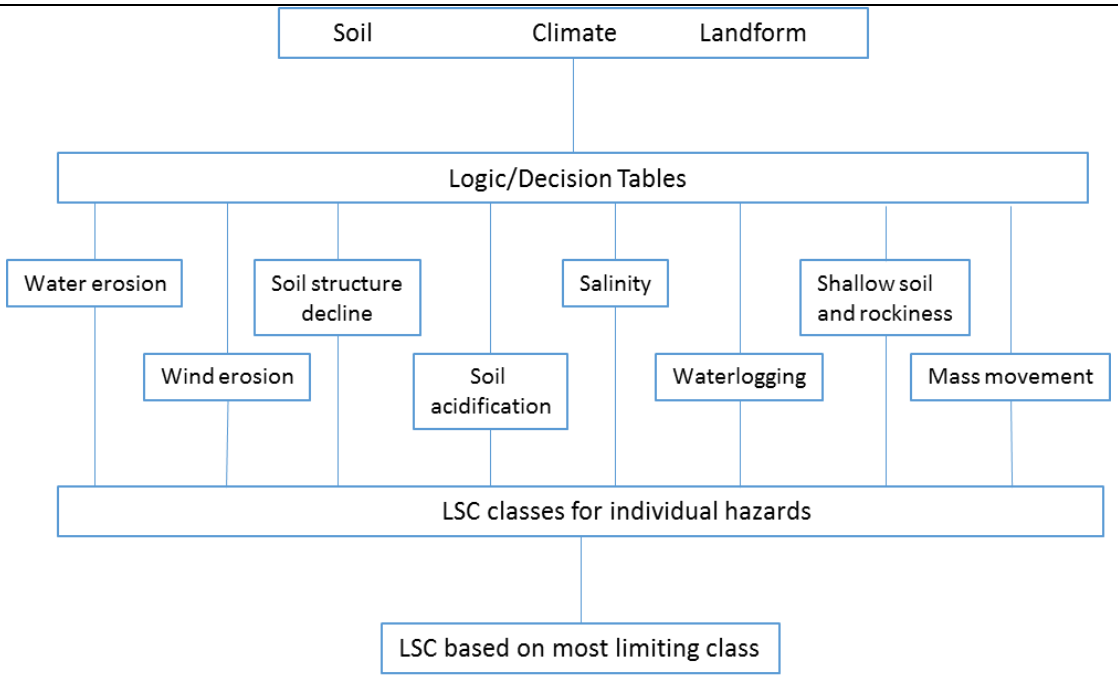


Figure 19
Biophysical Information Used to Determine LSC Class

Source: OEH (2012)

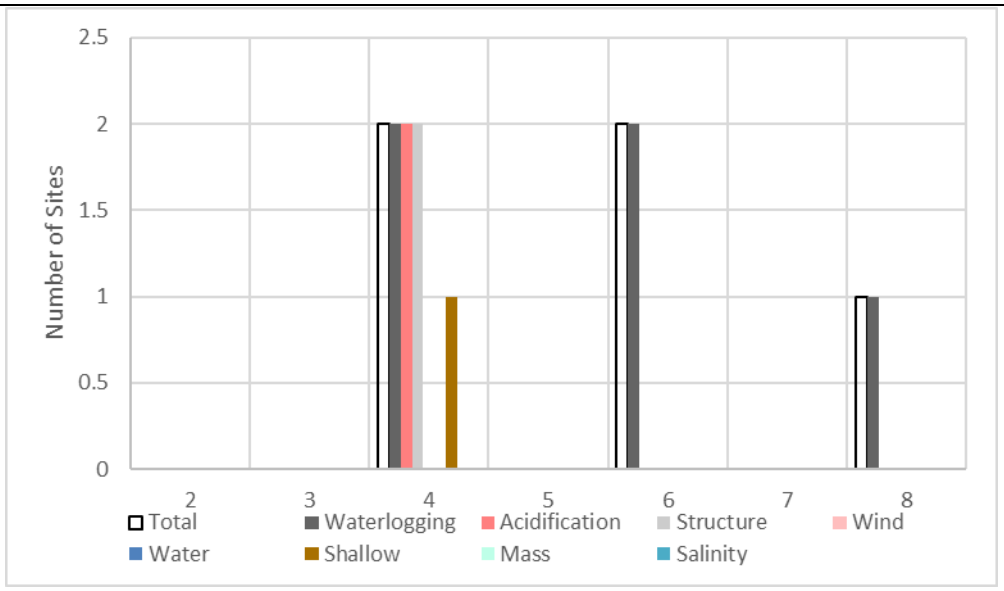


Figure 20
Hazard that Limits Land and Soil Capability in each LSC Class

Table 24
Land and Soil Capability Classes

LSC class	Description
Land capable of wide variety of uses (cropping, grazing, horticulture, forestry, nature conservation)	
1	Extremely high capability land: Land has no limitations. No special land management practices required. Land capable of all rural uses and land management practices.
2	Very high capability land: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	High capability land. Land: Has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental limitations.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	Moderate land capability land: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	Moderate-low capability land: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations will need to be carefully managed to prevent long-term degradation.
Land capable of a limited set of land uses (grazing, forestry, nature conservation and some horticulture)	
6	Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agriculture land use (selective forestry, nature conservation)	
7	Very low capability land: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	Extremely low capability: Limitations are so severe that land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.
Source: OEH (2012).	

Land and Soil Capability was limited by structure decline and acidification hazards to Land and Soil Capability Class 4 in addition to limitations imposed by the waterlogging hazard (**Table 25**). In summary, the Land and Soil Capability Class of the Extended TGO Mine Site is constrained to LSC 6, or low capability land. This is primarily caused by water logging, however the soil capability is also constrained by susceptibility to structure decline and acidification.

Table 25
Average LSC Class for Each of the Hazards Assessed

Map Unit	Water	Wind	Structure	Acidifi-cation	Salinity	Water-logging	Shallow	Mass	Land and Soil Capability
Sodosol	1.0	1.0	4.0	4.0	1.4	5.6	2.0	1.4	5.6
Note: Grey shading indicates the most limiting hazard									

6.5.3 Management and Mitigation Measures

The Proponent would continue to implement the following soil and land capability management and mitigation measures.

- Strip approximately 60cm of soil for use during rehabilitation operations.
- Ensure that there is adequate soil resource to construct the desired profile.
- Strip and stockpile the soil in a way that neither pulverises the soil nor compacts the soil. Pulverising soil essentially means during it into dust.
- Stockpile the soil no more than 2m high, vegetate the stockpiles to minimise erosion and maintain some biological activity in the soil.
- Spread gypsum at a rate of 5t/ha on the surface of stockpile to aid in water infiltration and plant growth in the stockpile.
- Before spreading soil, prepare the subgrade so that it is level enough to guarantee adequate soil thickness. Then loosen the subgrade to allow rocks and water to penetrate this layer.
- Amend the soil if required as it is spread through the addition of lime, fertiliser and organic matter as required.
- Consolidate but do not compact the soil as it is respread.
- Plant appropriate species and use agronomic practices to maximise the chance of successful plant establishment.
- Monitor all phases of this process and take steps to overcome shortcoming that the monitoring reveals.

6.5.4 Assessment of Impacts

Potential impacts on soil resources as a result of the Proposed Modification are associated with temporary disturbance of land during construction and operation and of the RSF2. The potential types of impacts on soil properties may include the following.

- Soil compaction by heavy vehicles and machinery during the soil stripping, stockpiling and respreading.
- Loss of soil resource when areas of soil are removed by construction of RSF2.
- Soil erosion when topsoil is disturbed and when surface drainage is modified by reshaping the land.
- Soil contamination from hydrocarbon spills and leaching of chemicals used in the processing of gold.

Restoration of land will require the formation of a functional soil profile and a landform with slope to drain excess water. The soil profile should supply water, nutrients, aeration and anchorage for plants, as well as some through drainage of water.

Table 26 presents the proposed growth medium establishment procedures to be implemented during rehabilitation operations and the anticipated land and soil capability class that may be achieved on the final landform. Based on this assessment, SSM determined that with appropriate management of soil resources, the final landform may have a greater land capability classification (average Class 4) than the current landform (average Class 6).

Table 26
Proposed Rehabilitation and Post-mining Land and Soil Capability

Area	Disturbance and Rehabilitation	Estimated post-mining LSC class
Tailings Storage Facility- top surface	Cover tailings with trafficking layer, then an impermeable clay barrier followed by 45cm of subsoil and 15cm of topsoil.	**Land and Soil Capability Class 4** Soil requirements include: Topsoil texture sandy loam or finer, stable topsoil structure, soil depth > 50 cm, topsoil pHCaCl2 > 4.7, waterlogging occurs less often than 2 to 3 months every 2 to 3 years, medium wind exposure.
Tailings Storage Facility- embankments	Earthen embankments with 10 cm topsoil cover and 25 cm subsoil over a rock core.	**Land and Soil Capability Class 6** Due to steep batter slope.
Topsoil stockpiles	Topsoil will be stockpiled, then removed and respread.	**Land and Soil Capability Class unchanged** The Land and Soil Capability Class should be the same as it was before disturbance provided some amendments are added to restart biological processes that occur in topsoil, but not subsoil.

6.6 HERITAGE

6.6.1 Introduction

The Heritage Assessment was prepared by OzArk Environmental and Heritage Management Pty Limited (OzArk). The assessment, referred to hereafter as OzArk (2020), is presented as **Appendix 7**. The heritage study area comprised the full Extended TGO Mine Site. This subsection presents an overview of the results of that assessment.

OzArk (2020) was prepared in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010a) and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011).

6.6.2 Aboriginal Community Consultation

Aboriginal community consultation was undertaken in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010b). OzArk (2020) includes a full description of the consultation undertaken, however, the following provides an overview of that program.

- Stage 1 – Identification of Aboriginal parties.

  OzArk placed an advertisement in the Daily Liberal and contacted a range of government agencies on 26 March 2020 requesting those Aboriginal groups or

persons with cultural knowledge to register their interest in the Proposed Modification. The following registered their interest and are referred to hereafter as RAPs.

- Peak Hill Local Aboriginal Land Council (LALC)
- Tubba-Gah Aboriginal Corporation
- Paul Brydon
- Bogan River Peak Hill Wiradjuri Aboriginal Corporation
- Jay and Warren Daley

Two respondents requested to remain anonymous and for the purposes of this document are referred to as Stakeholder 1 and Stakeholder 2

- Stage 2/3 – information about the Proposed Modification and request for cultural knowledge

  On 29 April 2020, all RAPs were sent information about the Proposed Modification and a draft of the survey methodology, with an updated survey methodology sent to all RAPs on 30 June 2020. No comments were received.

- Stage 4 – comments on the draft Heritage Assessment Report.

  A draft of OzArk (2020) was provided to all RAPs on 5 November 2020, with responses requested by 3 December 2020. No responses were received.

The following RAPs participated in the fieldwork.

- Karryn Keed - Bogan River Peak Hill Wiradjuri Aboriginal Corporation
- Lyn Bell - Peak Hill Local Aboriginal Land Council
- Jay and Warren Daley.

6.6.3 Local Setting and Environmental Performance

The following subsection provides an overview of the local setting, specifically in relation to Aboriginal and historical heritage.

- Geology – Landforms which typically comprise outcropping rock (i.e. hills and ridges), are not present within the Extended TGO Mine Site and therefore no sources of stone procurement for tool manufacture have been identified.
- Soils – The soils that characterise the majority of the Extended TGO Mine Site are relatively stable. However, repeated ground surface disturbance by ploughing; grazing and vegetation clearing will have allowed the soil to become more susceptible to erosion.
- Vegetation – Mature, native species which would have been present within the Extended TGO Mine Site in antiquity would have provided resources for Aboriginal people in the past, however, resources likely to have supported a large population of people would have been present closer to the banks of more

permanent water sources including the Bogan River. Given the near total absence of mature native vegetation, culturally modified trees (scarred or carved) are unlikely to be present.

- Climate – The climate would not have been an impediment to year-round occupation.
- Land use – High levels of ground surface disturbance exist throughout the Extended TGO Mine Site, with little undisturbed land considered to remain. Activities such as vegetation clearance, cultivation and grazing would have displaced Aboriginal objects and are likely to have reduced the potential for subsurface archaeological material. However, disturbance at a given location does not necessarily mean that there will be no cultural material present, as often a disturbed context will reveal objects which may have previously been at a subsurface level. As noted above, initial vegetation clearing would also have removed culturally modified trees.

Finally, the Proponent notes that a range of Aboriginal objects were identified within the TGO Mine Site prior to construction of the Mine in 2012 and that those objects were removed and appropriately managed in consultation with the local Aboriginal community. Indeed, the Proponent has a long history of working closely with the local Aboriginal community.

6.6.4 Management and Mitigation Measures

The Proponent would continue to implement the following heritage-related management and mitigation measures.

- Continue to implement the approved *Cultural Heritage Management Plan*. That plan would be reviewed following receipt of development consent and, if required, it would be revised.
- Ensure that all land and ground disturbance activities is limited to within the Extended TGO Mine Site.
- Ensure that all workers undergo cultural heritage induction as per Sections 8 and 16 of the *Cultural Heritage Management Plan* to ensure that all recognise Aboriginal artefacts and are aware of the legislative protection of Aboriginal objects under the *National Parkes and Wildlife Act 1974*.
- Should Aboriginal artefacts or human skeletal material be uncovered during works within the study area, all work should cease and Section 7.3.3 of the *Cultural Heritage Management Plan* should be followed.

The Proponent notes that, should the Proposed Modification be approved, the CHMP would be required under Schedule 5, Condition 5(d) of the Project Approval, to be reviewed and if necessary revised. The recommendations made by OzArk would be incorporated into the revised CHMP, where required, at that time.

6.6.5 Assessment of Impacts

6.6.5.1 Introduction

OzArk (2020) undertook an assessment of both Aboriginal and historic heritage within the Extended TGO Mine Site. The following subsections provide a summary of the survey methodology and results.

6.6.5.2 Aboriginal Heritage

Desktop Database Search

A desktop search was conducted on the following databases to identify any potential previously recorded heritage within the Extended TGO Mine Site. The results of this search are summarised in **Table 27** and presented in detail in Appendix 2 of OzArk (2020).

The search of the Aboriginal Heritage Information Management System (AHIMS) database on 14 April 2020 returned 98 records for Aboriginal heritage sites within a 30km x 30km search centred over the TGO Mine Site. None of the 98 sites identified are located within the Extended TGO Mine Site. Site 31-6-0036 has been erroneously registered with AHIMS and plots relatively close to the Extended TGO Mine Site when it is in fact in the Menindee Lakes area. This site was omitted from further analysis and it will be considered that the search area contains a total of 97 previously recorded sites.

Table 27
Aboriginal Heritage Database Serch Results

Name of Database Searched	Date of Search	Type of Search	Comment
Commonwealth Heritage Listings	1/7/2020	Narromine LGA	No places listed on either the National or Commonwealth heritage lists are located within the Extended TGO Mine Site.
National Native Title Claims Search	1/7/2020	NSW	No Native Title Claims cover the Extended TGO Mine Site.
AHIMS	14/4/2020	30 x 30 km centred on the Extended TGO Mine Site	98 sites were returned in the designated search. None of these are located within the Extended TGO Mine Site.
Local Environmental Plan (LEP)	1/7/2020	Narromine LEP of 2011	None of the Aboriginal places noted occur near the Extended TGO Mine Site.
Source: OzArk (2020) – Table 5-4			

As shown in **Table 28**, culturally modified trees are the dominant recorded site type in the local area. Of the culturally modified trees, 66 are scarred trees and seven are carved trees. Two of the carved trees have been recorded in association with potential burials.

Table 28
AHIMS Database Results

Site Type	Number	% Frequency
Culturally modified trees (scarred or carved)	73	75%
Stone artefact scatter	12	13%
Isolated finds	8	8%
Culturally modified trees; burial	2	2%
Stone artefact scatter with PAD	1	1%
Stone quarry with artefacts	1	1%
Total	**97**	**100%**
Source: OzArk (2020) – Table 5-5		

Predictive Model

Based on knowledge of the environmental contexts of the Extended TGO Mine Site and a desktop review of the known local and regional archaeological records, the following predictions are made concerning the probability of those site types being recorded within the Extended TGO Mine Site.

- Isolated Finds - As isolated finds can occur anywhere, particularly within disturbed contexts, it is predicted that this site type could be recorded within the Extended TGO Mine Site.
- Open Artefacts - Artefact scatters comprise only 14% of recorded sites within 15 km of the Extended TGO Mine Site, however, according to OzArk (2016), this site type is the most likely site to be recorded within the plains landscape unit which encompasses the Extended TGO Mine Site.
- Aboriginal Scar Trees – Vegetation within the Extended TGO Mine Site includes remnant eucalypt species. This site type therefore may be encountered, and it is also noted that this site type was the predominant site type recorded in landforms immediately north of the Extended TGO Mine Site that are distant from water (OzArk 2003 and OzArk 2011).
- Quarry sites and stone procurement sites – One quarry site has been identified within 12 km of the Extended TGO Mine Site. This site type is not considered likely to be recorded within the Survey Area due to a lack of geological formations.
- Heaths/Ovens – This site type is considered possible in areas where A-Horizon soils are relatively undisturbed. However, given the high levels of disturbance across the Extended TGO Mine Site, the likelihood of identifying this site type is significantly reduced.
- Bora/Ceremonial Sites – This site type does not necessarily follow landform predictability and are, overall, a rare site type with a low likelihood of being present and remaining extant.
- Burials - Potential burials have been identified in the local area in association with carved trees along the banks of the Bogan River. These sites are more likely to be found on elevated sandy contexts or in association with rivers and major creeks. No such landscape features exist within the Extended TGO Mine Site and therefore burials are unlikely to occur.

Field Survey Results

A field survey was completed at the Extended TGO Mine Site on 1 September 2020 by two OzArk archaeologists and four Aboriginal Site Officers. The majority of the Extended TGO Mine Site was assessed by systematic transects with surveyors spaced approximately 15m to 20m apart.

No Aboriginal sites were recorded as a result of the field assessment. Furthermore, no landforms within the Extended TGO Mine Site were identified as having potential to contain further, subsurface archaeological deposits due to the high level of disturbance and the undifferentiated landforms present.

6.6.5.3 Historical Heritage

Desktop Database Search

A desktop search was conducted on the following databases to identify any potential previously recorded heritage within the Extended TGO Mine Site. The results of this search are summarised in **Table 29**.

Table 29
Historic Heritage Database Search Results

Name of Database Searched	Date of Search	Type of Search	Comment
National and Commonwealth Heritage Listings	1/7/2020	Narromine LGA	No places listed on either the National or Commonwealth heritage lists are located within the Extended TGO Mine Site.
State Heritage Listings	1/7/2020	Narromine LGA	No items on the SHR are located within or near the Extended TGO Mine Site.
Section 170 Heritage and Conservation Register	1/7/2020	Narromine LGA	No items on the Section 170 Register are located within or near the Extended TGO Mine Site.
Local Environmental Plan (LEP)	1/7/2020	Narromine LEP of 2011	None of the listed items occur near the Extended TGO Mine Site.
Source: OzArk (2020) – Table 8-1			

A search of the Heritage Council of NSW administered heritage databases and the Narromine LEP returned no records for historical heritage sites within the designated search area.

Despite no historic heritage sites being listed within or near to the Extended TGO Mine Site, two historic heritage sites which have been assessed as having local heritage values are located near to the Extended TGO Mine Site: the village of McPhail and the McPhail Mine (OzArk 2011 and OzArk 2020). The closest of these two sites is the village of McPhail, 300m to the south east of the Extended TGO Mine Site. Due to the proximity of local historic heritage sites to the Extended TGO Mine Site there is a possibility for the occurrence of historic heritage sites within the Extended TGO Mine Site which might be associated with some historic themes related to these sites (i.e. the development of local and/or regional economy through channels such as mining or agriculture).

Field Survey Results

There were no historical heritage sites identified within the Extended TGO Mine Site as part of the assessment, in addition.

- No landform within the Extended TGO Mine Site were identified as having potential to contain further, subsurface archaeological deposits due to the high level of disturbance and the undifferentiated landforms present.
- Due to the proximity of local historic heritage sites to the Extended TGO Mine Site it was assessed that there was a possibility for the occurrence of historic heritage sites within the Extended TGO Mine Site and that it might be associated with some historic themes (i.e. the development of local and/or regional economy through channels such as mining or agriculture). However, no historic heritage sites were identified as a result of the field survey.

The Proponent contends that, the assessment completed for both Aboriginal and historical heritage was carried out in a manner that provided for the identification of any artefacts, sites or other items of significance within the TGO Mine Site. Given that none were identified, there are likely to be no impacts to Aboriginal or historical heritage as a result of the Proposed Modification.

6.7 SURFACE WATER

6.7.1 Introduction

The Surface Water Assessment has been prepared by RWC based on information presented in GHD (2020).

6.7.2 Local Setting and Environmental Performance

The Extended TGO Mine Site is largely flat, with the land surface sloping gently to the southwest. The elevation difference between the northeastern and southwestern corners of the Extended TGO Mine Site is approximately 4m over a distance of approximately 1.3km, implying an average slope of less than 1%. Surface water flows are typical overland, with shallow, indistinct drainage line in places.

The Proponent manages surface water within the TGO Mine Site based on the following classification.

- Clean water – water unaffected by mining operations. Clean water is permitted to flow around and through the TGO Mine Site via dedicated clean water diversions and is discharged to natural drainage.
- Dirty water – water with the potential to contain suspended sediment from disturbed sections of the TGO Mine Site. Dirty water is captured and stored in sediment basins prior to treatment and discharge or transfer to other storages within the TGO Mine Site.

- Raw water – water pumped to site for use for mining-related activities. This water is not permitted to be discharged from the TGO Mine Site.
- Mine water – water removed from the underground mine workings or stored within the open cuts. This water is not permitted to be discharged from the TGO Mine Site.
- Process water – water potentially contaminated with chemicals, including decant water with the Process Water Dam, Wyoming Central Dam and the Residue Storage Facility. This water is not permitted to be discharged from the TGO Mine Site.

Soils within the TGO Mine Site are highly dispersive and there have been a number of unplanned discharges of dirty water resulting from erosion of the clean water diversions within the TGO Mine Site. Each event has been reported to the Environment Protection Authority and the Proponent has invested substantial funds to remediate and rectify the issue.

No discharge of Mine or Process Water from the TGO Mine Site has occurred.

6.7.3 Management and Mitigation Measures

The Proponent would continue to implement the following surface water-related management and mitigation measures.

- Continue to implement the approved *Water Management Plan*. That plan would be reviewed following receipt of development consent and, if required, it would be revised.
- Maintain clean and dirty water diversions and sediment basins in accordance with the requirements of *Managing Urban Stormwater*. In particularly, ensure that clean water is prevented from entering the Extended TGO Mine Site and that other classes of water are retained within the disturbed areas
- Ensure that Mine and Process Water are not permitted to be discharged from the TGO Mine Site.
- Ensure that Dirty Water is only discharged from licenced discharge points following treatment and testing and only once the water quality criteria identified in EPL20169 have been achieved.
- Ensure that water is transferred from storage dams to other storages within the TGO Mine Site as described in Table 2.1 of the *Water Management Plan.*

6.7.4 Assessment of Impacts

The Proponent 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 RSF2 would flow or be pumped to the Process Water dam or the Wyoming Central Dam. The water balance prepared by GHD (2020) indicated that the Proposed Modification would not result in an increased risk of discharge of decant water from the contaminated water management system.

- There would be no material 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.

6.8 GROUNDWATER

6.8.1 Introduction

The groundwater assessment has been prepared by RWC based on information presented in GHD (2020).

6.8.2 Local Setting and Environmental Performance

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

- Shallow alluvium

  Shallow alluvium (less than 10m to 20m deep) dissects the plains surrounding the TGO Mine Site along creek flow paths. While not observed to be continuous across the TGO Mine Site, the alluvium appears to be more persistent along Gundong Creek. These aquifers are recharged from rainfall infiltration. Groundwater is of relatively good quality, however, yields are relatively low and dependent on rainfall.

- Deep alluvium

  Occurring as alluvial / sandy clay and saprolite clay up to 70m deep in the vicinity. The hydraulic conductivity of the upper clay is generally low to very low with DE Cooper & Associates (2011) reporting hydraulic conductivities of 2.3×10^{-8} to 10^{-9} m/s from falling head tests. Groundwater yields are 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 typically underlain by shale, siltstone and chert with several fractured rock aquifers in the vicinity of the TGO Mine Site (up to 100m below the deep alluvium layer). Groundwater yields range from nil to 3L/s, generally less than 1.5L/s, and water quality is poor with high salinity (electrical conductivities up to approximately 30 000µS/cm). This groundwater would be classified as less productive fractured rock groundwater under the NSW Aquifer Interference Policy.

Regional groundwater monitoring is undertaken at seven locations within and surrounding the TGO Mine Site. The 2018 Annual Review (TGO, 2018) identified that groundwater levels and quality within the monitored bores is not affected by mining-related activities.

In addition, shallow groundwater in the vicinity of RSF1 is monitored in 10 shallow piezometers located at the toe of RSF1. GHD (2019) undertook a review of that data, and the results may be summarised as follows.

- Groundwater chemistry results did not indicate geochemical changes in shallow groundwater consistent with influence from residue decant water.
- Groundwater levels in the vicinity of the Residue Storage Facility increased independently of rainfall since commencement of the Mine. GHD (2019) indicated that this was unlikely to be a result of seepage from the Residue Storage Facility. Rather the increase was attributed 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 Residue Storage Facility resulting in compression of the underlying aquifer and increasing groundwater levels around the perimeter.
  - Seepage from nearby sediment basins.

The Proponent notes that a geotechnical assessment of RSF2 is currently in progress, including testing to determine the natural permeability of the material that would underlie RSF2. However, given the proximity of the RSF1 to RSF2 and the similarity of the setting, similarly impermeable material is expected within RSF2.

6.8.3 Management and Mitigation Measures

The Proponent would continue to implement the following groundwater-related management and mitigation measures.

- Continue to implement the approved *Water Management Plan*. That plan would be reviewed following receipt of 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, including additional piezometers located around the perimeter of RSF2, and review resulting data to determine if the approved or proposed activities are adversely impacting on groundwater levels or quality.
- Implement the Trigger Action Response Plans identified in Section 8.2 of the *Water Management Plan.*

6.8.4 Assessment of Impacts

As identified in Section 2.2.8 GHD (2020) undertook a seepage analysis of Stages 1 and 2 of RSF2. In summary, GHD (2020) concluded the following.

- The permeability of the underlying strata under RSF2 is likely to be between approximately 2.3 x 10^{-8}m/s to 1 x 10^{-9}m/s.
- RSF2 poses a low risk of seepage-related impact to groundwater in the vicinity of RSF2.

6.9 VISUAL AMENITY

6.9.1 Local Setting and Environmental Performance

With the exception of the Mine, 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 consisting of land used for agriculture, transportation or other infrastructure, along with areas of remnant native vegetation. Outlooks from residences within the village of Tomingley include views of surrounding buildings, established trees and smaller vegetation, along with the Newell Highway and other local roads.

Notwithstanding the above, the approved 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 RSF1 is primarily visible from the south to the northwest, with views from the north to the southeast obscured by WRE1 and WRE2.

6.9.2 Assessment of Impacts

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

- The proposed RSF2, would reach a height of 272m AHD or 9m above the natural land surface. This would be insignificant in comparison to the existing visual footprint of the Mine and the approved RSF1 which has an approved maximum elevation of 286.5m, or 14.5m higher than the proposed height of RSF2.
- RSF2 would not be visible from the north.
- The closest residence to RSF2 to the southwest would be located at a distance of approximately 1.4km. RSF2 Stage 2, would reach a height of 7m above the natural ground level and would be below the sight line of the existing RSF1, resulting in a negligible change to the visual amenity from this residence.

6.10 SOCIAL AND ECONOMIC

6.10.1 Local Community and Economic Contributions

The Proponent has been operating the Mine since January 2014, but has been intimately involved in the surrounding community since the 1990's when it was operating the nearby Peak Hill Gold Mine. In summary, the communities surrounding the TGO Mine Site includes the following.

- Residents of the village of Tomingley

  The Proponent understands that approximately 30 people live in the village of Tomingley.

- Surrounding rural residences.

  The area surrounding the TGO Mine Site is a rural area with agricultural properties, typical with one or two houses on each property. These are typically occupied by residents who rely on the properties for some of all of their income.

- Surrounding villages and towns.

  The TGO Mine Site is surrounded by a number of other villages and towns, including the following.

  – Peak Hill, located approximately 18km to the south on the Newell Highway;

  – Narromine, located approximately 38km to the north on the Tomingley – Narromine Road;

  – Dubbo, located approximately 57km to the northeast on the Newell Highway; and

  – Parkes, located approximately 67km to the south on the Newell Highway.

Approximately 127 of the Proponent's 133 staff live within the above towns or surrounding areas, contributing approximately $10.3 million in total combined salaries and wages during the 2018/2019 financial year. In addition, during that period the Proponent spent between $4 million and $5 million with businesses based within the above towns and surrounding areas. As a result, the Proponent is a substantial contributor to the economy of the Orana Region.

6.10.2 Management and Mitigation Measures

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

- Engage the community surrounding the TGO Mine Site in regular dialogue in relation to the ongoing operation of the Mine and maintain an "open door" policy for any member of the community who wishes to discuss any aspect of the Project.
- Proactively and regularly consult with those residents most likely to be adversely impacted by the Mine.
- Continue to support community organisations, groups and events, as appropriate, and review any request by a community organisation for support or assistance throughout the life of the Project.[5]
- Implement a comprehensive and targeted environmental monitoring program.[6]
- Actively engage with the existing Community Consultative Committee.[7]

[5] Details in relation to the existing Tomingley Community Fund may be obtained from http://www.alkane.com.au/projects/tomingley-gold-operations/community-resources/tgo-community-fund/.
[6] Details in relation to the ongoing environmental monitoring results may be obtained from http://www.alkane.com.au/projects/tomingley-gold-operations/tgo-environment/environmental-reports/.
[7] Minutes of the committee's meetings and contact details for its members are available from http://www.alkane.com.au/projects/tomingley-gold-operations/community-resources/consultative-committee/

- Advertise and maintain a community complaints telephone line (02 6865 6116).
- Give preference when engaging new employees, where practicable, to candidates who live within the Narromine, Dubbo or Parkes Local Government Areas.
- Encourage the involvement of the local Aboriginal community in the workforce.
- Encourage and support participation of locally based employees and contractors in appropriate training or education programs that would provide skills and qualifications that may be of use following completion of the Project.
- Give preference, where practicable, to suppliers of equipment, services or consumables located within the Narromine, Dubbo or Parkes Local Government Areas.
- Assist community members and others, as appropriate, to establish complimentary businesses in the vicinity of the TGO Mine Site.
- Assist surrounding Councils, namely the Narromine, Dubbo and Parkes Councils, to promote and encourage economic development.
- Make available excess water from the water supply bores and pipeline to Narromine Shire Council for supply to the residents of Tomingley.
- Ensure that infrastructure and services installed for the Project, including the water supply bores and pipeline, electricity transmission line, appropriate buildings and hardstand areas, remain available for alternative uses following completion of the Project (provided that such uses are consistent with the final land uses identified in this document or any subsequent approval).
- Encourage and support, in consultation with the local community, the provision of services to the community. These may include health, education, transportation and other services.
- Continue to manage weeds, pests and bushfire risks in consultation with surrounding land owners.

6.10.3 Assessment of Impacts

Clause 12 of the Mining SEPP (see **Table 9**) requires that consideration be given to:

- the existing uses and approved uses of land in the vicinity of the development;
- the potential impact on the preferred land uses (as considered by the consent authority) in the vicinity of the development; and
- any ways in which the development may be incompatible with any of those existing, approved or preferred land uses.

The Proposed Modification would not modify or be incompatible with existing, approved uses of land within or surrounding the TGO Mine Site.

In addition, the Proposed Modification would enable the ongoing operation of the Mine until 31 December 2025, a further three years beyond the point at the Mine would otherwise cease to operate. This would ensure that the following benefits, based on actual payments for the 12 months to June 2019, would continue.

- Direct employment for approximately 133 people, with wages and salaries of approximately $10.3 million per year.
- Injection of approximately $4 million to $5 million per year into the local and regional economy, with an additional of $7 million to $8 million into the State and Federal economies. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities.
- Ongoing support for training and education of employees and others in the vicinity of the TGO Mine Site, including the Aboriginal community.
- Continued support for local sporting and other organisations.

6.11 ENVIRONMENTAL ASPECTS WHICH WOULD BE UNAFFECTED

Table 30 presents the environmental aspects which would be unaffected by the Proposed Modification, and a justification for that conclusion.

Table 30
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.
Traffic and transportation	The Proposed Modification would result in immaterial additional heavy vehicle movements to the TGO Mine Site during construction, associated with the mobilisation and demobilisation of equipment.
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.

7. EVALUATION OF MERITS

7.1 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

7.1.1 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 the Proposed Modification, the Proponent and GHD have adopted an anticipatory approach to impacts by undertaking an analysis of the risks posed by the Proposed Modification (see Appendix C of GHD (2020)) to guide the design of Stages 1 and 2 of RSF2. Examples of matters relating to the precautionary principle that were considered during the various stages of the Proposed Modification are listed below.

- The design of the Proposed Modification 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 was reviewed by GHD to ensure that it was not resulting adverse environmental impacts in order to inform the design of RSF2.
- The design of RSF2 was chosen to minimise disturbance to land not already the subject of prior disturbance. In particular, the Proponent has elected to construct RSF2 immediately adjacent to RSF1 to minimise the area to be disturbed and to maximise the potential for future lifts of the facility, pending receipt of subsequent approvals.
- Recognised experts in the fields of biodiversity, noise, air quality, soils and heritage were engaged by the Proponent to ensure that potential adverse impacts were well under stood and, therefore, were capable of being mitigated to the greatest extent practicable.

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.

7.1.2 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 Mine as a result of the Proposed Modification.

7.1.3 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 2.2.3 and Section 6.2, the Proposed Modification would result in the disturbance of an additional approximately 85ha of land adjacent to the approved RSF1. As a result of the increased disturbance area, the proponent would retire.

- 103 ecosystem credits for PCT82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion.
- 49 ecosystem credits for PCT201 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion.

Therefore, the Proposed Modification would not result in any unacceptable reduction in biodiversity values or ecological integrity.

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

7.2 STRATEGIC CONSIDERATIONS

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.

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 STATUTORY CONSIDERATIONS

The Proposed Modification is made under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* and the Minister for Planning, or their delegate, or the Independent Planning Commission, is the consent authority. Sections 4.4 and 4.5 identify the preconditions to granting approval and the matters that must be considered by the Consent Authority prior to doing so. In summary, however, the Proposed Modification meets all preconditions to granting of development consent and this application addresses all matters to be considered by the Consent Authority.

7.4 COMMUNITY CONSIDERATIONS

The Proposed Modification would not adversely impact on the community. Indeed, the Proposed Modification would extend operation of the Mine until 31 December 2025, with the resulting community benefits being extended over that time. In addition, as identified in Sections 3.2 and 5.2, the community have been provided with ample information and opportunity to communicate in relation to the Mine, the Proposed Modification and associated activities and no concerns or issues have been raised.

7.5 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.

- Biodiversity – The Proposed Modification would result in the disturbance of an additional approximately 85ha of land adjacent to RSF1. As a result of the increased disturbance area, the proponent would retire the following ecosystem credits through payment into the Biodiversity Conservation Trust.
  - 103 ecosystem credits for PCT82 - Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion.
  - 49 ecosystem credits for PCT201 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion.

  No species credit species were identified within the Extended TGO Mine Site.
- Noise – the Proposed Modification would result in minor increases in noise emissions associated with the construction phase RSF2, however, the Project would continue to satisfy the relevant noise criteria at all assessed receivers and for each noise assessment group under standard meteorological. In addition, MAC (2020) notes that the predicated noise levels are within +5dB of the proposed very noise enhancing conditions and, thus, are also compliant.

- Air Quality – the Proposed Modification would have a negligible impact on air quality surrounding the Extended TGO Mine Site for the following reasons.
  - The Proposed Modification would result in a negligible additional 1.4% emission of particulate material when compared with the approved MOD3 development.
  - The Proposed Modification would result in a negligible change in particulate matter received at surrounding residences.
- Soils – the Proposed Modification would result in disturbance of poorly drained soils with an average Land and Soil Capability Class of 6, or low capability land with very high limitations for high impact agricultural land uses. However, the soil materials are suitable for stripping and stockpiling and, assuming that appropriate amelioration measures are implemented, the Land and Soil Capability Class of the final RSF2 landform is likely to be Class 4 or moderate land capability land.
- Heritage – there were no Aboriginal or historical heritage sites identified within the extended TGO Mine Site and no heritage-related impacts are anticipated..
- Surface water – the Proposed Modification would not result in substantial changes to the approved water management system within the TGO Mine Site, nor would the existing risk of discharge of contaminated water be increased.
- Groundwater – the existing RSF1 is not resulting in adverse impacts to shallow groundwater in the immediate vicinity of the Residue Storage Facility and Proposed Modification is not expected to increase the risk of such an event occurring.
- Visual amenity - the RSF2 would not be result in an unacceptable change to the visual amenity from publicly accessible vantage points surrounding the TGO Mine Site because it would be 14.5m lower than the immediately adjacent RSF1. Furthermore, the closest residence to RSF2 would be located at a distance of approximately 1.4km from the facility.

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

7.6 SOCIO-ECONOMIC CONSIDERATIONS

The Proposed Modification would result in:

- continued employment of local residents;
- continued expenditure by Mine personnel in commercial facilities of Tomingley and other towns;
- continued contribution to the Narromine Shire and surrounding economies through payments for goods and services and contributions via taxes, royalties, rates and the VPA;
- the indirect flow-on benefits associated with the afore-mentioned employment and economic contributions; and
- extend these benefits over an additional three years.

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.

7.7 THE PUBLIC INTEREST

In concluding this document, the Proponent contends that the Proposed Modification would be in the public interest for the following reasons. Each of the benefits identified would continue for a further three years longer than would otherwise occur should additional residue storage not be available.

- Direct employment for approximately 133 people, with wages and salaries of approximately $10.3 million per year.
- Injection of approximately $4 million to $5 million per year into the local and regional economy, with an additional of $7 million to $8 million into the State and Federal economies. This expenditure is likely to generate additional economic activity and flow on effects, providing further employment opportunities.
- Payment of approximately $3.1 million in taxes, royalties, rates and other contributions.
- Continued economic activity in a rural area in a time of significant drought and hardship for the surrounding community.
- Continued extraction of a State-owned resource in a manner that does not result in significant additional environmental impacts.

8. REFERENCES

AREA Environmental Consultants and Communication Pty Limited (AREA) (2020). *Biodiversity Development Assessment Report* (BDAR). Prepared on behalf of Tomingley Gold Operations Pty Ltd.

Australian Bureau of Statistics (2019). https://itt.abs.gov.au/itt/r.jsp?RegionSummary&region=10503&dataset=ABS_REGIONAL_ASGS2016&geoconcept=ASGS_2016&measure=MEASURE&datasetASGS=ABS_REGIONAL_ASGS2016&datasetLGA=ABS_REGIONAL_LGA2018&regionLGA=LGA_2018&regionASGS=ASGS_2016 – Accessed 4 December 2019.

Australian National Committee on Large Dams (ANCOLD) (2019). *Guidelines on Tailings Dams*.

Banks, R., Wendling, L., Basford, K., Ringrose-Voase, A., & Banks, V. (2020). *Beneficial soil profile differences associated with tropical grass pastures on sodic texture contrast soils in Northern New South Wales*. Soil Research, 58(2), 207-218.

DE Cooper & Associates (2011). *Tomingley Gold Project, Residue Management, Design Report, Rev 1, August 2011*.

Department of Environment, Climate Change and Water NSW (DECCW) (2010b). *Aboriginal Cultural Heritage Consultation Requirements for Proponents*.

Department of Environment, Climate Change and Water NSW (DECCW) (2011). *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales*.

Department of Environment, Climate Change and Water NSW (DECCW) (2010a). *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*.

GHD Pty Ltd (GHD) (2019). *Residue Storage Facility Stage 7-9 Concept Design*. Prepared on behalf of Tomingley Gold Operations Pty Ltd.

GHD Pty Ltd (GHD) (2020). *TGO RSF 2 Concept Design Report - November 2020*. Prepared on behalf of Tomingley Gold Operations Pty Ltd.

Isbell, R., & National Committee on Soil and Terrain (NCST) (2016). *The Australian Soil Classification. 2nd Edition*. CSIRO Publishing, Clayton South, Australia

Jacquier, D., & Seaton, S. (2012). *Spline Tool for estimating soil attributes at standard depths*. Distribution notes. CSIRO Canberra.

Joint Ore Reserves Committee (JORC) (2012). *Australasian Code for Reporting of Exploration Results, Mineral Resource sand Ore Reserves*

Landcom (2004). *Managing Urban Stormwater*.

Muller Acoustic Consulting Pty Ltd (MAC) (2015). *Noise and Blasting Assessment.* Prepared on behalf of Tomingley Gold Operations Pty Ltd.

Muller Acoustic Consulting Pty Ltd (MAC) (2020). *Noise Assessment Report*.

National Committee on Soil and Terrain (NCST) (2009). *Australian Soil and Land Survey Field Handbook. (3rd ed.)*. CSIRO Publishing, Collingwood, VIC, Australia.

Northstar Air Quality Pty Ltd (Northstar) (2020). *Air Quality Impact Assessment (AQIA).* Prepared on behalf of Tomingley Gold Operations Pty Ltd.

Office of Environment and Heritage (OEH) (2011). *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*.

Office of Environment and Heritage (OEH) (2012). *Land and Soil Capability Assessment Scheme – Second Approximation*.

OzArk Environment & Heritage (OzArk) (2003). *Newell Highway Pavement Rehabilitation at Tomingley*. Prepared on behalf of Roads and Traffic Authority.

OzArk Environment & Heritage (OzArk) (2011). *Tomingley Gold Project Cultural Heritage Assessment.* Prepared on behalf of Alkane Resources Pty Limited.

OzArk Environment & Heritage (OzArk) (2016). *Central West Local Land Services Travelling Stock Reserves Study*. Prepared on behalf of Central West Local Land Services.

OzArk Environmental and Heritage Management Pty Limited (OzArk) (2020). *Aboriginal Cultural and Historic Heritage Assessment*. Prepared on behalf of Tomingley Gold Operations Pty Ltd.

Pacific Environment Limited (PEL) (2011). *Air Quality Assessment for the Tomingley Gold Project.*

Pacific Environment Limited (PEL) (2015). *Tomingley Gold Mine Modification - Air Quality*.

Roach, I. C. (2007). *Tomingley 1:25 000 Regolith-Landforms Map, central west New South Wales.* CRC LEME Open File Report 233, 31 pp.

Sherwin, L. (1996). *Narromine 1: 250,000 Geological Sheet SI/55-3: Explanatory notes*. Geological Survey of New South Wales, Sydney, 104 pp.

SLR Consulting Australia Pty Ltd (SLR) (2011). *Noise and Blasting Assessment.* Prepared for the Tomingley Gold Project.

Tomingley Gold Operations Pty Ltd (TGO) (2018). *Annual Review 1 January – 31 December 2018.*

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