Appendix 14

Site Water Balance

prepared by

GHD Pty Ltd

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Site Water Balance Assessment

Tomingley Gold Extension Project

Tomingley Gold Operations Pty Ltd

18 November 2021

→ **The Power of Commitment**

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Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	J M Macatanong	T Tinkler		S Gray		18/11/21

The Power of Commitment

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1. Introduction

1.1 Background

Tomingley Gold Operations Pty Ltd (the Applicant) is the operator of Tomingley Gold Operations (TGO), an existing gold mine located in Central Western NSW. Operations at TGO are undertaken in accordance with the requirements of development consent MP 09_0155. Tomingley Gold Operations Pty Ltd is a subsidiary of Alkane Resources Ltd. TGO is located near the village of Tomingley, approximately 50 km southwest of Dubbo and north of Peak Hill (refer to Figure 1-1).

The Applicant is proposing additional or modified TGO operations, plus extension of open cut and underground mining, at the San Antonio and Roswell Deposits (SAR) about 2 km south of TGO, hereafter referred to as SAR (refer to Figure 1-2). Collectively, TGO and SAR are referred to as the Tomingley Gold Extension Project (the Project).

GHD Pty Ltd (GHD) was engaged by Tomingley Gold Operations Pty Ltd to prepare a site water balance assessment (SWBA) for the Project). This assessment forms part of an environmental impact statement (EIS) to support a State significant development (SSD) application under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) for the Project.

1.2 Purpose

This report has been prepared to support the EIS for the Project. The objective of this assessment is to quantify the water balance over the life of the Project, including inflows, outflows and net change in storage. This report is only intended to form a technical appendix to the EIS for the Project and must be read only as part of the EIS.

1.3 Scope and limitations

The scope of work for this assessment is:

– Collation and review of data relating to the water balance for the Project.
– Update the existing GoldSim site water balance model for TGO to reflect existing and proposed conditions over the life of Project.

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

GHD otherwise disclaims responsibility to any person other than Tomingley Gold Operations Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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

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

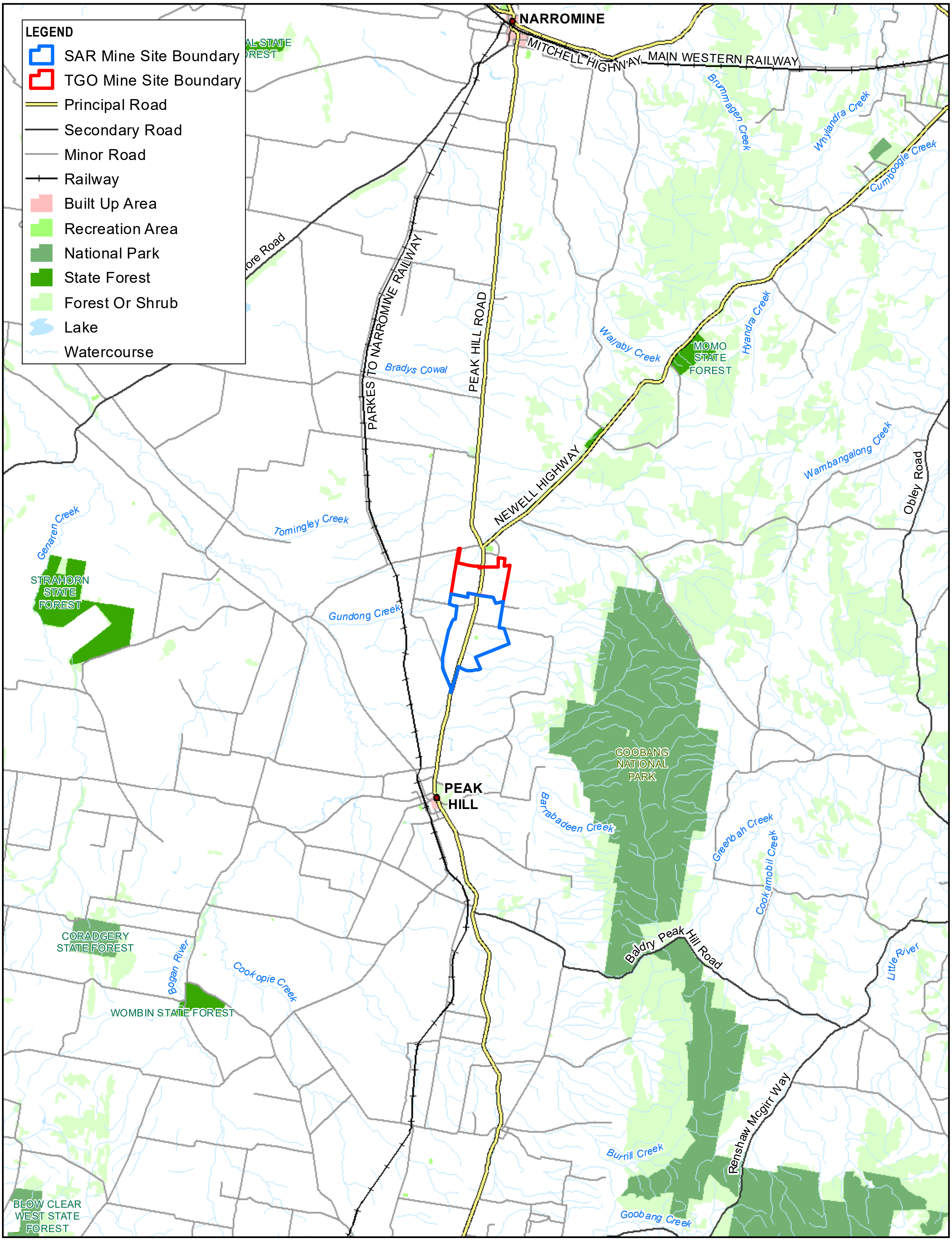
1.4 Project description

The Project comprises two components as follows:

– Approved TGO mining operations. These activities are undertaken in accordance with development consent MP 09_0155. The approved activities would continue under any new development consent, with MP 09_0155 to be surrendered following receipt of the new development consent and all required approvals for the Project. The approved activities include the following:
  - Extraction of ore and waste rock from four open cuts, with underground mining beneath three of those open cuts.
  - Construction of three out-of-pit waste rock emplacements and one in-pit emplacement.
  - 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 1.5 million tonnes per annum (Mtpa).
  - Construction and use of two residue storage facilities comprising Residue Storage Facility 1 (to Stage 9 or a maximum elevation of 286.5 m AHD) and Residue Storage Facility 2 (to Stage 2 or a maximum elevation of 272 m AHD).
  - Construction and use of ancillary infrastructure.

– The proposed SAR operations and additional or modified TGO operations, including the following.
  - Realigned Newell Highway and Kyalite Road and associated intersections with Back Tomingley West Road and McNivens Lane and Kyalite Road overpass.
  - The SAR Open Cut and Underground Mine.
  - Construction of two waste rock emplacements, namely the Caloma and SAR Waste Rock Emplacement and backfilling of the associated open cuts.
  - The SAR Amenity Bund, Haul Road and Services Road between the SAR Open Cut and the Caloma 2 Open Cut.
  - Processing of ore from the SAR deposits using the approved Processing Plant at a maximum rate of 1.75 Mtpa.
  - Increased capacity for Residue Storage Facility 2, from Stage 2 to Stage 9, with a maximum elevation of 286 m AHD).
  - Associated surface and underground activities and infrastructure.

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



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Tomingley Gold Operations
Tomingley Gold Extension Project
Site Water Balance Assessment

Project No.	12560976
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Locality plan

FIGURE 1-1

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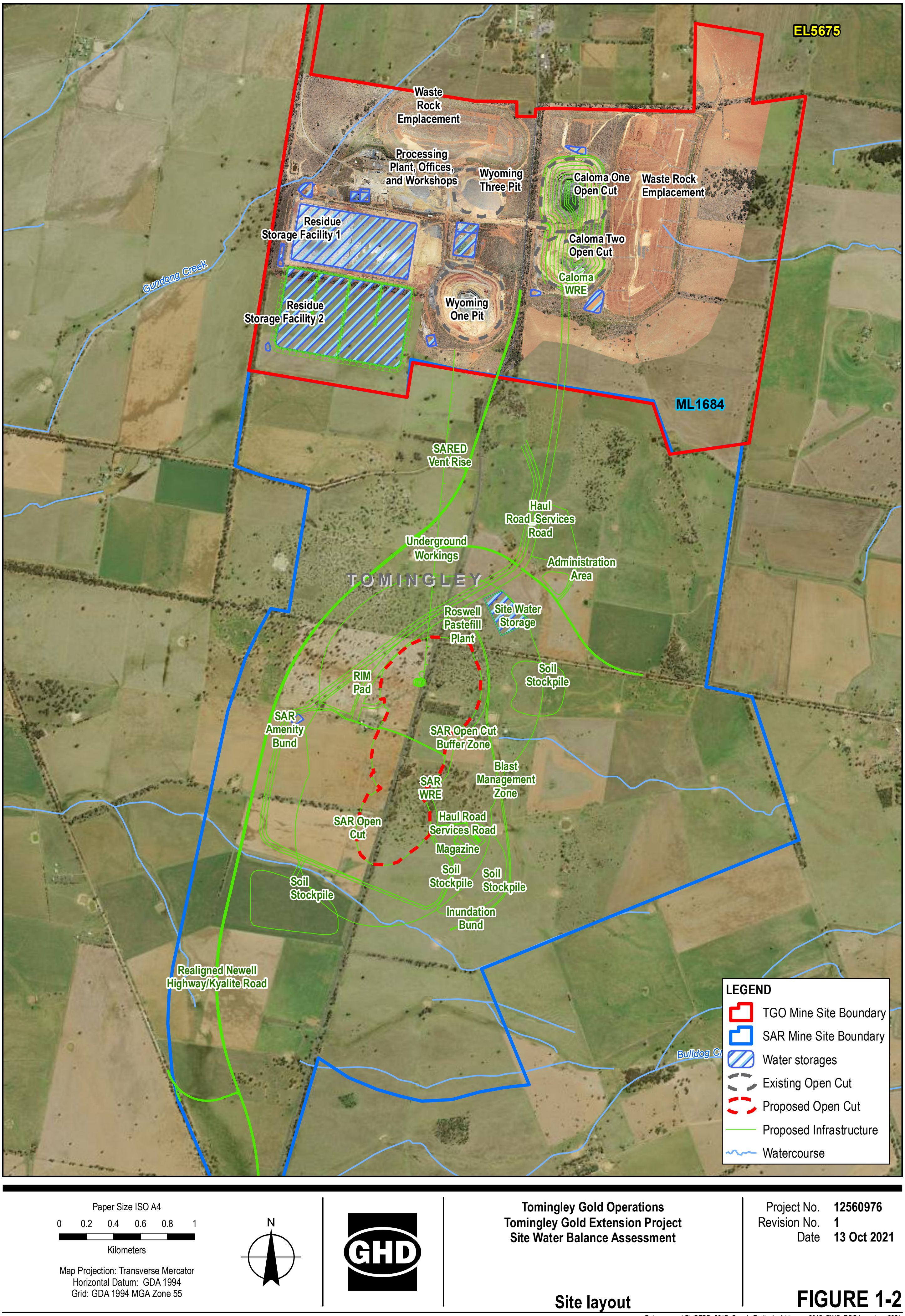
Data source: Commonwealth of Australia (Geoscience Australia): 250K Topographic Data Series 3, 2006. RWC: TGO boundary, 2021. Created by: tmorton



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Tomingley Gold Operations
Tomingley Gold Extension Project
Site Water Balance Assessment

Project No.	**12560976**
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Date	**13 Oct 2021**

Site layout

FIGURE 1-2

Data source: LPI: DTDB, 2017. Google Earth: Aerial image, 2015. RWC: TGO boundary, 2021.
 Created by: tmorton

2. Water management system

The water management system of the Project comprises the water management system of the existing TGO Mine and the proposed SAR Mine.

2.1 TGO Mine

The water management system at the existing TGO Mine is generally separate systems for the management of clean water, raw water, dirty water, mining water and process water. As clean water is diverted around the site, it is not considered as part of the site water balance. Sources of water at the surface sites include raw water supply, rainfall, runoff, moisture entrained in the ore and groundwater inflow into the open cut pits and underground mining areas. Water management demands include for underground operations, dust suppression, ore processing and staff amenities.

Dirty water typically consists of surface runoff generated within disturbed areas of the site including waste rock dumps, topsoil stockpile areas and haul roads that are not within the process water system. Dirty water runoff is intercepted and managed by a series of dirty water drains and sediment basins (SB) to allow for treatment and reuse on site.

Raw water is externally supplied (clean) water that is used for potable water and as top up water for the processing plant and other operations on site. Raw water is currently supplied from a bore located on the "Woodlands" property via pipeline to the Raw Water Dam (RWD).

Mine water consists of water generated within the open cut pits and intercepted by underground workings. Mine water is a mix of local runoff to the open cut pits and saline groundwater inflows. Mine water is managed by in-pit sumps, the north cell of the Wyoming Central Dam (WCD - North) and the Caloma One and Wyoming Three void.

Process water consists of water that has been used for ore processing or exposed to residue storage. Process water is stored within the Process Water Dam (PWD) (including a settling pond), the south cell of the Wyoming Central Dam (WCD – South) and the residue storage facilities (RSF) Decant Ponds.

2.2 Proposed water management

For the purpose of this assessment, the water management system was updated to reflect the proposed activities within the SAR Mine Site. The water management principles currently applied at TGO Mine Site would be extended to the SAR Mine Site following the commencement of construction and mining operations. Similar to the existing TGO Mine, sources of water at the surface sites include rainfall, runoff, and groundwater inflow into the open cut pits and underground stoping areas. Water management demands include for underground operations, dust suppression and staff amenities.

The following changes to the water management system proposed as part of the Project were considered in this assessment:

– Construction and operation of the proposed SAR Mine Site. The proposed water management infrastructure within the SAR Mine Site would include the following:
  - SAR Site Water Storage Dam - At the proposed SAR Mine Site, the clean water from upslope catchments will be diverted around site. For the purpose of this assessment, runoff from all hardstand and SAR WRE areas are classified as dirty water and were conceptualised as reporting immediately to the SAR Site Water Storage Dam. In reality, this dam would be constructed as an off-stream "turkey's nest" dam with no surface catchment and would receive pumped water only from the sediment basins within the SAR Mine Site, proposed open cut and underground mining operations and TGO Mine Site via the proposed water transfer pipeline between TGO Mine Site and SAR Mine Site.
  - SAR Clean Water Diversion Bund – would divert all surface water flows from the east of disturbed areas to the north and south of the SAR Open Cut.
  - SAR Administration Clean Water Diversion Bund - would divert surface water flows to the north of the SAR Administration Area and the south of the SAR Site Water Storage Dam.

- SAR Exclusion Bund - incident rainfall between the SAR Open Cut Clean Water Bund and the SAR Exclusion Bund would accumulate adjacent to the Exclusion Bund and would be pumped to the SAR Site Water Storage Dam.
- Culverts. A series of box culverts have been included in the design for the realigned Newell Highway and Kyalite Road as well as the Haul Road and Services Road. In addition, the SAR Amenity Bund would include gaps to permit surface water to pass from the Haul Road culverts to the Newell Highway culverts.

– Use of water from an replacement bore on the “Dappo” property to extract additional 400 ML/year of raw water using the same pipeline as is used for the existing bore on the “Woodlands” property.

– Construction of waste rock emplacement within the Caloma 1 and Caloma 2 Open Cut Voids. This will change the catchment areas of SB4, SB5 and SB7 over the Project life.

– Construction and operation of the proposed pipeline to permit two-way transfer of water between the Wyoming 3 Open Cut (TGO Mine Site) and SAR Site Water Storage Dam (SAR Mine Site).

– Storage of mine water within the existing Wyoming 3 Open Cut and the proposed SAR Site Water Storage Dam for reuse for mining related purposes.

The following simplifications to the proposed water management system were adopted for the purpose of this assessment:

– Sediment Basins 15 to 19 and associated dirty water collection bunds would be constructed in key locations within the disturbed sections of the SAR Mine Site consistent with the water management principles currently applied at TGO Mine Site. These storages have been conceptually grouped with the SAR Site Water Storage Dam.

– All tailings are assumed to be emplaced in the existing and approved RSF and RSF2. The use of tailings as backfill in the underground workings is not expected to affect the overall site water balance.

The following approved changes at the TGO Mine Site were considered as part of the proposed conditions.

– Raising the capacity of RSF 2 to Stage 9, with a maximum elevation of 286 m AHD. The change in catchment area was reflected in SB2 and SB3 and the addition of new sediment basin, SB8.

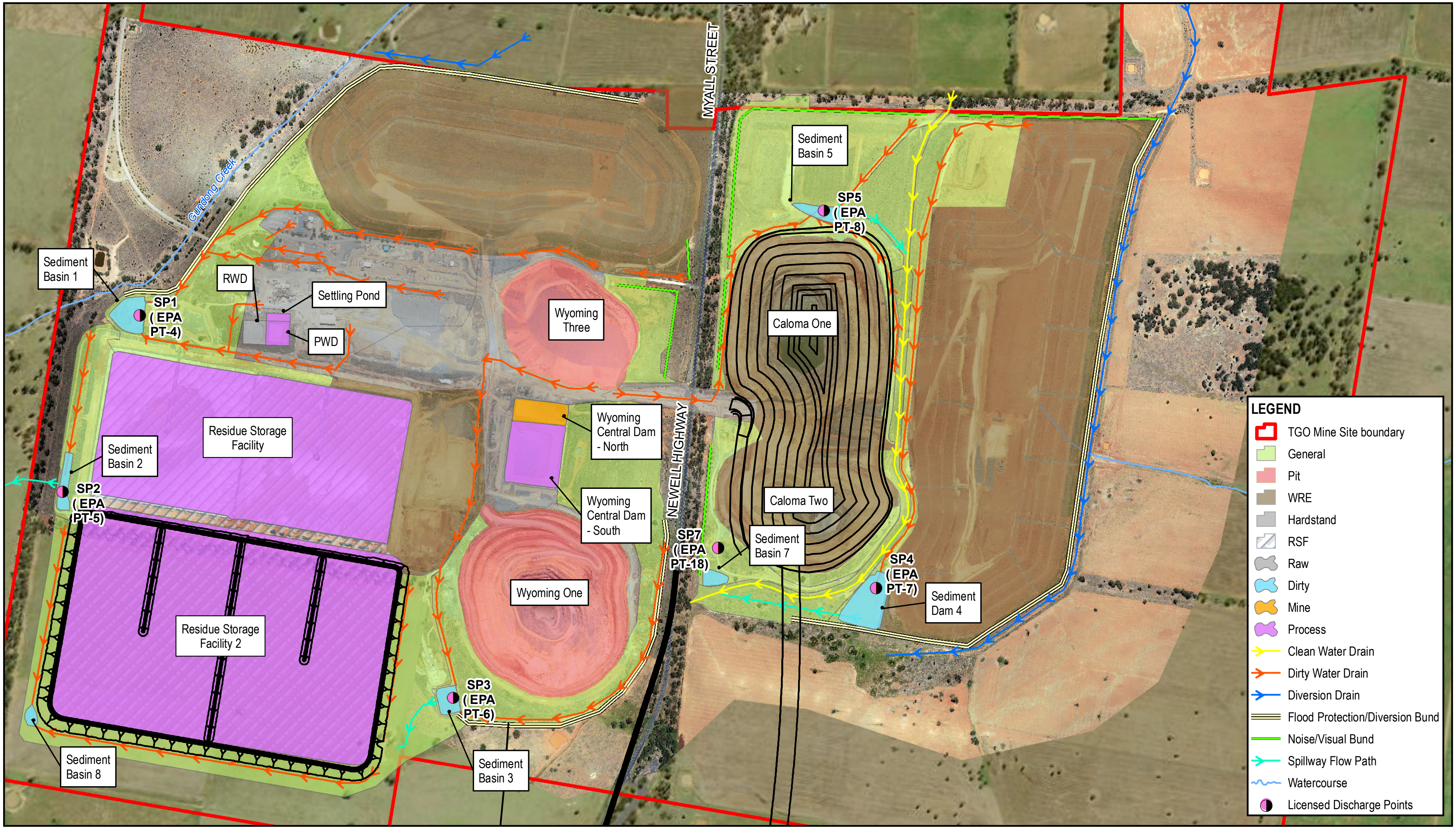
2.3 Water management features

The water management system at the site is comprised of surface water storages, operational processes, discharge points and receiving waters. The water management system was conceptualised as a network of water management features. Each water management feature was defined by its connection to other water management features by inflows and outflows of water. The water management features considered are summarised in Table 2.1. All surface water storages receive direct rainfall and catchment runoff and experience evaporation losses which, for brevity, are not included in Table 2.1. Plans of water management features for TGO Mine and SAR Mine are shown spatially in Figure 2-1 and Figure 2-2, respectively. The site water cycle is summarised schematically in Figure 2-3 and Figure 2-4.

Table 2.1 Water management features

Feature	Water storage	Surface water catchment	Inflows	Outflows
TGO Mine				
Sediment basins (SB1, SB2, SB3, SB4, SB5, SB7, SB8)	Yes	Yes	Sediment Basin 1 dewatering from Sediment Basin 2 Sediment Basin 4 dewatering from Sediment Basin 5	Emergency site discharge Sediment basins (SB1, SB3, SB4, SB7, SB8) dewaters to Wyoming Three pit Sediment Basin 2 dewaters to Sediment Basin 1 Sediment Basin 5 dewaters to Sediment Basin 4
Open cut pits (Caloma One and Two)	Yes	Yes	Groundwater inflows	Transfers to Wyoming Three pit
Wyoming One pit	Yes	Yes	Groundwater inflows Transfers from Underground workings Transfers from Raw Water Dam	Transfers to Wyoming Three pit Dust suppression for Wyoming One ramp
Wyoming Three pit	Yes	Yes	Groundwater inflows Dewatering of sediment basins and other open cut pits	Transfers to WCD – North
Wyoming Central Dam (WCD) - North	Yes	No	Transfers from Wyoming Three Pit Transfers from Raw Water Dam	Transfers to Process Water Dam (through Settling Pond) Dust suppression Underground mining operations
Wyoming Central Dam (WCD) - South	Yes	No	Transfers from RSF Decant Ponds	Transfers to Process Water Dam (through Settling Pond) Transfers to processing plant for detox
Raw Water Dam	Yes	No	Supply from external bores (Woodlands Borefileds including the additional bore at the “Dappo” property)	Transfers to processing plant for grinding/CIL and detox processes Transfers to Process Water Dam Transfers to WCD – North Transfers to Wyoming One pit

Feature	Water storage	Surface water catchment	Inflows	Outflows
Process Water Dam (including Settling Pond)	Yes	No	Transfers from WCD – North Transfers from WCD – South Transfers from RSF Decant Pond Transfers from Raw Water Dam Return water from thickener	Transfers to processing plant
Processing Plant (consists of grinding/CIL, thickener and detox)	No	No	Transfers from Process Water Dam Transfers from Raw Water Dam Ore moisture Transfers from RSF Decant Ponds	Overflow to Settling Pond Residue emplacement on to RSF cells
Residue Storage Facility (RSF) Cells	No	No	Outflows from processing plant detox processes Direct rainfall on RSF	Rewetting losses Active area evaporation Water in residue Primary and secondary release to the decant ponds
Residue Storage Facility (RSF) Decant Ponds	Yes	Yes	Primary and secondary release of water from the residue	Transfers to processing plant Transfers to Process Water Dam (through Settling Pond) Transfers to WCD - South
SAR Mine				
Open Cut	Yes	Yes	Groundwater inflows	Transfers to SAR Site Water Storage Dam
SAR Site Water Storage Dam (conceptually represents all sediment basins and minor storages)	Yes	Yes	Transfers from Wyoming Three pit Transfers from Open Cut Transfers from Underground mining operations	Transfers to Wyoming Three pit Dust suppression Underground mining operations



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Grid: GDA 1994 MGA Zone 55

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Tomingley Gold Extension Project
Site Water Balance Assessment

Water management system
TGO Mine

Project No. **12560976**
Revision No. **1**
Date **4 Nov 2021**

FIGURE 2-1

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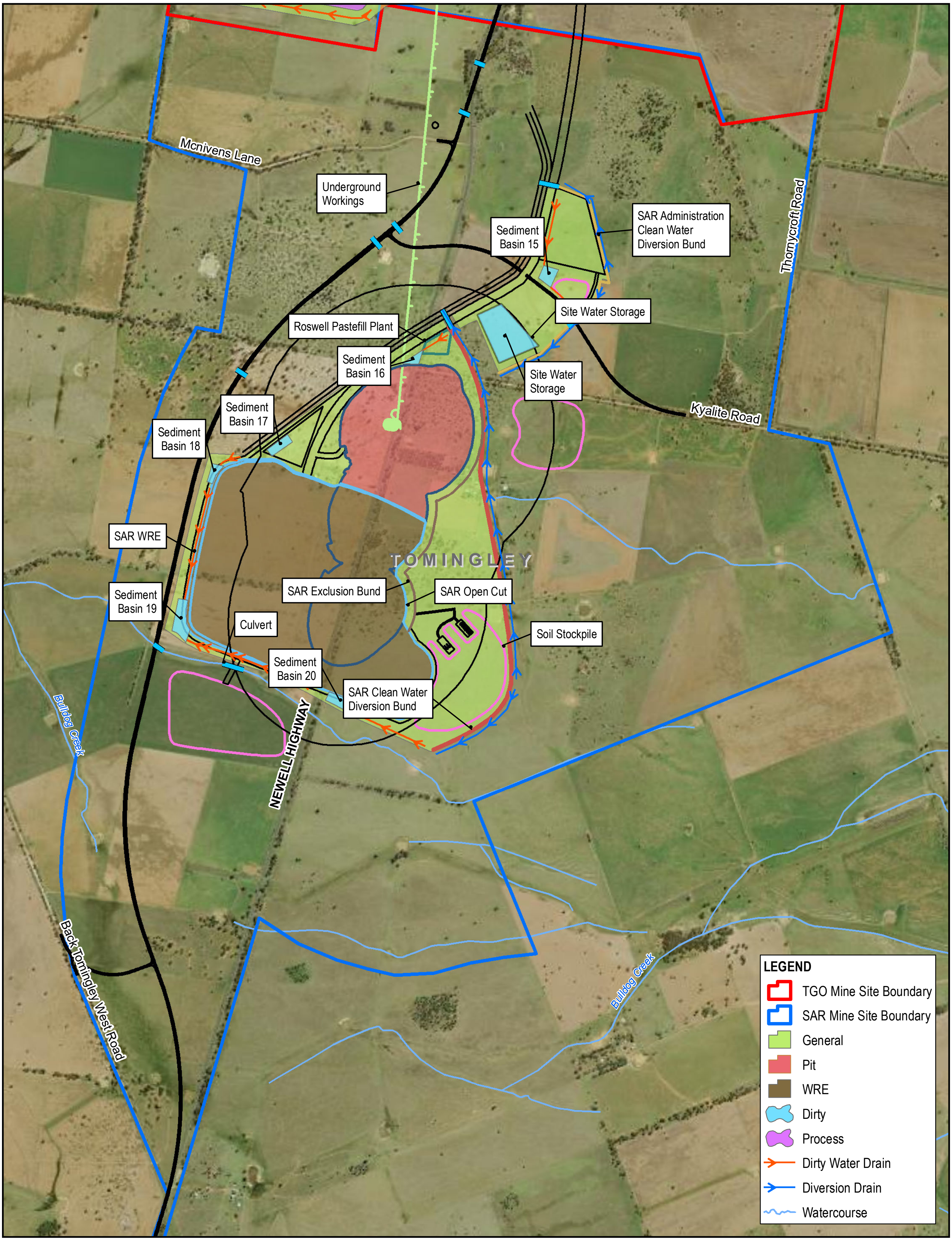
Created by: ttinkler, tmorton



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Kilometers

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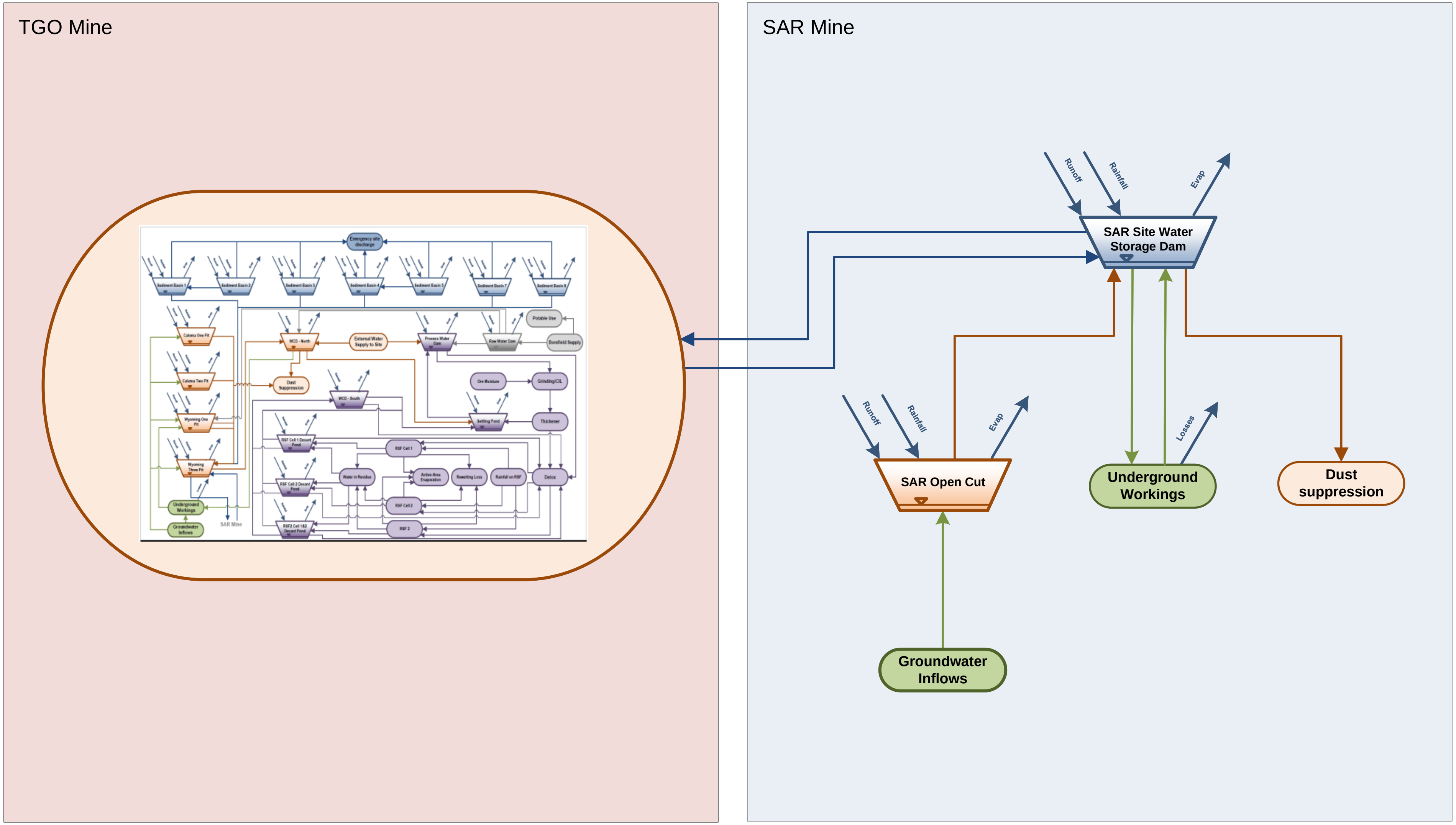
Tomingley Gold Operations
Tomingley Gold Extension Project
Site Water Balance Assessment

Water management system
SAR Mine

Project No. **12560976**
Revision No. **1**
Date **4 Nov 2021**

FIGURE 2-2



Legend

→	Water transfer		Raw water system		Process water system
	Storage		Dirty water system		Groundwater
XX ML (XX, XX)	Mean 10th, 90th percentile		Mine water system		

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Tomingley Gold Operations
Tomingley Gold Extention Projects
Site Water Balance Assessment

Water management features schematic Regional

Project No. 12560976
Revision No. 0
Date 15/11/2021

Figure 2-3

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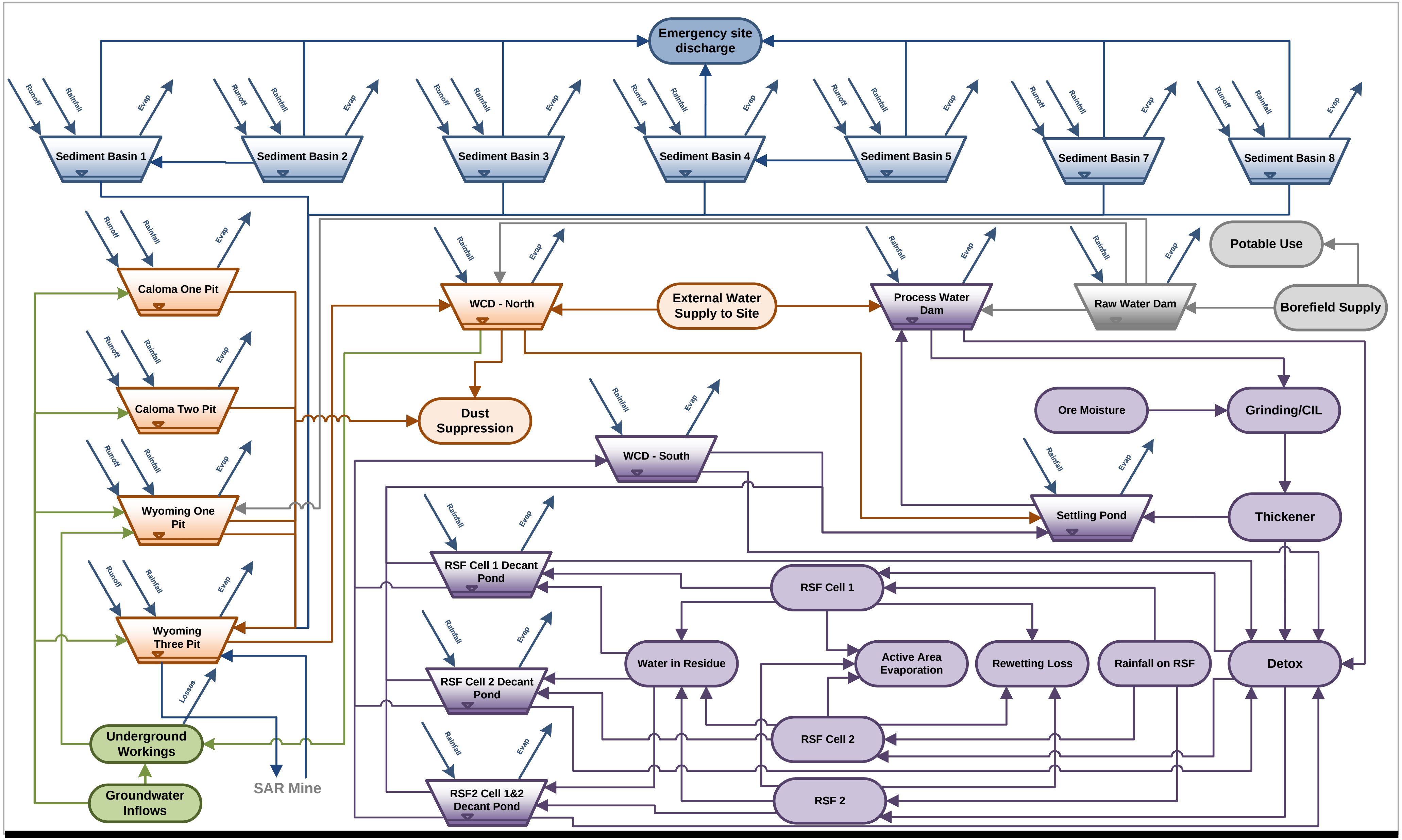

Legend

→	Water transfer		Raw water system		Process water system
	Storage		Dirty water system		Groundwater
XX ML (XX, XX)	Mean 10th, 90th percentile		Mine water system		

Tomingley Gold Operations
Tomingley Gold Extention Projects
Site Water Balance Assessment

Water management features schematic
TGO Mine

Project No. 12560976
Revision No. 0
Date 15/11/2021

Figure 2-4

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3. Data

The SWBA is based on data from various sources as shown in Table 3.1. The purpose of this section is to summarise the data used and their sources.

Table 3.1 Data sources

Source	Data
Provided by Tomingley Gold Operations Pty Ltd	Site rainfall Groundwater inflows Bore field licence entitlement Dust suppression demand Annual ore processing schedule Recorded water volumes and flow rates
Derived from information provided by Tomingley Gold Operations Pty Ltd	Storage geometry Process demands and loss rates TGO Mine catchment (based on supplied survey) SAR Mine catchment (based on site layout) Operating rules
Bureau of Meteorology, PSM	Historical rainfall and evaporation
Department of Lands	5m-grid elevation data

3.1 Rainfall

A historical record of daily rainfall depths was obtained in the form of a patched point data set from the Scientific Information for Land Owners (SILO) database operated by the Queensland Department of Science, Information Technology and Innovation (DSITI). SILO patched point data is based on observed historical data from a particular Bureau of Meteorology (BOM) station with missing data 'patched in' by interpolating with data from nearby stations (DSITI, 2020).

For this assessment, SILO data were obtained for the Peak Hill Post Office Station (station number 50031). This station was selected as it is located approximately 15 kilometres to the south of TGO. The period of rainfall data used for this assessment extended from 1 January 1889 to 1 January 2021 (a total of 132 years). The historical SILO rainfall data between 1889 and 2020 are shown in Figure 3-1.

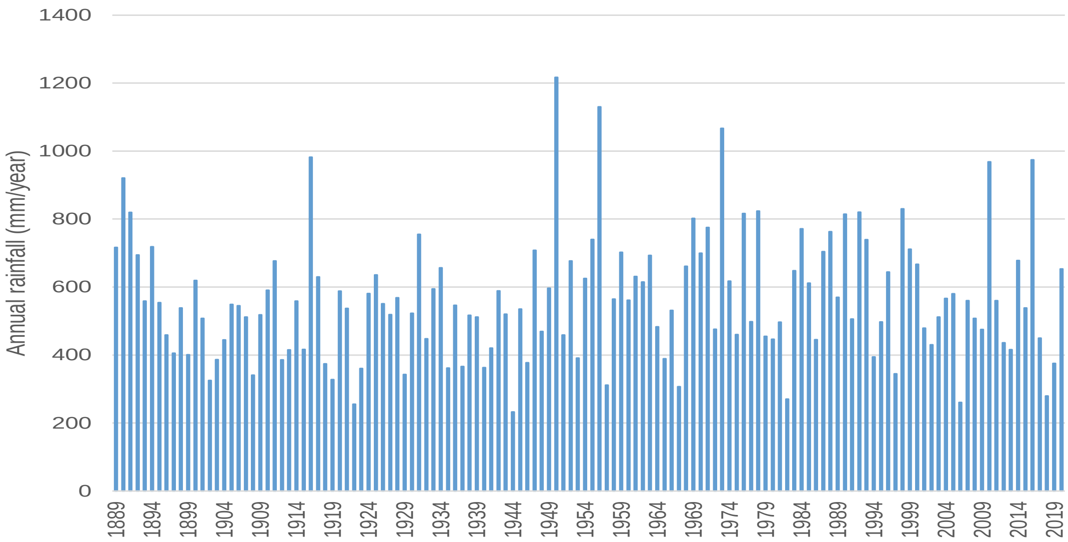


Figure 3-1 Historical rainfall record

The annual statistics associated with the SILO data represented in Figure 3-1 are:

- Minimum rainfall total – 232.6 mm in 1944
- Median rainfall total – 544.9 mm
- Average rainfall total – 563.9 mm
- Maximum rainfall total – 1217.1 in 1950

The total site rainfall for 2020 is 697.4 mm, which is above the long-term historical average rainfall total of 563.9 mm.

3.2 Evaporation

Initially, monthly average pan evaporation rates were obtained from observations at the Wellington Research Centre Station (BoM Station 065035). However, upon simulation of the model it was apparent that modelled evaporation losses were not matching general site observations. Therefore, revised higher pan evaporation rates were adopted from *Water Management Review,* Pells Sullivan Meynink, 3 October 2014 (PSM 2014) which were based on equilibrium temperature concepts. Based on validation of the water balance these higher pan evaporation rates appeared to more accurately represent evaporation loss at the site. Figure 3-2 shows a comparison of the two data sources for evaporation, demonstrating that the PSM data has higher values of evaporation particularly during the summer months.

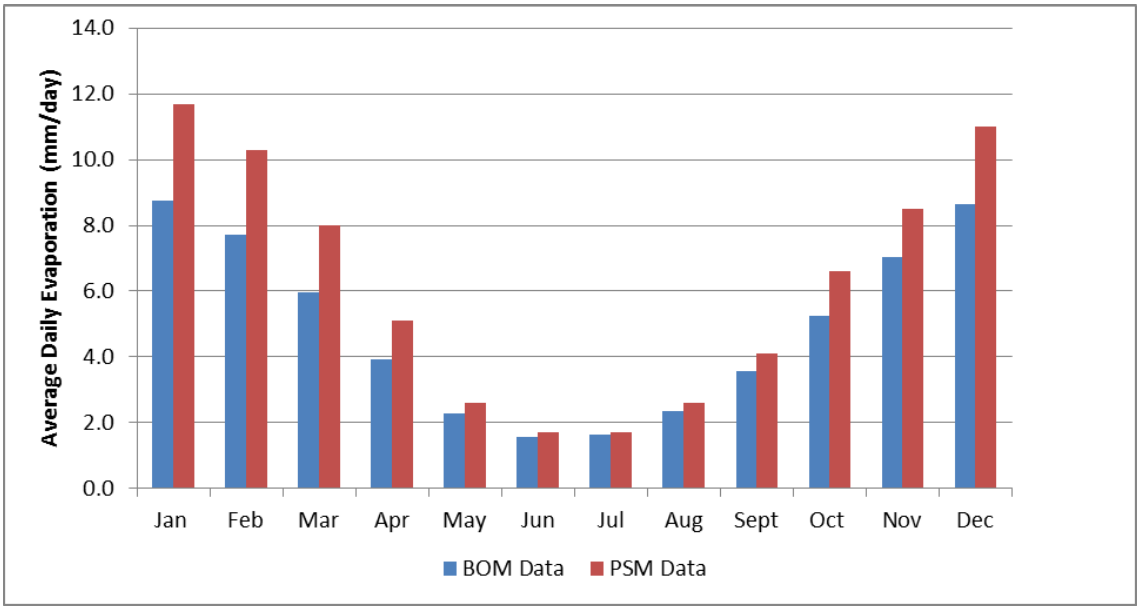


Figure 3-2 Comparison of monthly average evaporation

Monthly pan evaporation factors were used to convert the recorded pan evaporation to the potential field evaporation. The reference value for Scone included in McMahon *et al.* (2013) was selected as it was the closest available reference information and because modelled evaporation generally appeared to match site observations when these pan factors were adopted. Table 3.2 shows the adopted evaporation.

Table 3.2 Adopted monthly average evaporation

Month	Pan Evaporation (mm/day)	Pan Factor
January	11.7	0.86
February	10.3	0.85
March	8.0	0.84
April	5.1	0.87
May	2.6	0.88
June	1.7	0.90
July	1.7	0.91
August	2.6	0.93
September	4.1	0.95
October	6.6	0.94
November	8.5	0.89
December	11	0.85

3.3 Mining and waste rock

An indicative mining sequence, consistent with the groundwater assessment (Jacobs 2021), was used to estimate change in catchment and landuse presents the indicative mining sequence.

Table 3.3 Mining sequence

	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	FY 32	FY 33
Mining Sequence												
Caloma 1 Open Cut Cutback												
TGO Underground												
SAR Underground												
SAR Open Cut (South Pit)												
SAR Open Cut (Central Pit)												
SAR Open Cut (North Pit)												
Waste Rock Emplacement Sequence												
SAR WRE												
Caloma 1 and 2 Open Cuts												
SAR Open Cut (South Pit)												
SAR Open Cut (Central Pit)												

Table 3.3 shows that underground operations at SAR was planned to start in financial year ending June 2023 (FY23). For the purpose of this assessment, all infrastructure, water storages and pits at SAR Mine were assumed to commence at the same time. The mining sequence also indicates that Caloma 1 and 2 would be backfilled as an WRE by FY24 while SAR Open Cut pits (South and Central) would both be backfilled as an WRE by FY27.

3.4 Catchments

Catchments of each surface water management feature were identified based on recent site contours. The land uses of each catchment were identified based on inspection of aerial imagery and site inspections. The total catchment areas are summarised in Table 3.4.

Table 3.4 Catchment areas

Water management feature	FY2021 (ha)	FY2023 (ha)	FY2024 (ha)	FY2027 (ha)
TGO Mine				
Caloma One pit	32.5	32.5	0	0
Caloma Two pit	16.51	16.51	0	0
Sediment Basin 1	93.36	93.36	93.36	93.36
Sediment Basin 2	13.05	5.58	5.58	5.58
Sediment Basin 3	49.39	49.39	49.39	49.39
Sediment Basin 4	85.44	85.44	85.44	85.44
Sediment Basin 5	18.15	18.15	49.4	49.4
Sediment Basin 6	2.85	2.85	0	0
Sediment Basin 7	4.88	4.88	25.50	25.50
Proposed Sediment Basin 8	0	22.44	22.44	22.44
Wyoming One pit	21.9	21.9	21.9	21.9
Wyoming Three pit	11.05	11.05	11.05	11.05
SAR Mine				
Proposed SAR Open Cut pit	0	90.3	90.3	47.22
Proposed SAR Site Water Storage Dam (conceptually grouped with sediment basins)	0	218.1	254.7	297.9

3.5 Storages

Storage geometry was based on stage storage relationships. Capacity and maximum surface area of each surface water storage are summarised in Table 3.5.

Table 3.5 Storage geometry

Storage	Capacity (ML)	Maximum Surface Area (m^2)
TGO Mine		
Caloma One void	2130	105 000
Caloma Two void	3300	107 000
Sediment Basin 1	35	7 700
Sediment Basin 2	8	7 000
Sediment Basin 3	11.7	5 800
Sediment Basin 4	32.8	14 200
Sediment Basin 5	12.8	7 000

Storage	Capacity (ML)	Maximum Surface Area (m^2)
Sediment Basin 7	2.7	3 200
WCD - South	162.5	16 400
WCD - North	17.4	3 600
Raw Water Dam	10.7	3 400
Process Water Dam	9.2	3 400
Settling Pond	4.2	1 400
RSF1 Cell Decant Ponds (each)	200	20 000
RSF2 Cell 1 and 2 Decant Ponds (combined)	607	20 000 (approximate)
Wyoming One void	195 (below portal)	11 000
Wyoming Three backfill sump	1300 (nominal)	54 000 (nominal)
SAR Mine		
SAR Open Cut	100 (nominal sump)	903 300
SAR Site Water Storage Dam	98.9	57 700

The capacity of SAR Site Water Storage Dam was designed to provide adequate treatment for sediment laden runoff for design rainfall events up to the 90^{th} percentile 10-day rainfall event (50.5 mm) for design volume and was based on 50% volumetric runoff coefficient and 50% allowance for sediment storage.

3.6 Groundwater inflows

The results of hydrogeological modelling undertaken for the Groundwater Assessment (Jacobs 2021) were used to estimate the groundwater inflows into TGO Mine and SAR Mine under proposed conditions, as shown in Figure 3-3. Total groundwater inflow considered both:

– Groundwater inflow as a result of the open cut pit mining
– Groundwater inflow as a result of stoping (underground mining)

Total groundwater inflow at TGO Mine was expected to peak at 2023 with approximately 300 ML/year. Meanwhile, groundwater inflows at SAR Mine was predicted to peak at 2026 with approximately 671 ML/year of total groundwater inflows, with a combined inflow of approximately 767 ML/year.

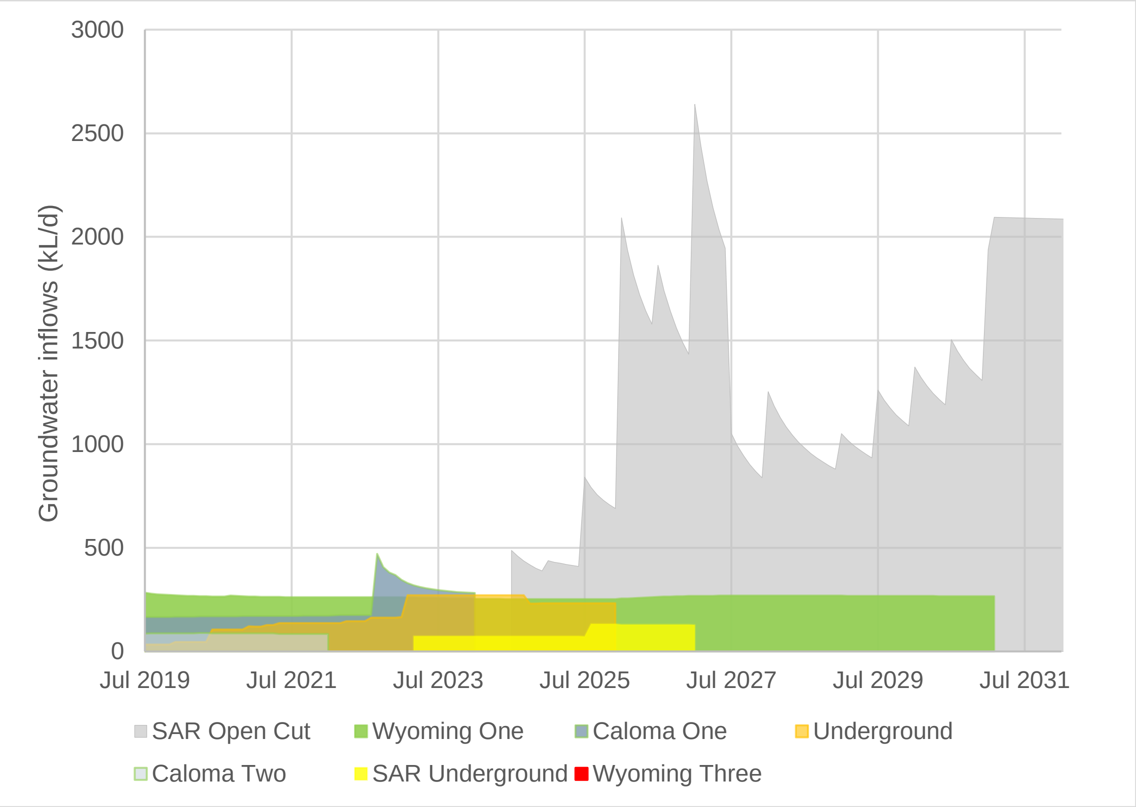


Figure 3-3 Simulated groundwater inflows

3.7 Production

A significant driver of water use on site is the rate of ore processing. An annual schedule of ore processed was provided by Tomingley Gold Operations Pty Ltd. The annual ore production is summarised in Figure 3-4.

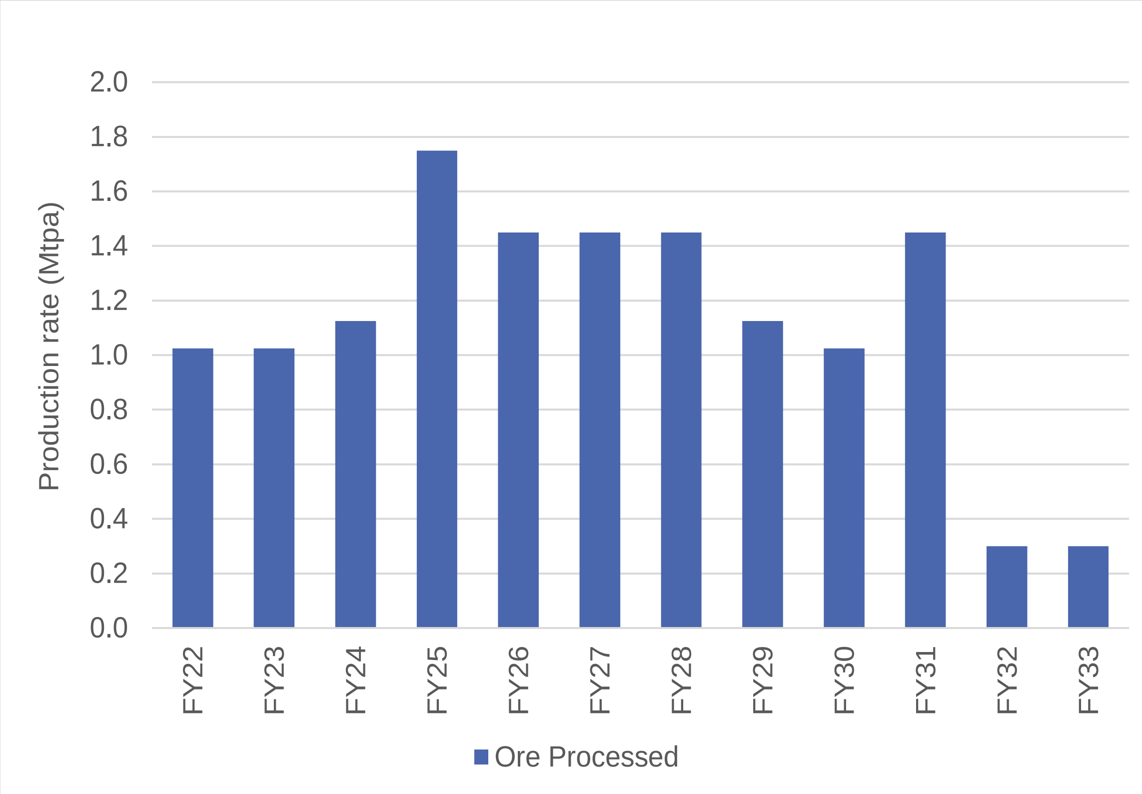


Figure 3-4 Simulated ore production

3.8 Operations

Operational parameters were adopted from the existing TGO site water balance to characterise the typical operation of the site. Site operations parameters are summarised in Table 3.6.

Table 3.6 Site operations parameters

Parameter	Value
TGO Mine	
Dust Suppression Annual Average Demand (scaled by monthly pan evaporation)	250 ML/year
Potable Demand (80 staff each using 30 L/day)	2400 L/day
Maximum borefield supply	1000 ML/year – Existing conditions 1400 ML/year – Proposed conditions
Water Tanker External Water Delivery Maximum Rate	1 ML/day
Processing % Solids By Weight	Grinding – 40% Thickener – 60% Slurry – 45%
Tailings 24 hr % Solids By Weight	Fresh Ore – 67.3% Oxide Ore – 57.5%
Tailings Final Dry Density	1.4 t/m^3
Post 24-hrs Release % Collected	15%

Parameter	Value
RSF1 Areas (Combined 2 Cells)	Total: 37 ha Active fraction (1/6 of total) Inactive: 37.5 ha (5/6 of total)
RSF2 Areas (Combined 2 Cells)	Total: 54 ha Active fraction (1/6 of total) Inactive: 37.5 ha (5/6 of total)
Inactive Beach % of Open Water Evaporation	40%
Underground operations	5 L/s with 5% loss
SAR Mine	
Potable Demand (80 staff each using 30 L/day)	2400 L/day
Dust Suppression Annual Average Demand (scaled by monthly pan evaporation and TGO dust suppression area)	140 ML/year

A set of water cycle management rules were developed based in consultation with Tomingley Gold Operations Pty Ltd and qualitatively validated against general site observations. Table 3.7 summarises the key rules adopted in relation to inflows and outflows into key elements of the site.

Table 3.7 Operational rules

Operation	Inflows
TGO Mine	
Dewatering sediment basins	Dewater (ultimately to WY3) if the volume in the sediment basins exceeds the trigger level.
Dewatering pits	Dewater all inflows to Wyoming Three void.
WCD - North	Requests water from Wyoming Three void and Raw Water Dam to maintain its low operating volume.
Wyoming Three	Receives dewatering from SAR Site Water Storage Dam (SAR Mine), open cut pits (Caloma One and Two), Wyoming One, and Sediment basins.
Dust Suppression	Annual demand rate assumed scaled by month by pan evaporation.
Raw Water Dam	The RWD requests water to maintain its low operating volume from the external bores.
Borefield Supply	Provides water to the RWD but is limited by the maximum transfer rate and the maximum annual licensing allowance. Provides potable water demand in addition to the above.
Potable Use	Based on an estimate of the number of staff and average daily water use per staff member.
Water Tanker External Water Delivery	If the total site mining water inventory falls below 10 ML, provide water at a maximum rate of 1 ML/day to meet shortfalls in the RWD and WCD – North.
Process Water Dam	Requests water to maintain its low operating volume from other sources in the following order of priority: RSF, WCD – South, WCD – North, RWD and external supplies.
Process Plant: Grinding/CIL	The total demand is estimated from the total ore dry mass and slurry density. The ore moisture and raw water supply rate is deducted from the total demand, to derive makeup demand requirements from the PWD.
Process Plant: Thickener	The total demand is estimated from the total ore dry mass and thickened slurry density. Excess water is transferred to the settling pond, and subsequently returned to the PWD.
Process Plant: Detox	The total demand is estimated from the total ore dry mass and residue density. The net makeup requirement is requested from the RSF, with any shortfall provided by the RWD and WCD - South.

Operation	Inflows
RSF: Water In Tailings	Water retained in tailings after 24 hours is based on 24 hour % solids by weight of fresh and oxide ore and the processing rates of these ores. Water released in the first 24 hours is the balance of water in slurry minus 24 hour water retained. Further water released after 24 hours is based on the required volume released to reach an estimated final dry density however only a proportion of this release is effectively captured in underdrains.
RSF: Rainfall on non-active areas	Rainfall on the non-active areas enters the system, joining the primary release and is subject to active area evaporation and re-wetting loss.
RSF: Active Area Evaporation	Water released from tailings is exposed to open water evaporation over the active area.
RSF: Re-Wetting Loss	Water can be lost from the system through infiltration and subsequent evaporation in the inactive beach. Represented as a loss storage of 10 mm depth subject to the open water evaporation rate operating over the entire non-active area with the proportion estimated based on calibration of the model to general observed conditions. This loss cannot be based on a reabsorption from a base density greater than the theoretical max density of 1.7 t/m3.
RSF: Decant	Water is decanted to supply the detox demand and to supply the PWD. If the volume in the decant pond exceeds high operating level, water is transferred to WCD – South if there is sufficient storage capacity.
Underground dewatering	Dewatering all inflows to underground workings immediately to Wyoming One void.
SAR Mine	
Underground dewatering	Dewatering all inflows to underground workings immediately to SAR Site Water Storage Dam.
SAR Site Water Storage Dam	Dewaters to Wyoming Three void to maintain its high operating volume and requests water from Wyoming Three void to maintain its low operating volume. Supplies water to operational demands such as dust suppression, pastefill plant and underground mining operations.

4. Modelling methodology

4.1 Water balance

The site water balance was modelled as a semi-distributed mass balance, considering each water management feature described in Section 2.3.

4.2 Rainfall variability

Rainfall variability was considered in the site water balance by sampling simulated rainfall from the historical rainfall record (refer to Section 3.1). A series of simulations were performed, each beginning in a different year of the historical rainfall record and proceeding consecutively through the record (and looped where required).

4.3 Rainfall runoff model

The Australian Water Balance Model (AWBM) (Boughton & Chiew, 2003) was used to estimate the runoff contributing to the surface water storages. The AWBM was adopted as it:

– Is widely used throughout Australia, especially for mining application
– Has been verified through comparison with large amounts of recorded streamflow data
– Has literature available to assist in estimating input parameters
– Considers soil moisture retention state when determining runoff

The AWBM is a soil moisture water balance model that calculates runoff from rainfall after allowing for losses and storage. Figure 4-1 shows a schematic of the model.

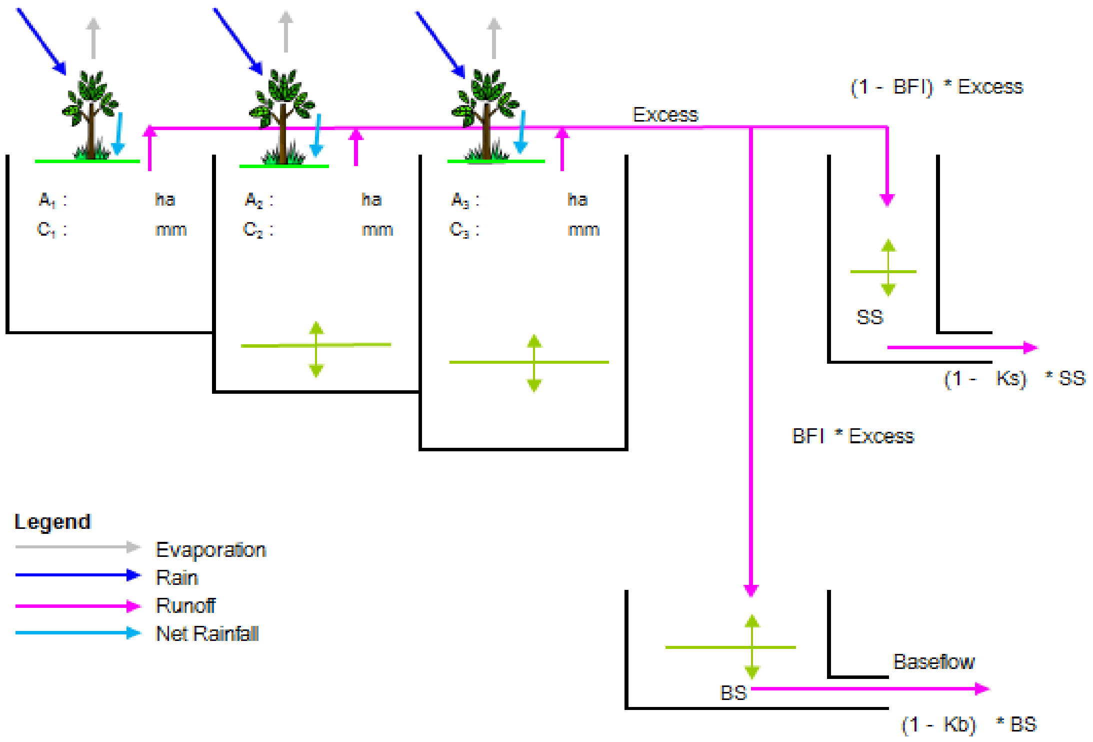


Figure 4-1 AWBM model schematic

Rainfall enters these storages and when a storage element is full, any additional rainfall is considered to be excess rainfall. Of this excess rainfall a proportion is routed to the baseflow storage (BS) while the remainder is routed to the surface storage (SS). The discharge from the baseflow storage and surface storage is estimated as a proportion of the volume of the storages at the end of each day. The total runoff is the combined volume of water discharged from these two storages. The parameters of the AWBM are summarised in Table 4.1.

Table 4.1 AWBM parameters

Parameter	Description
A1, A2, A3	The partial areas of the overall catchment contributing to each storage.
C1, C2, C3	The capacity of storages 1, 2 and 3 respectively.
BFI	The proportion of excess rainfall flowing to the baseflow.
Kb	The proportion of the volume of the baseflow storage remaining in the storage.
Ks	The proportion of the surface storage remaining in the storage.

The site-specific land uses (refer to Section 3.3) were characterised with different sets of AWBM parameters.

The AWBM parameters adopted for the water balance model are summarised in Table 4.2.

Table 4.2 Parameterisation of AWBM

Parameter	Vegetated	Hardstand	Pit	WRE
Cave	150	20	87.8	91.9
A1 A2 A3	0.134 0.433 0.433	0.134 0.433 0.433	0.05 0.2 0.75	0.134 0.433 0.433
C1 C2 C3	0.01 0.33 0.66	0.01 0.33 0.66	0.0043 0.0342 0.9615	0.0109 0.2826 0.7065
BFI	0.1	0	0.1	0.35
Kb	0.813	0	0.96	0.898
Ks	0	0	0	0

4.4 Numerical implementation

The water balance model was implemented in GoldSim (version 12.1). A basic timestep of 1 day was used, with timesteps dynamically inserted were required. GoldSim uses the forward Euler method to solve the mass conservation equations described in Section 4.1.

5. Validation

The water balance model for the project was simulated from 1 July 2019 to 1 January 2021 (the validation period). The simulation used combination of SILO rainfall and observed site rainfall and operated under the existing conditions. The purpose of validation is to test whether the model is of adequate accuracy for the purpose of making predictions (refer to Section 6).

The objectives of the validation were, in order of priority:

1. Matching total mining water inventory to target the observed water inventory. This is representative of the fitness of the model to replicate the overall water balance of the site.
2. Matching Caloma 1 pit water level and cumulative flow rate by calibrating groundwater inflows to target the observed water level. This is representative of the fitness of the model to replicate the mine water balance of the site.
3. Matching RSF cell 1 and 2 cumulative flow rate to target the observed cumulative flow rate. This is representative of the fitness of the model to replicate the contaminated water balance of the site.

The model was initialised with all storage volumes at their normal operational volumes and all soil moisture storages in the hydrologic model empty. The groundwater inflows were scaled and validated against observed water levels and discharges at Caloma One.

A comparison of the observed and modelled total mining water inventory is shown in Figure 5-1. Observed and modelled water storage volume and cumulative flow rates of Caloma 1 are shown in Figure 5-2 and Figure 5-3 respectively and combined RSF cell 1 and 2 cumulative flow rates is shown in Figure 5-4. Additional validation plots are presented in Appendix A.

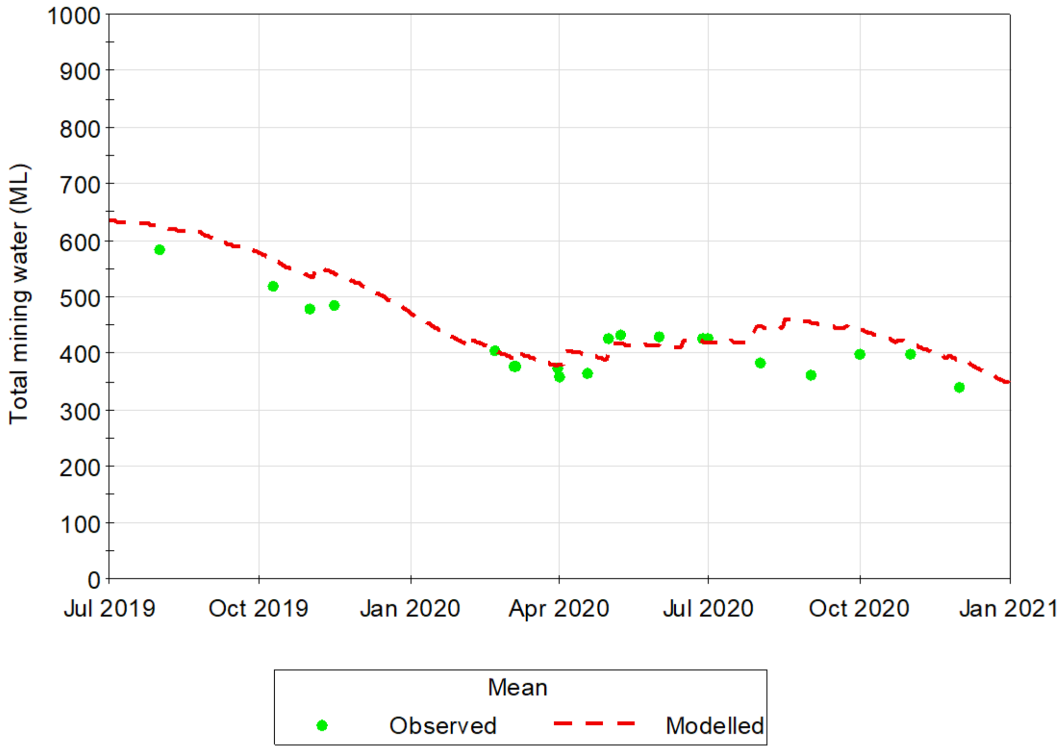


Figure 5-1 Observed and modelled total mining water

Figure 5-1 shows that total mining water is on a downtrend starting from approximately 650 ML at start of 2019 and ended with around 350 ML by the end of 2020. The model was able to provide a good fit to the observed values. This indicates that the model can replicate the overall water balance of the site. The total water inventory is mainly stored in the Caloma 1 void, shown in Figure 5-2.

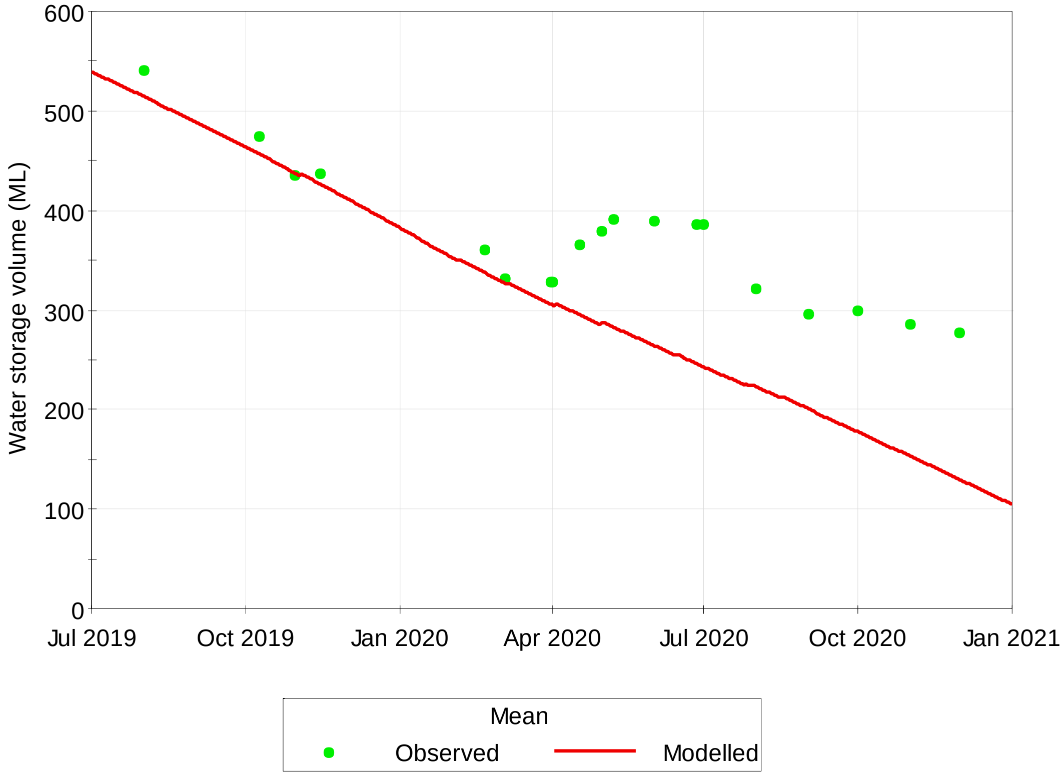


Figure 5-2 Observed and modelled Caloma 1 pit water storage volume

Figure 5-2 shows that Caloma 1 pit water level has a downslope trend starting from 650 ML at start of 2019 to around 300 ML by end of 2020. The model was able to provide a good fit until April 2020 but was unable to simulate the stabilizing of Caloma 1 storage volume at around 300 ML for the rest of 2020.

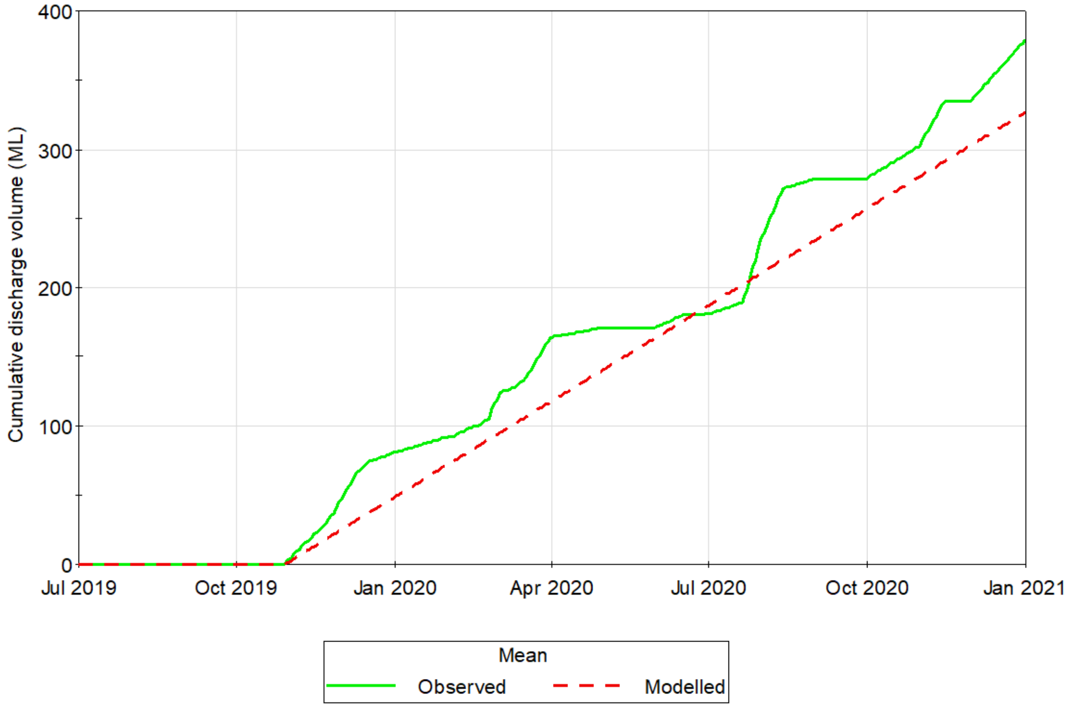


Figure 5-3 Observed and modelled Caloma 1 pit cumulative transfer volume

Figure 5-3 shows that Caloma 1 pit cumulative transfer volume has a total discharge volume of 376 ML starting from November 2019 to end of 2020. The model was able to provide a good fit having a modelled total discharge volume of 325 ML by end of 2020.

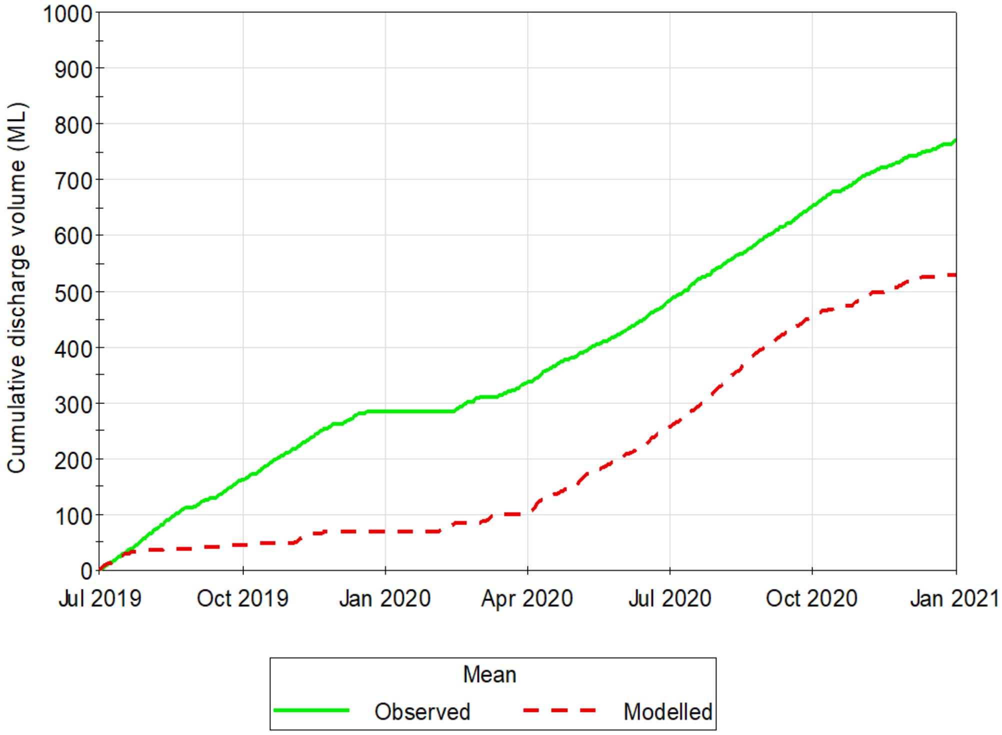


Figure 5-4 *Observed and modelled RSF Cell 1 and 2 cumulative discharge volume*

Figure 5-4 shows that the model was able to provide a good fit for overall decant volumes from RSF over 2019 and 2020, even after adjusting the tailings solids fraction to 45% with final dry density of 1.4 tonne/m^3 for consistency with the decant management requirements in the TGO RSF 2 Concept Design Report (GHD 2020).

This overall discrepancy is mainly attributable to the second half of 2019. The difference may be attributable to a lower actual residue solids content or other processing change during processing of the remaining ore won from the open cut pits prior to the plant shutdown in late 2019 and early 2020 and the commencement of underground mining. For 2020, it can be observed that the model was able to replicate the increasing slope of the observed total discharge volume, maintaining about a 200 ML difference from start of 2020 until end of the same year.

6. Modelling results

The site water balance model was simulated over the period from 1 January 2021 to 1 January 2033. The prediction simulations were initialized with the final values of the validation simulation, discussed in Section 5. For the purpose of this assessment, PWD was used as the main source for processing demands and modelling results present combined water transfers from TGO Mine and SAR Mine. Two scenarios were considered:

– **Existing conditions**: this represents the existing operations at TGO Mine for year 2021. The predicted groundwater inflows as discussed in Section 3.6 were adopted as representative of approved workings at TGO Mine.
– **Proposed conditions**: this represents the proposed operations as part of the Project, including the proposed water transfers from SAR Mine and adopted groundwater inflow predictions for SAR Mine as described in Section 3.6.

The year 2026 was selected for the purpose of comparison between existing and proposed conditions, as this corresponded to peak in groundwater inflows and greatest increase in groundwater inflows at SAR Mine relative to existing conditions.

6.1 Interpretation of results

To consider potential climate variability, a total of 132 different rainfall patterns were simulated (as described Section 4.2). The results presented show the average, 10th percentile and 90th percentile value. The purpose of displaying the three results is to indicate both the average value and the likely possible range. The 10th percentile represents the value at which 10 % of the modelled outputs were less than this value. Similarly, the 90th percentile represents the value at which 90 % of the modelled outputs were less than this value.

The 10th and 90th percentile values have been used rather than minimum and maximum values to exclude infrequent extreme wet and dry conditions. The set of 10th or 90th percentile values do not necessarily all correspond to the same rainfall series, that is, they do not correspond to a 10th percentile “dry” or 90th percentile “wet” year.

Some predictions are presented using cumulative frequency distributions of the predicted daily average discharge. Cumulative frequency distribution show the probability (based on water balance modelling results) that discharge will exceed a particular value on any particular day.

6.2 Annual water balance

The reporting and forecast average annual water balance for combined TGO Mine and SAR Mine is summarised in Table 6.1. Results under existing and proposed conditions are presented in Figure 6-1 to Figure 6-4.

Table 6.1 Average annual water balance for TGO

Mine Stage	Existing conditions (2021) (ML/year)	Proposed conditions (2026) (ML/year)
Inputs		
Direct rainfall and catchment runoff	414	850
Supplied from external bores	500	356
External water delivery	0	0
Moisture in ore	56	72
Secondary release from residue	22	21
Groundwater inflows	238	766
Total Inputs	**1230**	**2065**

Mine Stage	Existing conditions (2021) (ML/year)	Proposed conditions (2026) (ML/year)
Outputs		
Evaporation from water storages	78	145
Discharge from sediment basins	1	1
Potable use	1	2
Water in residue	553	669
Evaporation from active residue	120	178
Losses from rewetting of inactive residue	220	529
Dust Suppression	250	388
Losses from underground workings	8	16
Total Outputs	1231	1928
Change in Storage	-1	**137**
Balance	**0**	**0**

Direct rainfall, runoff and evaporation

Direct rainfall, catchment runoff and evaporations are expected to increase in proposed conditions as a result of the Project reflecting the additional catchment and water storages within the combined water management system.

Supplied from external bores and external water delivery

Raw water supply from the external bores is expected to decrease as a result of the Project. This reflects the increase in water potentially available from groundwater inflows in the proposed conditions. A water security sensitivity scenario is considered in Section 6.4.

Modelling results indicate no external supply of water (other than the external bores) is needed in proposed conditions reflecting the adequate supply of water for the Project.

Moisture in ore

Modelling results suggest a slight increase in ore moisture in proposed conditions as a result of the Project reflecting the increase in planned production rate under proposed conditions as discussed in Section 3.7.

Groundwater inflows

Modelling results suggest an increase in total groundwater inflows to TGO Mine Site and SAR Mine Site as a result of the Project. This reflects the modelled average of 0.65 ML/day total groundwater inflow at TGO in existing conditions and the modelled average of 1.8 ML/day total groundwater inflow at SAR Mine in proposed conditions.

Potable use

Modelling results suggest a slight increase in potable water usage in proposed conditions as a result of the Project reflecting the increase in staff at SAR Mine in proposed conditions.

Water in residue, evaporation from active residue, and losses from rewetting of inactive residue

Water in residue, evaporation from active residue and losses from rewetting of inactive residue are expected to increase in proposed conditions as a result of the Project reflecting the increase in planned production rate under proposed conditions as discussed in Section 3.7.

Modelling results indicate no significant change in secondary release from residue during proposed conditions.

Dust suppression

Dust suppression is expected to increase in proposed conditions as a result of the Project reflecting the construction of additional haul roads connecting TGO Mine and SAR Mine.

Losses from underground workings

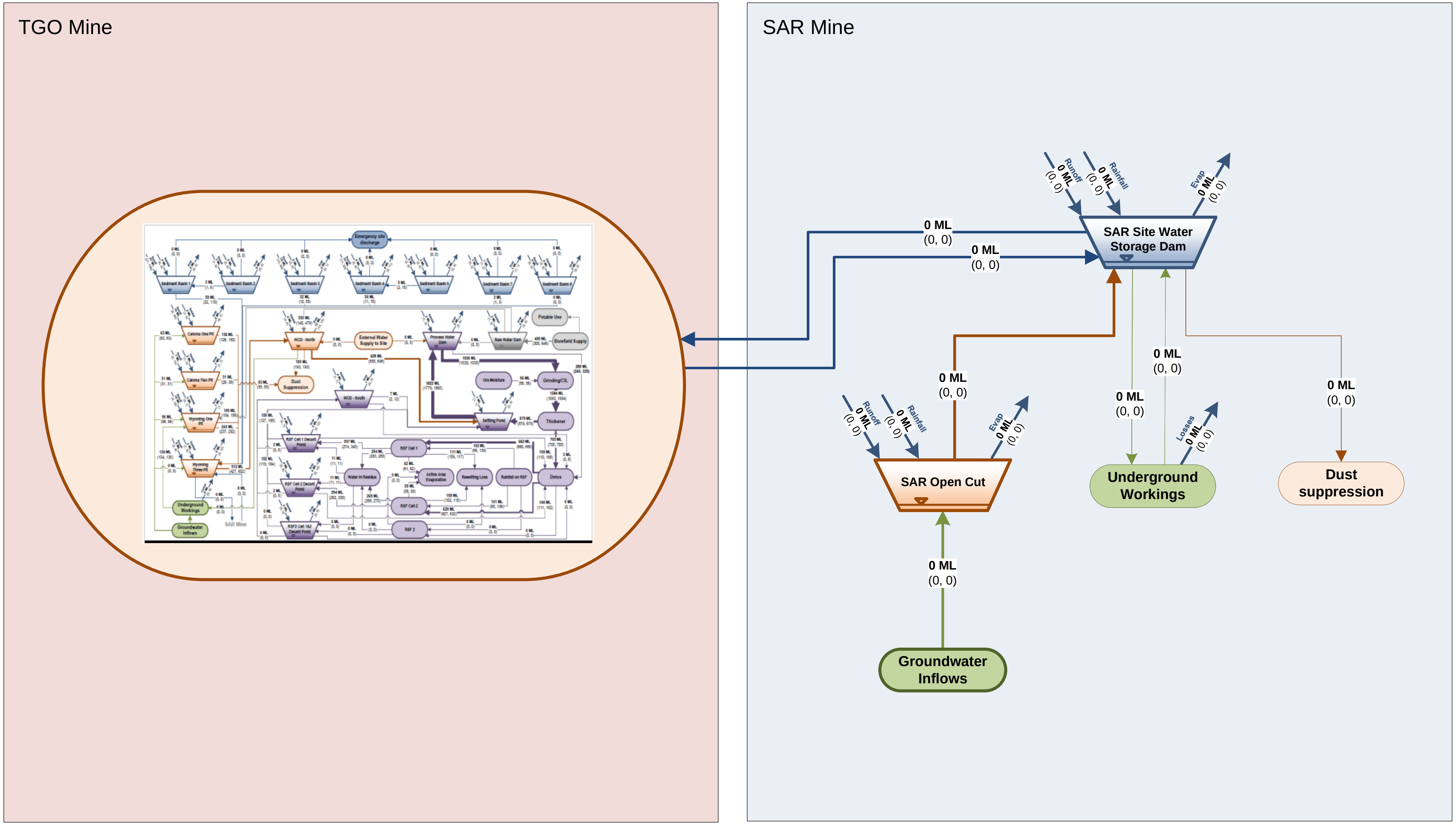
Losses from operations in underground workings is expected to increase in proposed conditions reflecting the additional underground workings area in SAR Mine as a result of the Project.

Potential discharge from sediment basins

The additional proposed water storages represented conceptually by SB8 and the SAR Site Water Storage Dam are expected to provide a similar environmental containment performance to the existing dirty water management system at TGO. No potential for increased off-site volumes was forecast. The actual potential for off-site discharge will depend on the storage and pumping infrastructure implemented as part of the Project.

Change in storage

Modelling results suggest an expected increase in overall water storage volume in proposed conditions. This reflects the increase in combined groundwater inflow in both mines and the adequate supply of water in proposed conditions.



Legend

- Water transfer
- Storage
- **XX ML** (XX, XX) — Mean, 10th, 90th percentile
- Raw water system
- Dirty water system
- Mine water system
- Process water system
- Groundwater

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Tomingley Gold Operations
Tomingley Gold Extention Projects
Site Water Balance Assessment

Existing conditions (2021)
Regional

Project No. **12560976**
Revision No. **0**
Date **15/11/2021**

Figure 6-1

Created by: Jean Macatanong

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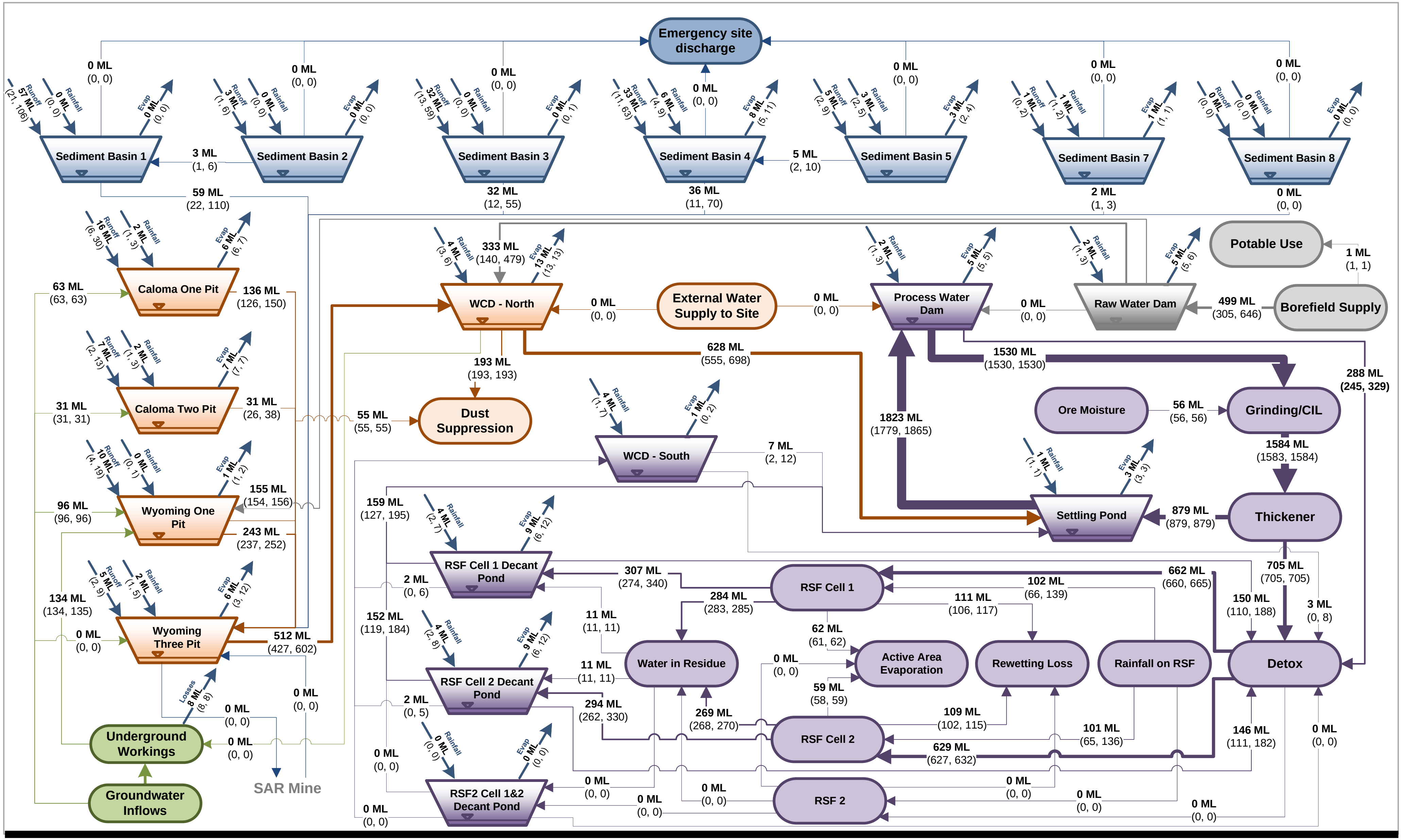

Legend

Water transfer	Raw water system	Process water system
Storage	Dirty water system	Groundwater
XX ML (XX, XX) Mean 10th, 90th percentile	Mine water system	

Tomingley Gold Operations
Tomingley Gold Extention Projects
Site Water Balance Assessment

Existing conditions (2021)
TGO Mine

Project No. 12560976
Revision No. 0
Date 16/11/2021

Figure 6-2

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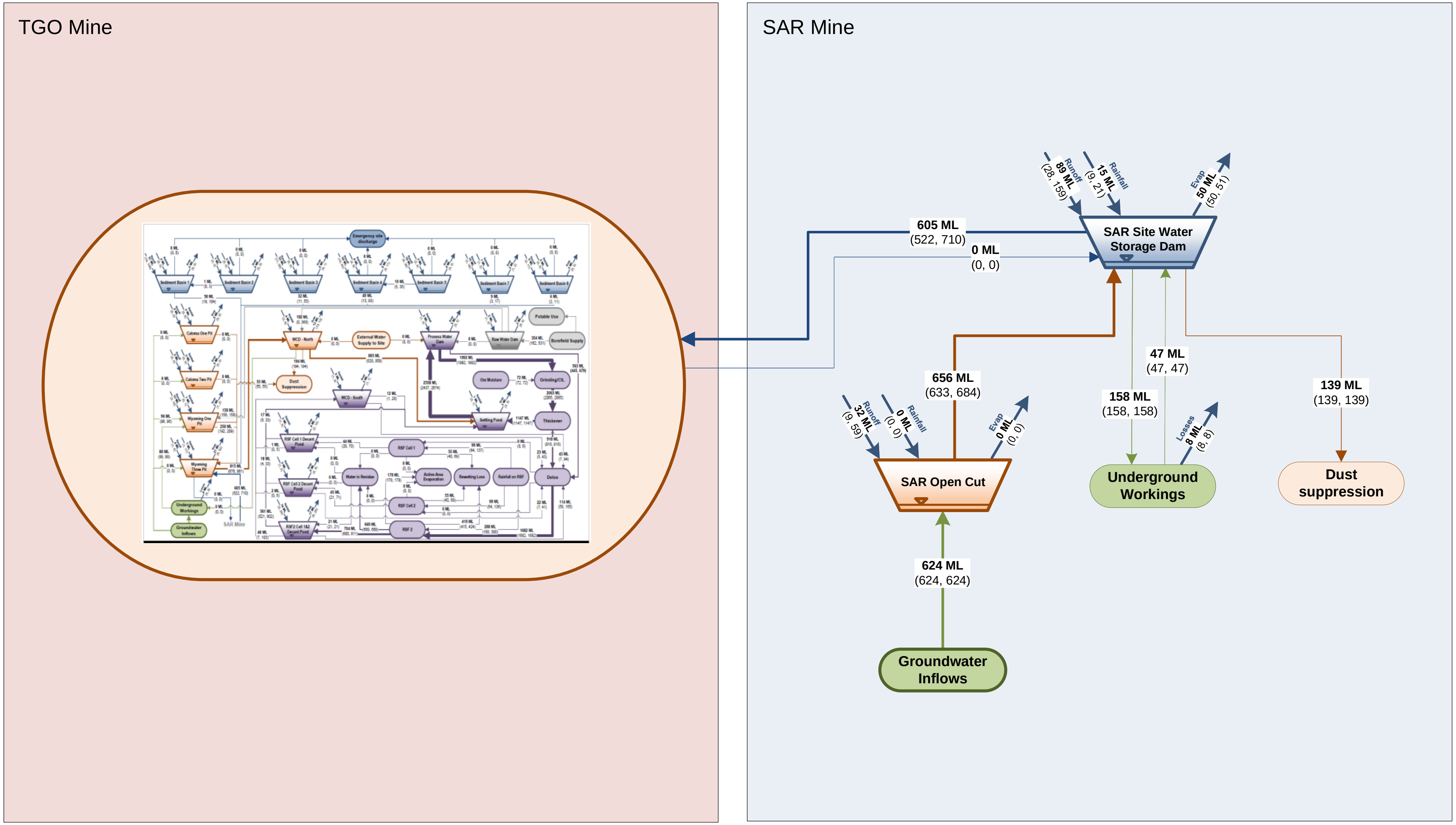

Legend

→	Water transfer		Raw water system		Process water system
	Storage		Dirty water system		Groundwater
XX ML (XX, XX)	Mean 10th, 90th percentile		Mine water system		

GHD

Tomingley Gold Operations
Tomingley Gold Extention Projects
Site Water Balance Assessment

Proposed conditions (2026)
TGO Mine

Project No. 12560976
Revision No. 0
Date 15/11/2021

Figure 6-3

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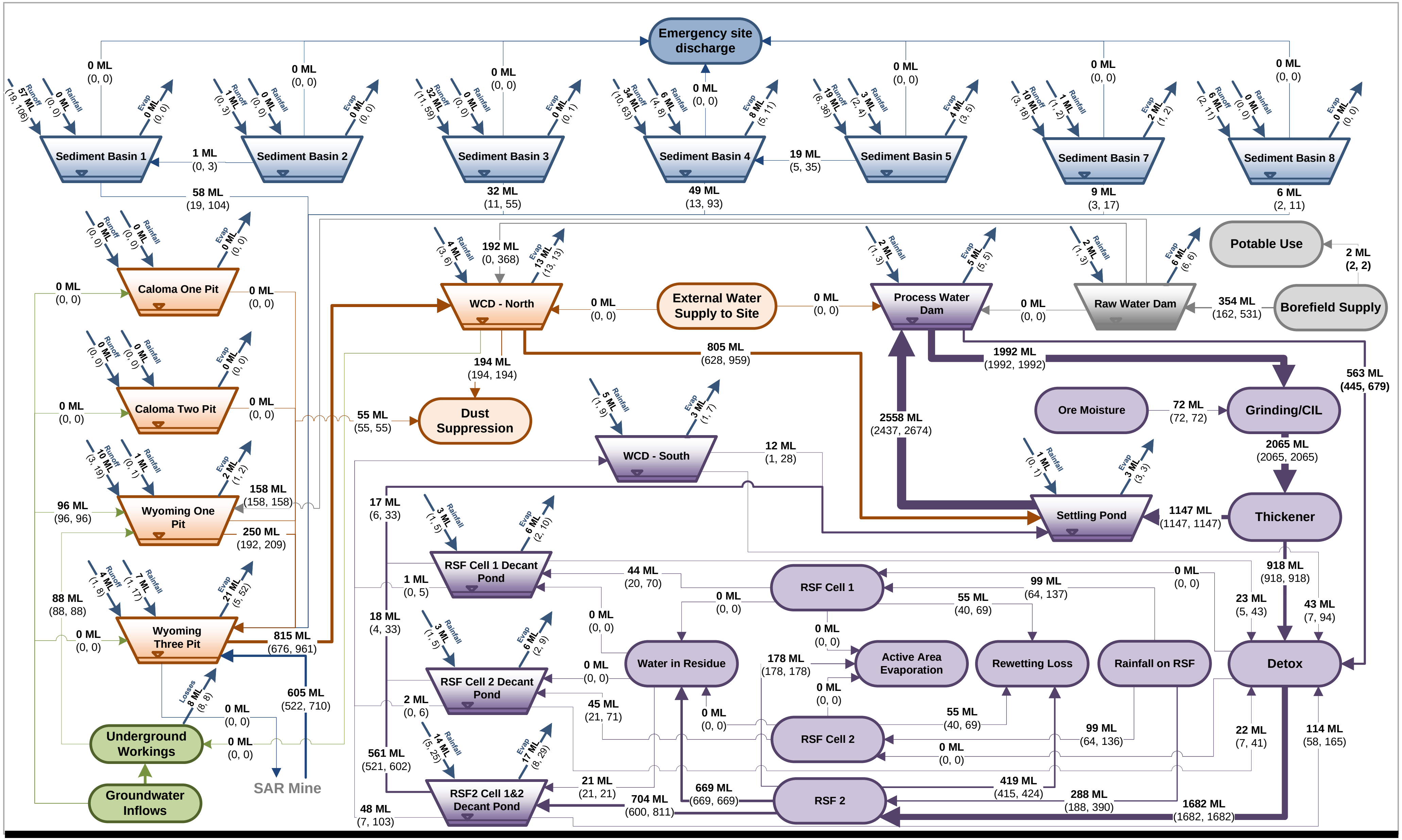

Legend

Water transfer	Raw water system	Process water system
Storage	Dirty water system	Groundwater
XX ML (XX, XX) Mean 10th, 90th percentile	Mine water system	

GHD

Tomingley Gold Operations
Tomingley Gold Extention Projects
Site Water Balance Assessment

Proposed conditions (2026)
TGO Mine

Project No. 12560976
Revision No. 0
Date 16/11/2021

Figure 6-4

Created by: Jean Macatanong

6.3 Water inventory

The site water balance model simulated the volume of water in each water storage over the prediction period from January 2021 to January 2033. The total inventory of mining and process water are shown in Figure 6-5 and Figure 6-6 respectively.

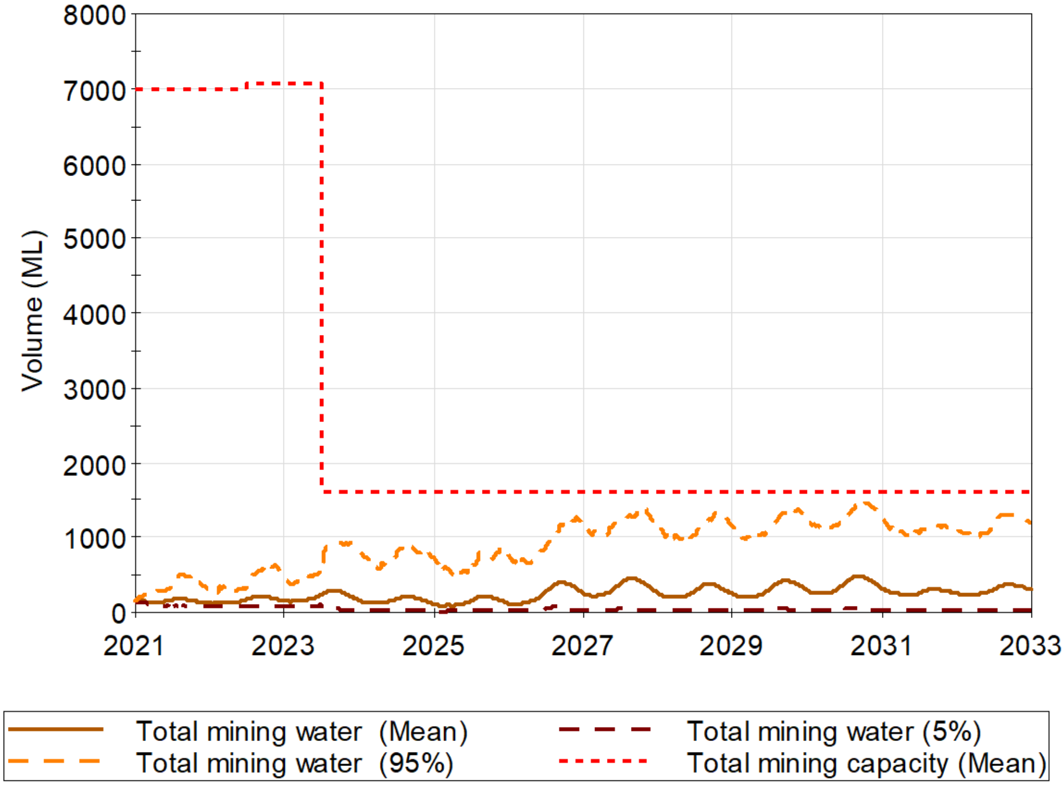

Figure 6-5 Mining water inventory

Figure 6-5 shows that, on average, total mining water is forecast to stabilize during 2026 to 2031 with estimated total mining water of about 400 ML to 500 ML. The potential for above or below average rainfall conditions results in a likely forecast range of about 20 ML to 1500 ML, which is within the total mining water capacity of the site, which is 1612 ML.

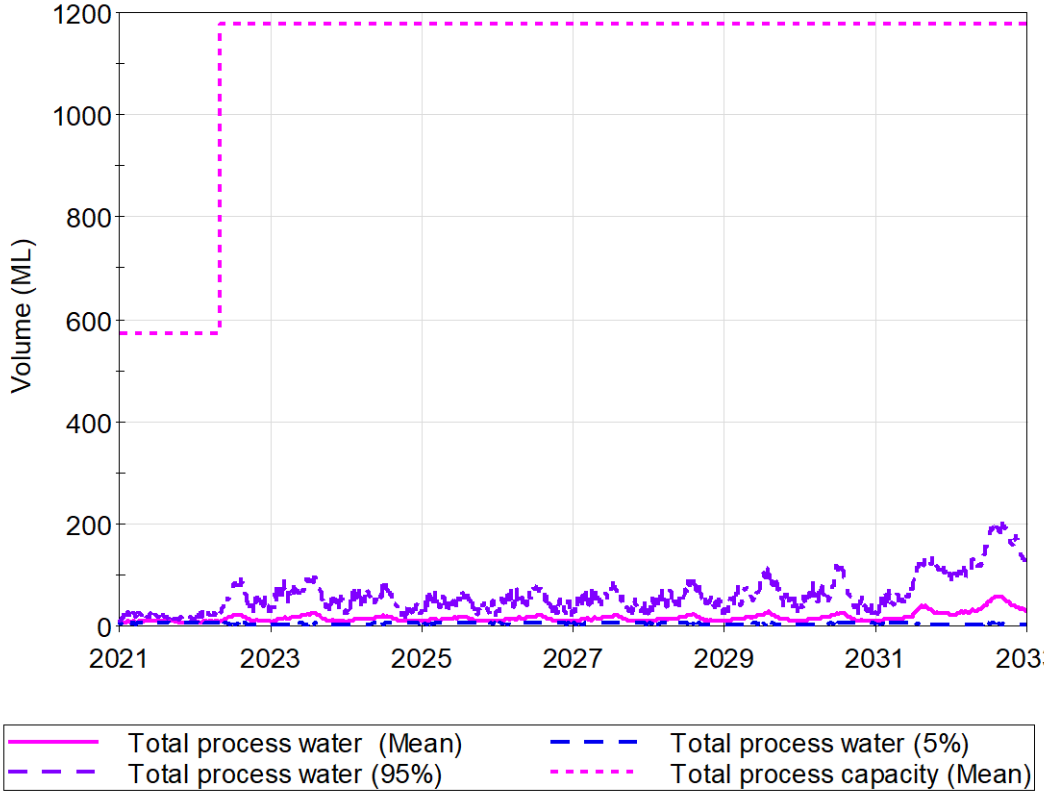

Figure 6-6 ***Process water inventory***

Figure 6-6 shows that, on average, total process water is predicted to continue to vary seasonally between 5 to 60 ML until end of 2032. Ore processing is expected to conclude by the end of FY32. The modelling results indicates that it is unlikely for total process water to exceed the total process water capacity, as adequate surplus water storage is likely to be available in the decant ponds of the RSF1 and 2 and the Wyoming Central Dam – South cell.

6.4 Water security

A sensitivity scenario was conducted to analyse the effect of groundwater inflows. Groundwater inflows as presented in Section 3.6 was scaled to 0%, which was consistent with the scaling adopted for the purpose of the validation discussed in Section 5. Transfer rates from the external bores was simulated at a higher maximum rate of 60 L/s without limitation by water access licence entitlements. Under this scenario, external bores was modelled to supply both TGO Mine and SAR Mine. Forecast borefield demand is presented in Figure 6-7.

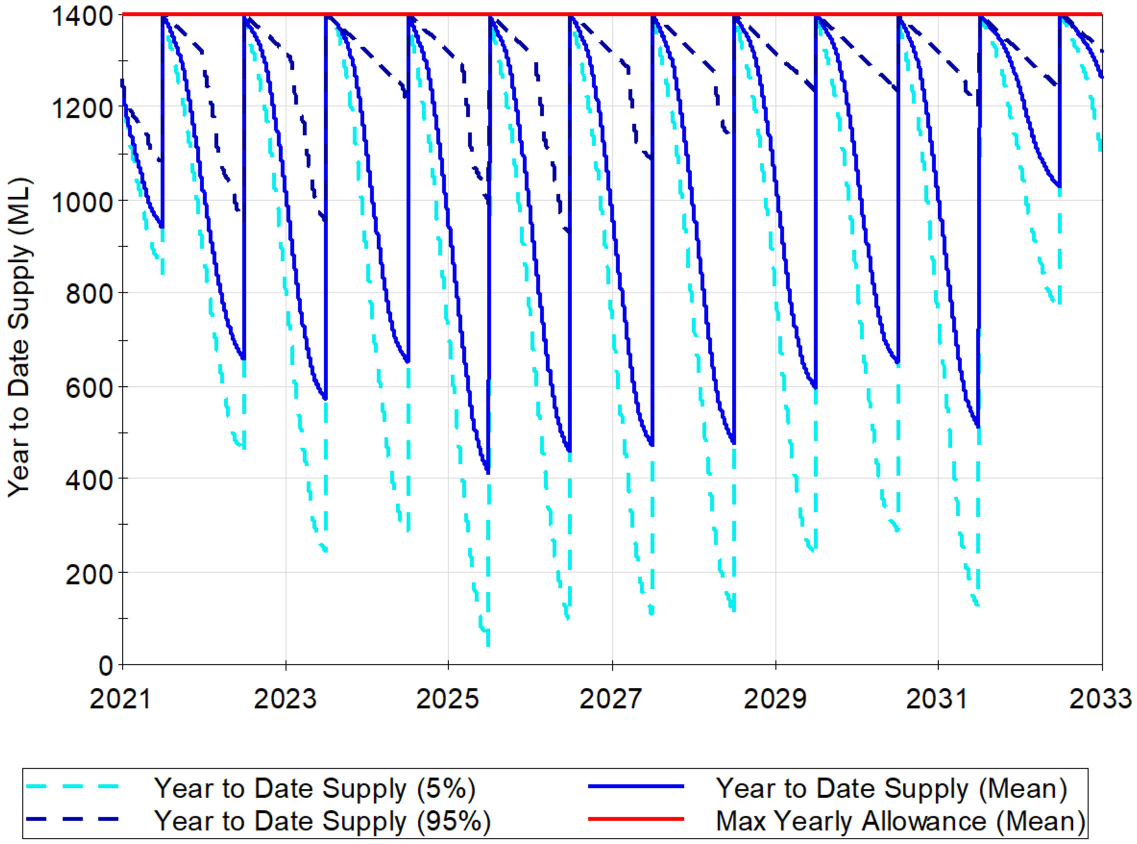

Figure 6-7 *Borefield Allocation*

Figure 6-7 indicates that borefield allocation is forecast to peak in 2025 with an estimated 40 ML/year remaining in a dry (5th percentile) year out of 1400 ML total annual borefield allocation. The potential for above or below average rainfall conditions results in a likely forecast required water from the borefield of about 40 ML to 1240 ML. This is within the groundwater entitlement of 1400 ML proposed to be held for the site.

7. Summary

GHD Pty Ltd (GHD) was engaged by Tomingley Gold Operations Pty Ltd to prepare a SWBA for the proposed Tomingley Gold Extension Project (the Project). The assessment was undertaken by updating an existing GoldSim site water balance model for TGO to reflect existing and proposed site conditions.

The assessment found that site water balance for the Project would be generally consistent with the existing site water balance, with increased volumes reflecting the larger disturbance footprint, additional haul road length, interception of groundwater and scheduled production rates. The overall site water storage capacity was found to be adequate to contain to the range of dirty and process water inventory forecast over the life of the Project.

A sensitivity scenario that assumed effectively no groundwater intercepted during mining forecast that reliable water sources in addition to the existing water access licence entitlement held for the Woodlands Borefield may be required for the Project.

8. References

Bureau of Meteorology, *Climate Data Online,* 2021, Available from: http://www.bom.gov.au/climate/data/ (August 2021).

Boughton, W. and Chiew, F. (2003). *Calibrations of the ABM for use on ungauged catchments*, Technical Report 03/15, CRC for Catchment Hydrology, Monash University, 37 pp.

GHD (2015) Tomingley Gold Operations Modification 3: Water Resources Assessment.

GHD (2020) TGO RSF2 Concept Design Report. Prepared by GHD Pty Ltd for Tomingley Gold Operations Pty Ltd.

Jacobs (2021) Tomingley Gold Extension Project Ground Water Assessment. Prepared by Jacobs Australia Pty Limited for Tomingley Gold Operations Pty Ltd.

Landcom (2004), *Managing Urban Stormwater: Soils and Construction.*

McMahon *et al.* (2013) *Estimating actual, potential, reference crop and pan evaporation using standard meteorological data: a pragmatic synthesis. Hydrology and Earth System Sciences*. 17, 1331–1363. DOI:10.5194/hess-17-1331-2013.

PSM (2014), *Water Management Plan Review*, Pells Sullivan Meynink, 3rd October 2014.

R.W. Corkery (2021) Tomingley Gold Extension Project Scoping Report. Prepared by R.W. Corkery & Co. Pty Limited for Tomingley Gold Operations Pty Ltd.

Appendices

Appendix A

Validation Graphs

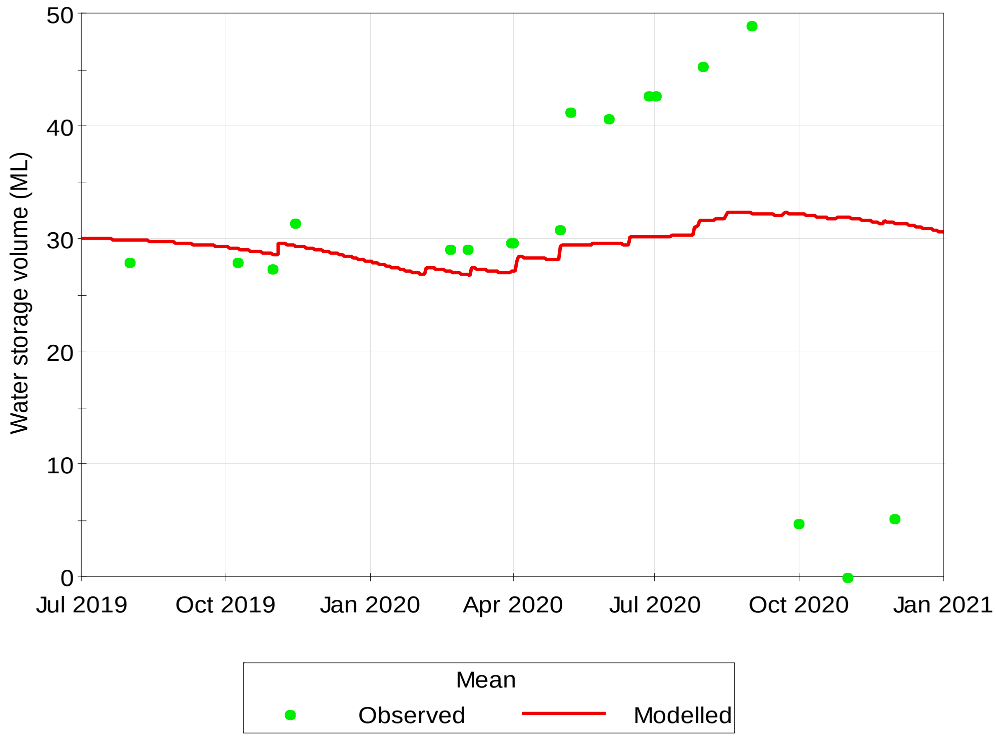

Figure A 1 Caloma 2 void storage volume

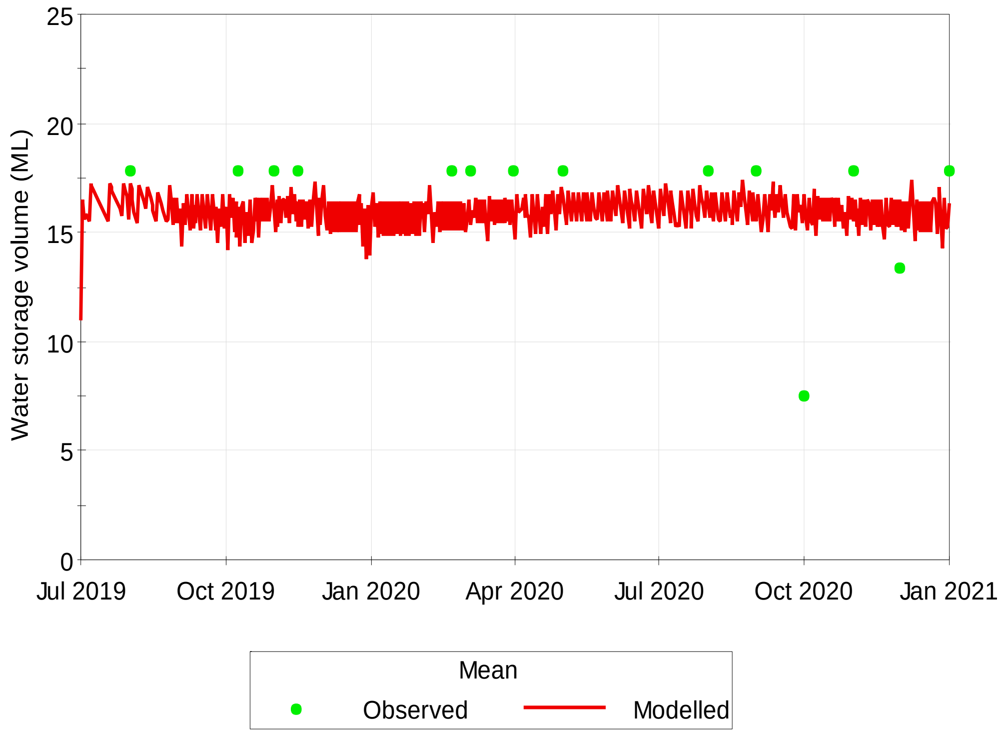

Figure A 2 WCD North storage volume

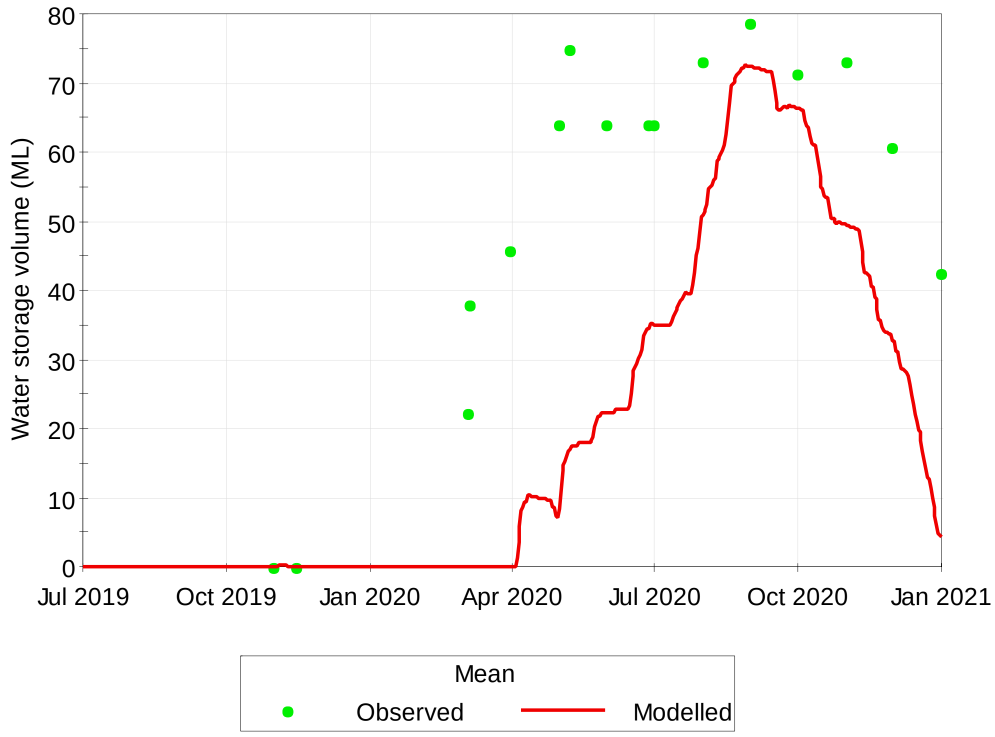

Figure A 3 WCD South storage volume

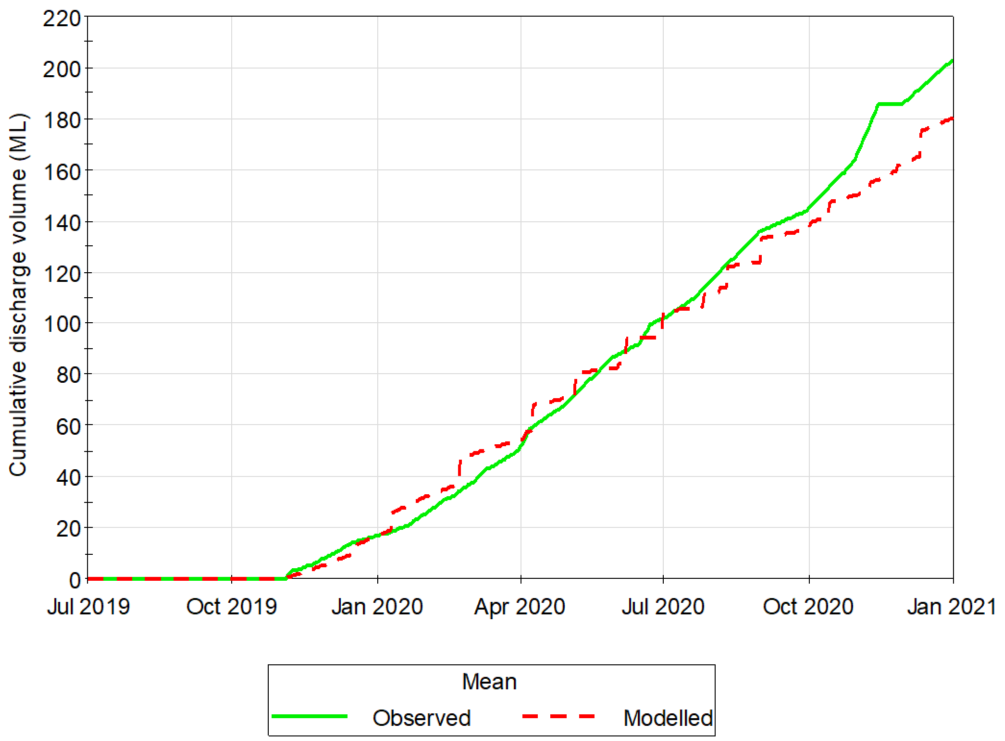

Figure A 4 Wyoming 1 cumulative discharge volume (Nov 2019 – Jan 2021)

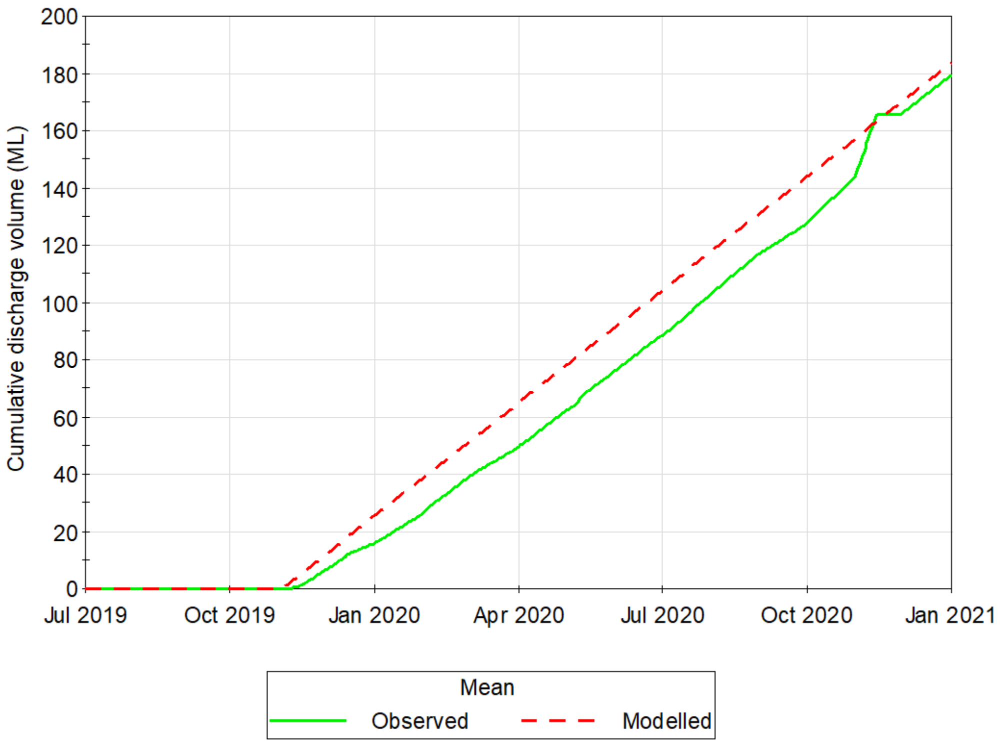

Figure A 5 WCD North cumulative discharge flow (Nov 2019 – Jan 2021)

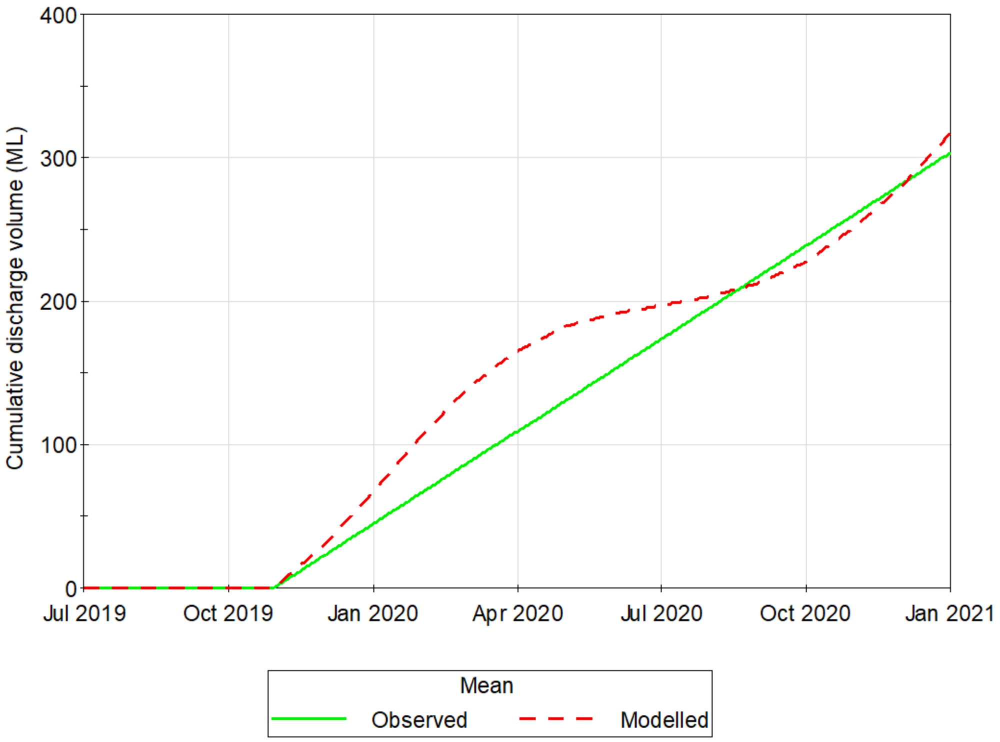

Figure A 6 Cumulative dust suppression volume (Nov 2019 – Jan 2021)

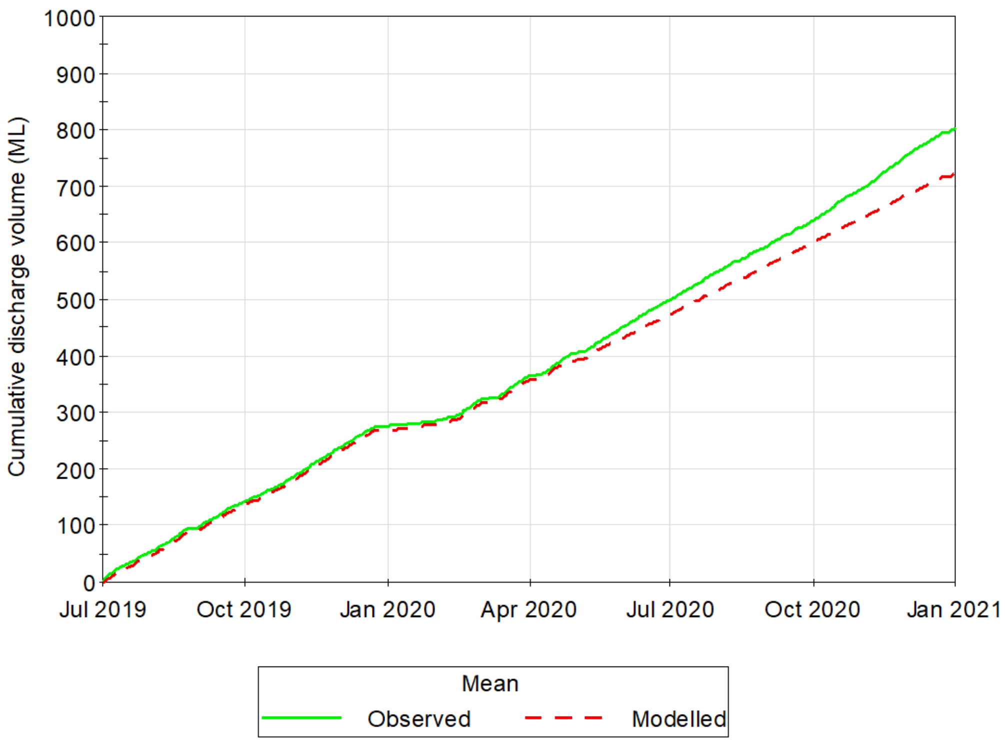

Figure A 7 Cumulative borefield volume

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