SARAJI EAST MINING LEASE PROJECT

Environmental Impact Statement

Appendix E-2

Mine Water Balance Technical Report

BMA

BHP Mitsubishi Alliance

Prepared for
BM Alliance Coal Operations Pty Ltd
ABN: 67 096 412 752

AECOM

Environmental Impact Statement

E-2 Mine Water Balance Report

29-Aug-2024
Saraji East Mining Lease Project

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Environmental Impact Statement

E-2 Mine Water Balance Report

Client: BM Alliance Coal Operations Pty Ltd

ABN: 67 096 412 752

Prepared by

AECOM Australia Pty Ltd
Turrbal and Jagera Country, Level 8, 540 Wickham Street, PO Box 1307, Fortitude Valley QLD 4006, Australia
T +61 1800 868 654 www.aecom.com
ABN 20 093 846 925

29-Aug-2024

Job No.: 60507031

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Acronyms

AEP	Annual exceedance probability
AWAS	Australian Water Accounting Standard
AWBM	Australian water balance model
BMA	BM Alliance Coal Operations Pty Ltd
BOM	Bureau of Meteorology
CCA	Consequence Category Assessment
CHPP	Coal handling and preparation plant
DES	Department of Environment and Science
DEHP	Department of Environment and Heritage Protection
DIIS	Department of Industry, Innovation and Science
DNRME	Department of Natural Resources, Mine and Energy
DoR	Department of Resources
DSA	Design storage allowance
EC	Electrical conductivity
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act 1994*
EPC	Exploration Permit for Coal
ESS	Extreme storm storage
EWPC	Eungella Water Pipeline Company
GRI	Global Reporting Initiative
ha	Hectare
kL	Kilolitre
km	Kilometre
LPSDIP	The Leading Practice Sustainable Development Program
m	metres
MAW	Mine affected water
mg/L	Milligrams per litre
MIA	Mine infrastructure area
µS/cm	Micro Siemens per centimetre
ML	Mega litre
MLA	Mining lease application
mm	Millimetres
MRL	Mandatory reporting level
PET	Potential Evapotranspiration
PWD	Process Water Dam
RE	Regional Ecosystem

REMP	Receiving environment monitoring program
ROM	Run of mine
ROP	Resource operations plans
RWD	Raw Water Dam
SILO	Scientific Information for Land Owners
SMD	Slightly to moderately disturbed
STP	Sewage treatment plant
TDS	Total dissolved solids
TLO	Train load out
TOR	Terms of Reference
tph	Tonnes per hour
TSF	Tailings storage facility
TSS	Total suspended solids
WAF	Water accounting framework
WBM	Water balance model
WMS	Water management system
WP	Water Plan
WTP	Water treatment plant

Executive Summary

BM Alliance Coal Operations Pty Ltd (BMA) proposes to develop the Saraji East Mining Lease Project (the Project), a greenfield single-seam underground mine development on Mining Lease Application (MLA) 70383 commencing from within Mining Lease (ML) 1775. The Project also comprises supporting infrastructure, including a Coal Handling Preparation Plant (CHPP), a Mine Infrastructure Area (MIA), a conveyor system, rail spur and balloon loop, water pipelines and dams, powerlines, stockpiles and a construction accommodation village. Infrastructure will be located on the adjacent Saraji Mine MLs as well as on MLA 70383 and MLA 70459. The Project will mine up to 11 million tonnes per annum (Mtpa) and produce up to 8 Mtpa of product coal for the export market over a 20-year production schedule.

This document presents the basis for the conceptual design of the mine Water Management System (WMS) for the Project. It has been prepared to address the Project's Terms of Reference (ToR) for an Environmental Impact Statement (EIS) (DEHP, 2017) and submissions on the draft EIS.

The conceptual mine WMS has been progressed to a level of detail commensurate with the current Project design and data availability. The WMS is in line with best management practice for mine water management including:

- minimising generation of mine affected water (MAW) by passively diverting clean runoff around the mine WMS where practical
- minimising the volumes of MAW stored onsite by preferencing use of the stored MAW (e.g. for CHPP process and dust suppression)
- minimising the consumption of raw water by preferencing the use of MAW.

Proposed Mine WMS

The conceptual mine WMS consists of the following key components:

- MAW Storages
  - Process Water Dam (PWD)
  - Collection dams for each Project process area:
    - MIA
    - CHPP
    - ROM Pad
    - Product Coal Stockpile Pads
  - a sump located adjacent to the Underground Mine Portal Area, and
- Raw Water Dam (RWD).

A water transfer network of pumps and pipes will provide pumped transfer capacity between the storages.

MAW is proposed to be collected from each process area dam and transported to the PWD. In addition, the PWD also receives MAW from the Underground Mine Portal Sump. MAW enters the sump as a by-product of dewatering of the underground mine. MAW stored in the PWD is the preferred source of water for the CHPP and dust suppression activities.

Raw water is stored in the RWD, which has been sized to meet cumulative Project water demands for approximately one month. Raw water is used to satisfy potable, underground mine, CHPP and dust suppression water demands when MAW is unavailable.

Water storage structures proposed as part of the development have been assessed in a preliminary consequence category assessment (CCA) completed pursuant to the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (DES, ESR/2016/1933). A summary of WMS dams which were assessed as comprising 'regulated structures' is shown in Table 1. For these regulated structures, the annual exceedance probability (AEP) of regulatory containment volumes for Extreme Storm Storage (ESS) and Design Storage Allowance (DSA) volumes were calculated.

A probabilistic Water Balance Model (WBM) was developed to assess the proposed WMS system's performance in a range of climatic conditions, including climate change projections developed for the site location. Using the WBM, preliminary water storage capacities were calculated for each structure, such that:

- uncontrolled releases of MAW to the receiving environment are minimised
- the regulated structures accommodate the ESS and DSA volumes.

To allow flexibility and contingency management of MAW inventories, BMA will be seeking authority and licence conditions to conduct the controlled release of MAW from the PWD. The indicative location for controlled release of MAW is located on Boomerang Creek adjacent to the proposed PWD. The potential release water quality of MAW from the PWD has been assessed in a simple dilution assessment. Subject to appropriate controls, coordination with proximate mining proponents and flow criteria, water quality objectives for downstream waterways were demonstrated to be achievable. Model results show that the implementation of managed releases complying with predefined conditions reduces the likelihood of uncontrolled releases, which may lead to significant downstream impacts.

Operational spillway flows are not proposed to occur, however proposed dams will include emergency spillway structures to protect the integrity of the embankments should excess water inventories accumulate. Potential spills from emergency spillway structures from the PWD are proposed to be directed to Boomerang Creek. Similarly, potential spills from emergency spillway structures associated with the process area dams will be directed to the Plumtree and Hughes Creek diversion. Where dam overflow locations cannot deliver flows directly to Hughes Creek or its tributaries, conveyance channels are proposed to convey the discharge.

Table 1 Mine WMS – Regulated Structures - Summary

Mine WMS Dam	Configuration	Catchment (Ha)		Preliminary Consequence Category	Required DSA* and ESS AEP**	Preliminary Dam Capacity (ML)	Preliminary Hydrological Design Criteria (ML)			Preliminary Overflow Destination
		External	Total				ESS***	Dam Vol. Equivalent to MRL[1]	DSA	
PWD	Turkey's Nest (pumped inflows)	N/A	3.8	Significant	1:20	125	8.6	116.4	23.3	Boomerang Creek, and Hughes Creek

*Design storage allowance

**Extreme storm surge annual exceedance probability

***Extreme storm storage

[1] Due to the preliminary nature of the assessment the level of the MRL is currently unknown and has been given as the equivalent dam volume

1.0 Introduction

BM Alliance Coal Operations Pty Ltd (BMA) commissioned AECOM Australia Pty Ltd (AECOM) to recommence and finalise the Environmental Impact Statement (EIS) and obtain approval for the Saraji East Mining Lease Project (the Project).

The Project Site (bounded by Exploration Permit for Coal (EPC) 837, EPC 2103, Mining Lease Application (MLA) 70383, MLA 70459, Mining Lease (ML) 1775, ML 70142 and ML 1782) is located to the north of Dysart in Queensland's Bowen Basin and encompasses approximately 11,427 hectares (ha) of land (Figure 1).

This section of the Report introduces the Project context, as listed in Table 1.

Table 1 Section 1 Contents

Section	Description
1.1 Project description	Provides a brief description of the primary Project features.
1.2 Scope of work	Describes the scope of works for the Mine Water Balance Report.
1.3 Methodology	Introduces the methodology utilised for the assessment.
1.4 Relevant legislation	Outlines key legislation and regulatory requirements for the Project.
1.5 Existing environment	Provides a brief description of the existing environment at the site location.

1.1 Project description

The Project is a greenfield, single-seam underground mine development on MLA 70383 commencing from within ML 1775 with the underground mine portal to be developed in the highwall of the existing Saraji Mine open cut pit. The Project has been designed to utilise the existing approved Saraji Mine infrastructure, such as electricity lines, water supply pipelines, coal handling and preparation plant (CHPP), haul roads, workshops and warehouses, wherever practical. The Project will require upgrades to existing mine infrastructure and additional mine infrastructure. As such, the Project also comprises a new CHPP, associated mine infrastructure area (MIA) and a new rail spur and balloon loop, each of which is proposed to be located on the existing adjacent Saraji Mine. A new infrastructure and transport corridor will be constructed on MLA 70383 and MLA 70459 to accommodate the reconfiguration of existing power and water networks and internal access roads.

Key attributes of the Project mine water management system (WMS) are shown in Table 2 and the proposed Project layout is shown in Figure 1.

Table 2 Key Attributes of the Project Mine WMS

Aspect of the Project	Details
Total production	Approximately 150 million tonnes (Mt) run-of-mine (ROM) coal equates to approximately 110 Mt of product coal over 20 year life of mine.
Average annual production (excluding ramp up and ramp down and potential extensions)	8.2 Mtpa ROM coal annual average with a maximum of 11 Mtpa. 6.2 Mtpa product coal annual average with a maximum of eight Mtpa
Mine life • Construction • Production • Rehabilitation	Underground mine plan for 20 year life of mine, including: • Approximately 2 years (coinciding with production) • Approximately 20 years • Nominally 10 years.
Operating hours	24 hours per day, 7 days per week
Mining method	Underground long wall mining
Existing mining lease areas	ML 70142, ML1782 and ML 1775
Proposed mining lease area	MLA 70383 and MLA 70459

Aspect of the Project	Details
Water infrastructure	Dams, catchment diversions and drains will be required to support mining operations, manage mine affected water (MAW) and protect downstream environmental values by minimising uncontrolled releases. Key Project water infrastructure to be built consists of: • Process Water Dam (PWD) - Runoff from disturbed areas of the Project, including the MIA, CHPP, stockpiles (ROM and product coal), train load out, and portal entry sump will be collected at source and transferred to the PWD. The PWD will be constructed as a turkey's nest (no external catchment) and located on MLA 70383. • Temporary gas dewatering storage - The pre-drainage of incidental mine gas will result in the production of water. This water will be collected in local facilities near the well head. These facilities will act as a balancing storage to allow transfer at a constant rate to the PWD. • Raw Water Dam (RWD)* - The RWD will be a turkey's nest design and will receive clean water inflows from BMA's 10,000 mega litres per year (ML/yr) allocation from the Northern Network Pipeline. Water from the RWD will be used to satisfy the Project's potable water and underground mining equipment demands, as well as makeup supply for dust suppression and CHPP process demand when supplies of MAW are unavailable for reuse. The RWD will be located on ML 70142. • Additional highwall pumps - The access portal to the underground workings will be via the existing open cut highwall. Water collected in the highwall portal pit sumps will be pumped to the PWD to maintain the flood immunity of the underground workings. • Pipelines - Relocation and re-connection of the existing Eungella Water Pipeline Company (EWPC) Southern Extension Water Pipeline into a new infrastructure and transport corridor to the eastern boundary of MLA 70383 and northern boundary of MLA 70459. - A water pipeline will be constructed connecting the Project's surface infrastructure located on ML 70142 to the PWD located on MLA 70383. - Water transport associated with the Project will be achieved via the utilisation (and enhancement where necessary) of BMA's existing water pipeline network connecting Saraji Mine to BMA mines to the north and south of Saraji Mine. • Mine affected stormwater drainage infrastructure - Mine affected runoff dams, bunds and drains to capture and treat run-off from disturbed areas, including ROM and product stockpile pads, CHPP and MIA.

*For the purposes of this assessment, Raw Water refers to water supplied via the EWPC pipeline facility.

1.2 Scope of work

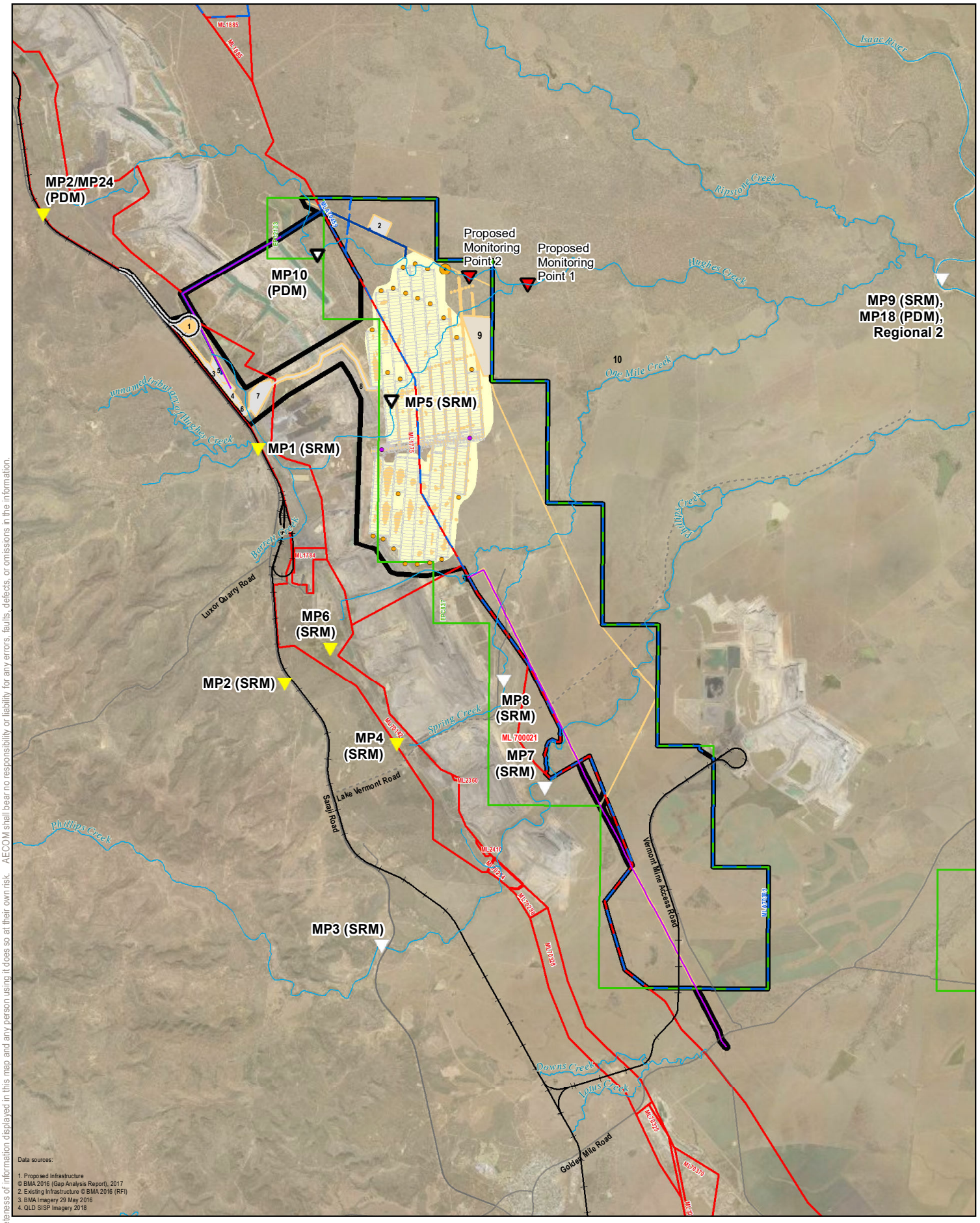
This Report has been developed to address the relevant requirements of the Project's Terms of Reference (ToR) (DEHP, 2017). The relevant requirements of the ToR and summary of how and where they are addressed in this Report is listed in Table 3. This Report also responds to public submissions on the draft EIS.

Table 3 Terms of Reference Addressed by this Report

ToR Reference	Information Requirement	Comment	Relevant Report Section(s)
8.3.4	Identify the quantity, quality, location and timing of all potential and/or proposed releases of contaminants (such as controlled water releases to surface water streams) from water and waste water from the project, whether as point sources (including controlled or uncontrolled discharges, stormwater run-off from regulated structures or other dams and sediment basins) or diffuse sources (such as seepage from waste rock dumps or irrigation to land of treated sewage effluent).	• All mine water management dams have been provisionally sized assuming containment of potential inflows using climate data (baseline and considering climate change) and under assumed operational rules. • All mine water management dams will still have the potential to discharge to the receiving environment via emergency spillway structures during extreme weather events. • Potentially mine affected stormwater runoff from disturbed sites will be contained at source by collection dams and transferred to the PWD. • A sewage treatment plant (STP) will be installed to service the MIA, the construction accommodation village, and to treat all sewage generated onsite. Sewage from the stockpile/CHPP area, and from the ablutions facility at the mine portal, will be pumped back to the MIA. Treated effluent from the STP and the WTP will be captured in the PWD.	2.1.3, 2.2.5 and 4.6
8.4.1	Provide details of any proposed impoundment, extraction, discharge, injection, use or loss of surface water or groundwater. Identify any approval or allocation that would be needed under the *Water Act 2000*.	• Groundwater inflow to the mine WMS will be through dewatering of the underground mine as well as from the proposed gas drainage bore field. • Except where originating from disturbed areas, and therefore potentially mine affected and contained, no impoundment, extraction, discharge, injection, use or loss of surface water is expected.	2.1 and 2.2

ToR Reference	Information Requirement	Comment	Relevant Report Section(s)
8.4.3	Describe the options for supplying water to the project, and assess any potential consequential impacts in relation to the objectives of any Water Plan and resource operations plan that may apply.	Raw water from BMA's existing surface water allocations will be piped to the Project Site to supply clean water for: • makeup water to the CHPP and dust suppression • supply to underground mining operations • potable demands. Project demand for raw water has been estimated through the use of water balance modelling.	4.8.7
8.4.5	Develop hydrological models as necessary to describe the inputs, movements, exchanges and outputs of all significant quantities and resources of surface water and groundwater that may be affected by the project. The models should address the range of climatic conditions that may be experienced at the site, and adequately assess the potential impacts of the project on water resources. The models should include a site water balance. This should enable a description of the project's impacts at the local scale and in a regional context including proposed:	• A GoldSim water balance model for the Project has been developed. • The water balance model simulates the life of mine under historical climate conditions, projected climate change conditions, and assumed operational rules.	4.0
8.4.5.1	• Changes in flow regimes from diversions, water take and discharges.	• No new diversions are planned as part of the Project. • Raw water will be sourced from BMA's existing surface water allocations. • Overland flow (runoff) from mine affected catchments will also be captured and contained within the Project. • Project water storages have been provisionally sized to minimise to the need to conduct controlled releases of MAW. Refer to the Project's Surface Water Quality Technical Report (AECOM, 2024).	-
8.4.5.2	• Alterations to riparian vegetation and bank and channel morphology.	Refer to the Project's Surface Water Quality Technical Report (AECOM, 2024) and Hydraulics, Hydrology and Geomorphology Technical Report (Alluvium, 2023).	-

ToR Reference	Information Requirement	Comment	Relevant Report Section(s)
8.4.5.3	• Direct and indirect impacts arising from the development.	Refer to Project's Surface Water Quality Technical Report (AECOM, 2024) and Hydraulics, Hydrology and Geomorphology Technical Report (Alluvium, 2023).	-
8.4.5.4	• All of the above information is to be provided in a mine water management plan, for the life of the project, which details management strategies of mine-affected water, sediment-affected water and drainage from areas not disturbed by mining activities.	This Report satisfies this requirement.	All



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LEGEND

- Project Site
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Underground layout (optimised)
- Surface Infrastructure
- Private Access
- Public Road
- Existing Railway
- 66kV Powerline
- Pipeline
- Rail Loop
- Watercourse
- Flare
- Vent
- Indicative Proposed Monitoring Point Location
- Indicative Proposed Mine Water Release Point
- Existing environment (for EIS)
- Future monitoring of mining impacts
- Background data (used for water quality objectives)

Surface Infrastructure

1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

N

Figure 1
Project Location and Proposed Layout

Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 26/08/2024 VERSION: 4

Filename: L:\Secure\Projects\605X\60507031\4. Tech Work Area\4.98 GIS 2021\02_MXDs\01 Environmental Impact Statement\E-2 Mine Water Balance Report\60507031_G171_v4_A4P_F_1_LocationProposedLayout.mxd

1.3 Methodology

The Mine Water Balance (MWB) assessment was completed to address relevant requirements of the ToR as outlined in Section 1.2. Key steps undertaken include:

- identification and description the existing environment relevant to the conceptual Project mine WMS (Section 1.5)
- identification of key objectives and considerations for the mine WMS (Section 2.0)
- development of the proposed mine WMS required to meet the key objectives and considerations (Section 2.3.4.4)
- validation of proposed mine WMS through water balance assessment (Section 4.0)
    - development of schematic for mine WMS
    - development of a water balance model to analyse the potential hydraulic performance of the WMS, subject to a range of climatic conditions, including:
        - Historical climate data
        - Climate change sequences
        - A robust set of sensitivity analyses
    - validation of proposed mine WMS against key objectives and regulatory requirements, including:
        - Containment requirements as outlined in DES (ESR/2016/1933)
    - Consideration of net WMS balance, including:
        - Estimated water balance within WMS elements
        - Estimate of the required external make up water supply
        - Estimated salt balance
        - Internal transfers and dewatering volumes
        - Potential for spills via emergency spillway structures.

      The initial water balance modelling was developed according to a conservative approach with respect to:
        - Seepage losses from proposed dam features were not modelled.

    BMA is seeking authority and licence conditions to conduct the controlled release of MAW from the PWD to allow responsible flexibility and contingency management of MAW inventories. In the rare event the site experiences extreme rainfall conditions exceeding the containment volume developed for each storage, BMA may utilise licensed release as a water management strategy in preference to allowing spills from MAW dam emergency spillway structures.

    Because the WMS was not modelled to spill via emergency spillway structures in the initial WMS validation, a ***Stress Test Scenario*** was established that specifically creates an elevated water condition, such that licensed release(s) are required to prevent spills. This Stress Test Scenario is not an expected water inventory scenario.

    As a licensed release from the PWD into Boomerang Creek has the potential to interact with the downstream receiving environment, submissions on the draft EIS requested additional analysis of managed releases. Sensitivity testing of potential release volumes and MAW water quality from the PWD has been assessed to demonstrate when and how much water could be released to the receiving environment while meeting minimum conditions as per neighbouring mines. Notwithstanding, the modelling of water quality within the WBM was simply developed, and due to available data limitations, does not model all water quality contaminants applicable to the Project.

1.4 Relevant legislation

Legislation and guidelines relevant to the proposed WMS are listed below. Additional legislation is listed in other sections of the EIS and should be read in conjunction with the information below.

1.4.1 Commonwealth policies

Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The Guidelines (ANZECC 2000) provide recommended parameters for:

- water and sediment quality that will sustain the ecological health of aquatic ecosystems
- irrigation and general water use
- livestock drinking water
- aquaculture and human consumers of aquatic food
- waters for recreational activities, such as swimming and boating
- preservation of the aesthetic appeal of these waters.

Water Stewardship – Leading Practice Sustainable Development Program for the Mining Industry (September 2016)

The Leading Practice Sustainable Development Program (LPSDP) is managed by a steering committee chaired by the Australian Government Department of Industry, Innovation and Science. The LPSDP aims to provide practical approaches to improving mine water management and reducing water risk. Approaches include practising water stewardship and developing practical, fit-for-purpose mitigation measures.

The LPSDP has been developed for a broad audience, encompassing site and operational staff, and corporate management.

1.4.2 Queensland State legislation and policies

Environmental Protection (Water and Wetland Biodiversity) Policy 2019

The quality of Queensland waters is protected under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water and Wetland Biodiversity). The EPP Water and Wetland Biodiversity achieves the object of the *Environmental Protection Act 1994* (EP Act) to protect Queensland's waters while supporting ecologically sustainable development. Queensland waters include water in rivers, streams, wetlands, lakes, groundwater aquifers, estuaries and coastal areas.

The EPP Water and Wetland Biodiversity seeks to protect and enhance the suitability of Queensland's waters for various beneficial uses. The Queensland Department of Environment and Science (DES) hold responsibility for administering the EPP Water and Wetland Biodiversity.

Water Act 2000

The *Water Act 2000* (Water Act) provides a framework for delivering sustainable water planning, allocation management and supply processes, which will contribute to water security in Queensland. The Water Act and its instruments are administered by the Department of Resources (formerly the Department of Natural Resources, Mines and Energy (DNRME)). Water Plans (WPs) and Resource Operations Plans (ROPs) are governed by the Water Act.

WPs establish a framework for sharing water between human consumptive needs and environmental values. ROPs are developed in parallel with WPs and provide a framework by which objectives from the WPs are implemented, including water allocations and administrative directions.

The Water Act defines a watercourse as a:

- river, creek or stream in which water flows permanently or intermittently in a natural channel, whether artificially improved or not, or
- an artificial channel that has changed the course of the watercourse.

The Water Act lists approvals that are required for activities that interfere with a watercourse. The Water Act also sets out the law with respect to:

- rights to surface and groundwater
- control of works with respect to surface and groundwater conservation and protection
- irrigation, water supply, drainage and flood control.

Under the Water Act, an approval or licence is required for any works that may affect surface or groundwater. BMA has applied for an EA, which will include a condition permitting the impacts to surface and groundwater.

Mineral Resources Act 1989

The *Mineral Resources Act 1989* provides for the assessment, development and utilisation of mineral resources to the maximum extent practicable, consistent with sound economic and land use management. It provides for the issuing of permits, licences and leases relating to prospecting, exploration, mining and mineral development, and the granting of mining claims. It also provides for landholders affected by these activities to be compensated.

Section 50 (4) of the Act states that:

> *"Where any Act provides that water may be diverted or appropriated only under authority granted under that Act, the holder of a mining claim shall not divert or appropriate water unless the holder holds that authority"*

There are no new diversions planned as part of the Project; water will be managed through a series of existing diversion drains designed to contemporary standards to comply with regulatory requirements.

Manual for Assessing Consequence Categories and Hydraulic Performance of Structures [ESR/2016/1933, 29/03/16]

The Manual (March 2016) sets out the requirements of the DES, formerly DEHP (the administering authority), for consequence category assessment (CCA) and associated design requirements of dams and levee structures, constructed as part of environmentally relevant activities (ERAs) under the EP Act.

Structures which are Dams or Levees Constructed as Part of Environmentally Relevant Activities [ESR/2016/1934, 14/04/2022]

This guideline provides information about the procedures of the administering authority, for dealings involving dams and related containment structures, constructed as part of ERAs pursuant to the EP Act. This guideline should be read in conjunction with the manual described above. No new watercourse diversions or levees are proposed as part of the Project.

1.4.3 Other relevant guidance documents

Water Accounting Framework for the Minerals Industry

The water accounting framework (WAF) user guide (Minerals Council of Australia, 2022 - Version 2.0) provides an outline for reporting of site water management that allows site water managers to account for, report on and compare site water management practices in a rigorous, consistent and unambiguous manner that can easily be understood by non-experts. It has also been designed to align with frameworks for the Global Reporting Initiative (GRI) and Australian Water Accounting Standard (AWAS).

Strategic Water Management in the Minerals Industry – A framework

This framework sets out the strategic issues that mineral operations need to consider for responsible water management at a site, and corporate level to manage risks and identify opportunities for continuous improvement. It provides high level guidance in issues that should be addressed in developing water strategies, such as valuing water, strategic planning, implementation, and engaging framework.

1.5 Existing environment

1.5.1 Climate

Climate at the Project Site is classified as subtropical with a moderately dry winter (as per then Köppen Climate Classification). Climate data for the Project Site has been obtained from SILO Data Drill service (DSITI). The database consists of gridded data covering a 0.05 degree (latitude and longitude) grid. The database commenced on 1 January 1889. The database has been developed by interpolating data from the Bureau of Meteorology (BOM) recording station network.

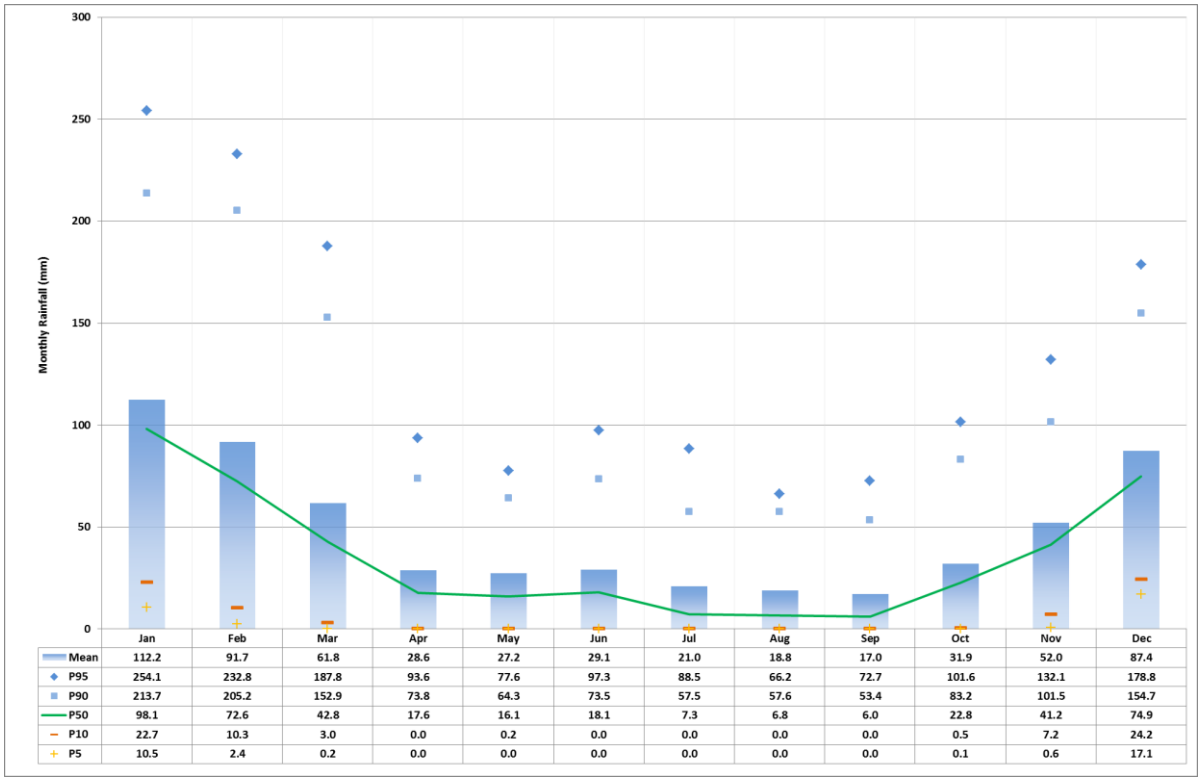
The Data Drill has been used to derive a basic understanding of the existing climate at the Project Site. Annual rainfall totals (based on hydrologic years: 1 October to 30 September) and monthly rainfall totals derived from the SILO Data Drill are shown in Table 4 and Figure 2 respectively show.

The existing climate at the Project Site can be summarised as follows:

- Mean annual rainfall (Table 4) is approximately 580 millimetres (mm); however, total annual rainfall is relatively variable. The 5th and 95th percentile totals of 285 mm and 957 mm indicate that there is a 5% probability that total annual rainfall may be between 50% and 155% of the mean rainfall value.
- Monthly rainfall (Figure 2) shows a distinct seasonal distribution with well-defined wet season occurring from December through March. Approximately 60% (320 mm) of the median annual rainfall falls during this five-month period.
- Mean monthly rainfall during the dry season months of April through October ranges from a minimum of around 17 mm per month in August, to a maximum of approximately 29 mm in April. Median rainfall for July, August and September is approximately 7 mm.
- Monthly rainfall variability during the wet season is high with the potential for both flood and drought. Variability is greatest during January where monthly total rainfall ranges from approximately 10.5 mm (5th percentile) to 254 mm (95th percentile).

Table 4 Annual Rainfall (SILO Data Drill, 1889-2017, Hydrologic Years, 1st October to 30th September)

Statistic	Annual Rainfall (mm)	Percent of Mean
Mean	579	100%
95th Percentile	957	165%
90th Percentile	891	154%
Median	537	93%
10th Percentile	384	66%
5th Percentile	285	49%
Standard Deviation	190	-

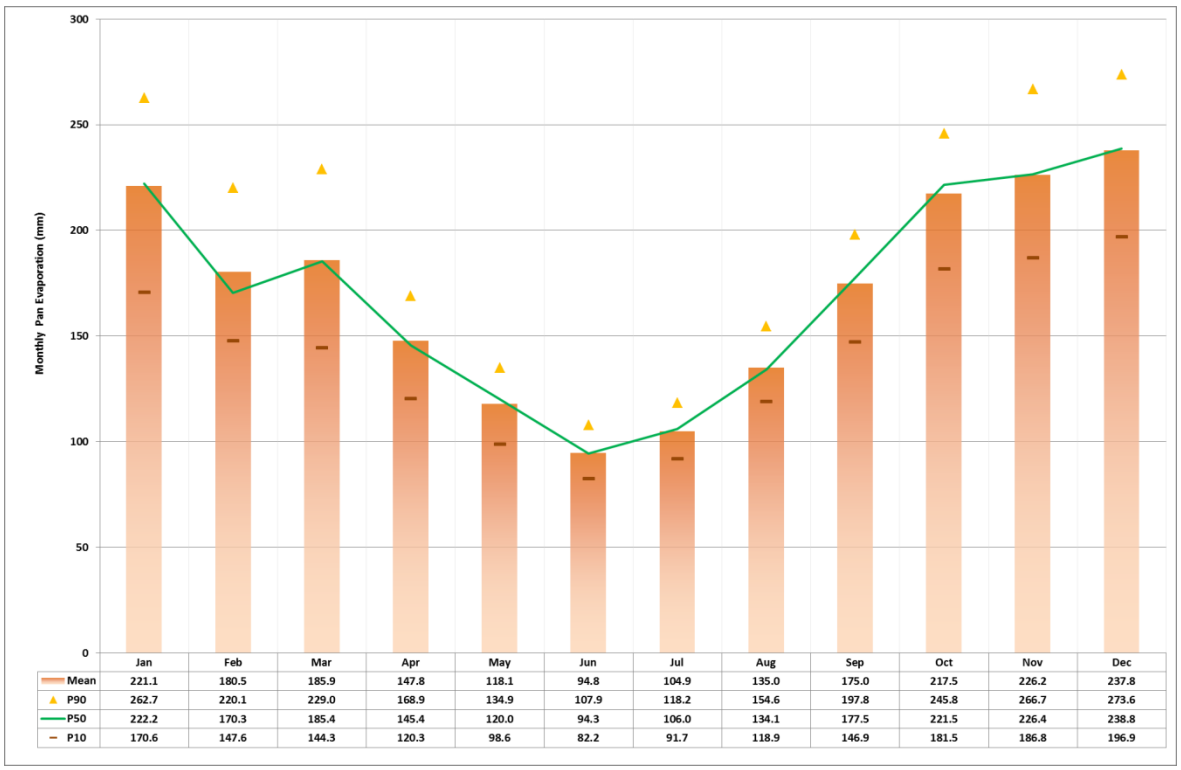


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	112.2	91.7	61.8	28.6	27.2	29.1	21.0	18.8	17.0	31.9	52.0	87.4
P95	254.1	232.8	187.8	93.6	77.6	97.3	88.5	66.2	72.7	101.6	132.1	178.8
P90	213.7	205.2	152.9	73.8	64.3	73.5	57.5	57.6	53.4	83.2	101.5	154.7
P50	98.1	72.6	42.8	17.6	16.1	18.1	7.3	6.8	6.0	22.8	41.2	74.9
P10	22.7	10.3	3.0	0.0	0.2	0.0	0.0	0.0	0.0	0.5	7.2	24.2
P5	10.5	2.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	17.1

Figure 2 Monthly Rainfall (SILO Data Drill, 1889-2018)

Figure 3 shows monthly pan evaporation data derived from the SILO Data Drill for the Project Site. The data can be summarised as follows:

- Monthly evaporation follows a broadly similar seasonal distribution to rainfall, with rates highest from October through March, and lowest from April through September.
- The maximum monthly evaporation of 238 mm occurs in December, and the minimum monthly evaporation of 95 mm occurs in June.
- Comparing this data with Figure 2, mean evaporation exceeds mean rainfall for all months indicating a strongly negative mean annual water balance.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	221.1	180.5	185.9	147.8	118.1	94.8	104.9	135.0	175.0	217.5	226.2	237.8
P90	262.7	220.1	229.0	168.9	134.9	107.9	118.2	154.6	197.8	245.8	266.7	273.6
P50	222.2	170.3	185.4	145.4	120.0	94.3	106.0	134.1	177.5	221.5	226.4	238.8
P10	170.6	147.6	144.3	120.3	98.6	82.2	91.7	118.9	146.9	181.5	186.8	196.9

Figure 3 Monthly Pan Evaporation (SILO Data Drill, 1970-2017)

1.5.2 Surface water environment

The Project Site is located within the Isaac River catchment, which is a key tributary of the Fitzroy River, the largest river catchment flowing to the eastern coast of Australia. The Fitzroy River discharges to the ocean in Keppel Bay, near Rockhampton, approximately 260 km from the Project Site. Its major tributaries are the Nogoa, Comet, Mackenzie, Isaac, Connors and Dawson Rivers and Callide Creek. The Isaac River, with a catchment area of approximately 22,365 km^2 represents 15.7% of the catchment area of the Fitzroy Basin.

Watercourses flowing through the Project Site include Boomerang Creek, Plumtree Creek, Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek (Figure 4). The underground mine footprint intersects only Boomerang Creek, Plumtree Creek and Hughes Creek, which flow easterly and onto the floodplain of the Isaac River.

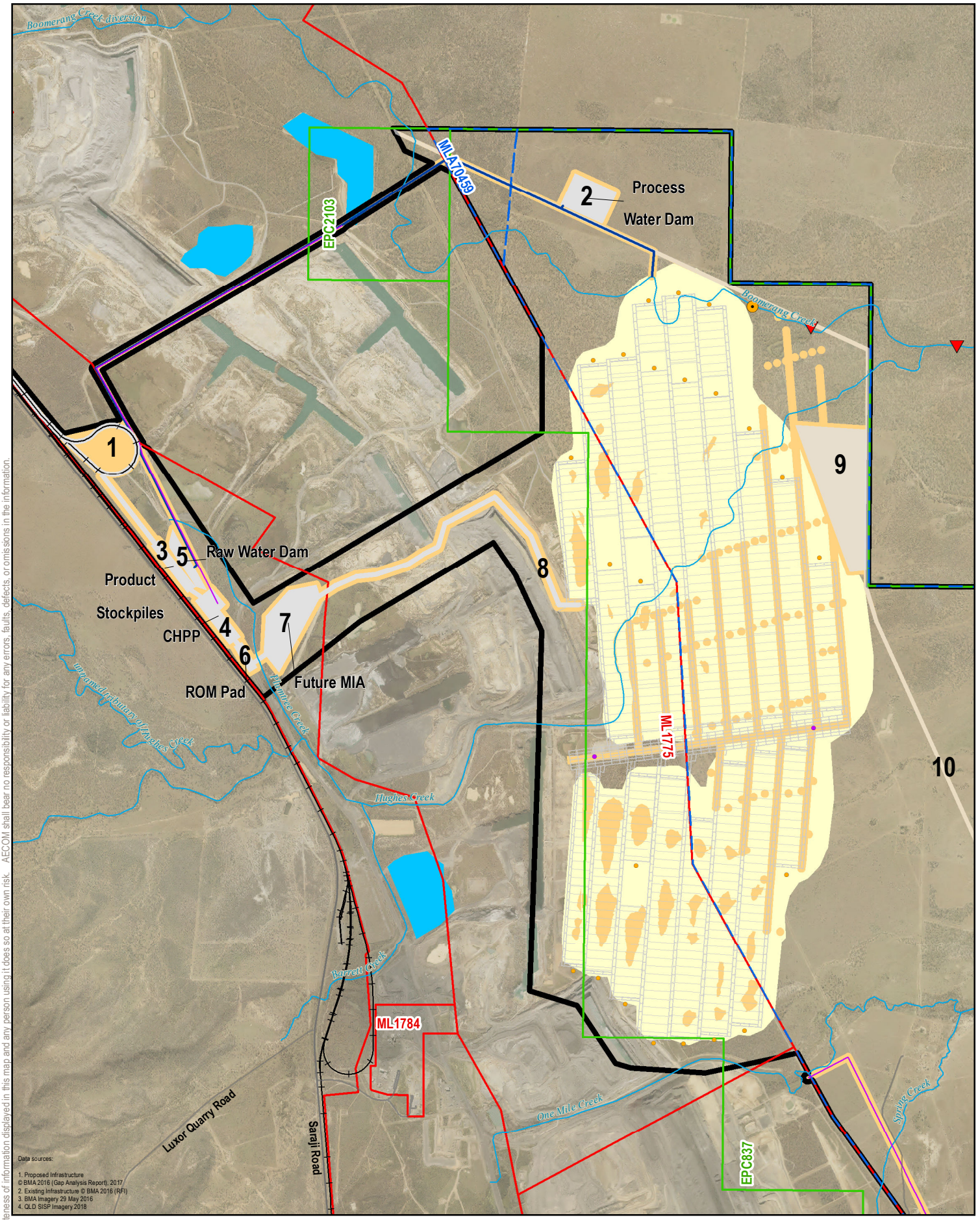
Existing open cut mining operations immediately west of the Project Site have modified the upstream catchment and landscape of the streams. Both Boomerang Creek and Hughes Creek flow through open cut MLs and contain diversion reaches. Plumtree Creek is a tributary of Boomerang Creek, commencing on the eastern edge of the Saraji Mine ML. Boomerang Creek and Hughes Creek converge approximately 1 km downstream of the Project.

Boomerang Creek and Hughes Creek commence in the Harrow Range west of Peak Downs Mine and Saraji Mine, where the upper reaches are relatively confined in narrow valleys. These upper catchments are much steeper, containing occasional scarps. As streams emerge from the range, the valley widens and longitudinal slope decreases as they enter a broad, gently undulating floodplain.

Vegetation in the upper catchment is mostly continuous, while many of the flatter areas in the floodplain have been cleared for agriculture and grazing. Through the Project, the streams flow within a wedge of woodland in a shallow valley contained by the last of the hillslope of the Harrow Range. Much of Hughes Creek has a very narrow strip of riparian vegetation along its southern bank where it abuts cleared land.

1.5.3 Water quality

Local receiving watercourses represent a ‘slightly to moderately disturbed’ (SMD) aquatic habitat. Receiving environment water quality data collected as part of BMA’s receiving environment monitoring program (REMP) indicates water quality is above the guideline for most parameters. Water quality in the receiving environment is described in more detail in the Saraji East Mining Lease Project Surface Water Quality Technical Report (AECOM, 2024).



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LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Underground Mine Plan
- Lake / Reservior
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Public Road
- Watercourse
- Existing Railway
- Rail Loop
- 66kV Powerline
- Pipeline
- Flare
- Vent
- Indicative Proposed Monitoring Point Location
- Indicative Proposed Mine Water Release Point

Surface Infrastructure

1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

N

Figure 4
Surface Water Environment

Saraji East Mining Lease Project

0 0.35 0.7 1.4
Kilometres

Scale: 1:60,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 30/05/2024 VERSION: 5

2.0 Conceptual WMS objectives and considerations

The purpose of the Project conceptual mine WMS is to examine and address all issues relevant to the importation (of raw water), generation, use, and management of water on the Project Site. The objective of the WMS is to minimise the quantity of water that is contaminated and released by Project activities. This will broadly be achieved by:

- managing the generation, storage, distribution, and reuse of all potential MAW (including groundwater) captured and generated by the Project
- handling the conveyance of natural runoff originating from undisturbed clean catchments through the Project Site
- managing the storage and distribution of raw water.

The development of the Project conceptual mine WMS has been guided by a set of key objectives based on information provided by BMA, previous studies, best management practice for the management of MAW, and previous experience with coal mines in the Bowen Basin.

This section of the Report outlines the WMS objectives, features and regulatory approach, as listed in Table 5.

Table 5 Section 2 Contents

Section	Description
2.1 Key mine WMS objectives	Presents key water management objectives for the site WMS.
2.2 Conceptual mine WMS considerations	Details the primary considerations for water inflow and outflow from the WMS.
2.3 Preliminary consequence category for dams	Presents a preliminary CCA of proposed structures, and outlines anticipated design and management requirements for regulated structures.

2.1 Key mine WMS objectives

2.1.1 Segregation of waters based on source and assumed quality

Consistent with current practices for mine water management, it is intended, wherever practicable and achievable, to passively divert clean runoff beyond the mine WMS MAW dams (and other mine infrastructure), such that non-MAW runoff remains undisturbed. The exclusion of clean, uncontaminated runoff will reduce the volume of MAW generated onsite, which requires additional containment and management requirements. Disturbed areas within the mine WMS have been assumed to include all mine process areas as well as the catchment reporting to the underground mine portal to be developed in the highwall of the existing open cut pit.

The use of catchment drains, bunding and other devices will be used wherever feasible and practicable to reduce the risk of clean water flows from entering the mine WMS. Table 6 summarises requirements and assumptions that relate to achieving the stated objective for the segregation of water based on its assumed quality.

Table 6 Proposed segregation of water

Disturbed Mine Area	Aspect	Assumption
All mine process areas: • Stockpile areas (both product and ROM coal) • CHPP • MIA	Collection and containment of mine affected runoff.	It has been assumed that the design of the mine process areas (by others) will allow for all potentially mine affected runoff to be directed to a common point for collection in the associated collection dams for subsequent transfer to the PWD.
Underground mine portal entrance located	Collection and containment of mine affected runoff originating from the	Runoff from the catchment area reporting to underground mine portal will be collected in a sump that will also act as a pump stage for underground mine

Disturbed Mine Area	Aspect	Assumption
in the highwall of the existing open cut pit	external catchment reporting to the portal entry sump.	dewatering. It is assumed that the external catchment area currently reporting to the existing open cut pit will be minimised as far as practical by: • re-profiling of the backfilled spoil and overburden material currently occupying the pit • the use of roll-over bunding for all entry roads • highwall check dams and diversion drains.

2.1.2 Minimise volumes of MAW generated and stored onsite

Potential volumes of MAW generated onsite will be minimised wherever possible and stored volumes of MAW will be preferentially sourced to satisfy those Project water demands for which reuse of MAW is suitable. The following assumptions have been made in the development of the Project conceptual mine WMS:

- MAW from the stockpile dams (ROM and product coal), CHPP dam, MIA dam and the portal sump will be transferred to the PWD which is the primary storage for MAW.
- To maximise containment capacity at each collection point, MAW is assumed to be transferred to the PWD as soon as it is received. This will reduce the likelihood of spill events via emergency spillway structures, resulting in discharge of MAW being triggered by subsequent storm event inflows. Accordingly, the process area runoff dams comprise collection dams, for short term storage of MAW prior to on-transfer to the PWD. The Saraji East WMS will operate according to a Trigger Action Response Plan (TARP), to be developed specifically for the operation.
- MAW stored onsite (primarily in the PWD) will be preferentially sourced for site water demands wherever possible. This serves to provide a continual draw on the stored inventory of MAW, thus ensuring that the capacity to receive future inflows is optimised and reliance on an external raw water source is minimised. The PWD therefore acts as the primary source of water for CHPP process demand, and stockpile and haul/light vehicle (LV) road dust suppression.
- Raw water will be stored onsite in the RWD and will be used to satisfy those Project water demands for which reuse of MAW is unsuitable (e.g. potable, underground mine and firefighting water) or when the stored inventory of MAW has been exhausted.
- Wherever practical and achievable, runoff diversion bunds will be constructed around key mining infrastructure to reduce clean runoff originating from undisturbed catchment runoff entering these areas and potentially becoming mine affected.

2.1.3 Containment and release of MAW

A conservative approach has been taken towards controlled and uncontrolled releases of MAW from the Project. Preliminary capacity estimates for all dams and the water transfer network (using the water balance assessment described in Section 4.0) within the Project conceptual mine WMS have been based on the containment of all potential inflows using historical climate data and under a set of assumed operational rules. This conservative approach ensures:

- Sizing of the regulated structures is consistent with the hydraulic criteria outlined within the Manual for assessing consequence categories and hydraulic performance of structures – ESR/2016/1933 (DES, 2016)
- Detailed design of regulated structures and drainage features will be completed according to internal BMA guidelines for MAW and Erosion and Sediment Control (ESC) structures, which exceed the requirements of ESR/2016/1933
- Licensed release of MAW to the receiving environment is not required within the normal operation of the WMS, and;
- Capacities are sufficient to minimise the uncontrolled (spillway) discharge of MAW to the receiving environment.

Notwithstanding, BMA are seeking a licensed release condition for the development, to allow for emergency and contingency management of MAW.

The indicative location for controlled release of MAW is located on Boomerang Creek adjacent to the proposed PWD (Figure 4). Spillway discharges (uncontrolled) from the PWD are also proposed to be directed to Boomerang Creek.

Spills via process area dam emergency spillway structures will be directed to the receiving environment based on existing topographical constraints. Where dam overflow locations cannot deliver flows directly to Hughes Creek or its tributaries, conveyance channels are proposed to convey the discharge.

2.1.4 Water transfer system

The water transfer network provides the ability to move MAW from the various collection dams to the PWD, as well as the subsequent transfer of MAW to the various consumptive demand points (e.g. CHPP and dust suppression uses). The operating rules for the WMS have been developed in support of the other mine WMS objectives as follows:

- Inflows to the various collection dams will be transferred to the PWD as soon as practical, provided capacity is available in the PWD. This will ensure that the containment capacity of each collection dam is maximised.
- MAW will be managed according to a site-specific TARP to be developed for the Saraji East operation proceeding grant of an environmental authority.
- Nominal pump capacities will be selected to ensure that pumped transfers from each collection dam to the PWD are sufficient to support the above objective.

2.2 Conceptual mine WMS considerations

2.2.1 Mine progression

The proposed underground mining method employed by the Project, as well as the absence of any surface spoil dumps and out of pit tailings storage facilities (TSFs), allows for a static assessment of the conceptual Project mine WMS. Disturbed catchment areas reporting to the WMS have therefore been assumed as fixed for the operation of the mine. Refer to Section 4.5.2 for details of Project catchment areas.

The estimated rate of mine dewatering is a function of the development and progression of the underground mine workings. Therefore, the estimated dewatering volumes (refer to Section 4.5.3) vary throughout the operation of the mine.

2.2.2 Sources of potentially MAW

Sources of potentially MAW have been assumed as follows:

- Process area runoff – surface runoff associated with the following areas is assumed to be mine affected and will be contained at each respective source and transferred to the PWD:
    - ROM coal stockpile pad
    - product stockpile pad (including the train load out)
    - CHPP and MIA areas
    - catchment reporting to the underground mine portal located in the existing open cut pit.
- Runoff generated over the underground mine development, where subsidence may occur, will be managed according to BMA policies. The management intent for runoff generated in these areas, which is not MAW, is discharge to the receiving downstream environment, subject to water quality controls.
- Groundwater – water from underground mine dewatering will be mine affected and will be transferred to the PWD as soon as practical. Dewatering of the underground mine will initially discharge to the portal sump. From there it will be transferred to the PWD.

- Underground mining operations process return water– water reclaimed from underground mining operations is assumed to be mine affected and will similarly be initially discharged to the Underground Mine Portal Area sump and transferred to the PWD.

2.2.3 MAW demands

All mine consumptive water demands for which MAW is suitable (CHPP process demand and dust suppression) will be preferentially supplied with MAW from the PWD. This is in line with current management practices for reducing reliance on an external water supply. It also provides a continual draw on stored inventories of MAW, thereby increasing storage potential for future inflow events. A detailed breakdown of water demands for the Project Site is provided in Section 4.5.5.

2.2.4 Raw water supply

The Project's raw water supply will be linked to the existing Saraji Mine WMS. While it is planned to reuse MAW whenever possible, raw water is still required for those consumptive demands for which MAW is unsuited or for when supplies of MAW are unavailable.

BMA holds contractual rights to approximately 10,000 ML/yr of water from the Burdekin Pipeline (owned by SunWater) as a supply source for BMA operations in the vicinity of Moranbah. In addition, BMA has a water allocation of 6,200 ML/yr from the Eungella Dam that is also available for use in BMA operations in the Moranbah vicinity. In securing its water rights, BMA has allowed for the current and potential future use of water from these sources at the Saraji Mine and for development associated with MLA 70383.

In relation to the proposed activities on MLA 70383, BMA will prepare, update and maintain a Water Management Plan (WMP).

The WMP will recognise that water to be used for Project operations will be sourced via an off-take from the existing water pipelines developed to support BMA's current and future mining operations, along with various other purposes. Further, the WMP will recognise that water will be sourced from the Eungella Dam and/or the Burdekin Pipeline. The Project will have an internal BMA allocation to draw water from as part of the BMA-related water allocations.

These allocations are held by BMA directly or indirectly via contractual arrangements with SunWater in accordance with the Burdekin Water Resource Plan and the Water Act.

The key demands for raw water are:

- Underground mining demands
- Potable water for domestic requirements
- Make-up supply for CHPP process water and dust suppression operations.

2.2.5 Water treatment within the mine WMS

For the current scope, no quality restrictions have been placed on the reuse of MAW by the CHPP or for dust suppression. Where potential quality restrictions may arise, it is expected that the blending of raw and MAW could be conducted to achieve the desired quality.

A small potable water treatment plant (WTP) will be installed at the MIA for the treatment of raw water for potable use. This water will be transferred to storage tanks at each demand location as required.

A sewage treatment plant (STP) will be installed to service the MIA and the construction accommodation village to treat generated sewage. Sewage from the CHPP area and from the washdown facilities at the mine portal will be pumped back to the MIA. The STP will be designed to provide sufficient capacity for the construction and operation workforce. Treated effluent from the STP and the WTP will be captured and stored on site at the PWD. The expected rate of treated effluent generated is minor (23m^3/day) and is discussed further in Section 3.7.

2.2.6 Groundwater inflows

Groundwater dewatering volumes reclaimed underground mining water and proposed gas drainage bore field associated with the underground mine will be managed within the WMS. The quality of groundwater is expected to be suitable for reuse by the Project's consumptive demands (CHPP and dust suppression). It will be pumped to the Underground Mine Portal Area sump prior to transfer to the

PWD. Refer to Section 4.5.3 for estimated rate of groundwater and gas drainage inflow volumes expected during the operation of the mine.

2.3 Preliminary consequence category for dams

In the Queensland regulatory context, a CCA is required for water storages associated with ERAs that meet the definition of a structure, as described in 'Structure which are dams or levees constructed as part of environmentally relevant activities' ESR/2016/1934 (DES, 2022).

A preliminary CCA has been completed for all proposed Project dams as per guidance provided by the DES (formerly DEHP) 'Manual for assessing consequence categories and hydraulic performance of structures' ('the Manual') (DES, 2016 - ESR/2016/1933). The proponent commits to perform full CCAs as a condition in the EA for the described structures which will be updated and confirmed during the detailed design phase of each structure.

2.3.1 Failure Events

The preliminary assessment of consequence categories has been undertaken for the following failure scenarios:

- Failure to Contain – Seepage

  Spills or releases to ground and/or groundwater via seepage from the floor and/or sides of the structure.

- Failure to Contain – Overtopping

  Spills or releases from the structure that result from loss of containment due to overtopping of the structure.

- Dam Break

  Collapse of the structure due to any possible cause.

2.3.2 Downstream receiving domain

A review of the receiving environment of each proposed Mine Water Management structures was completed, as follows:

- Failure to Contain – Seepage

  The receiving domain comprises a zone of hydrogeological regimes in proximity to each proposed structure.

Table 7 Failure to Contain - Seepage - Receiving Environment

Structure(s)	Receiving Environment
PWD	Hydrogeological regimes underlaying pasture and remnant bush vegetation areas within ML70383.
CHPP Dam, Product Coal Stockpile Pad Dam, ROM Coal Stockpile Pad Dam, RWD	Hydrogeological regimes underlaying existing mining areas (disturbed) and diversion systems within ML700073, ML70142 and ML1775.
UG Mine Portal Sump	Hydrogeological regimes overlaying the underground Mine development. This regime will comprise a dewatered coal seam aquifer.

- Failure to Contain – Overtopping, Dam Break

  The receiving environment comprises adjacent areas and downstream waterways (refer Appendix B) and is listed in Table 8.

Table 8 WMS Structures Receiving Domain

Structure(s)	Receiving Environment Order	Receiving Domain	Distance Downstream (km)
PWD	1	Boomerang Creek	<1
	2	Hughes Creek	6
	3	Isaac River	22
CHPP Dam, Product Coal Stockpile Pad Dam, ROM Coal Stockpile Pad Dam, RWD	1	Plumtree and Hughes Creek Diversion	<1
	2	Hughes Creek	7
	3	Isaac River	29
UG Mine Portal Sump	1	Underground Mine Portal Area	<1
	2	Existing Highwall Pit	<1

The Isaac River receiving domain is located a minimum distance of 22 km away from the proposed WMS structures. Hughes Creek, Boomerang Creek and Isaac River are defined Watercourses under the Water Act.

A review of relevant receptors, including ecological, infrastructure and residential aspects was completed for the receiving domain, and is described in Sections 2.3.2.2 and Section 2.3.2.3.

2.3.2.1 Hydrogeological receptors

As discussed in the Terrestrial Ecology Technical Report (AECOM, 2024a), vegetation within the Project Site is not considered groundwater dependent and no known aquatic, terrestrial or subterranean groundwater dependent ecosystems have been mapped within the Project Site as per the National Atlas of groundwater dependent ecosystems and supporting field verification (3D Environmental, 2023). Most floral assemblages within the downstream areas are characterised by drought tolerant species with low physiological sensitivity to water availability.

2.3.2.2 Surface ecological receptors

The receiving environment within the Project Site is disturbed by existing mining activities. Environmental values with potential to be impacted within the Project Site based on information contained within the Terrestrial Ecology Technical Report (AECOM, 2024a) include:

- Matters of National Environmental Significance (MNES) protected under the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act) and Matters of State Environmental Significance (MSES) protected in Queensland:
    - Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (listed Endangered under the EPBC Act and Queensland *Vegetation Management Act 1999*) associated with reach of Boomerang Creek passing through the Project Site (refer Appendix A - Figure 6-4).
    - Most of the immediate downstream area, featuring Eucalyptus and/or Corymbia Open Woodland (refer Appendix A - Figure 6-6), is potentially suitable habitat (breeding and foraging) for endangered tree-dwelling Koala (*Phascolarctos cinereus)* and species presence was confirmed during field survey (2020) (refer Appendix A - Figure 6-7).
    - Habitat for the vulnerable tree-dwelling species Greater Glider (*Petauroides volans*) corresponds to mapped riparian vegetation along Boomerang Creek and Hughes Creek (refer Appendix A - Figure 6-6). Multiple sightings of this species are recorded (refer Appendix A - Figure 6-7).
    - Modified grasslands bordering the upper tributaries of Hughes Creek to the west of the disturbed area provide suitable habitat for the ground-dwelling vulnerable Squatter Pigeon

(Southern) (*Geophaps scripta scripta)* (refer Appendix A - Figure 6-6). Essential habitat is mapped directly upstream of the potential overtopping locations (refer Appendix A - Figure 6-7).

- Mapped essential habitat for the vulnerable ground-dwelling Ornamental Snake (*Denisonia maculata)* within suitable habitat provided by River red gum riparian woodland and gilgai adjacent to Hughes Creek and Boomerang Creek. Essential habitat and known recorded sightings of this species are identified in Appendix A - Figure 6-7.
- Ground-dwelling Short-beaked Echidna (Special Least Concern) (*Tachyglossus aculeatus)* inhabits the site, and all vegetation is classed as potential habitat for this species.
- All vegetation types may also provide some value for the lifecycle requirements of the Grey Falcon (*Falco hypoleucos)* considered likely to occur.
- Four species of bird listed as migratory under the EPBC Act and special least concern under the NC Act, may utilise the vegetation, watercourses or dams in the vicinity of the Project.
- Regulated vegetation containing endangered and of concern regional ecosystems (refer Appendix A - Figure 6-3).
- Category B Environmentally Sensitive Areas within a 100km search radius from the Project Site (refer Appendix A - Figure 6-8).
- Conservation significant aquatic flora or fauna and high environmental value (HEV) waters are not reported to occur; waterways are ephemeral, but during flow are important corridors for fish passage, with Boomerang Creek and Hughes Creek rated major risk (purple) waterways for waterway barrier works under the *Fisheries Act 1994* (refer Appendix A - Figure 7-3).
- The two aquatic fauna species identified as MNES with potential to occur (white-throated snapping turtle and Fitzroy River turtle) do not have any known populations within 80 km of the Project Site.

2.3.2.3 Infrastructure and land-use

Limited economic/social infrastructure is located downstream of the proposed WMS structures:

- Review of registered bores (refer Appendix B) indicates that bores located in proximity to the receiving environment are limited, as follows:
  - Bores located in proximity to the Plumtree and Hughes Creek Diversion, Hughes Creek and Boomerang Creek are associated with Mine Monitoring and were therefore not considered.
  - The nearest bore, not associated with mining operations, is a water supply bore located on the Isaac River (RN 97180). This bore is located at an approximate distance of 27 km downstream of the proposed WMS structures.
- Linear Infrastructure

  Road infrastructure in proximity to the proposed WMS structures is generally limited,

  - Access Tracks

    Ten access tracks, which are not gazetted (private assets), traverse the downstream ephemeral creeks (Hughes Creek and Boomerang Creek) between the site location and Isaac River. Based on inspection of available aerial imagery, these tracks comprise at-grade crossings and do not feature bridges and would not be traversable during creek flow events.
  - Carfax Road

    Carfax Road is located some 40 km downstream and is located adjacent to Isaac River. This road is gazetted and is aligned adjacent to Isaac River (south side). No crossing is located in association with the road.

- Fitzroy Developmental Road

  The Fitzroy Developmental Road crosses the Isaac River some 57 km downstream of the proposed WMS structures. This road is gazetted, and the bridge crossing comprises a simple span bridge, based on inspection of aerial imagery.

- Land Use
  - Based on inspection of Queensland State-wide land use mapping (QLUMP, 2022), downstream land-uses are listed in Table 9.

Table 9 Downstream Receiving Domain - Land Use

Type	Location	Comment
Production from Relatively Natural Environments with secondary uses for Grazing Native Vegetation or Production from Dryland Agriculture and Plantations	Hughes Creek, Boomerang Creek, Isaac River	Predominant land use. No other land-use type is mapped for Hughes Creek and Boomerang Creek.
Farm Infrastructure	Isaac River	One instance, 200 m away from Isaac River

- Water Dams and Water Bodies
  - A minor water supply dam is located some 15 km downstream of the proposed PWD location, located offline to Hughes Creek.
  - Four lake bodies are mapped offline to Isaac River (i.e. at a distance greater than 20 km from the PWD)

2.3.2.4 Downstream population

Prior to the Fitzroy Developmental Road and Isaac River crossing, a single dwelling and nearby farm infrastructure areas is located some 270 m away from the Isaac River and 41 km downstream of the PWD.

2.3.3 Consequence categories

Preliminary assessment of consequence categories for the structures associated with the proposed development was completed as follows:

- A qualitative characterisation of the failure event was developed for each failure event type, and each structure (refer Table 10)
- The potential impacts arising from the characterised failure events were assessed against Table 1 of the *Manual for assessing consequence categories for dams* (DES, 2016)
- A preliminary consequence category was established for each scenario (Failure to Contain – Seepage, Failure to contain – overtopping, Dam Break).

Noting that the assessed structures generally comprise limited water storage volume dams (≤200 ML), the consideration of downstream infrastructure and assets included a potential impact distance between 10 km and 20 km. This distance exceeds the recommended distance from ANCOLD[2] (2012) of 5 km for dams containing less than 200 ML of water inventories.

Table 10 Characterised Failure Events

Structure(s)	Failure to Contain - Seepage	Failure to Contain - Overtopping	Dam Break
PWD	Seepage plume localised to the vicinity of the structure.	Discharge of contained water inventories, during rainfall conditions, to	Propagation of a moderate dambreak wave through receiving

[2] Table A1 of *Guidelines on the Consequence Categories for Dams* (ANCOLD, 2012)

Structure(s)	Failure to Contain - Seepage	Failure to Contain - Overtopping	Dam Break
	Potential for groundwater resource impact, however it is noted that the water table is expected to be generally drawn down in the vicinity of structures. Potential impact to vegetation species (die-off), in the event of prolonged surface expression.	downstream receiving waterways, likely during periods of substantial flow.	waterways. Due to the overall size of the PWD anticipated being moderate, the dam break wave is expected to attenuate within 5 km. Inundation of local creeks is possible. Dependent on the degree of natural flow in downstream waterways at the time of a hypothetical dambreak event, water quality impacts of Hughes Creek and Boomerang Creek are possible.
Underground Mine Portal Sump			N/A*
CHPP Dam, Product Coal Stockpile Pad Dam, ROM Coal Stockpile Pad Dam, MIA Dam			Propagation of a minor dambreak wave through receiving waterways. Due to the overall size of the structures anticipated being minor to moderate, the dam break wave is expected to attenuate within 10 km.
RWD	Seepage plume, with potential waterlogging of areas. Negligible potential for impact to ecological communities or groundwater resources due to reasonable water quality.		

*the Underground Mine Portal Sump is not expected to comprise a structure formed by embankments, with the risk of a dambreak failure considered non-credible.

Preliminary consequences for each structure were assessed against the levels of impact described in Table 11, which was reproduced from the Manual (DES, 2016).

Table 11 Consequence Category Assessment

Environmental Harm	Consequence Category		
	High	**Significant**	**Low**
Harm to Humans	Location such that people are routinely in the failure path and if present loss of life to greater than 10 people is expected.	Location such that people are routinely present in the failure path and if present loss of life to 1 person or greater but less than 10 people is expected.	Location such that people are not routinely present in the failure path and loss of life is not expected.
	Location such that contamination of waters (surface and/or groundwater) used for human consumption could result in the health of 20 or more being affected.	Location such that contamination of waters (surface and/or groundwater) used for human consumption could result in the health of 10 or more people but less than 20 people being affected.	Location such that contamination of waters (surface and/or groundwater) used for consumption could result in the health of less than 10 people being affected.
General Environmental Harm	Location such that: a) Contaminants may be released to areas of MNES, MSES or HEV waters that are not already authorised to be disturbed to at least the same extent under other conditions of this authority subject to any applicable offset commitment (Significant Values); and b) Adverse effects on Significant Values are likely; and c) The adverse effects are likely to cause at least one of the following: i) Loss or damage or remedial costs greater than $50,000,000; or ii) Permanent alteration to existing ecosystems; or iii) the area of damage (including downstream effects) is likely to be at least 5 km^2	Location such that contaminants may be release so that adverse effects (that are not already authorised to be disturbed to at least the same extent under other conditions of the authority subject to any applicable offset commitment) either: a) Would be likely to be caused to Significant Values but those adverse effects would not be likely to meet the thresholds for the High consequence category and instead would be likely to cause at least one of the following: i) Loss or damage or remedial costs greater than $10,000,000 but less than $50,000,000; or ii) Remediation of damage is likely to take more than 6 months but less than 3 years; or iii) Significant alteration to existing ecosystems; or iv) The area of damage (including downstream effects) is likely to be at least 1 km^2 but less than 5 km^2 or b) Would be likely to be cause to environmental values classed as slightly or moderately disturbed waters, wetland of general ecological significance, riverine areas, springs or lakes and associated flora and fauna (Moderate Values), and the adverse effects are likely to cause at least one of the following: i) Loss or damage or remedial costs greater than $20,000,000; or ii) Remediation of damage is likely to take more than 1 year; or iii) Significant alteration to existing ecosystems; or iv) The area of damage (including downstream effects) is likely to be at least 2 km^2	Location such that either: a) Contaminants are unlikely to be released to areas of Significant Values or Moderate Values; or b) Contaminants are likely to be released to those areas, but would be unlikely to meet any of the minimum thresholds specified for the Significant Consequence category for adverse effects.
General Economic Loss or Property Damage	Location such that harm (other than a different category of harm as specified above) to third party assets in the failure path would be expected to require $10 million or greater in rehabilitation, compensation, repair or rectification costs.	Location such that harm (other than a different category of harm as specified above) to third party assets in the failure path would be expected to require $1 million and greater but less than $10 million in rehabilitation, compensation, repair or rectification costs.	Location such that harm (other than a different category of harm as specified above) to third party assets would be expected to require less than $1 million in rehabilitation, compensation, repair or rectification costs.

The assessed consequences for the characterised failure events are listed as follows:

- Failure to contain – Seepage Table 12
- Failure to contain – Overtopping Table 13
- Dam Break Table 14

Table 12 Failure to Contain - Seepage

Structure(s)	Harm to Humans	General Environmental Harm	General Economic Loss or Property Damage	Consequence Category
PWD	**Low** No water supply bores or dams are located in the receiving domain for seepage impacts. No known groundwater dependent ecosystems (GDEs) are present.	**Significant** Contaminants may be released to areas of moderate or significant values, but are not expected to meet the thresholds for High. Remediation of a failure event involving seepage may take more than 1 year.	**Low** Remediation and compensation costs not expected to meet the threshold for Significant.	**Significant**
Underground Mine Portal Sump		**Low** Receiving domain comprises the UG Mine Portal Area or UG Mine.		**Low**
CHPP Dam, Product Coal Stockpile Pad Dam, ROM Coal Stockpile Pad Dam, MIA Dam		**Low** Contaminants may be released to areas of moderate or significant values, but are not expected to meet the thresholds for Significant.		**Low**
RWD		**Low** Water Quality is not expected to be contaminated.		**Low**

Table 13 Failure to Contain - Overtopping

Structure(s)	Harm to Humans	General Environmental Harm	General Economic Loss or Property Damage	Consequence Category
PWD	**Low** No water supply bores or dams are located in the receiving domain for seepage impacts.	**Significant** Contaminants may be released to areas of moderate or significant values, but are not expected to meet the thresholds for High.	**Low** Remediation and compensation costs not expected to meet the threshold for Significant.	**Significant**
Underground Mine Portal Sump		**Low** Contaminants are not expected to be released to areas of moderate or significant values. An overtopping failure is expected to result in swamping of the UG Mine Portal Area.		**Low**
CHPP Dam, Product Coal Stockpile Pad Dam, ROM Coal Stockpile Pad Dam, MIA Dam		**Low** Contaminants may be released to areas of moderate or significant values, but are not expected to meet the thresholds for Significant.		**Low**
RWD		**Low** Water Quality is not expected to be contaminated.		**Low**

Table 14 Dambreak

Structure(s)	Harm to Humans	General Environmental Harm	General Economic Loss or Property Damage	Consequence Category
PWD	**Low** No downstream populations are expected to be impacted by propagation of a dambreak wave. The nearest infrastructure which may have people present include: a) a farmhouse on Isaac River, however this residence is located some 270m away from the waterway and is some 40 km downstream. Accordingly, impact is not anticipated. b) Carfax Road is located 40 km downstream, however this road is relatively minor and impacts are expected to have attenuated prior to this location **c)** Fitzroy Developmental Road (Bridge Crossing) is located some 57 km downstream, however impacts are expected to have attenuated prior to this location.	**Significant** Contaminants may be released to areas of moderate or significant values, but are not expected to meet the thresholds for High. Propagation of a moderate magnitude dambreak wave may induce erosion of the immediate downstream reaches of Boomerang Creek and Hughes Creek.	**Low** Remediation and compensation costs not expected to meet the threshold for Significant.	**Significant**
Underground Mine Portal Sump	**Low** N/A	**Low** N/A	**Low** N/A	**Low**
CHPP Dam, Product Coal Stockpile Pad Dam, ROM Coal Stockpile Pad Dam, MIA Dam	**Low** No downstream populations are expected to be impacted by propagation of a dambreak wave. The nearest infrastructure which may have people present include: a) a farmhouse on Isaac River, however this residence is located some 270m away from the waterway and is some 40 km downstream. Accordingly, impact is not anticipated. b) Carfax Road is located 40 km downstream, however this road is relatively minor and impacts are expected to have attenuated prior to this location c) Fitzroy Developmental Road (Bridge Crossing) is located some 57 km downstream, however impacts are expected to have attenuated prior to this location.	**Low** Contaminants may be released to areas of moderate or significant values, but are not expected to meet the thresholds for Significant. Minor erosion of immediate downstream reaches of Hughes Creek Diversion may occur.	**Low** Remediation and compensation costs not expected to meet the threshold for Significant.	**Low**
RWD		**Low** Released water quality is not expected to be contaminated. Dambreak wave is not expected to have sufficient magnitude to cause erosion.	**Low** Remediation and compensation costs not expected to meet the threshold for Significant.	**Low**

Based on the characterised consequences of potential failure scenarios, preliminary consequence categories have been summarised in Table 15.

Table 15 Preliminary CCA for the Project WMS Storages

Structure(s)	Failure to Contain - Seepage	Failure to Contain - Overtopping	Dam Break	Regulated Structure?
PWD	Significant	Significant	Significant	Yes
Underground Mine Portal Sump	Low	Low	Low	No
CHPP Dam	Low	Low	Low	No
Product Coal Stockpile Pad Dam	Low	Low	Low	No
ROM Coal Stockpile Pad Dam	Low	Low	Low	No
MIA Dam	Low	Low	Low	No
RWD	Low	Low	Low	No

2.3.4 Performance and management criteria

As per the Manual (DES, 2016), a Significant or High consequence category in any failure event category results in the application of a 'regulated structure' status to the structure being assessed.

Notwithstanding, the determined consequence categories are preliminary, and based upon the expected configuration of the structures. A comprehensive CCA is required during the detailed design of the structures. Should the rating of any dams change during detailed design, the associated performance and management criteria recommended in this Report may also change.

Further, due to BMA internal policies for structures containing MAW, the process area dams are proposed to include consideration of relevant design criteria for the failure to contain – overtopping and dam break consequence categories at the 'significant' level.

Specific design and operation requirements apply to regulated structures, as listed in Table 16.

Table 16 Preliminary Hydrological and Hydraulic Design Criteria for Mine WMS Dams

Failure to Contain – Seepage		
Consequence Category	Containment	Leak detection and/or monitoring
Significant	Designed with a floor and side of material that will minimise (or reduce) seepage to avoid the environmental harm in the significant consequence category in Table 11* and ensure that the environmental harm likely to occur is only as in the low consequence category of that table.	Have a system that is appropriate to demonstrate that significant harm as per table 1* will not occur.
Failure to Contain - Overtopping		
Consequence Category	Wet Season Containment (Design Storage Allowance (DSA))	Storm Event Containment (Extreme Storm Storage, ESS)
Significant	1:20 wet season volume	1:10 AEP 72 hour duration
Dam Break		

Failure to Contain – Seepage		
Consequence Category	Flood Passage - Spillway Event Capacity	Flood Level for Embankment Crest Level
Significant	1:100 AEP to 1:1,000 AEP	Spillway design flood peak level + wave run-up allowance for 1:10 AEP wind.

*Table 11 is a reproduction of Table 1 of the Manual (DES, 2016).

2.3.4.1 Seepage Detection and Minimisation

Seepage minimisation for the PWD is expected to comprise:

- Embankment detail featuring clay or low-density barrier cores, designed for the hydrostatic water pressure to limit the potential of seepage transmission.

Where foundations of dams are not suitable to prevent basal seepage, the design will incorporate a high-density polyethylene (HDPE), clay-barrier layer or similar low permeability system.

Seepage detection measures are expected to include the following:

- Regular visual inspections of embankments and downstream areas for seepage expression.
- Regular monitoring of downstream waterways as part of the proponent's commitment to participate in the Fitzroy Regional Receiving Environment Monitoring Program (FRREMP)
- Monitoring post-closure to be outlined in the Progressive Rehabilitation and Closure Plan (PRCP)
- Piezometer and bore monitoring and sampling.

The precise location and design mitigations are to be considered during detailed design.

2.3.4.2 Design storage allowance (DSA)

Based on the preliminary hydraulic performance criteria shown in Table 16, the PWD is required to incorporate a nominated storage capacity which includes a DSA. This is the storage volume to be made available in each dam upon the commencement of the wet season (1 November) each year. The DSA is the sum of all catchment runoff, direct rainfall over the dam and process water inflows over the critical wet period (three month) and assuming no evaporative or runoff losses. Using the method of deciles as outlined in the Manual, DSA depths for the Project have been estimated (refer to Figure 5) as:

- Significant consequence category – 5% AEP - 603 mm.

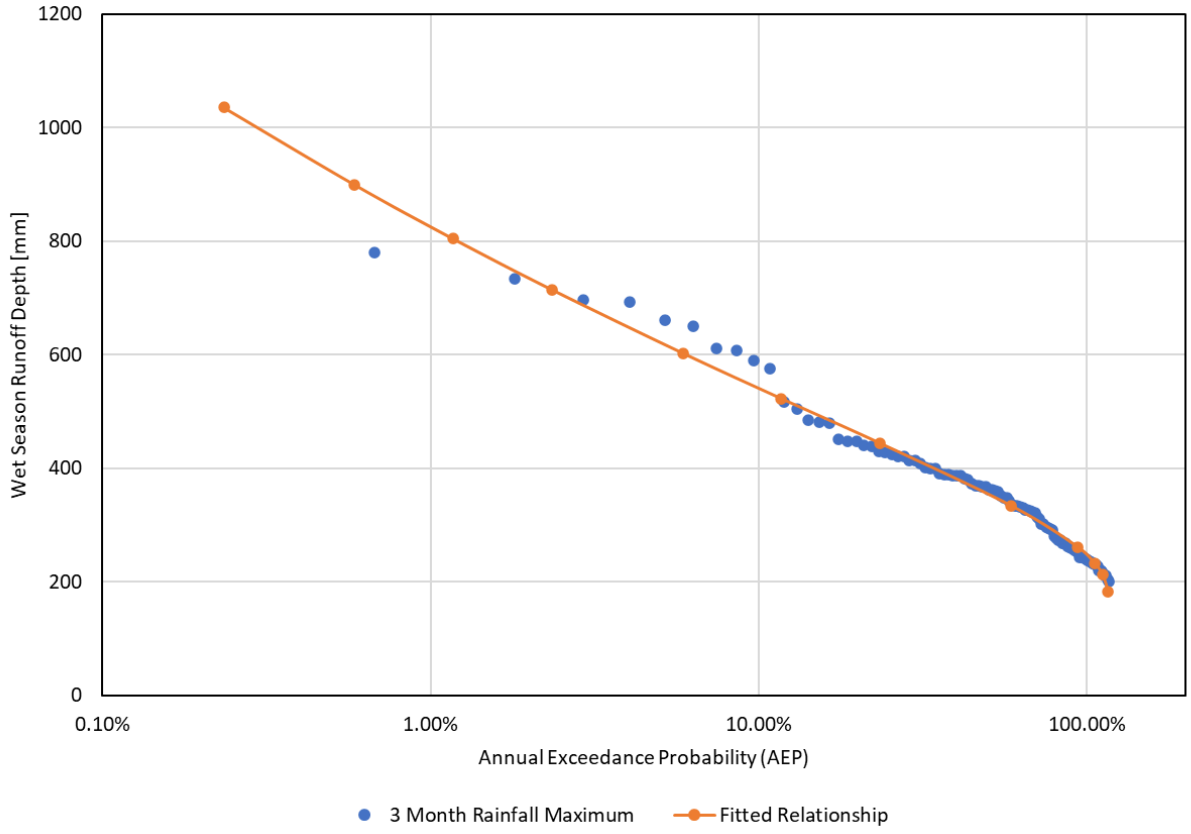


Figure 5 DSA Estimation – Method of Deciles (Log Pearson Type 3) SILO Data Drill

It is noted that the developed wet season runoff depth was developed as follows:

- Data from 1889 to 1900 was censored from the data-set, as the data was derived from weather stations more than 50 km away from the site location.
- Wet season runoff depths of less than 200mm were censored from the data-set, to achieve a better statistical fit.
- Process inputs were not considered, as net process demands are expected to exceed net process inputs for the WMS.

2.3.4.3 Extreme Storm Storage Mandatory Reporting Levels

The Extreme Storm Storage (ESS) provides a nominated containment volume that can be held within the dam prior to spillway discharge. The Mandatory Reporting Level (MRL) is then the maximum volume that the dam can reach and still contain the ESS without a spillway discharge occurring. The volume of the ESS is estimated by determining the total storm event inflow (assuming no runoff losses) for the 72-hour duration storm at the adopted AEP (10%) relevant to the dam's consequence category. Using Intensity Frequency Duration (IFD 2016) data obtained from the BoM online IFD service, ESS depths for the Project have been estimated as:

- Significant consequence category – 10% AEP, 72-hour duration event - 189 mm.

Due to the current level of design progression the ESS wave run-up has not been calculated; however, this will be a requirement of future stages of the Project design. Table 17 provides a summary of the preliminary hydrological design criteria for relevant Project mine WMS dams.

Table 17 Mine WMS – Preliminary Hydrologic Design Criteria

Mine WMS Dam	Catchment (Ha)		Preliminary Consequence Category	Required DSA AEP	Required ESS AEP	Preliminary Dam Capacity (ML)	Preliminary Hydrological Design Criteria (ML)		Preliminary Overflow Destination
	External	Total					ESS	DSA	
PWD	N/A	3.8	Significant	1:20	1:10 (72 hr storm)	125	7.2	23	Boomerang Creek, and Hughes Creek
CHPP dam	7.3	9.6	Low	1:20*	1:10 (72 hr storm)**	65	18.2	58	Hughes Creek via Hughes Creek Diversion
Product coal stockpile pad dam	11	13.3	Low	1:20*	1:10 (72 hr storm)**	87	25.2	80.2	
ROM pad dam	4.4	6	Low	1:20*	1:10 (72 hr storm)**	42	11.4	36.2	
MIA dam	8.8	11.2	Low	1:20*	1:10 (72 hr storm)**	74	21.2	67.6	

*As the CCA of the CHPP, Product coal stockpile pad, ROM pad and MIA dams is 'Low', they do not require a DSA. DSA values are provided here regardless, in line with BMA's internal guidelines for sizing MAW dams.

**As the CCA of the CHPP, Product coal stockpile pad, ROM pad and MIA dams is 'Low', they do not require an ESS. ESS values are provided here regardless, in line with BMA's internal guidelines for sizing MAW dams.

2.3.4.4 Spillway Design and Crest Embankment Levels

Consistent with the performance and management hydraulic criteria outlined in Section 2.3.3, the regulated structures are expected to include the spillway overflow structures to safely convey contained water inventories in the event of excess water accumulation.

The ultimate configuration of the spillways is expected to be confirmed during the detailed design phase, proceeding the completion of a comprehensive CCA. Notwithstanding, the spillway and crest design is expected to comprise:

- Where practical to do so, spillway structures will be founded in natural sequences.
- The expected configuration of the spillways comprises is a trapezoidal geometry, with sufficient width and depth to accommodate the combined depth of:
  - flow depths resulting from a 1% to 0.1% AEP critical duration rainfall event (depending on the final CCA rating for failure to contain – dam break)
  - wind setup and wave run-up allowance.
- Where possible, the MWS structures will be partially excavated, with the aim of balancing cut / fill needs, and reducing the height of above ground embankments. Considering the storage volume of the different WMS structures (refer to Table 17), it is expected that external embankment heights will be limited to a maximum of 4 m above surrounding ground levels. However, this will be confirmed during detailed design, with input from the outcomes of the comprehensive CCAs.

Where required, the downstream chutes of the spillway structures are expected to include armouring to mitigate the potential of erosion of embankments or abutting natural sequences to each WMS structure. Where appropriate, spillway flows will be directed to the nearest receiving environment waterway via safe and effective hydraulic controls.

Due to the size of the WMS structures, the wind setup and wave runup allowance is expected to be minor, as limited water surface fetch distances are available to establish wind setup and wave height conditions.

2.3.5 Underground Mine Portal Sump immunity

The Underground Mine Portal Area Sump has been assigned a consequence category of ‘low’. Accordingly, specific hydraulic design criteria are not expected to apply. Therefore, the Underground Mine Portal Area Sump has been nominally sized as nominally comprising a 7.5 ML storage, to contain 10 days of underground dewatering volumes at the peak extraction rate.

The Underground Mine Portal Area Sump has assigned a nominal catchment area of 10 ha, representing the benches and adjacent areas upgradient of the portal, which cannot be diverted and drained elsewhere.

Flood immunity of the portal has therefore been considered by including the runoff from this 10 ha area as a potential inflow to the WMS. Additional flood immunity for the portal is to be considered during detailed design once the precise arrangement of the portal and sump areas has been further developed.

3.0 Proposed mine WMS components

This section of the Report details the WMS, as listed in Table 18.

Table 18 Section 3 Contents

Section	Description
3.1 Process Water D	Describes the primary MAW storage proposed for the mine.
3.2 Process Area Runoff Collection System	Describes ancillary runoff collection dams associated with the CHPP, ROM and Product stockpile areas.

Section	Description
3.3 Underground Mine Portal Area Sump	Describes the Underground Mine Portal Area Sump
3.4 CHPP process and dust suppression water supply	Describes the water sourcing requirements for coal handling and dust suppression.
3.5 Rejects and tailings management	Describes the management of tailings produced from the operation.
3.6 Raw water system	Describes the Raw Water system proposed for the mine.
3.7 Effluent management	Describes treated effluent management.

3.1 Process Water Dam

The PWD is proposed for the Project (refer to Figure 4) to provide the storage required to contain the estimated volume of MAW generated over the operation of the mine. The PWD will be constructed as a turkey's nest storage with no external catchment area. However, the final geometry for the dam design will be determined through later dates of the design progression.

The conceptual design and operational rules applied to the PWD for the assessment are:

- Water will be transferred to the PWD following localised containment and collection in one of the various process area runoff dams or sumps located around the Project Site.
- The PWD will be used to preferentially supply water to CHPP process supply and dust suppression.
- In the event of a spillway discharge from the PWD, water will be directed via existing drainage pathways to the receiving environment (Figure 4).

The PWD is also proposed to include a licensed release point on Boomerang Creek (refer Figure 4).

The proposed release point has been included as a conservative management approach, consistent with BMA's approach to responsible water management. Should the site experience very rare to extreme rainfall conditions, in excess of the containment volume developed for each storage, BMA may utilise licensed release as a water management strategy in preference to uncontrolled discharge from MAW dams.

The receiving waterways for the PWD are listed in Table 19.

Table 19 Receiving Waterways

Waterway Hierarchy Order	PWD
1	Boomerang Creek
2	Hughes Creek
3	Isaac River

The expected water quality of MAW within the PWD is likely to exceed Water Quality Objectives (WQOs) for downstream waterways. Accordingly, the licensed release is proposed to occur as event-based releases, whereby releases are only permissible during periods of significant flow.

Dilution of released MAW will therefore occur by mixing with Boomerang Creek, Hughes Creek and Isaac River flows.

3.1.1 Licensed release point components

The licensed release point for PWD, to be confirmed during detailed design, may comprise of the following infrastructure:

- Pump Infrastructure

PWD inlet structure, pump-set and diesel generator to allow operation of the system during inclement weather conditions. The capacity of the pump infrastructure system is currently estimated as being 100 L/s.

- Pipeline

  The pump will convey water via a pipeline to the release point structure. The expected internal diameter of the pipeline is 200 mm.

- Release Point Structure

  The release point structure will comprise of a rock armoured pad (which the pipeline will discharge directly to) which will be sized in accordance with rock outlet structures published in the Queensland Urban Drainage Manual (Institute of Public Works Engineering Australasia, 2017). An indicative diagram of a rock pad structure is shown in Figure 6.

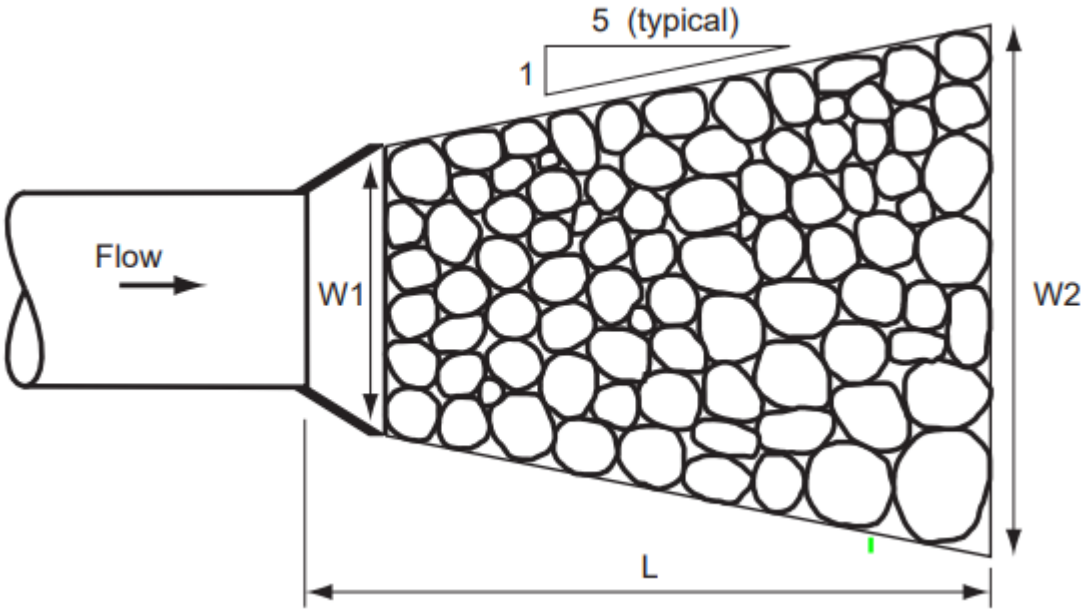


Figure 6 Indicative Rock Pad Outlet Structure – Reproduced from QUDM (2017)

If progressed, the final dimensions of the pipeline and rock outlet pad are to be finalised in detailed design. Notwithstanding, assuming an internal pipe diameter of 200 mm, the dimensions of the rock pad structure to mitigate the potential of jetting flows causing erosion would be as follows:

- Length of Pad 1.2 m (6 x D)
- Armouring Minimum two layers of d_{50} = 200 mm.

Should conveyance of licensed release flows be required between the rock pad outlet structure and Boomerang Creek, a drainage channel would be constructed including a liner barrier system overlaid with rock armouring to dissipate flows. If necessary, the channel would terminate in a level spreader device, to dissipate the energy of the pumped MAW, allowing discharge to Boomerang Creek in a safe, non-erosive manner. An indicative diagram of a level spreader is shown in Figure 7.

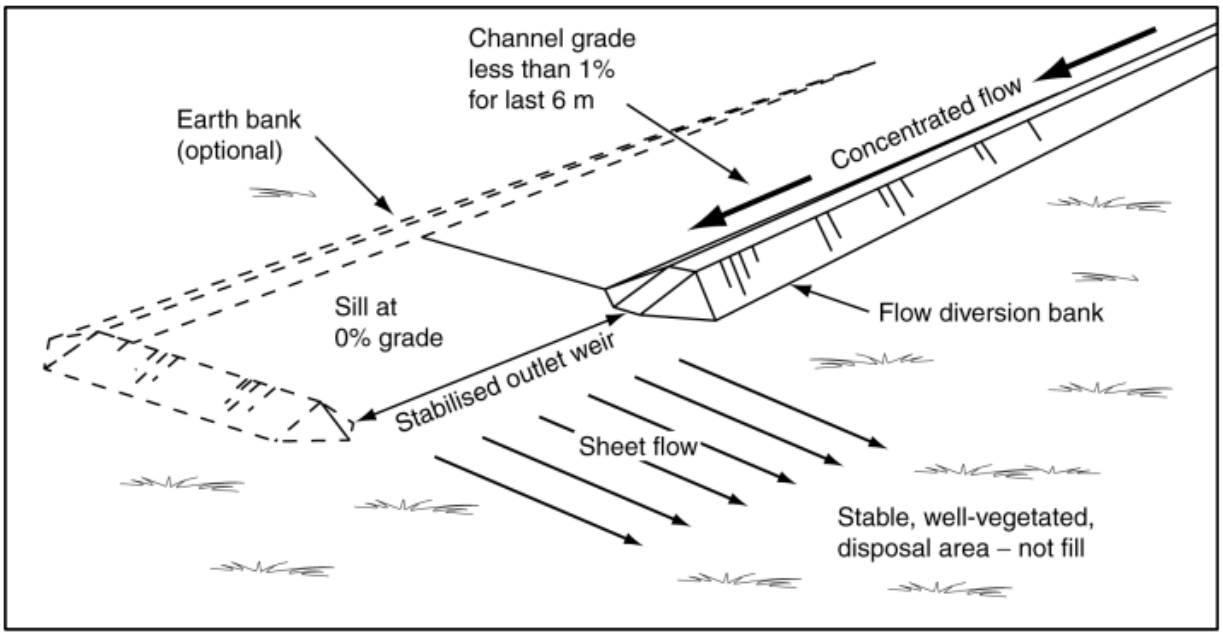


Figure 7 Indicative Conceptual Layout of a Level Spreader Outlet (IECA, 2008)

3.1.2 Release conditions

Release conditions for the PWD licensed release point have been developed consistent with:

- Model Water Conditions for Coal Mines in the Fitzroy Basin (DES, ESR/2015/1561)
- Peak Downs Mine EA: EPML00318213.

It is proposed that the PWD licensed release conditions adopted follow similar criteria to neighbouring sites (i.e. Peak Downs Mine), which could be routinely complied with by the proposed Saraji East operations.

The expected receiving water flow criteria for discharge are as follows:

- Boomerang Creek ≥0.1 m^3/s
- Isaac River (Deverill Station MP19) ≥3 m^3/s.

The expected MAW release limits (end of pipe concentrations) are as follows:

- Electrical Conductivity ≤10,000 µS/cm
- pH 6.5 – 9.5.

The receiving waters contaminant trigger levels, during a release event, are expected to be as follows:

- Electrical Conductivity 2,000 µS/cm
- pH 6.5 – 9.0.

It is noted that the current water balance modelling, under the Stress Test Scenario (which is conservative relative to the expected process water demands) suggests these limits will be met.

3.1.3 Operation of releases

The licensed release point will be operated according to the conditions outlined in the EA for the site, which is expected to include:

- Minimum Flow Threshold.

  Licensed release is expected to be permissible during flow events in Boomerang Creek. Flow estimates for Boomerang Creek are discussed further in Section 4.4.

- Water Quality Requirements.

- Sampling, Notification and Observation and Reporting:
  - Flow Gauge

    A flow gauge will be located upstream of the release point to a) establish a baseline flow condition for Boomerang Creek and b) indicate when flow conditions are sufficient for dilution of licensed release to occur.
  - Release Point Sampling

    During release events, continuous sampling will occur at the release point at the pipeline outlet location.
  - Receiving environment sampling

    Monitoring of downstream flows is proposed to occur within Boomerang Creek and Hughes Creek, as shown on Figure 4.
- Coordination with other Releases

  Coordination with proximate mines may occur, to manage the risk of concurrent releases to result in exceedances of water quality objectives in the downstream receiving environment. The coordination is expected to include existing Saraji operations and Peak Downs Mine (which maintains a licensed release point on Boomerang Creek under the relevant EA: EPML00318213).

  Specifically, BMA are a party to the ongoing development of the 'BHP Real-Time Forecasting System (RTFS) – Hydrologic, Hydrodynamic and Water Quality Models' (Water Technology & Deltares, 2021) which models the potential release water quality in the receiving environment for releases originating from the central mines region, including Goonyella Riverside, Caval Ridge, Peak Downs, Saraji (existing), Norwich Park, Daunia and Poitrel mines. It is envisioned that the Project would be included within this assessment in the next periodic update of the RTFS tool.

3.2 Process area runoff collection system

Runoff from several operational areas and facilities is expected to generate MAW. Runoff originating from these areas are proposed to be collected in dams assigned to each location via gravity inflow. Process areas within the Project are the CHPP, the ROM pad and product stockpile.

Conceptual design and operational rules for the process area runoff collection system applied within the assessment include:

- MAW generated as runoff from each process area will be conveyed by a series of drains and sumps which direct flows to a local MAW dam.
- Clean runoff originating outside of the process areas will, as far as practical, be passively diverted around the process areas by way of catch drains as required to reduce the total volume of water requiring containment.
- Water will be pumped from each MAW dam to the PWD as soon as possible to maximise capacity to contain additional inflows.
- In the event of a spill via an emergency spillway from any of the process area dams, water will be directed via existing drainage pathways and diversions to the receiving environment.

3.3 Underground Mine Portal Area Sump

Both groundwater ingress and reclaimed underground mine water use are considered mine affected and will be collected as required within the underground mine and pumped to the Underground Mine Portal Area sump.

Conceptual design and operational rules for the Portal Sump are as follows:

- Pumped inflows to the sump will come from dewatering of the underground mine (groundwater ingress and process effluent) and from the gas drainage bore field.
- Runoff from the Underground Mine Portal Ramp will enter the Portal Sump via gravity inflow.

- Water will be transferred from the Portal Sump to the PWD as required.

3.4 CHPP process and dust suppression water supply

It is proposed that processing and washing of coal will be conducted onsite with the Project CHPP located within ML 70142. The CHPP will be designed to progress ROM coal at a rate of 800 tonnes per hour (tph), equivalent to a yield up to 5 Mtpa of metallurgical product coal (or 7 Mtpa of ROM coal) which will be delivered to the train load out bin at a rate of approximately 4,500 tph. The CHPP will require a raw water supply of approximately 1,500 ML/yr to achieve this production rate. Water will be preferentially sourced from the PWD in line with the objectives stated in Section 2.0.

The use of the existing Saraji Mine CHPP will be used for processing Project coal in years where ROM tonnes exceeds 7 Mtpa.

Water for dust suppression (e.g. haul roads and stockpiles) will also be preferentially sourced from the PWD in line with objectives stated in Section 2.0.

Conceptual design and operational rules for the CHPP process and dust suppression water supply are as follows:

- reuse of MAW to be prioritised over raw water use whenever sufficient supply available in the PWD
- dust suppression demand reduced to zero when daily rainfall exceeds evaporation.

3.5 Rejects and tailings management

All reject and tailings material will be disposed of via a dry disposal system and managed via trucking to the existing Saraji Mine's in-pit spoil dumps. Accordingly, the moisture content of reject and tailings waste generated within the Project is expected to be insignificant. Therefore, reject and tailings material has been not considered in this Report.

3.6 Raw water system

To supply Project water demands for which reuse of MAW is unsuited (potable, washdown, underground mine process), or for when MAW is unavailable, a RWD is proposed for the Project Site. The conceptual sizing of the RWD is to provide approximately one month's supply of water for all Project water demands including potable, processing and operations in the absence of alternative sources such as the reuse of MAW. The provisional location of the RWD is shown on Figure 4.

In the context of this assessment, Raw Water refers to water sourced via the EWPC pipeline facility.

3.7 Effluent management

As described in Section 2.2.5, it is proposed to treat effluent waste generated by personnel within the STP. Treated water generated by the STP will be pumped to the PWD (where dilution will occur).
A nominal treated effluent input rate of 23 m^3/day has been applied to the PWD, based on a workforce of 125 equivalent persons and a 180 L/day effluent generation rate.
During the operational phase, the Project will employ up to 500 Full Time Equivalent, however based on a 4-week roster rotation with 12-hour shifts, an approximate 125 workers are expected to be in residence at peak times during operation. Water usage and wastewater production estimates are therefore based on these predicted workforce numbers. The generation of wastewater has been calculated based on 180 L per equivalent population per day, in accordance with 02- 2014-3.1 Gravity Sewerage Code of Australia (Water Services Association of Australia, 2014).

4.0 Assessment of proposed conceptual mine WMS

This section outlines the development of a WBM, utilised to assess the estimated performance of the WMS proposed for the mine, as listed in Table 20.

Table 20 Section 4 Contents

Section	Description
4.1 Model purpose	Describes the primary objectives of the development of a WBM.
4.2 Model Software and Simulation Settings	Describes the software and simulation settings utilised for the WBM.
4.3 Climate Modelling Approach	Details the climatic Monte Carlos approach to the WBM and the development of climate data sequences, including consideration of potential future climate change conditions.
4.4 Rainfall - runoff sub-model	Describes the Australian Water Balance Model (AWBM) utilised to estimate surface runoff within the model
4.5 Water Management System Input Data	Details the geometry and rules used to simulate the WMS system
4.6 Scenario Development	Describes the scenarios utilised to analyse the performance of the WMS
4.7 Assumptions and limitations	Describes the assumptions and limitation of the model, as developed.
4.8 Modelling results	Details the outcomes of the WBM.

4.1 Model purpose

The purpose of the water balance assessment is to validate the proposed mine WMS under a range of climatic conditions, including potential future climate change projections, with the aim of:

- estimating the potential quantity and quality of MAW that may be generated by the Project throughout the operation of the mine
- estimating the storage capacity required for each of the WMS dams to meet the stated MAW containment objectives
- confirming that the proposed operational rules are supportive of the proposed MAW containment reuse objectives
- identifying the required transfer capacities to move MAW around the mine WMS so that containment, productivity (CHPP operations) and reuse objectives are met
- estimating the potential volumes of raw water required to satisfy Project consumptive demands considering:
    - process demands that cannot be satisfied through use of MAW due to water quality requirements, or
    - when stored volumes of MAW are unavailable following periods of prolonged drought.
- developing an understanding of the potential risk and impacts of controlled and uncontrolled releases to the receiving environment.

4.2 Model software and simulation settings

A dynamic WBM was developed for the Project using the GoldSim probabilistic modelling software (GoldSim Technology Group LLC, 2021). GoldSim is a Monte Carlo simulation software package that is commonly used in the mining industry for water balance modelling. Key settings for the model developed are listed in Table 21.

Table 21 Model Settings

Aspect	Description
Software	GoldSim 14.0 Build #344 (October 4, 2021) including contaminant transport module.
Model Timestep	Daily
Model Duration	20 years (equivalent to Mine Plan)
Model Type	Probabilistic (Monte Carlo Climatic Approach)

4.3 Climate modelling approach

To validate the performance of the proposed mine WMS under a range of historical climatic conditions, multiple simulations (known as realisations) of the 20-year production schedule were calculated in an approach termed as 'Monte Carlo analysis'. In this approach, a rule-based representation of the WMS is developed. Subsequently the performance of the WMS is evaluated by inputting multiple sequences of climate data – referred to as 'Realisations'.

To address the potential risks to mine water management on-site, the climate data utilised for the MWB has included consideration of Climate Change projections. The development of climate data sequences and application of the sequences is detailed within the following subsections.

4.3.1 Data requirements

Water balance modelling requires input climate data for daily rainfall and evaporation rates.

Daily rainfall data [mm/day] is used:

- By the runoff model (AWBM) to estimate runoff depths and consequent runoff volumes entering the mine WMS.
- To estimate the direct rainfall component falling over each water management dam extents.

Daily evaporation data [mm/day] is used to derive:

- Potential evapotranspiration (PET), which is used to inform the runoff model (AWBM).
- Dam evaporative water losses.

4.3.2 Development of climate sequences

For the purposes of this assessment, input climate data has been developed according to:

- Guideline for Climate Change Adaptation in Mine Water Planning and Hydrologic Assessments (BHP, August 2020 – CTD-WTR-GDL-001).

The guideline outlines an approach for determining the potential consequences of Climate Change in a risk framework, utilising input data from:

- **Climate Change Projections**

  The Biophysical Modelling (CCS) program maintained by the Queensland Government (Long Paddock, 2022) provides projections of potential future climate scenarios. The CCS data utilised comprises climate projections based on Global Climate Models (GCMs) for a Representative Concentration Pathway (RCP) of 8.5 Watts/Square Metre [W/m^2]. This RCP 8.5 projections are equivalent to 4.3 degrees of warming at 2100, compared to pre-industrial levels.

- **2020 – 2040 (HP Future Climate Partition) climate projection**

  A 20-year projection centred around the **2030** pivotal year, assuming a high level of global warming, where the Eastern Indian Ocean warms faster than the Western Pacific Ocean. This scenario predicts a drier Australia compared to other climate change projections.

- **2040 – 2060 (HI Future Climate Partition) climate projection**

  A 20-year projection centred around the **2050** pivotal year, assuming a high level of global warming, where the Eastern Indian Ocean warms faster than the Western Pacific Ocean. This scenario predicts a wetter North East Australia compared to other climate change projections, though dryer than the baseline.

- **2040 – 2060 (HP Future Climate Partition) climate projection**

  A 20-year projection centred around the **2050** pivotal year, a assuming a high level of global warming, where the Eastern Indian Ocean warms faster than the Western Pacific Ocean. This scenario predicts a drier Australia compared to other climate change projections.

- **SILO Data Drill – Baseline Data**

  Historical observations obtained from the SILO Data Drill program for the Saraji East location. This sequence does not include consideration of climate change GCMs.

4.3.2.1 Stochastic Daily Rainfall Sequences

The CCS projections and SILO Data Drill sequences were used as input data to the Stochastic Climate Library Tool (SCL, eWater Toolkit, 2022) to produce 20-year duration stochastic sequences for daily rainfall [mm/day] utilising the Transition Probability Matrix (TPM) method for the Saraji site location. Each stochastic climate data sequence features 500 realizations, resulting in 10,000 years of generated data (per sequence). The produced stochastic sequences for daily rainfall [mm/day] are summarised in Table 22 and depicted in Figure 8 through Figure 11.

Table 22 Stochastic Climate Sequence – Annual Rainfall [mm] - Basic Statistics

Parameter	Baseline	2030 HP	2050 HI	2050 HP
Mean Annual Rainfall [mm]	575	532	543	486
Standard Deviation [mm]	191	174	180	157
Minimum	70	71	89	75
5th Percentile	290	276	274	252
10th Percentile	345	323	323	297
25th Percentile	439	408	414	375
Median	561	515	529	470
75th Percentile	698	640	658	582
90th Percentile	827	762	781	695
95th Percentile	910	840	861	766
Maximum	1,845	1,318	1,511	1,343

Figure 8 shows that the baseline stochastic data-set generated closely matches the distribution of the available historical climate data available through the SILO data drill program.

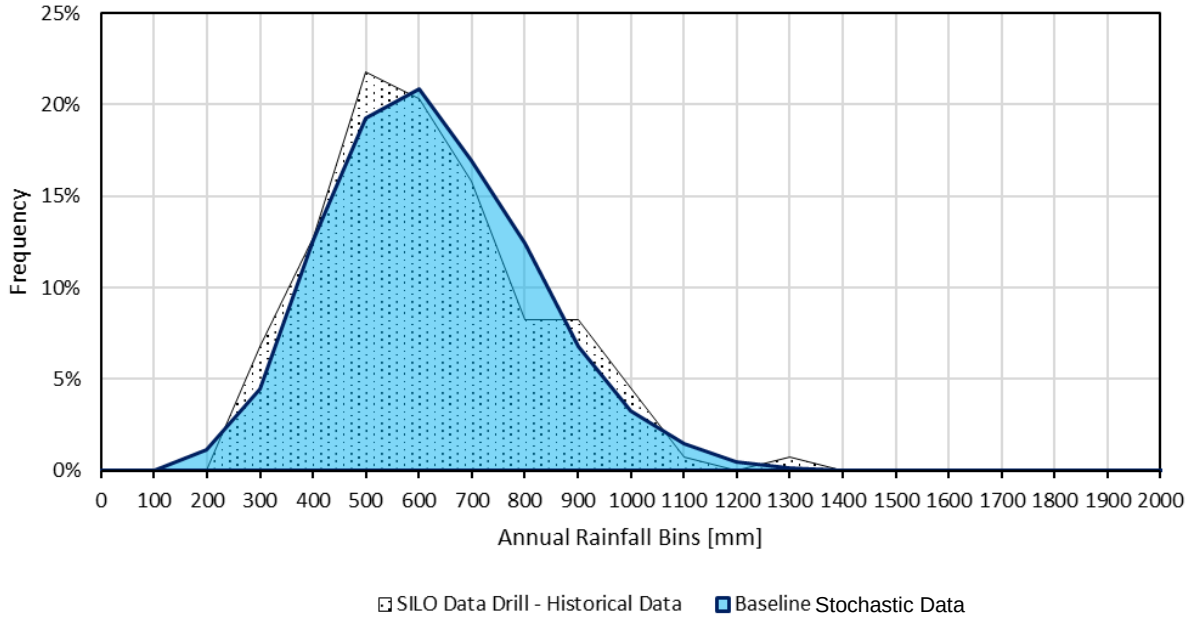


Figure 8 Histogram Comparison of Baseline Stochastic Sequence to Historical Data – Annual Rainfall [mm]

Figure 9 and Figure 10 show that the 2030 HP and 2050 HI climate change projections represent a moderate reduction in annual rainfall totals, compared to the available historical climate data available through the SILO data drill program.

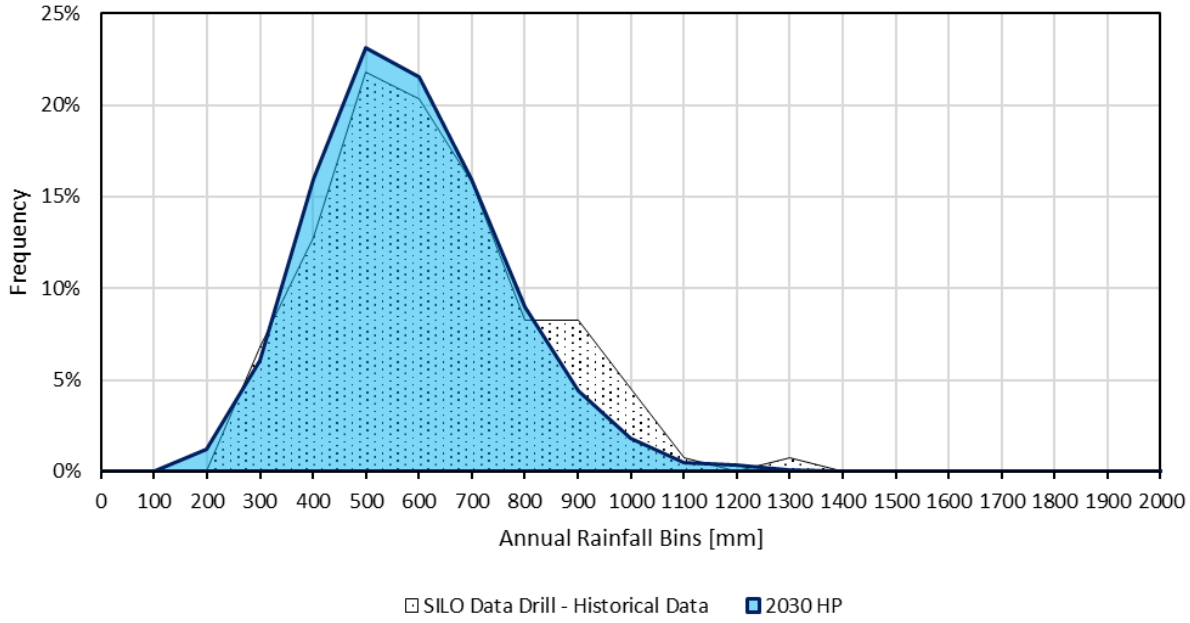


Figure 9 Histogram Comparison of 2030 HP Stochastic Sequence to Historical Data – Annual Rainfall [mm]

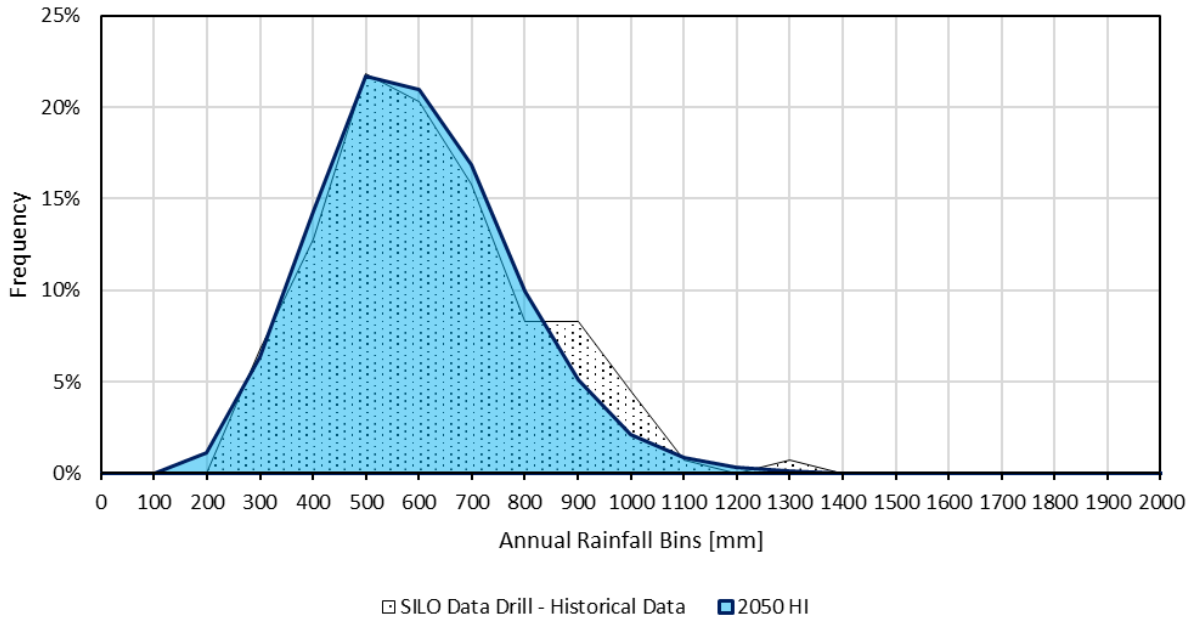


Figure 10 Histogram Comparison of 2050 HI Stochastic Sequence to Historical Data – Annual Rainfall [mm]

Figure 11 shows that the 2050 HP climate change projection represents a significant reduction in annual rainfall totals, compared to the available historical climate data available through the SILO data drill program.

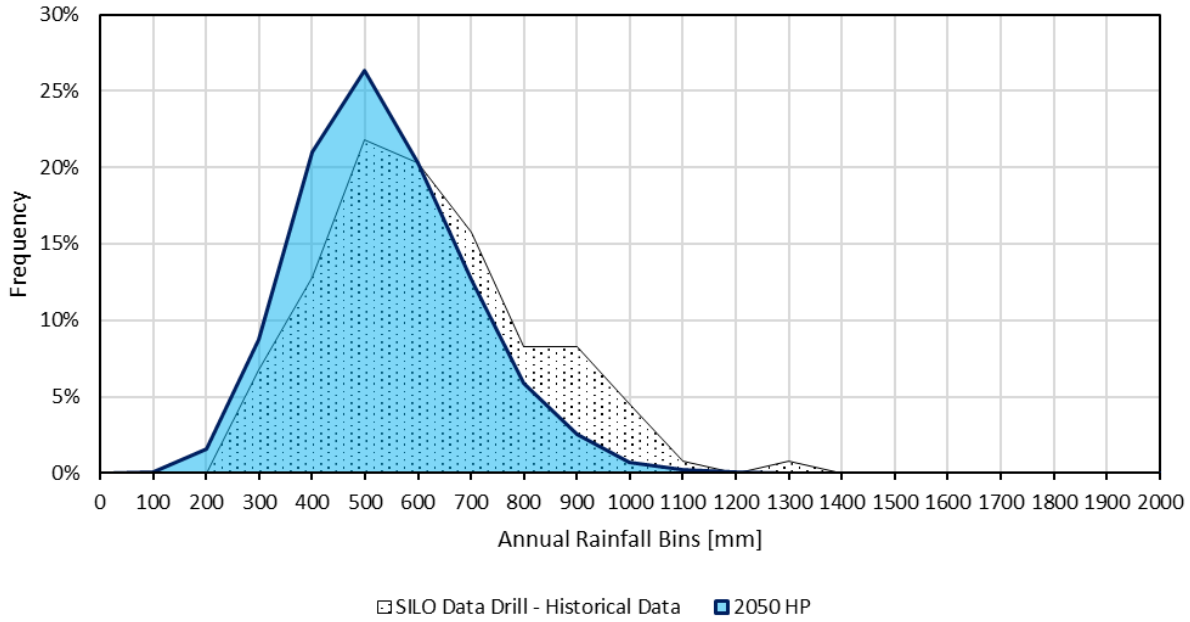


Figure 11 Histogram Comparison of 2050 HP Stochastic Sequence to Historical Data – Annual Rainfall [mm]

4.3.2.2 Daily Evaporation

Daily evaporation rates [mm/day] were developed based upon the SILO Data Drill and CCS Climate Change projections and are listed in Table 23. The developed evaporation estimates were applied on a monthly average basis in the WBM.

Table 23 Monthly Evaporation Rates – SILO Data Drill and CCS Model Projections

Climate Scenario	Month of Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Average Monthly Evaporation (mm)											
Baseline	219.9	181.0	182.8	147.6	116.8	93.3	103.4	133.1	173.2	215.3	226.4	235.7
2030 HP	231.7	190.9	192.6	154.0	122.0	98.1	107.0	138.1	180.2	225.6	236.4	245.8
2050 HI	242.8	201.3	205.2	158.8	125.1	99.2	108.0	137.7	184.7	231.5	249.6	253.0
2050 HP	245.5	202.5	204.4	161.7	128.5	103.7	111.5	144.2	188.4	237.4	247.9	257.4
	Increase from Baseline											
Baseline	N/A											
2030 HP	5.4%	5.5%	5.4%	4.3%	4.5%	5.2%	3.5%	3.8%	4.0%	4.7%	4.4%	4.3%
2050 HI	10.4%	11.2%	12.3%	7.6%	7.1%	6.3%	4.5%	3.5%	6.6%	7.5%	10.2%	7.3%
2050 HP	11.6%	11.9%	11.9%	9.6%	10.0%	11.2%	7.9%	8.3%	8.7%	10.2%	9.5%	9.2%

4.3.2.3 Potential Evapotranspiration (PET) Derivation

PET factors were derived from the available historical SILO Data Drill data for:

- Runoff Model (AWBM) catchment surfaces PET losses

  Calculated as the ratio of FAO56[3] PET to Daily Evaporation as depicted in Figure 12.

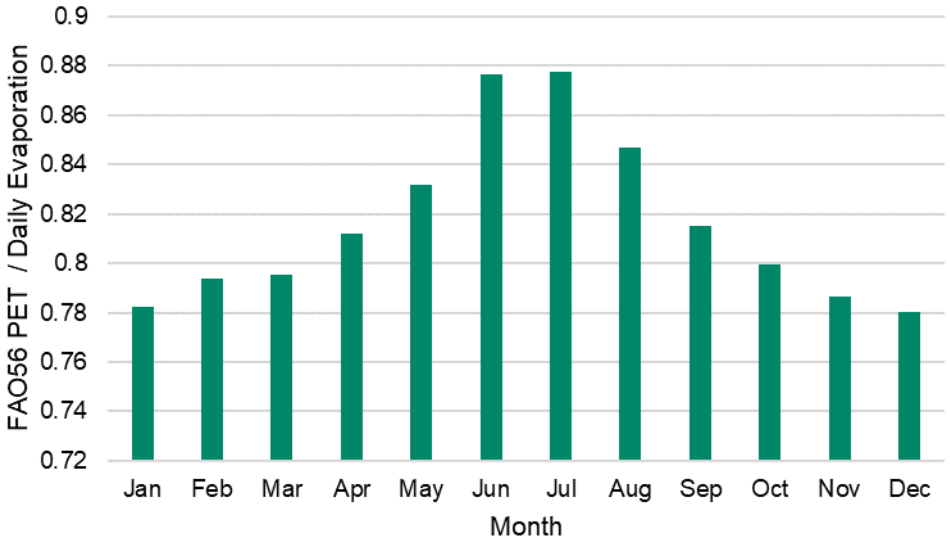


Figure 12 Developed Ratio of FAO56 to Daily Evaporation

4.3.2.4 Dam Water Surfaces Evaporation losses

In recognition of the potential for reduced evaporation rates from large bodies of water and water containing elevated salinity levels, the daily pan evaporation rate was reduced to 80% of the input Class A pan rate when estimating evaporation from each dam. Dam evaporative losses are calculated daily with each time step and are a function of each dam's water surface area on that particular day.

4.3.2.5 Application of Developed Sequences

The developed stochastic climate data sequences were applied against the mine plan as detailed in Table 24.

Table 24 WBM Climate Scenarios

Year	Applied Stochastic Sequence (TPM Method)		
	Business As Usual	Climate Change (HI) Scenario	Climate Change (HP) Scenario
Year 1-20	Baseline sequence derived from SILO Data Drill	2030 HP	
Project closure		2050 HI	2050 HP

The Project commencement year was adopted as 2024.

[3] Potential Evapotranspiration calculated using the FAO Penman-Monteith formula as in FAO Irrigation and Drainage paper 56, http://www.fao.org/docrep/X0490E/X0490E00.htm

4.3.2.6 Discussion of Climate Change Estimates

Overall, the developed baseline and climate change sequences suggest the following potential influences upon the WBM model results:

- The developed estimates generally suggest lower rainfall totals and higher potential evaporation and evapotranspiration estimates, potentially resulting in:
  - Reduced water storage volumes within water management dams, which may reduce potential accumulation of water volumes, but result in worsened water quality.
  - Reduced overall stream-flow in downstream waterways (such as Boomerang Creek and Hughes Creek).
  - Increased demand for make-up raw water supply (refer Section 2.2.4)

4.4 Rainfall - runoff sub-model

To estimate the potential volumes of runoff entering the proposed mine WMS, the WBM utilises the Australian Water Balance Model (Boughton, 1993). The AWBM was selected for this purpose due to its simplicity, widespread usage in many similar applications and ease of parameterisation and calibration. This conceptual rainfall-runoff model uses three independently balanced surface stores to simulate partial areas of rainfall excess. The excess rainfall is then divided into surface and baseflow stores which are then allowed to discharge at rates governed by their respective recession constants.

To reflect the differences in land use, potential for contamination and runoff depth within the Project, the WBM utilises different land use types as detailed in Table 25. Each utilises the AWBM to simulate the different volumes of runoff generated by each land use and is managed within the mine WMS according to its assumed quality (refer section 4.5.4).

Table 25 AWBM Land use Types

Land-use	Proposed runoff management
Disturbed *(All potential sources of contaminated runoff originating from mine WMS process areas)*	Contained onsite and managed within the mine WMS
Spoil *(All spoil and overburden areas)*	Contained onsite and managed within the mine WMS

Adopted AWBM parameters for each model land use have been taken from the existing Saraji Mine WBM and are shown in Table 26[4]. Based on the assumptions regarding the passive diversion of clean water catchments around the mine WMS (refer to Section 2.1) no undisturbed (natural) catchments are assumed to report to the mine WMS. In addition, the catchment reporting to the mine portal sump is assumed to consist entirely of spoil and has conservatively been modelled assuming that it remains un-rehabilitated over the operation of the mine.

Table 26 Adopted AWBM Land use Parameters

Parameter	Description	Land use	
		Disturbed	Spoil
A1	Partial area	0.134	0.134
A2	Partial area	0.433	0.433
A3	Partial area	0.433	0.433
C1	Surface storage capacity	10	10
C2	Surface storage capacity	50	70

[4] Email Correspondence (9/06/22) from BMA

Parameter	Description	Land use	
		Disturbed	Spoil
C3	Surface storage capacity	100	140
BFI	Base Flow Index	0.1	0.8
K_b	Base flow recession constant	0.7	0.7
K_s	Surface flow recession constant	0.1	0.1

4.4.1 Characterisation of receiving waterway flows

The immediate receiving waterways for license releases are Boomerang Creek and Hughes Creek. These waterways are ephemeral, whereby negligible or no flow is the predominant condition. Limited flow data for the waterways is available, for the purposes of establishing a baseline flow condition.

Accordingly, to characterise the potential impact of licensed release upon receiving waterways, a daily timestep GoldSim runoff yield sub-model has been developed as follows:

- A runoff model (AWBM) calibration has been developed for the Phillips Creek waterway, upstream of the historical Phillips Creek at Tayglen gauge (closed), utilising historical climate data sourced from the SILO Data Drill for the site location.
- The calibrated model parameters have been applied, by proxy, to the Boomerang Creek and Hughes Creek systems, upstream of the proposed Water Management Dams and associated release point(s).
- Using the stochastic baseline and climate change sequences developed for the MWB, daily streamflow estimates were developed for Hughes Creek and Boomerang Creek over the Project duration.
- The streamflow estimates were used to develop estimates of:
    - Total Flow [ML/d] within Receiving Waterways (in excess of 0.1 m^3/s average daily rate)
    - Maximum possible licensed release volume
    - Estimated Dilution Rate

The developed catchment areas are listed in Table 27.

Table 27 Catchment Areas - Waterways

Location	Total Catchment Area (km^2)
Phillips Creek at Tayglen (Closed Gauge)	344
Boomerang Creek at PWD Licensed Release Point	94*
Hughes Creek at MIA Dam	140*

*Catchment areas were delineated for areas upstream of the underground mine disturbance footprint only, as a conservative measure.

Calibration of flows within Phillips Creek was completed, with the AWBM calibrated parameters listed in Table 28. A comparison of the Phillips Creek at Tayglen gauge records and AWBM runoff modelled with the calibrated parameters is shown in Figure 13.

Table 28 AWBM Calibration Parameters - Phillips Creek at Tayglen

Parameter	Value
A1	0.134
A2	0.433
A3	0.433
C1	20 mm
C2	80 mm
C3	280 mm
BFI	0.25
K_s	0.05
K_b	0.75

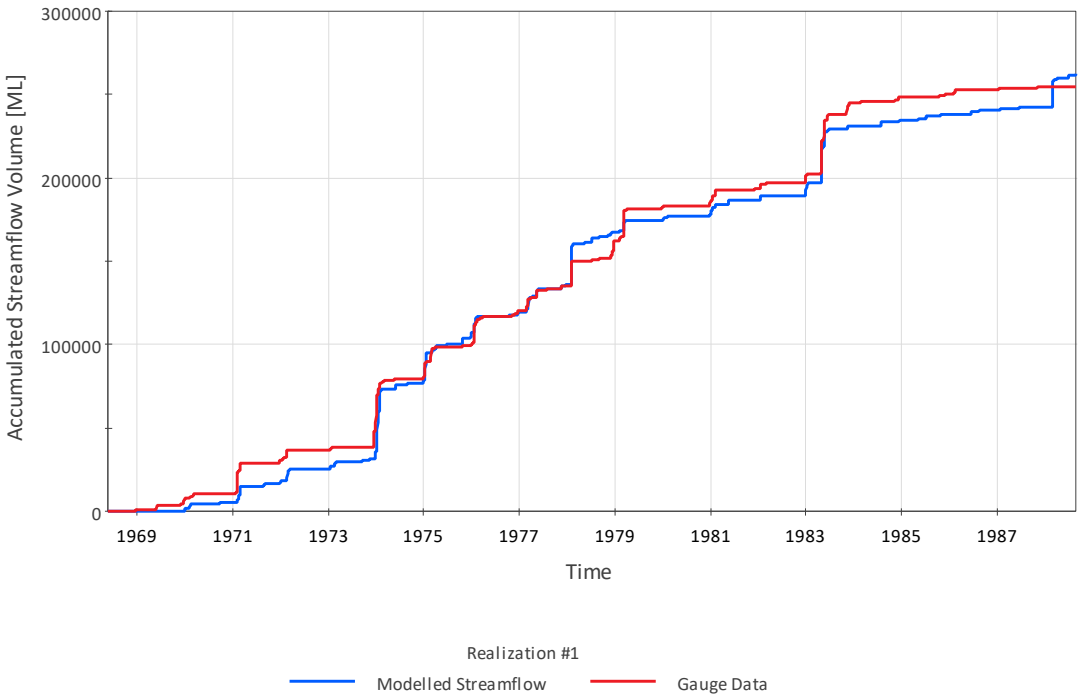


Figure 13 Calibration Plot – Phillips Creek at Tayglen

Application of the determined parameters to the Boomerang Creek and Hughes Creeks was completed, with baseline runoff estimates shown in Figure 14. A comparison of the modelled flow rates under climate change sequences is shown in Figure 15.

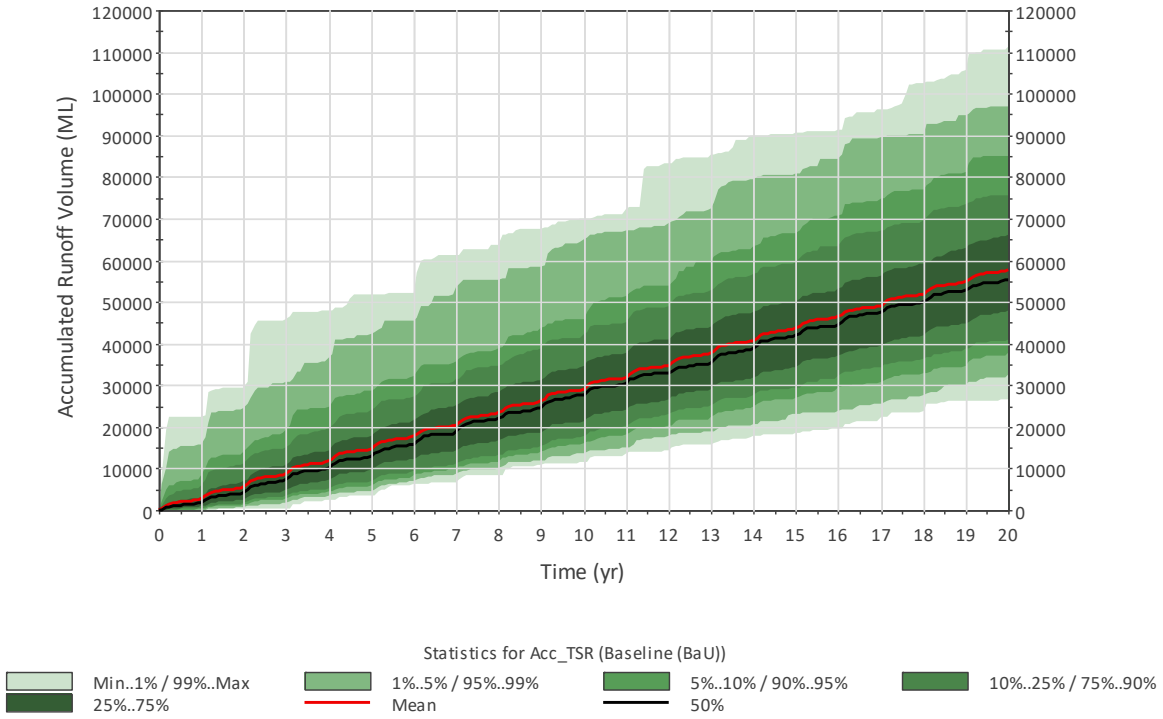


Figure 14 Modelled Streamflow – Boomerang Creek at PWD

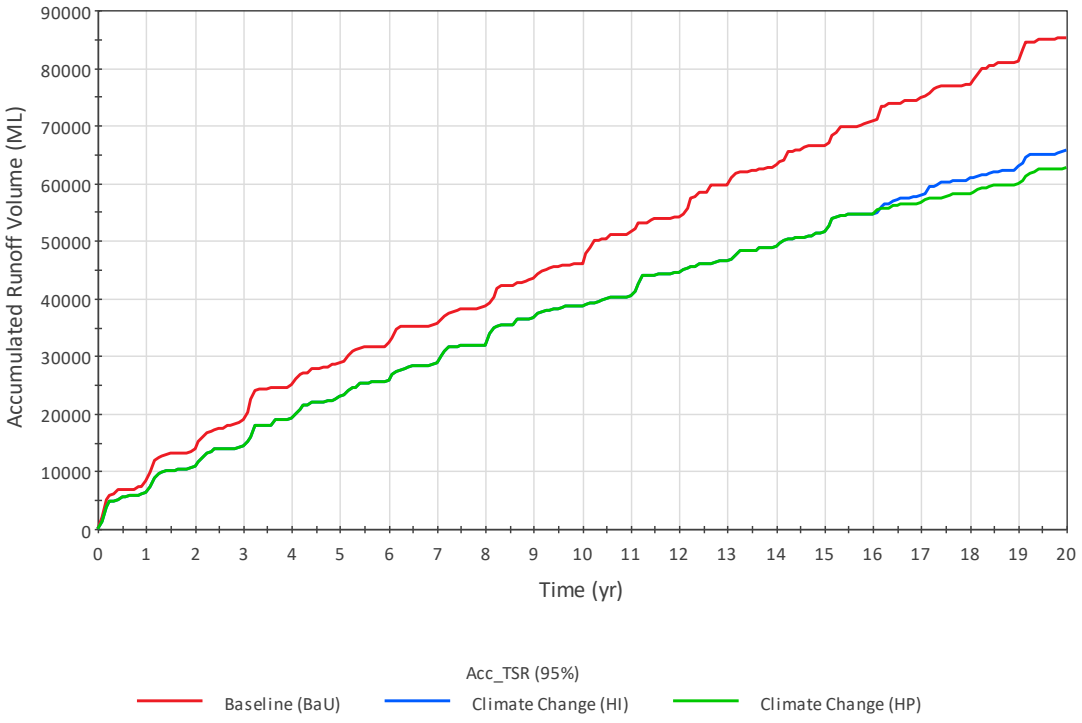


Figure 15 Modelled Streamflow – Boomerang Creek at PWD – Climate Change Comparison – 95th Percentile

The model results confirm that the streamflow within Boomerang Creek is highly ephemeral, with significant flows occurring in response to significant rainfall events. Climate change impacts may materially reduce the volume of flow, potentially resulting in a reduced capacity within the downstream waterways to accommodate licensed release flows.

The modelled Boomerang Creek flows are shown in Figure 16 as an exceedance plot, suggesting that flows within the Boomerang Creek are expected to be nil to low approximately 70% of the time. Significant flows (≥ 4.5 m^3/s) are expected less than 10% of the time.

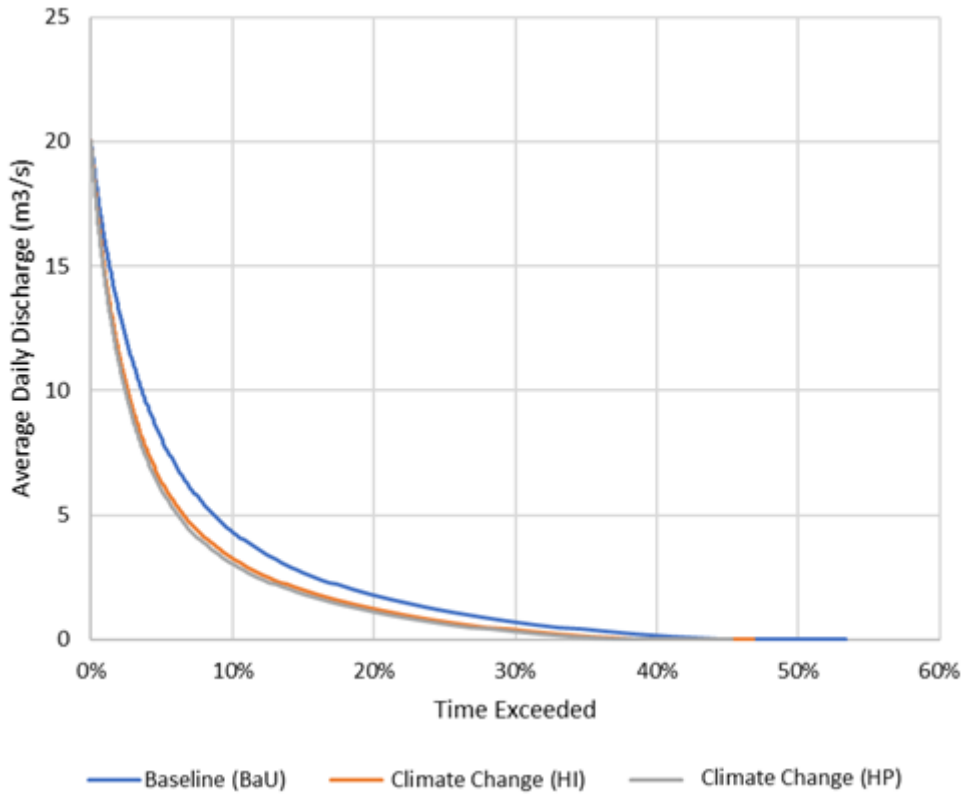


Figure 16 Modelled Streamflow – Boomerang Creek at PWD – Time Exceeded

4.5 WMS input data

Input data defining the Mine WMS is detailed in the following sections. The data was developed based on discussions and direction provided by BMA, as well as from auxiliary technical studies prepared for the EIS.

4.5.1 Model schematic

Figure 17 shows the schematic for the conceptual mine WMS as represented by the WBM. The different components of the system are described in sections 4.5.2 to 4.5.7.

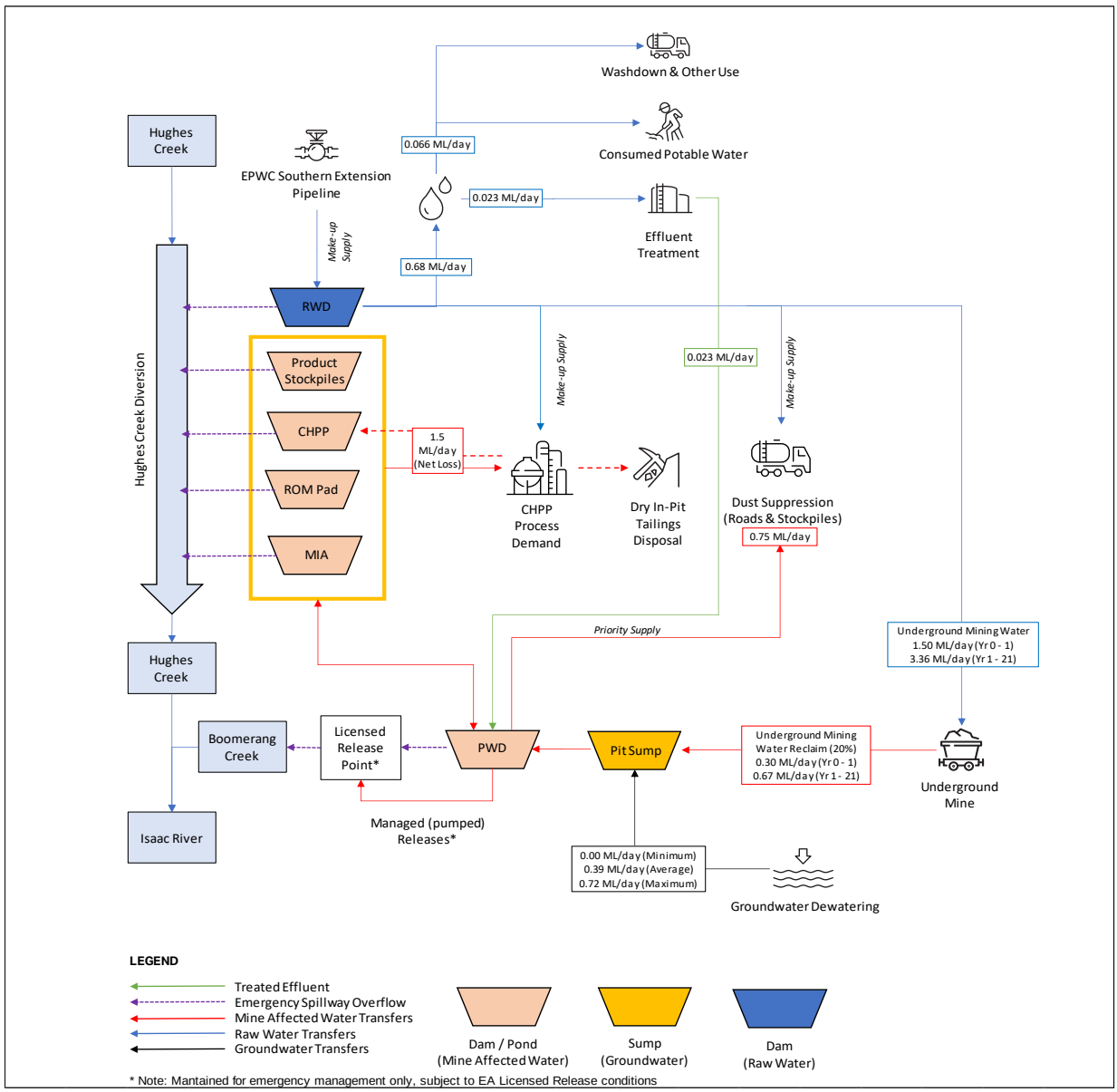


Figure 17 Conceptual Mine WMS – Model Schematic

4.5.2 Mine catchment areas

The catchment areas reporting to each mine process area dam were defined on the basis of the mine layout plan and advice provided by BMA. Due to the underground nature of the proposed mining activities, the catchment area reporting to the Underground Mine Portal Sump remains fixed for the operation of the mine. Catchment land use has been defined based on the assumed process taking place within each catchment area. Existing highwall check dams, catchment drains and other such strategies have been assumed to remain in place such that incident runoff to the pit is minimised to the greatest extent practical. Table 29 summarises adopted catchment areas and assumptions for the mine WMS. Locations of WMS dams and catchments are shown in Figure 4.

Table 29 Mine WMS Catchments and Assumptions

Catchment	External Catchment Area (ha)	AWBM Land use	Assumptions
Process and RWDs	0	N/A	Turkeys nest dams with no external catchment.
Product stockpile and train load out	11	Disturbed	Includes approximately 2.5 ha for Train Load Out (TLO)
ROM coal stockpile	4.4	Disturbed	The design of the mine process areas (by others) will allow for all potentially mine affected runoff to be directed to a common point for collection in the associated collection dams for subsequent transfer to the PWD.
MIA	8.8	Disturbed	• Total area of MIA assumed at approximately 58.7 ha. • 15% assumed to be mine affected. • Other areas (85% of MIA) are not considered to comprise a MAW catchment, and therefore are directed off-site, subject to relevant stormwater management controls as required.
CHPP	7.3	Disturbed	• Total area occupied by CHPP assumed to be approximately 14.6 ha. • 50% of CHPP area assumed to be mine affected and is directed to the CHPP dam. • Other areas are not considered to comprise a MAW catchment, and therefore are directed off-site, subject to relevant stormwater management controls as required.
Underground mine portal area sump	10	Spoil	The external catchment area currently reporting to the underground mine portal area sump will be minimised as far as practical by: • Re-profiling of the backfilled spoil and overburden material currently occupying the pit. • The use of roll-over bunding for all entry roads.

Catchment	External Catchment Area (ha)	AWBM Land use	Assumptions
			• Highwall check dams and diversion drains.

4.5.3 Groundwater

Groundwater enters the mine WMS either as dewatering of the underground workings or via the gas drainage bore field. Potential groundwater inflow rates have been assessed in SLR (2022), and are reproduced in Figure 18. Mine dewatering was modelled as a single, combined input to the WBM.

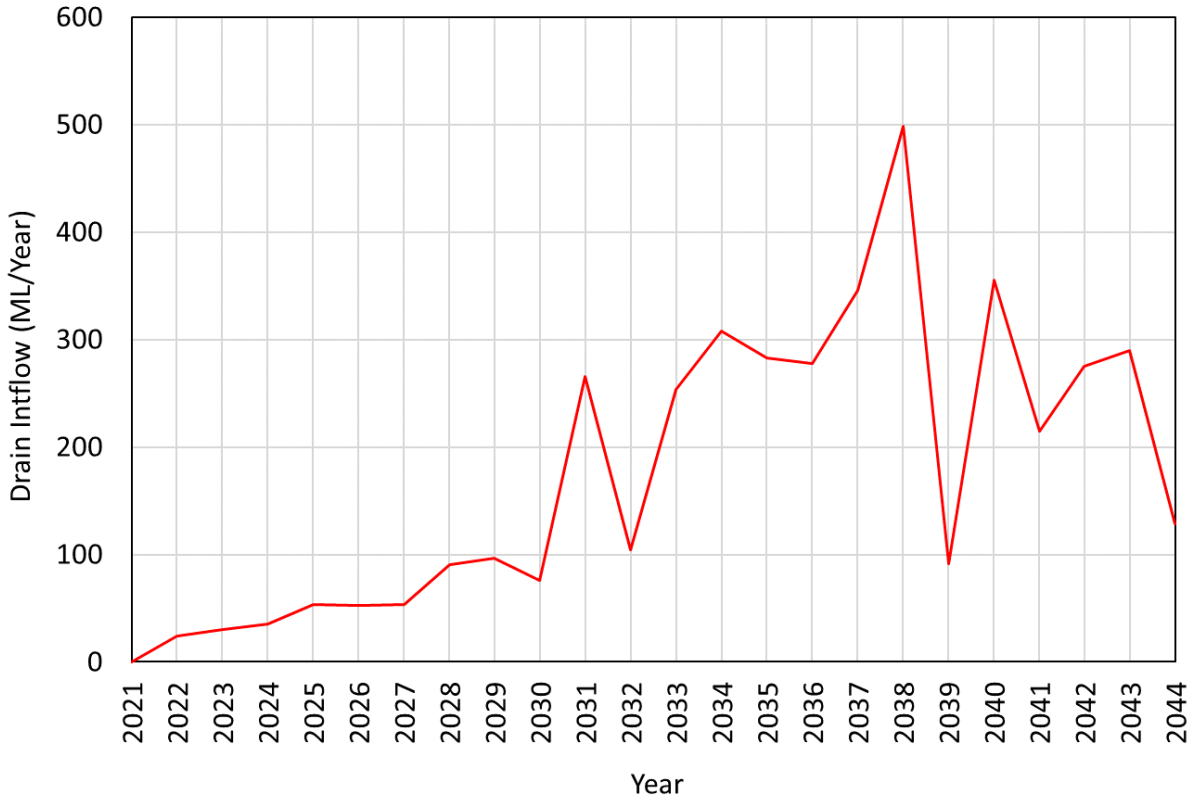


Figure 18 Predicted Underground Mine Development Groundwater Inflows

4.5.4 Water quality assumptions

Table 30 shows the assumed water quality for the various model land uses and water inputs. Salt mass enters the model each timestep based on the estimated flow rate and assumed total dissolved solids (TDS) from each source. The estimated TDS of water in each modelled dam is calculated daily based on the mass of salt and volume of water contained in each dam. A solubility limit of 330 g/L was also assumed.

Table 30 Assumed Model Water Quality

Water Source	Assumed Salinity (µS/cm)[5]	Assumed TDS (mg/L)
Groundwater inflow (underground mine inflow and gas drainage)	4,478	3,000 (approximate mean of monitoring bores PZ10 and PZ09 which are located within the underground mine footprint)
Underground process return water (assumed to be co-mingled with dewatering)	4,478	3,000 (as per groundwater quality)
Process Area Catchments	3,000	2,000
Raw water	200 (assumption)	134
AWBM disturbed (runoff)	500	335
AWBM spoil (runoff)	1,000	667
Rain	45	30

4.5.5 Water demand

Mine consumptive water demand sources are shown in Table 31. Potable and underground process water demands are sourced solely from the RWD, whereas CHPP and dust suppression are preferentially sourced from the PWD with make-up from the RWD.

Table 31 Water Demand Sources

Water Demand	Quality Restrictions	Proposed Source	
		1st Preference	2nd Preference
Potable	Treated raw water	WTP (supplied from RWD)	N/A
Underground process	Raw water	RWD	N/A
CHPP	None	PWD	RWD
Surface road dust suppression	None	PWD	RWD
Stockpile dust suppression	None	PWD	RWD

Assumed water demands were provided by BMA and are shown in Table 32 below. Modelled dust suppression demand has been based on the following assumptions:

- stockpile dust suppression (ROM and product coal) – 3.5 mm/m^2/d over 15.4 ha
- six kilometres of access road (light vehicle) from portal entrance to ROM pad – 3.5 mm/m^2/d assuming that the road is eight metres wide with one metre shoulders.

Dust suppression demand is assumed to be zero on days where rainfall is in excess of evaporation.

Table 32 Assumed Mine WMS Water Demands

Mine Year	CHPP Net Demand [6](ML/d)*	Underground Mine Processes (ML/d)**	Stockpile Dust Suppression (ML/d)	Access Road Dust Suppression (ML/d)	Raw Water incl. Potable (ML/d)
1	0	1.5	0	0.21	0.68

[5] Based on an assumed conversion of 0.67
[6] Inclusive of all return water

Mine Year	CHPP Net Demand [6](ML/d)*	Underground Mine Processes (ML/d)**	Stockpile Dust Suppression (ML/d)	Access Road Dust Suppression (ML/d)	Raw Water incl. Potable (ML/d)
2-21	1.5	3.36	0.539	0.21	0.68

*Represents the net loss rate of water from CHPP operations
**20% of the listed underground mine processes rate is assumed to be reclaimed via the Underground Mine Portal Area Sump

4.5.6 Water transfer rules

Basic operating rules suitable for concept level design were incorporated into the WBM. Model water transfers dictate when transfers occur, where water is transferred to and at what rate the transfer should take place. Table 33 summarises the model water transfer rules.

Table 33 Model water Transfer Rules

Source Dam	Volume in Source Dam*	Volume in PWD*	Transfer Rate
Prod. Stockpile Dam	≥2 ML	<100 ML	30 L/s
ROM Coal Stockpile Dam	≥2 ML	<100 ML	30 L/s
MIA Dam	≥2 ML	<100 ML	30 L/s
CHPP Dam	≥2 ML	<100 ML	30 L/s
Underground Mine Portal Area Sump	≥2 ML	<150 ML	100 L/s

*Both conditions are required within the model before transfer pumping occurs.

4.5.7 Project water storage assumptions

Stage-storage relationships for each dam that relate volume to water surface area (from which evaporative losses are calculated) have been developed using a set of common assumptions as shown below:

- all dams are based on simple trapezoidal design with a flat, rectangular base
- batter slopes of 3:1 (Horizontal:Vertical)
- 0.5 m freeboard for all process area dams and 1 m freeboard for PWD and RWD
- 3.5 m wide internally draining crest for all process area dams and 5 m for PWD and RWD
- dam embankment heights have been limited to approximately 8 m.

4.6 Scenario development

Scenarios were developed to test the performance of the WMS under a range of conditions. The developed scenarios are listed in Table 34.

Table 34 WBM Scenarios

Scenario	Description
Baseline (BaU)	Performance of WMS considering baseline (BaU) climate data as described in Section 4.3.2.5
Climate Change (HI)	Performance of WMS considering climate change (HI) data as described in Section 4.3.2.5
Climate Change (HP)	Performance of WMS considering climate change (HP) data as described in Section 4.3.2.5
Pump Failure - Temporary	Models a cessation of all transfers and process sourcing for a period of seven days, during wet

Scenario	Description
	conditions. Wet conditions were defined as >100 mm of rainfall over three days.
Stress Test Scenario – Uncontrolled Releases	Models a 25% reduction in all process sourcing rates across the WMS. It is noted that a 25% reduction in process sourcing rates is not expected. This scenario has been specifically developed to allow assessment of potential spills and licensed release(s). The reduction could represent reduced sourcing, suppression, wash-down, and processing rates. Similarly, the scenario might represent the water conditions on site if a significantly greater groundwater dewatering rate were required for underground mine development.
Stress Test Scenario – Licensed Releases	As per the above Stress Test Scenario with consideration of licensed releases from the PWD.

4.6.1 Extreme storm event considerations

Individual storm events larger than those in the historical records were not explicitly modelled for the following reasons:

- An extreme storm event will lead to larger spill volumes than those modelled. However, this would not change the maximum volume of MAW stored in the MWS after such event. This is because all dams will be full at spillway level shortly after such event, similar to any other scenarios where spills are modelled. As such, long-term performance of the MWS (i.e. total inventories) caused by an extreme storm event would not show material changes to the other scenarios considered.
- During the entire life of the Project, pit dewatering of the different Saraji Mine pits will continue to be managed via the Saraji Mine MWS. Any increases to MAW pit inventories in Saraji Mine caused by a hypothetical extreme storm event will not have an impact on the performance of the Project's MWS.
- All MWS dams and their spillways will be designed in accordance with their final CCA ratings, including any applicable ESS and DSA requirements. The assessment of an individual storm event larger than that required by the Manual for assessing consequence categories and hydraulic performance of structures (DESI, 2024) would not lead to any changes to the design of the MWS structures.
- From a MWS impact assessment standpoint, the Stress Test scenarios considered (refer to Section 4.6) provide conditions that are more critical than those that might arise from an individual extreme storm event. In the Stress Test scenarios, the system is consistently subject to an excess of water during the entire mine life, leading to larger spill frequencies than if a single extreme storm event was considered. Section 4.8.7.2 provides an overview of the expected water quality of releases under the stress test scenarios assessed.

4.7 Assumptions and limitations

The WBM has been developed to a level of complexity commensurate with the level of available data and Project design progression. A variety of simplifications and assumptions were made as follows:

- mine plan:
  - the groundwater inputs have been assessed through modelling which assessed a maximised underground layout

  - no additional land disturbances are required beyond those completed to develop the Project prior to the start of operations
  - runoff from all process area dams (ROM pad and product stockpile, CHPP, MIA and underground mine portal) dams with an external catchment will enter via gravity inflows
  - to the greatest extent practical it is assumed all runoff from undisturbed areas within the Project Site will be diverted around the mine WMS.
- mine operations:
  - pumped transfers occur 'instantly' within each water balance model timestep (i.e. daily) and are based on specific transfer rules
  - no allowance is made for the time taken for water to actually move from one location to the next and pump availability is assumed to be 100% of potential capacity for 100% of the time
  - pump capacity remains fixed irrespective of head differential in dams due to draw down
  - water transfer rules prevent the transfer of water to another dam if the destination dam has insufficient capacity
  - no quality restrictions have been placed on the reuse of MAW for either CHPP or dust suppression use
  - no restrictions have been placed on the availability of raw water based on the amount being significantly less than the available allocation. Sourcing of water by other operations, which may comprise a component of this allocation, have not been considered.
  - model inputs for mine consumptive water demands have been based on rates provided by BMA.
- environmental considerations:
  - performance of the mine WMS was assessed on the basis of the developed climate data sequences (refer Section 4.4). The developed climate data considers a range of potential climate conditions, however cannot comprehensively include consideration of extreme conditions which have not been observed in the historical record.
  - evaporative water losses from all dams have been estimated to be 80% of Class A Pan evaporation
  - seepage losses have been assumed to be negligible
  - potential loss of dam storage capacity over time due to sedimentation has not been considered.
- water quality considerations:
  - Modelled water quality has been estimated for electrical conductivity, utilising static salinity rates for water entering the WMS, derived from water quality at the existing Saraji sites.
  - Precipitation of salts has not been modelled, with the modelled EC comprising a conservative estimate of potential MAW water quality.

4.8 Modelling results

Comprehensive plot outputs for the modelled scenarios are shown in Appendix C. Modelling plots have been exported as maximum modelled volumes per wet season year, at minimum, 5th percentile, median, 95th percentile and maximum levels, based upon the 500 climate sequences developed for each scenario.

4.8.1 Overview

An overview of modelled water storage inventories is:

- Overall Water Inventories

The WMS is modelled to operate in generally deficit, with contained inventories of MAW generally being low. The modelled water storage across the WMS is seasonally driven, with minimal to negligible water contained in the dry season, with short-term accumulation of water occurring over the wet season in response to wetter than average rainfall conditions. Accumulation of water occurring in response to significant rainfall events is typically steadily drawn down by the combined sourcing of water for site operation and processing needs, and evaporation. The greatest potential volume of water is modelled for the first year of the mine plan, reflecting the reduced operations and process sourcing requirements.

- PWD

  The PWD is modelled to generally contain less than 40 ML of MAW, accumulating to 40-100 ML in wetter than average rainfall conditions (refer Figure 19). The volume modelled for the PWD is strongly influenced by transfer pumping of water from the other elements of the WMS. Accumulation above 100 ML is modelled to occur in rare circumstances, generally reflecting a <1% probability. Accumulation of water above 120 ML, which is influenced by rainfall and dewatering from the UG Mine Portal Area Sump was modelled as being a non-typical condition (approximately 0.2% annual probability of occurrence). It is noted that the PWD receives transferred waters from many WMS elements, such that the seasonal variation of MAW volumes within the PWD is amplified compared to other WMS elements.

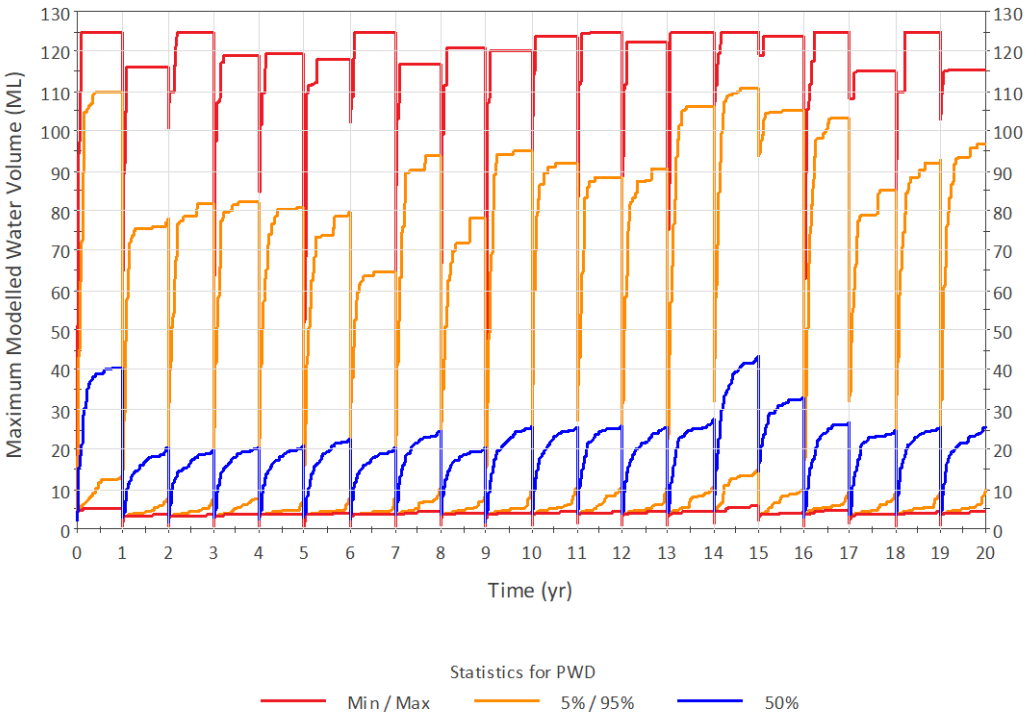


Figure 19 Modelled Water Storage Volume – PWD – Baseline (BaU) Scenario

- CHPP Dam, Product coal stockpile pad dam, ROM coal stockpile pad dam, MIA Dam

  The modelled MAW inventories in these dams are generally modelled as being less than 5 ML, primarily influenced by persistent dewatering of inventories to the PWD. Short term accumulation above this level was generally modelled as being unlikely (less than 5% of climatic sequences), associated with very wet rainfall conditions.

- RWD

  The RWD was modelled as generally containing between 146 and 155 ML. This level was based upon the make-up water supply rulesets implemented in the model. Seasonal variation and accumulation of the RWD was not generally evident in the model results.

- Underground Mine Portal Area Sump

  The modelled water inventory was generally modelled as being less than 2 ML. The volume of water contained in the sump is primarily influenced by runoff from the local portal area catchment (10ha) and dewatering volumes from the underground mine. The level is effectively controlled by ongoing transfer of these waters to the PWD. Accumulation of the sump was modelled as being a very rare occurrence, typically coincident with the PWD MAW volume exceeding 120 ML, which results in transfers from the sump being ceased.

Potential climate change scenarios indicate the following overall changes to the WMS performance, relative to the baseline (BaU) scenario:

- Climate Change (HI)

  This sequence results in a minor decrease in modelled water storage volumes across the WMS. This potential future climate condition, if realised, will reduce the overall available MAW water, leading to a reduced probability of spill from the dams, but also a decreased availability of MAW for process operations. Reliance on raw water make-up supply is modelled to increase in this condition.

- Climate Change (HP)

  This sequence is identical to the Climate Change (HI) scenario, excepting in the last four years of the mine plan. The modelled water storage inventories are significantly reduced in this period, with accumulation of MAW only occurring in response to very wet sequences. The modelled water storage volumes suggest a reliance on make-up water, excepting in very wet sequences.

A comparison of the modelled water volume within the PWD, at the 95th percentile level, is shown in Figure 20 and Figure 21. It is noted that the variation of modelled water volume is greatest within the PWD, compared to other WMS structures – where the variation is negligible.

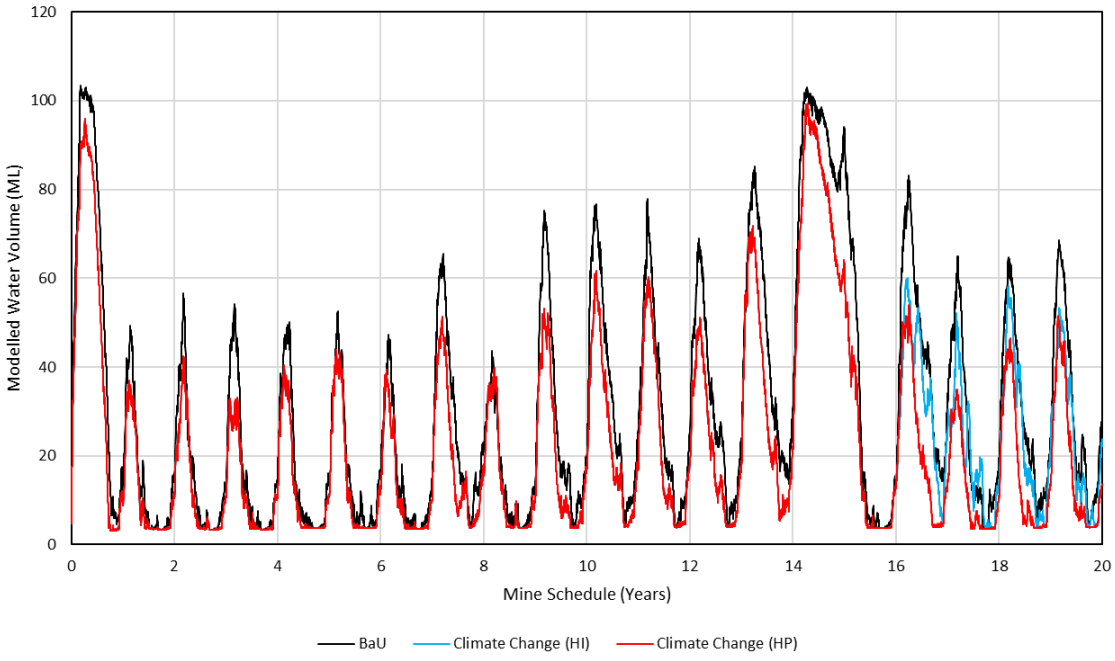


Figure 20 Comparison of Modelled PWD Water Storage Volume at 95th Percentile

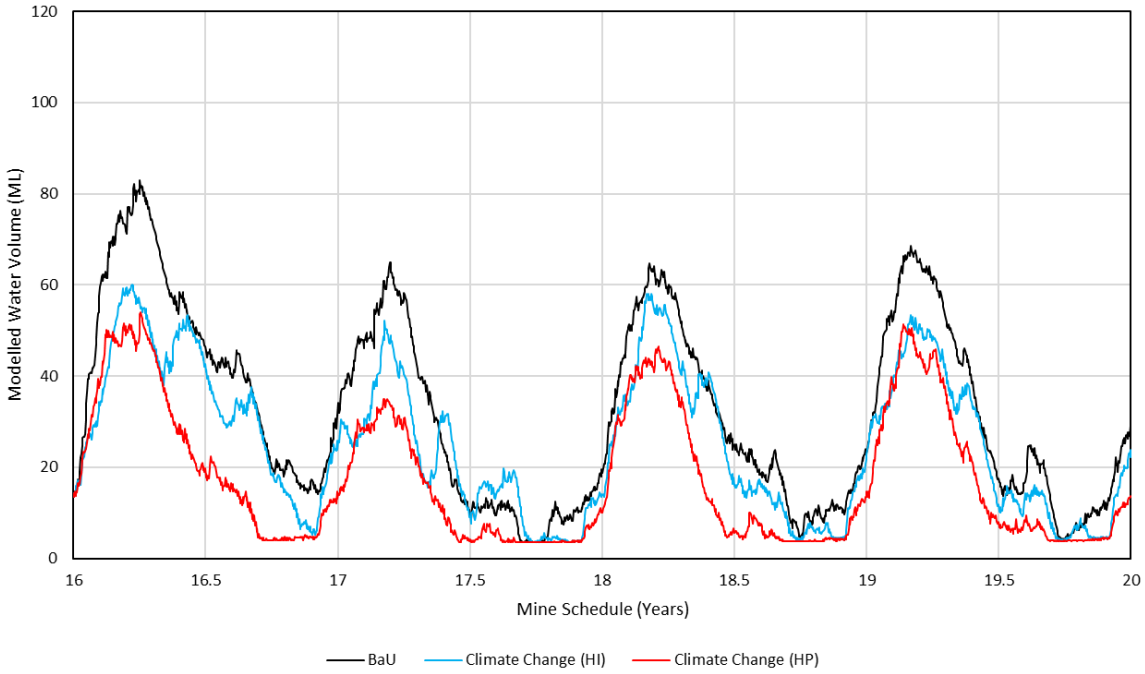


Figure 21 Comparison of Modelled PWD Water Storage Volume at 95th Percentile (Year 16-20)

Calculation of scenarios in which ceased, interrupted or reduced process sourcing was assumed, results in the following general WMS performance:

- Pump Failure Scenario

  Temporary pump failure (up to seven days), in response to significant rainfall events, was modelled to examine the potential WMS performance response to short term cessations of transfer capacity. The model results generally suggest minimal, generally imperceptible, differences in total stored water volume inventories.

- Stress Test Scenario

  The Stress Test Scenario models the potential WMS performance for a large reduction in all water sourcing operations across the Saraji East development (25% net reduction). The modelled water inventories are significantly greater, particularly over the wet season, with accumulation of MAW noted in all storages during the wet season. The volume of MAW modelled within the PWD is significantly increased. Notwithstanding, drawdown of modelled water inventories generally occurs over the dry season, such that minimal water storage volumes are modelled at the start of each regulatory wet season period (1 November).

4.8.2 Modelled water volumes

Modelled water volumes for each scenario developed are listed in Table 35 to Table 38.

Table 35 Modelled Water Volumes – Baseline (BaU) Scenario

Output Level	Modelled Water Volume (ML)						
	PWD	CHPP Dam	Product coal stockpile pad dam	ROM coal stockpile pad dam	MIA dam	RWD	Underground Mine Portal Area Sump
Maximum	125.0	53.9	77.2	35.6	63.3	168.4	7.5
95th Percentile	39.8	1.7	1.7	1.6	1.7	153.8	1.9
50th Percentile (Median)	3.2	0.7	0.6	0.6	0.7	149.4	0.9
5th Percentile	0.7	0.1	0.1	0.1	0.1	145.0	0.0
Minimum	0.2	0.0	0.0	0.0	0.0	106.3	0.0

Table 36 Modelled Water Volumes – Climate Change (HI) Scenario

Output Level	Modelled Water Volume (ML)						
	PWD	CHPP Dam	Product coal stockpile pad dam	ROM coal stockpile pad dam	MIA dam	RWD	Underground Mine Portal Area Sump
Maximum	125.0	33.5	45.7	20.2	39.3	163.0	7.5
95th Percentile	30.1	1.6	1.7	1.5	1.6	153.8	1.9
50th Percentile (Median)	3.1	0.6	0.6	0.6	0.6	149.4	0.9
5th Percentile	0.6	0.1	0.1	0.1	0.1	145.0	0.0
Minimum	0.2	0.0	0.0	0.0	0.0	106.3	0.0

Table 37 Modelled Water Volumes – Climate Change (HP) Scenario

Output Level	Modelled Water Volume (ML)						
	PWD	CHPP Dam	Product coal stockpile pad dam	ROM coal stockpile pad dam	MIA dam	RWD	Underground Mine Portal Area Sump
Maximum	125.0	33.5	45.7	20.2	39.3	162.7	7.5
95th Percentile	28.4	1.6	1.6	1.5	1.6	153.7	1.9
50th Percentile (Median)	3.1	0.6	0.6	0.6	0.6	149.4	0.9
5th Percentile	0.6	0.1	0.1	0.1	0.1	145.0	0.0
Minimum	0.2	0.0	0.0	0.0	0.0	106.3	0.0

Table 38 Modelled Water Volumes – Pump Failure Scenario

Output Level	Modelled Water Volume (ML)						
	PWD	CHPP Dam	Product coal stockpile pad dam	ROM coal stockpile pad dam	MIA dam	RWD	Underground Mine Portal Area Sump
Maximum	125.0	53.9	77.2	35.6	63.3	171.5	7.5
95th Percentile	42.6	1.7	1.8	1.6	1.7	153.8	1.9
50th Percentile (Median)	3.2	0.7	0.6	0.6	0.7	149.5	0.9
5th Percentile	0.7	0.1	0.1	0.1	0.1	145.0	0.0
Minimum	0.2	0.0	0.0	0.0	0.0	106.3	0.0

4.8.3 Modelled spill probabilities

Based upon the modelled water storage inventories, spill probabilities for the WMS structures were estimated. Spill probabilities provide an indication of the WMS ability to meet containment criteria requirements for regulated structures, as described in Section 2.3.4.

The spill probability of each structure varies inter-annually, reflecting climatic variation inherent in the developed sequences and the changing rates of system water inflows and outflows. The maximum modelled spill probabilities, across the mine plan duration, are listed in Table 39.

Table 39 Estimated Maximum Spill Probabilities

Dam/Sump	Model Scenario				Containment Criteria
	Baseline (BaU)	Climate Change (HI)	Climate Change (HP)	Pump Failure	
PWD	1%	0.4%	0.4%	1%	<5%
CHPP dam	<0.2%	<0.2%	<0.2%	<0.2%	<5%
Product coal stockpile pad dam	<0.2%	<0.2%	<0.2%	<0.2%	<5%
ROM coal stockpile pad dam	<0.2%	<0.2%	<0.2%	<0.2%	<5%
MIA dam	<0.2%	<0.2%	<0.2%	<0.2%	<5%
RWD	<0.2%	<0.2%	<0.2%	<0.2%	N/A
Underground Mine Portal Area Sump	0.8%	0.4%	0.4%	0.8%	N/A

Note: A listed spill probability of <0.2% indicates that no spills were modelled across the 500 realisations of climate data analysed for each scenario.

The results indicate that the WMS has sufficient capacity to manage the expected inventories of water. Additionally, it is noted that containment criteria for structures preliminary assessed as regulated are satisfied for the scenarios listed in Table 39. Subject to the assumptions developed for the WMS WBM, the site WMS is expected to have sufficient containment capacity for the expected flows of MAW and Raw Water.

4.8.4 Preliminary dam capacities

The Project WMS outlined in Section 2.3.4.4 was assessed using water balance simulation to confirm the containment and release design objectives and criteria presented in Section 2.0 can be met. Sufficient system containment and transfer capacity has been provided to prevent the uncontrolled release (i.e. spillway overflow) of water to the receiving environment and without the requirement for controlled release of MAW. The estimated preliminary capacities for all WMS dams are given in Table 40.

Table 40 Preliminary Dam Capacities

Dam	Preliminary Capacity (ML)
PWD	125
CHPP dam	65
Product coal stockpile pad dam	87
ROM coal stockpile pad dam	42
MIA dam	74
RWD	200
Underground Mine Portal Area Sump	7.5

The model results indicate that the system operates generally in deficit, whereby ongoing sourcing of MAW from the various site dams persistently draws down runoff reporting to the WMS, and generally maintains a low overall water inventory excepting in response to very wet conditions. Additionally, the scenarios analysed suggest:

- Baseline water inventories are modelled as being greater than either of the modelled climate change scenarios. Accordingly, the WMS preliminary capacities are suitable for potential future climate conditions.
- The system was modelled as being sufficiently robust in response to temporary pump failure conditions modelled, suggesting that short term pump inoperability will not significantly compromise the system.

4.8.5 Water quality

The model results provide an indication of the expected water quality within the WMS. The potential water quality is particularly relevant for the PWD, where a licensed release point is proposed. Due to limited available input data, water quality modelling was modelled for salinity and electrical conductivity only.

Based on the model parameters established (refer Section 4.4.1), the modelled PWD water quality for the baseline (BaU) scenario is shown in Figure 22 and Figure 23.

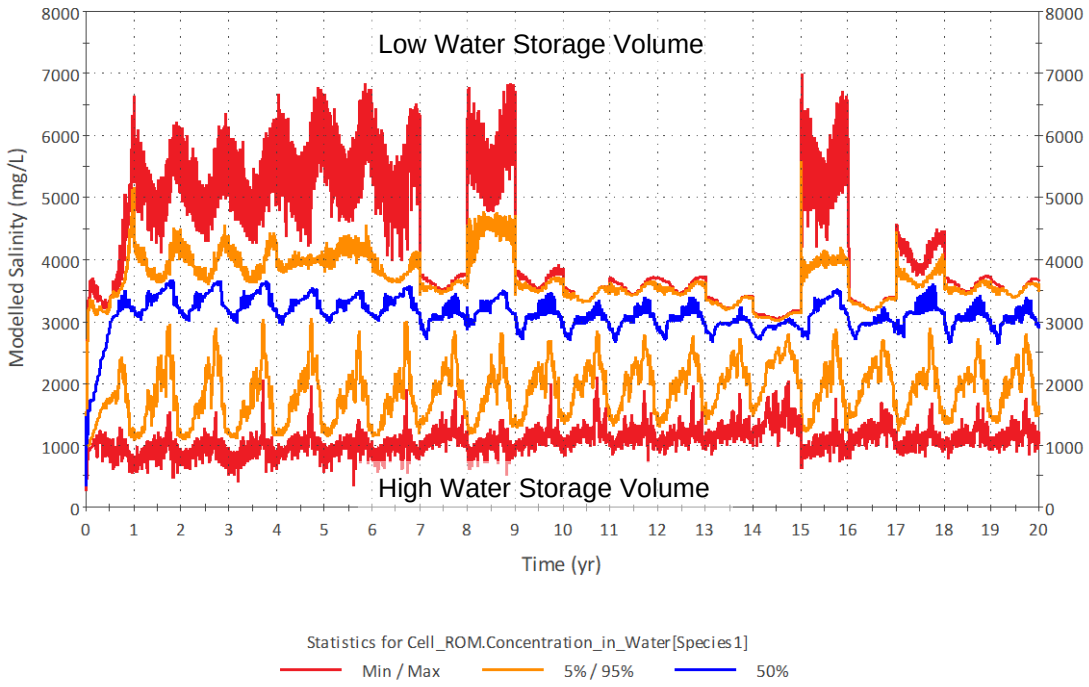


Figure 22 PWD – Baseline (BaU) Scenario - Salinity

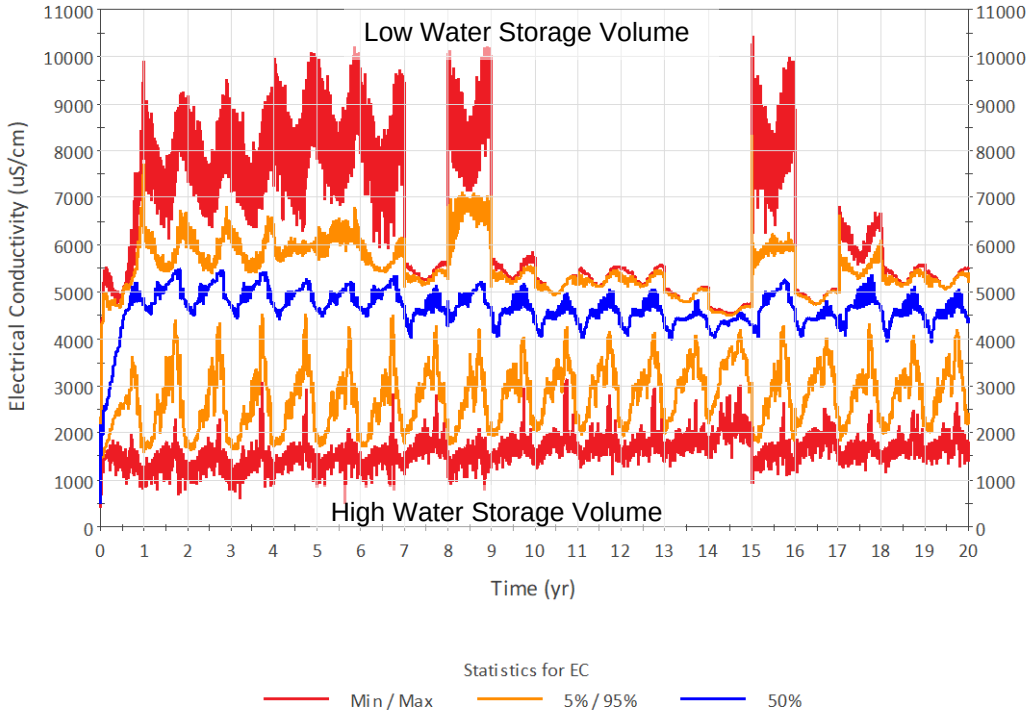


Figure 23 PWD – Baseline (BaU) Scenario – Electrical Conductivity

The model results indicate that the modelled water quality concentration is highly variable, and principally influenced by the volume of water stored in the PWD. During periods of significant water storage volume (i.e. >100 ML), the modelled Salinity is generally 600 to 2,000 mg/L and the modelled Electrical Conductivity (EC) is 1,000 to 3,000 µS/cm. The results suggest that while the water quality analytes may be elevated during periods of low water inventories, the water quality is expected to be suitable for potential licensed release in periods of significant water inventories when licensed release would be considered (subject to appropriate testing, controls and release criteria).

4.8.6 Mine water and salt balance accounting

Summary water and salt balance fluxes for the WBM are presented in Table 41 and Table 42. All dams within the WBM as well as the entire model have been subjected to water and mass balance checks to confirm model continuity and mass balance.

Water balance

Referring to Table 41:

- raw water represents the largest single input to the mine WMS, with median values of 35,760 ML over the operation of the mine (Table 41) or 1,788 ML/yr
- rainfall and runoff input is moderately variable, with the 10th and 90th percentile total annual rainfall and runoff volumes ranging from 112 ML/yr to 146 ML/yr respectively
- site-wide water demand is 2,263 ML/yr (median result).

Salt balance

Referring to Table 42:

- groundwater and reclaimed underground mining water represent the largest salt input over the operation of the mine at approximately 26,580 tonnes or 1,329 t/yr

Note that results presented under each percentile result may not occur within a single realisation and are a function of the total distribution of all results from all model realisations (500 in total).

Table 41 Mine Water Balance Summary

Component	Life of Mine				Annual			
	Units	10th	Median	90th	Units	10th	Median	90th
WMS Inputs								
Direct rainfall	ML	1,791	1,957	2,147	ML/yr	90	98	108
Total runoff	ML	441	581	748	ML/yr	22	29	38
Raw water input	ML	35,470	35,760	36,050	ML/yr	1,774	1,788	1,803
Groundwater and UG Mine Reclaim input	ML	8,857			ML/yr	443		
Treated Effluent	ML	168			ML/yr	8.4		
Total water Input	ML	**47,301**	**47,337**	**47,382**	ML/yr	**2,365**	**2,367**	**2,369**
WMS Outputs								
Total evaporation	ML	2,003	2,038	2,082	ML/yr	100	102	104
Total water demand	ML	45,250			ML/yr	2,263		
External overflows	ML	0	0	0	ML/yr	0	0	0
Total water output	ML	**47,252**	**47,288**	**47,332**	ML/yr	**2,363**	**2,365**	**2,367**

Table 42 Mine Salt Balance Summary

Component	Life of Mine				Annual			
	Units	10th	Median	90th	Units	10th	Median	90th
WMS Inputs								
Direct rainfall	t	54	59	65	t/yr	2.7	3.0	3.2
Total runoff	t	607	797	1029	t/yr	31	40	52
Raw water input	t	4,753	4,792	4,830	t/yr	238	240	242
Groundwater and UG Mine Reclaim input	t	26,580			t/yr	1329		
Total Input	t	**32,068**	**32,229**	**32,427**	t/yr	**1,604**	**1,612**	**1,622**
WMS Outputs								
Total water demand	t	32,037	32,198	32,405	t/yr	1,602	1,610	1,621
External overflows	t	0	0	0	t/yr	0	0	0
Total output	t	**31,606**	**31,641**	**31,678**	t/yr	**1,581**	**1,583**	**1,584**

4.8.7 Water quality of releases

Further analysis of the potential water quality of uncontrolled discharges from the PWD was completed. This analysis was completed utilising the 'Stress Test Scenario', as no uncontrolled discharges (spills from MAW dams) were modelled under the Baseline (BaU) or climate change scenarios.

It is noted that the Stress Test Scenario is not expected to occur. Rather, the scenario was developed to force excess water inventories within the WBM, such that the potential water quality of spills can be examined. Accordingly, the analysis represents a conservative approach based on a sensitivity analysis of reduced water sourcing rates (25% of expected net process water demands).

To demonstrate that the provision for licensed release point results in greater protection of downstream waterways, two scenarios have been assessed:

- Uncontrolled Releases

  MAW within the PWD is allowed to spill, resulting in discharge to downstream waterways.

- Managed Releases

  MAW within the PWD is modelled to be released during periods of downstream flow only.

The basis of the flow dilution estimates was simply calculated, based on the volume of the relative uncontrolled release and flow rates within downstream waterways modelled (Boomerang Creek and Hughes Creek). The EC for the receiving waterways (Boomerang Creek and Hughes Creek) was adopted as follows:

- Assumed EC of flows within Boomerang Creek and Hughes Creek: 300 μS/cm

  Examination of upstream (reference) water quality for Boomerang Creek suggests a median EC of approximately 120 μS/cm. Noting the potential impact of upstream mining operations, the background EC was conservatively adopted at 300 μS/cm. This assumption is considered conservatively bounded, as it assumes a higher degree of impact of natural flows within Boomerang Creek, resulting in a potential higher EC of released flows, post mixing within the creek.

4.8.7.1 Flow dilution – uncontrolled releases

Using the Stress Test Scenario (which is not expected to occur), the modelled EC for the PWD, at times of modelled spills, is shown in Figure 24. The modelled EC peaks during the middle of the mine plan schedule, with maximum EC modelled as being approximately 5,000 μS/cm.

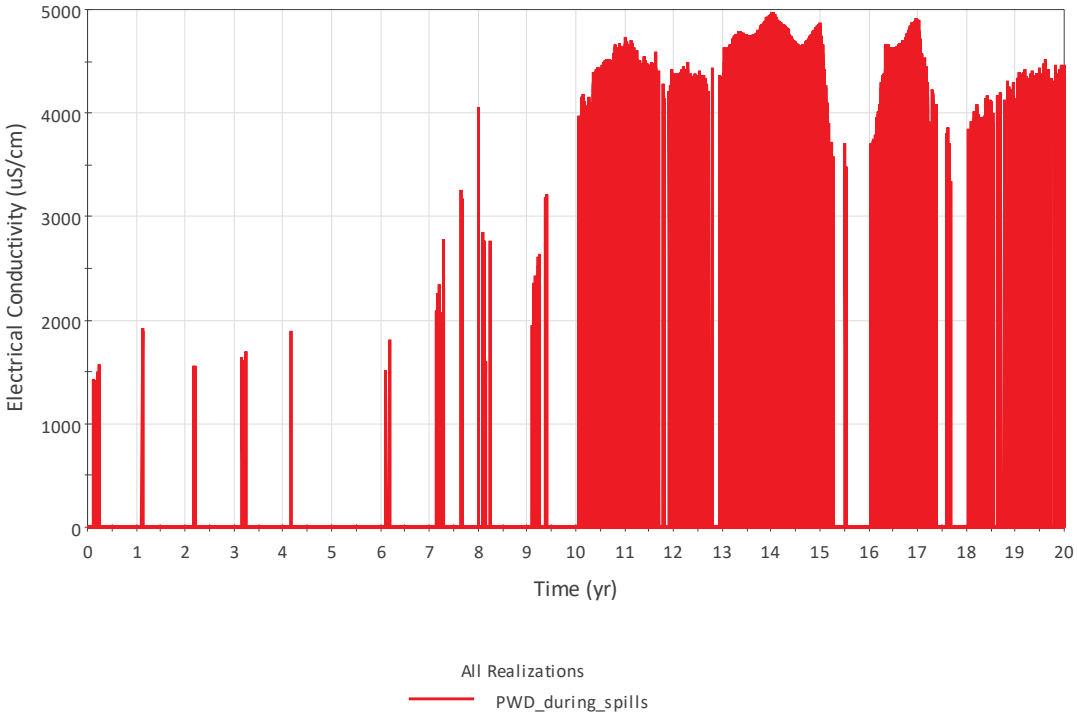


Figure 24 Modelled PWD EC During Spill Events – Stress Test Scenario

Figure 25 and Figure 26 show the estimated EC within Boomerang Creek and Hughes Creek, respectively, assuming full mixing of the released flows occur (under the hypothetical Stress Test Scenario). The results show the general expected EC in the receiving waterways, subject to the developed assumptions, is generally lower than 1,000 µS/cm.

In exception, the model results (under the Stress Test Scenario) suggest that the timing of elevated water inventories, on occasion, coincide with times of negligible or low flow within Boomerang Creek and Hughes Creek. This outcome is driven by the timing of underground mine water inflows, which peak during the middle of the mine plan duration.

This potential does not occur under the baseline, or climate change scenarios.

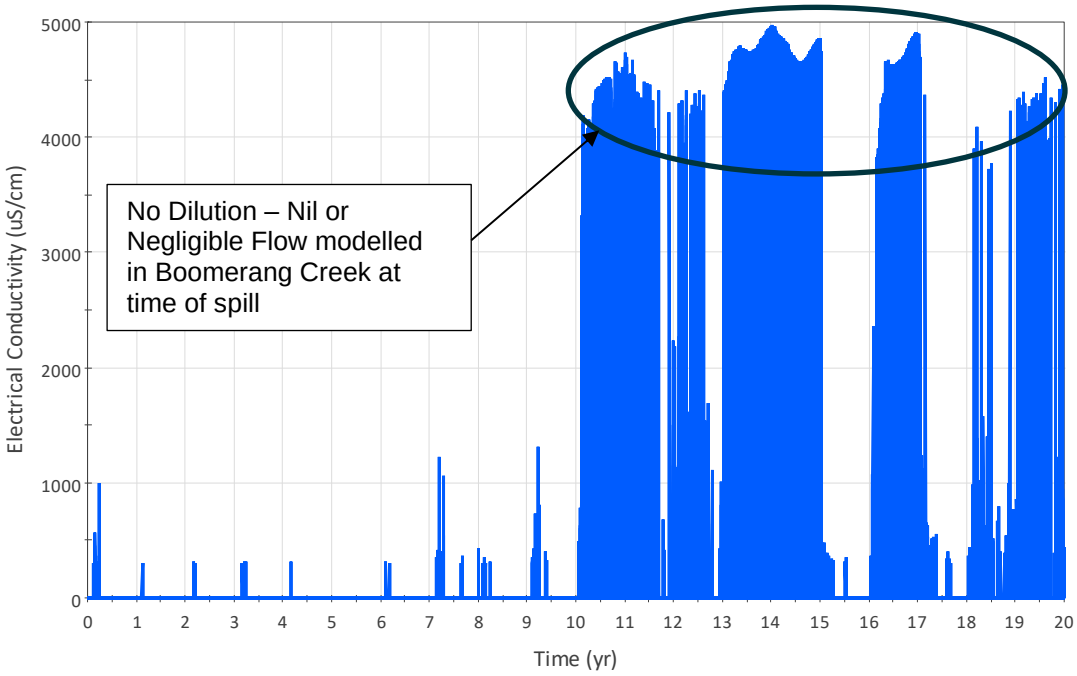


Figure 25 Modelled Boomerang Creek EC During Spill Events

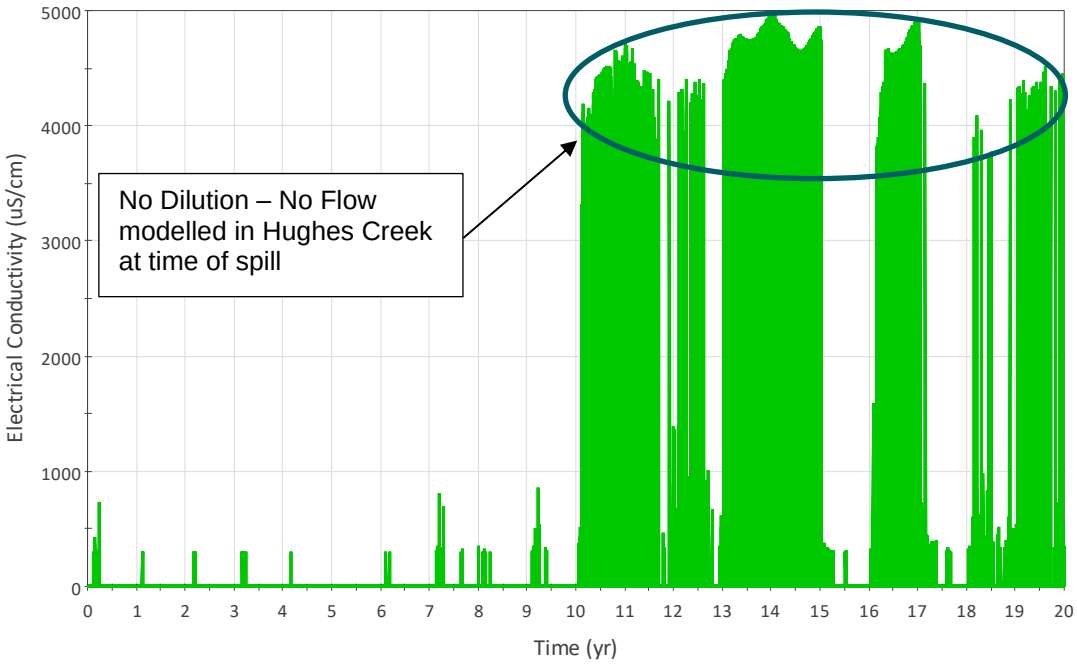


Figure 26 Modelled Hughes Creek EC During Spill Events

4.8.7.2 Flow dilution – managed releases

To further examine the potential water quality issues arising from licensed releases, the WBM results were further analysed to understand the potential water quality within the PWD, and potential flow dilution rates that may occur during licensed releases utilising the Stress Test Scenario. The basis of the flow dilution estimates was simply calculated, based on the volume of the relative releases and flow rates within downstream waterways modelled (Boomerang Creek and Hughes Creek).

To estimate the potential receiving water quality, releases were assumed to occur for the following conditions:

- Flow Trigger Criteria: Flow in Boomerang Creek ≥ 0.1 m³/s

  The flow criteria of 0.1 m³/s was adopted based upon a) the ephemeral nature of Boomerang Creek, in which negligible flow occurs throughout much of the year. Accordingly, licensed release is proposed to be event based, concurrent with flows exceeding 0.1 m³/s. Additionally, this flow criteria is consistent with other licensed release schemes authorised for the Boomerang Creek.

- Licensed Release Rate: Minimum of 8% of Boomerang Creek Flows, and 0.1 m³/s

  The licensed release rate was selected to approximate the equivalent daily volume of the Extreme Storm Storage (ESS) containment volume, to allow emergency management dewatering of the PWD.

- Assumed EC of flows within Boomerang Creek and Hughes Creek: 300 μS/cm

  Examination of upstream (reference) water quality for Boomerang Creek suggests a median EC of approximately 120 μS/cm. Noting the potential impact of upstream mining operations, the background EC was conservatively adopted at 300 μS/cm. This assumption is considered conservatively bounded, as it assumes a higher degree of impact of natural flows within Boomerang Creek, resulting in a potential higher EC of released flows, post mixing within the creek.

- Assumed Minimum Volume in PWD for Licensed Releases: 75 ML

  This volume was adopted on the basis that it exceeds expected operational levels, and represents a volume in the PWD at which active management of the MAW would be triggered, which is expected to be developed in a future Trigger Action Response Plan (TARP). This mirrors the management intent for regulated structures outlined in the DES, 2016 (ESR/2016/1933), whereby accumulation of water above the DSA level, and accumulating towards the MRL, would trigger an operational response by site personnel.

Based upon the flow trigger (>0.1 m³/s within Boomerang Creek) and a minimum PWD volume of 75 ML for consideration of licensed release, the modelled PWD EC during release windows is shown in Figure 27. The model results indicate an expected EC of between 1,000 and 5,000 μS/cm.

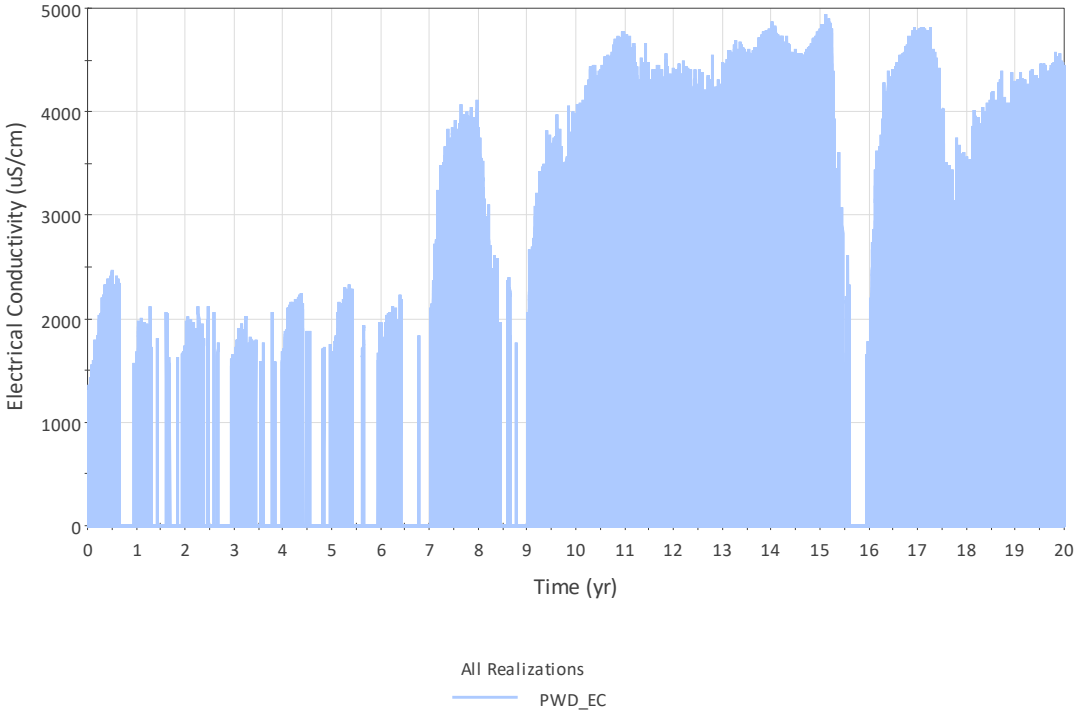


Figure 27 PWD – Electrical Conductivity during Modelled Managed Licensed Release – Stress Test Scenario

Assuming full mixing occurs, the resulting electrical conductivity in Boomerang Creek and Hughes Creek, subject to the assumptions made, is shown in Figure 28 and Figure 29, respectively.

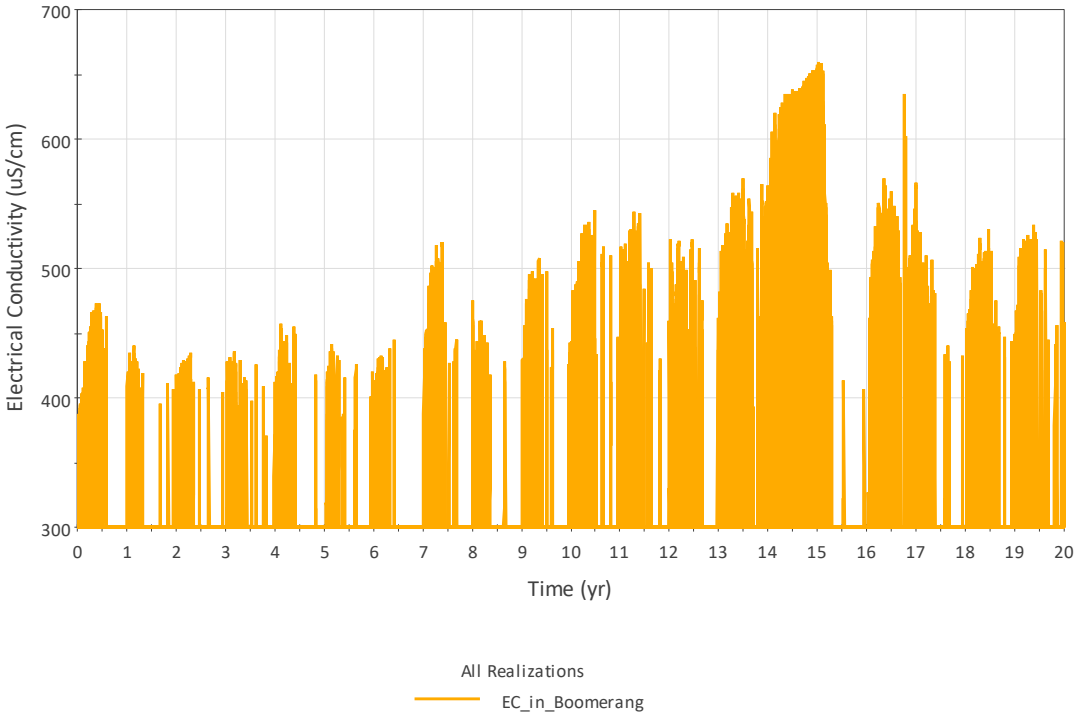


Figure 28 Estimated EC – Boomerang Creek during Modelled Managed Licensed Releases – Stress Test Scenario

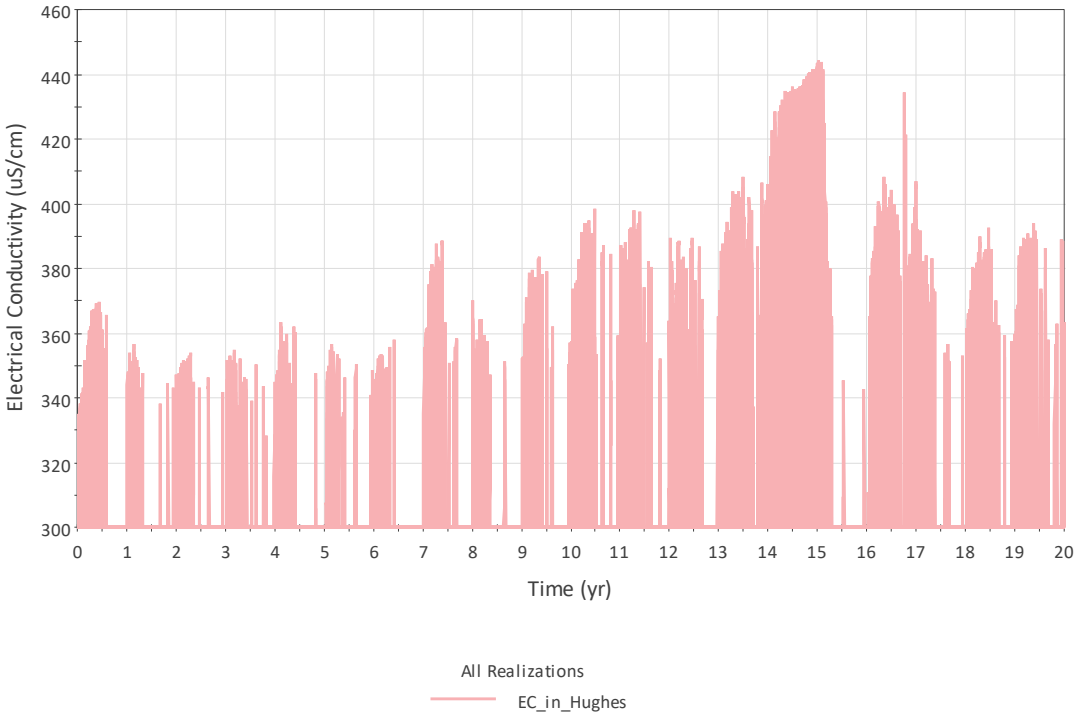


Figure 29 Estimated EC – Hughes Creek during Modelled Managed License Releases – Stress Test Scenario

4.8.7.3 Comparative performance

A comparison of the uncontrolled releases and managed releases suggests that the provision of a licensed release point, managed according to the operation described, is likely to result in a reduced potential impact to downstream waterways. Principally this is because:

- Licensed release is subject to release criteria and is likely to result in a controlled, managed and monitored release program. Active management of releases may involve water blending, or release during downstream flow events, rather than passive spills via emergency spillway structures.
- Modelling for uncontrolled and managed releases indicates that EC and pH outcomes, based on assumed mixing conditions, indicates that licensed release results in fewer occasions of significantly elevated EC in downstream waterways.

Overall, the modelling completed suggests that the licensed release of MAW from the PWD can be feasibly achieved without exceeding trigger levels for event-based releases in downstream creeks.

Additionally, although simply developed, inclusion of licensed releases within the water balance logic results in:

- A reduced maximum water storage inventory within the PWD and all MAW dams, which has flow on benefits for:
    - Reduced risk to WMS dam embankment infrastructure.
    - Reduced frequency of flows via emergency spillway structures, and therefore reduced risk of failure of emergency spillway structures.
    - Increased operational freeboard.

4.8.7.4 Future works

The modelling completed for licensed release indicates that meeting water quality requirements for EC is achievable subject to the release criteria outlined. Notwithstanding, the modelling of water quality within the WBM was simply developed, and due to available data limitations, does not model water quality objectives that would also apply.

Future works and assessments to further understand the feasibility of licensed release are expected to be developed as the water quality data to inform them is developed during the initial years of the development:

- A water quality monitoring and sampling program for water stored within the PWD and groundwater dewatering inventories will commence upon initial mine development.
- Once specific MAW water quality data is available, the feasibility of release of MAW, will be re-assessed, within a release assessment, including a mixing assessment for releases.

4.8.8 Estimated raw water consumption

Figure 30 shows the estimated raw water demand for each mine year.

As Project water demands (underground mine process and potable) cannot use MAW, and cannot be met by water generated within the Project, there will always be an annual demand for raw water which, based on the assumed demands given in Table 32 is generally between 1,500 and 2,000 ML/yr from year two onwards. Other results to note include:

- Median total annual demand is approximately 1,392 ML/yr in the first year of mine development
- The intra-annual variability in additional raw water required between each mine year is a function of the availability of MAW to satisfy the remaining Project water demands for CHPP process demand and dust suppression. This is a result of variability in the estimated inflow of runoff and rainfall whereas the inter-annual variability is a function of the rate of estimated groundwater inflow to the underground mine development.

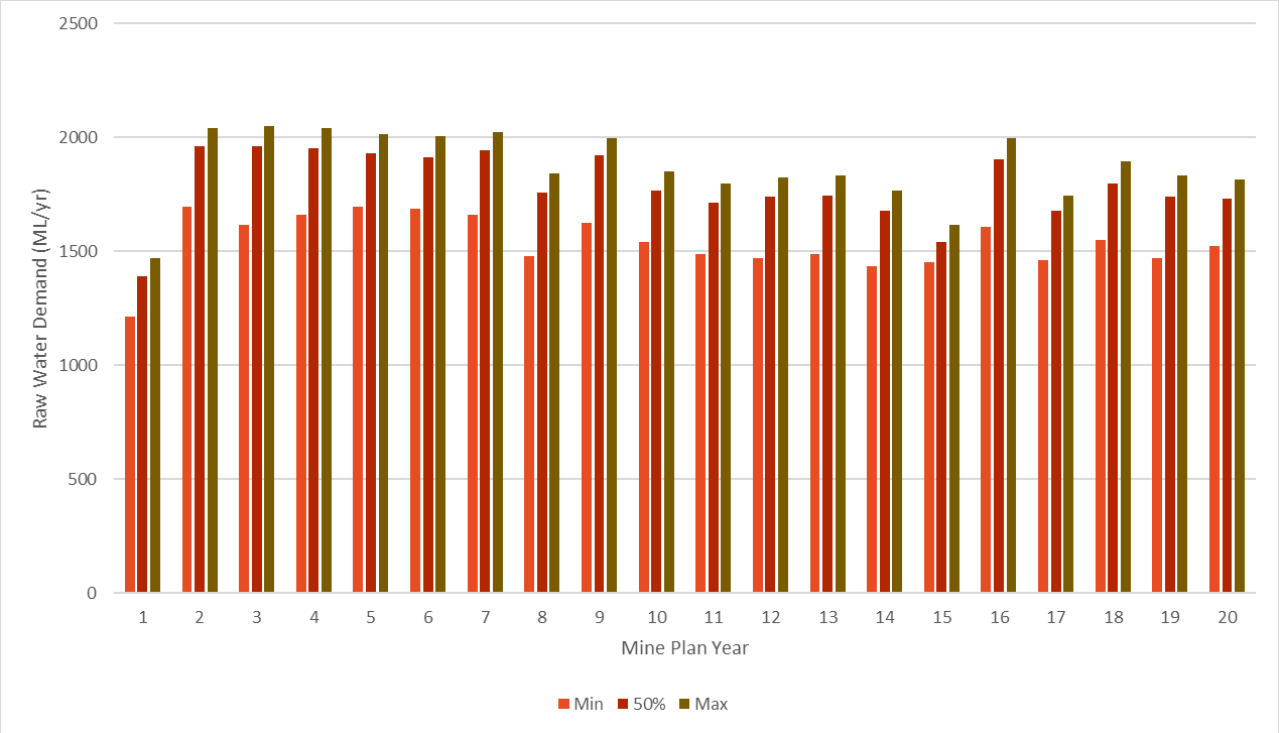


Figure 30 Estimated Project Annual Raw Water Demand – Baseline (BaU)

Interrogation of the climate change scenarios suggest that increased reliance upon Raw Water make-up supplies may result during the mine operation. The magnitude of the increased raw water sourced is generally minor, representing a 1-2% increase in raw water demand.

4.8.9 Potential reduction in flows to receiving environment

The development of the conceptual mine WMS does not include any significant loss of catchment area reporting to Hughes Creek or its tributaries. The combined disturbed catchment area of the process area dams is 53.9 ha (0.539 km^2). Most of this disturbance area is located within the limits of the existing Saraji Mine development, which is already considered a disturbed catchment. The PWD is located outside of the existing development; however, comprises a Turkey's nest storage with limited extent. As such, potential loss in flow due to the development of the WMS would likely be immaterial.

Potential impacts on surface water regimes due to subsidence and other mine aspects are covered in:

- Subsidence Ponding Assessment (Engeny, 2023)
- Hydrology, Hydraulics and Geomorphology Technical Report (Alluvium, 2023).

5.0 Conclusions

The conceptual design of the Project WMS was developed in line with current management practice for mine water management. Assessment of the Project indicates that the proposed mine WMS meets the objectives and considerations outlined within Sections 2.1 and 2.2. The key findings and conclusions of the Report are:

- Clean stormwater runoff originating from non-mine affected catchments will, wherever practical and achievable, be passively diverted around mine-affected areas through clean runoff conveyance channels and bunds.
- Potentially mine affected stormwater runoff will be collected at source and conveyed as soon as practical to the PWD.
- Volumes of MAW stored onsite are minimised through their preferential reuse wherever possible.

- Collection and containment of MAW has been optimised to reduce the risk of uncontrolled overflows to less than 0.2% AEP, based on the climate data developed for the assessment.
- A preliminary CCA has been conducted for all Project dams containing MAW, as well as the RWD.
- Estimated dam storage capacities are sufficient to meet the hydrologic design criteria requirements of the preliminary DES CCA.
- Reliance on an external raw water source has been minimised through the preferential reuse of MAW for Project water demands for which it is suitable (CHPP process demand and dust suppression).
- Security of water supply (in the absence of all other sources including groundwater) has been provided by the RWD which, at 200 ML can supply all site water demands for approximately one month.
- The potential accumulation of MAW has been assessed under a variety of conservative scenarios, with preliminary containment criteria for the structures maintained under the assessed scenarios.
- The potential water quality impacts for receiving waterways, based on an assumed licensed release program, has been assessed using the Stress Test Scenario to be:
    - Within the general limits of release criteria conditions documented in the Model Mining Conditions for Coal Mines in the Fitzroy Basin (DES, ESR/2015/1561).
    - Preferable to uncontrolled release, as uncontrolled release (spills) may not coincide with periods of flow within Boomerang Creek and Hughes Creek.
- Impacts from a hypothetical extreme storm event are expected to be less than those assessed using the Stress Test Scenarios.

The WMS has been designed based on the available level of information. It is noted that the WMS capacities determined are particularly sensitive to the following parameters:

- Total defined disturbed catchment areas, which report runoff to the process area collection dams.

  Currently, the defined catchment areas reporting to the various WMS elements is relatively minor. Accordingly, the runoff generated from significant rainfall events is relatively muted. Any changes which result in greater catchment areas reporting runoff flows to WMS elements will necessarily increase the DSAs, ESS's and Storage Capacities estimated for each regulated structure.

- The net process sourcing rate, estimated for the Project.

  The net process sourcing rate, which comprises CHPP, Underground and Dust Suppression activities, is estimated to be a significant negative (i.e. net deficit). The site wide performance of the WMS, and in particular the PWD, which receives water transferred via pipeline, is highly sensitive to increases in the net process sourcing rate. Any significant increase of the net process sourcing rate is likely to impact the water storage volumes modelled for the process area collection dams and the PWD.

- The groundwater dewatering rate from the underground mine development is a significant inflow to the site-wide WMS water balance. Any significant increases in groundwater dewatering volumes may increase the required capacity of the Underground Mine Portal Area Sump and the PWD.

Accordingly, should detailed design result in significant changes to these parameters, the WMS concept may need to be revised.

Additionally, the preliminary CCAs completed for the proposed WMS elements will require full CCAs in accordance with the *Manual for assessing consequence categories and hydraulic performance of structures* (DESI, 2024) during detailed design.

6.0 References

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7.0 Standard limitations

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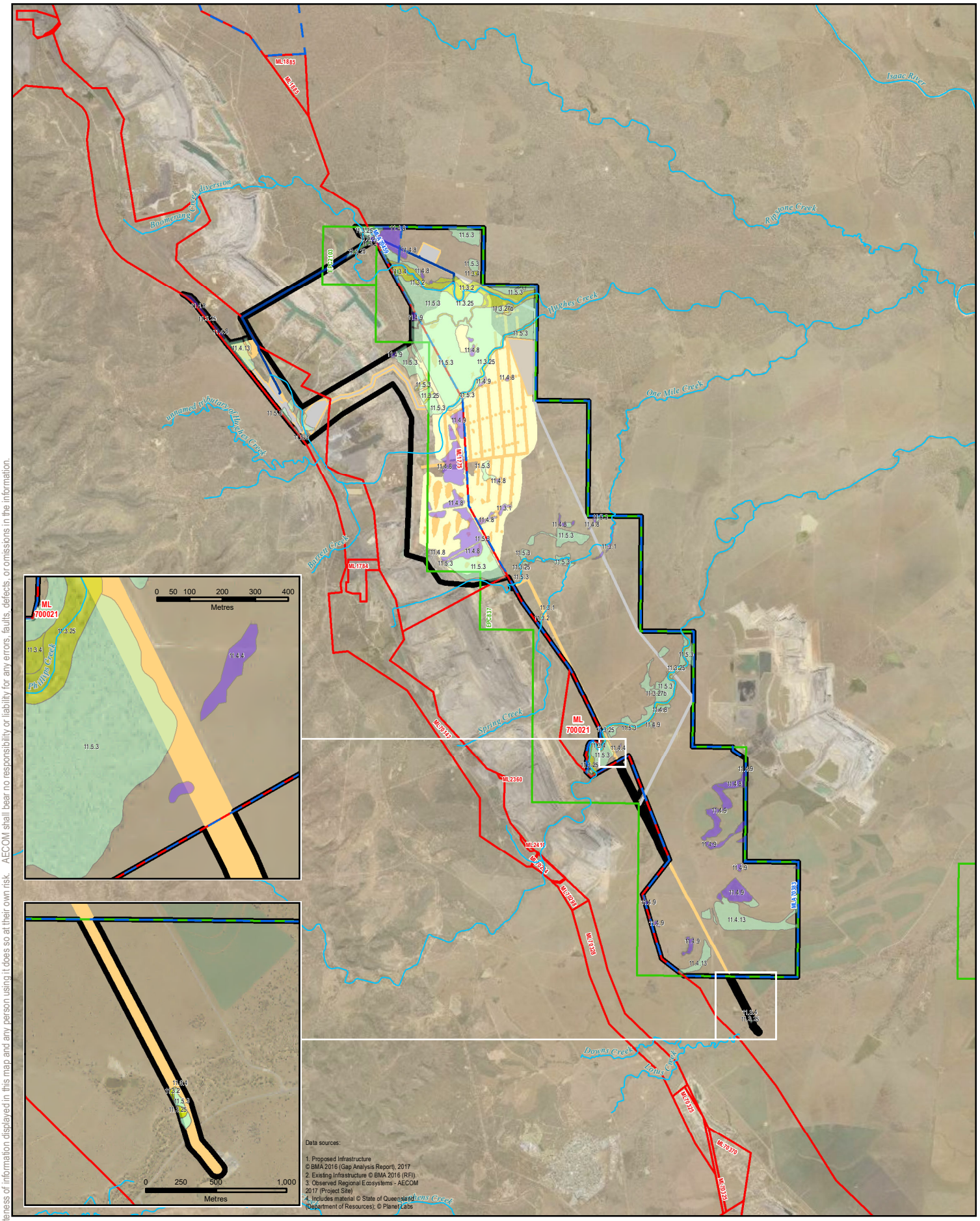
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Appendix A

CCA - Receiving Environment Maps



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Direct Impact
- Project Footprint - Indirect Impact
- Pipeline
- Watercourse

Regional Ecosystem biodiversity status

- Endangered
- Of Concern
- No Concern at Present

N

Figure A1
Ground-truthed regional ecosystems

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.5 1 2
Kilometres

Scale: 1:158,094 (when printed at A4)

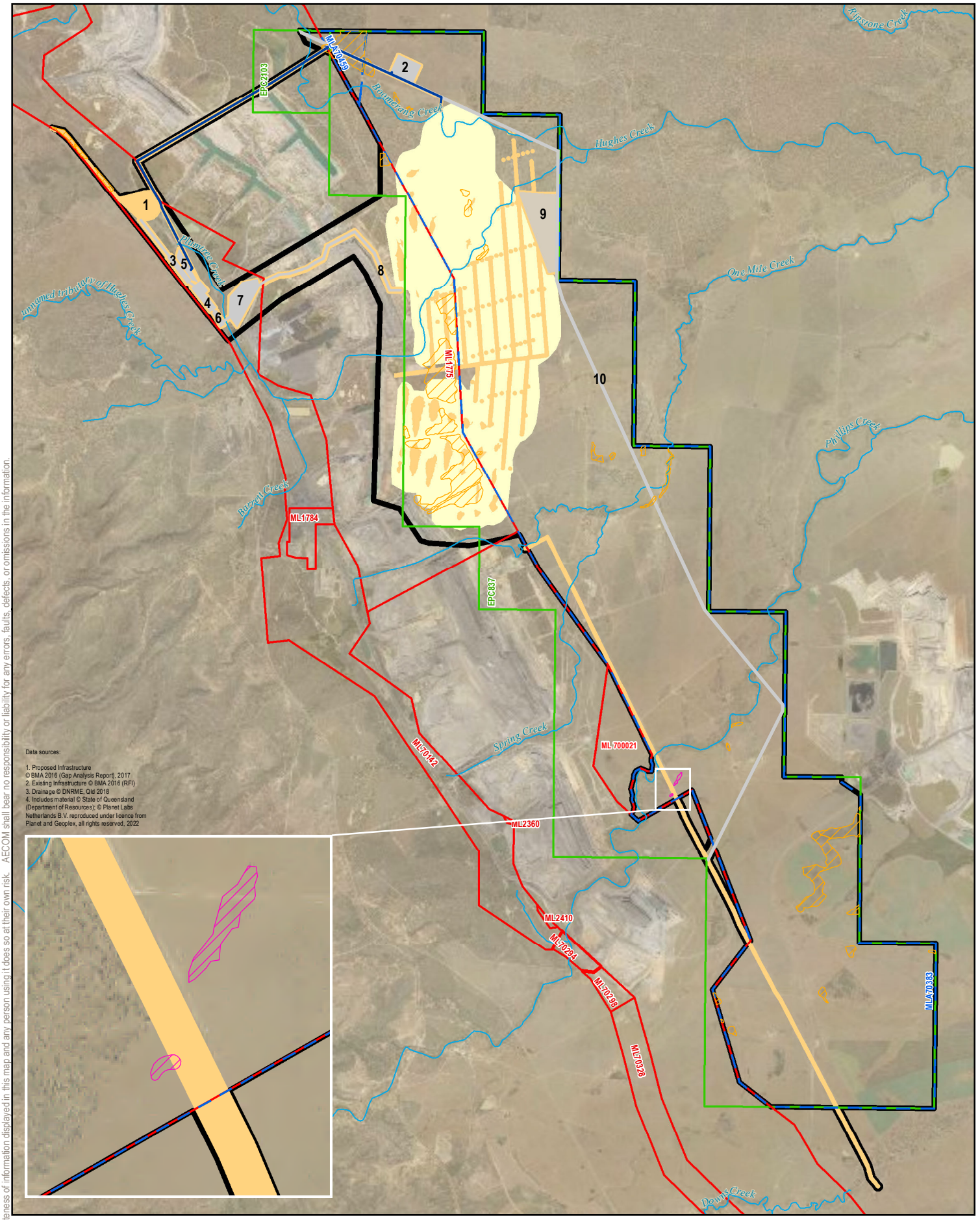
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LEGEND

- Watercourse
- Project Site
- Surface Infrastructure
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Pipeline

Threatened ecological community

- Brigalow (Acacia harpophylla dominant and co-dominant)
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

Surface Infrastructure

1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

N

Figure A2
Threatened ecological communities observed within the Project Site

Environmental Impact Statement
Saraji East Mining Lease Project

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Kilometres

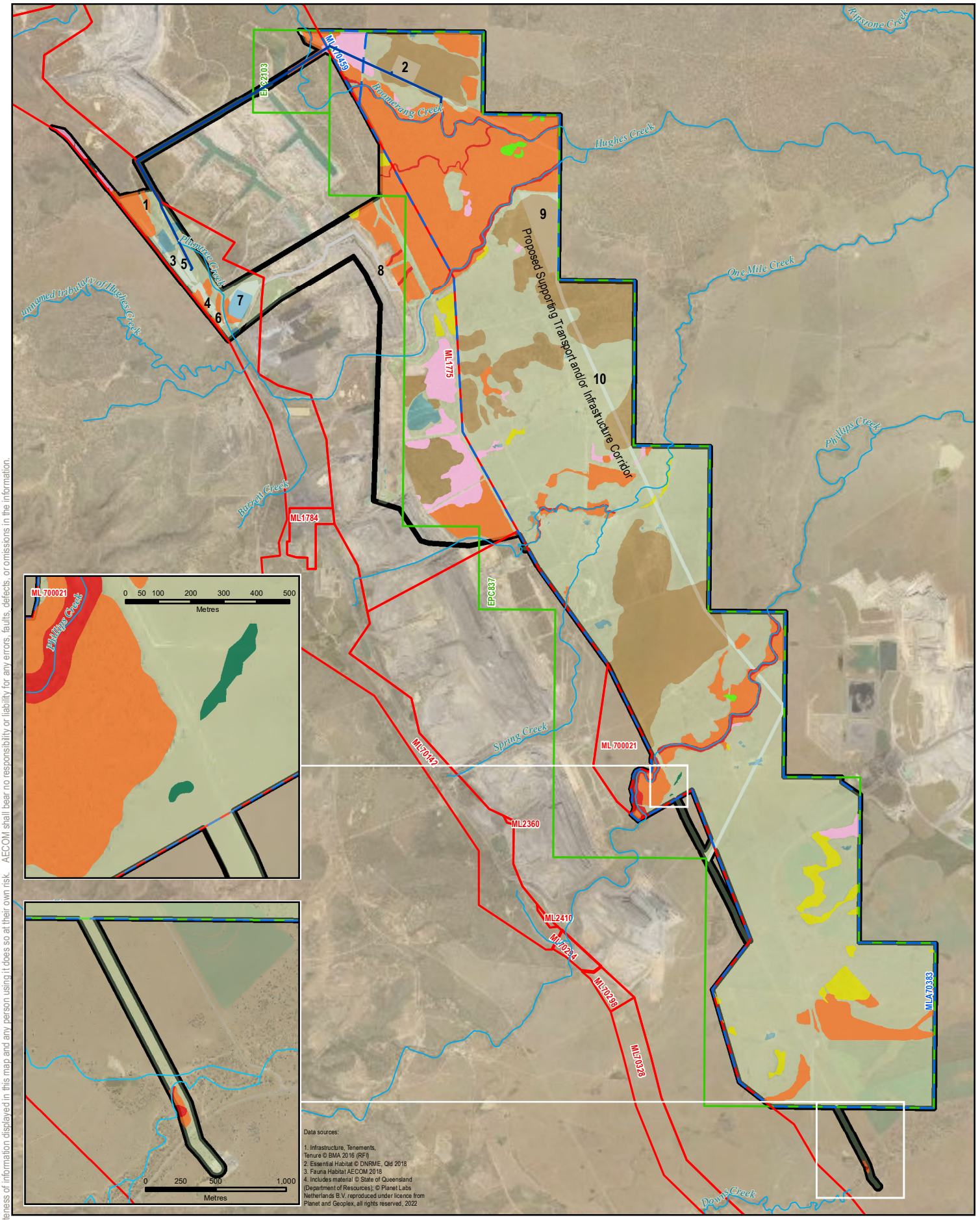
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LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Pipeline
- Watercourse

Fauna habitat types

- River red gum riparian woodland
- Eucalyptus and Corymbia open woodland
- Dawson gum and brigalow woodland
- Brigalow and belah woodland
- Oxbow wetland
- Natural grasslands

Non-remnant Habitat

- Modified Grasslands
- Shrubby Brigalow Regrowth with Gilgai
- Dams

Surface Infrastructure

1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

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Figure A3
Fauna habitat types within the Project Site

Environmental Impact Statement
Saraji East Mining Lease Project

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Kilometres

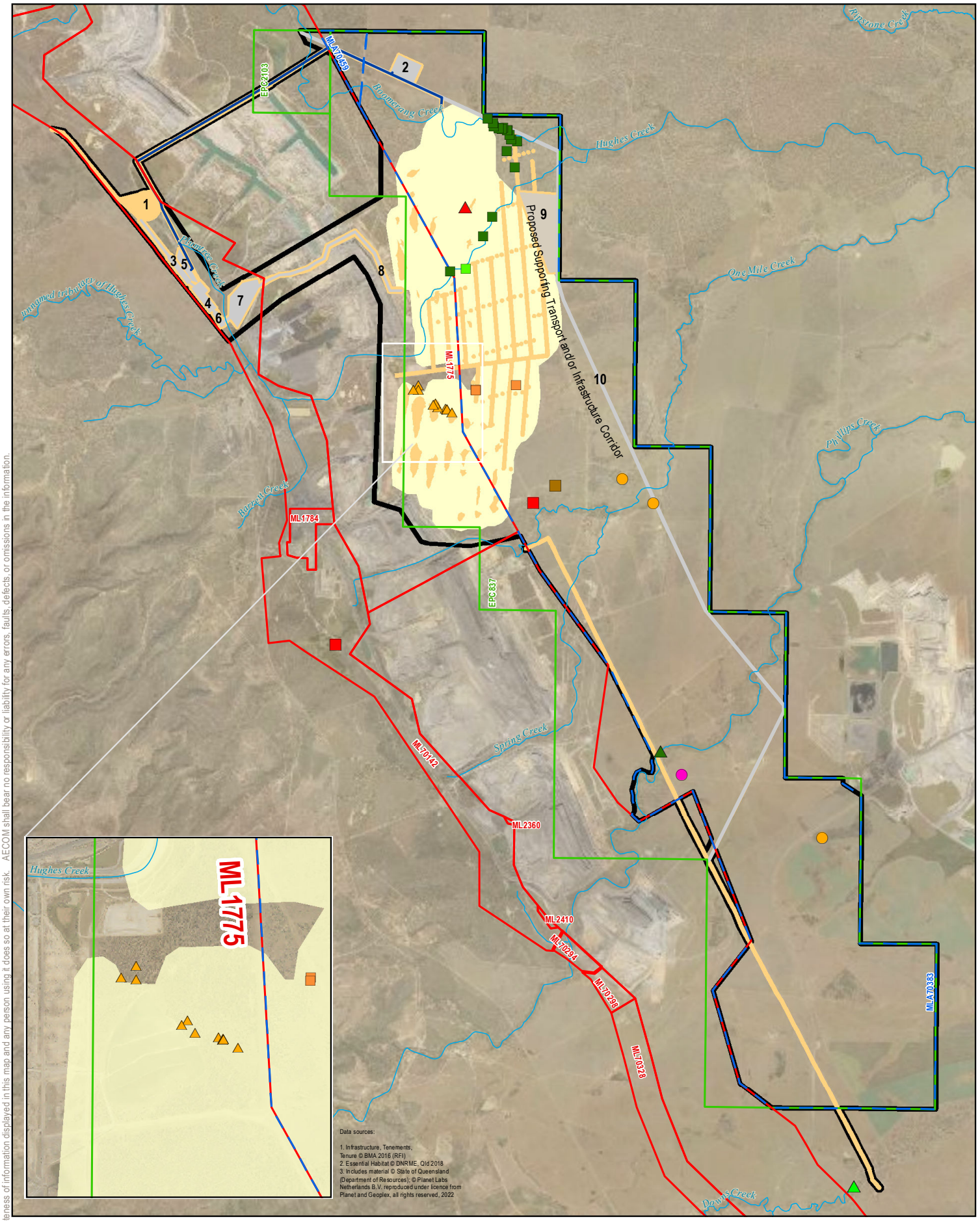
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LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Pipeline
- Watercourse

Threatened Fauna and Flora Records

- Ornamental Snake (SKM 2012)
- Ornamental Snake (Australian Living atlas 2016)
- Ornamental snake (AECOM 2020)
- Koala (URS 2014)
- Koala (AECOM 2020)
- Greater glider (AECOM 2020)
- Greater Glider (SKM 2012)
- Squatter pigeon (AECOM 2017)
- Squatter Pigeon (SKM 2012)
- Painted Snipe (SKM 2012)
- Bluegrass

Surface Infrastructure

1. Rail Loading Balloon Loop
2. Process Water Dam
3. Product Stockpiles
4. CHPP
5. Raw Water Dam
6. ROM Pad
7. Future MIA
8. Conveyor
9. Construction Village
10. Transport and Infrastructure Corridor

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Figure A4

Observed Conservation Significant Fauna and Flora within the Project Site

Environmental Impact Statement
Saraji East Mining Lease Project

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Kilometres

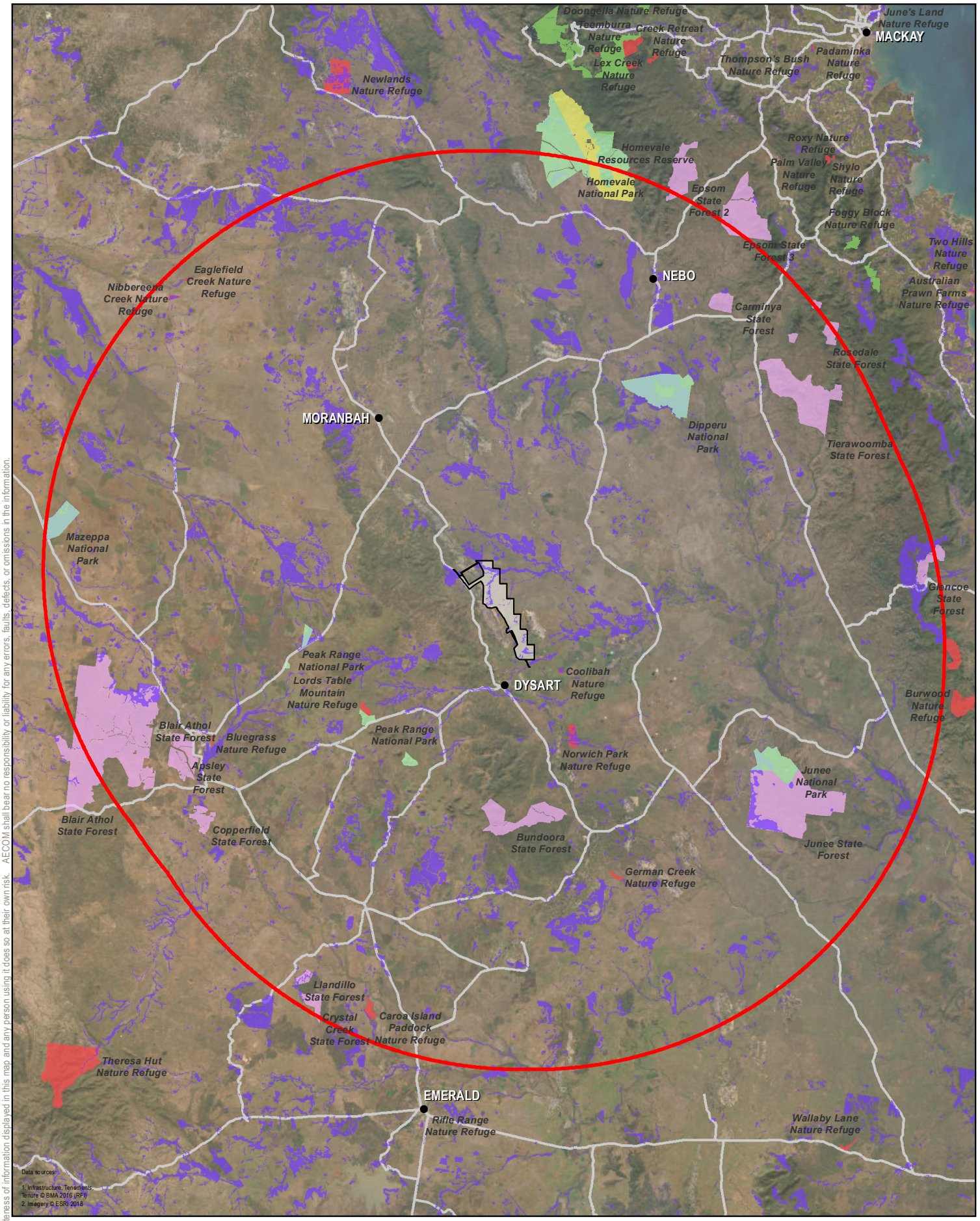
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LEGEND

- Locality
- Major Road
- Project Site
- 100km Project Area radius

Category A ESA

- National Park
- Conservation Park
- Forest Reserve

Category B ESA

- Endangered Regional Ecosystem (Biodiversity Status)
- Queensland Heritage Register Place

Category C ESA

- Nature Refuge
- Resource Reserve
- State Forest

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Figure A5
Environmentally Sensitive Areas

Environmental Impact Statement
Saraji East Mining Lease Project

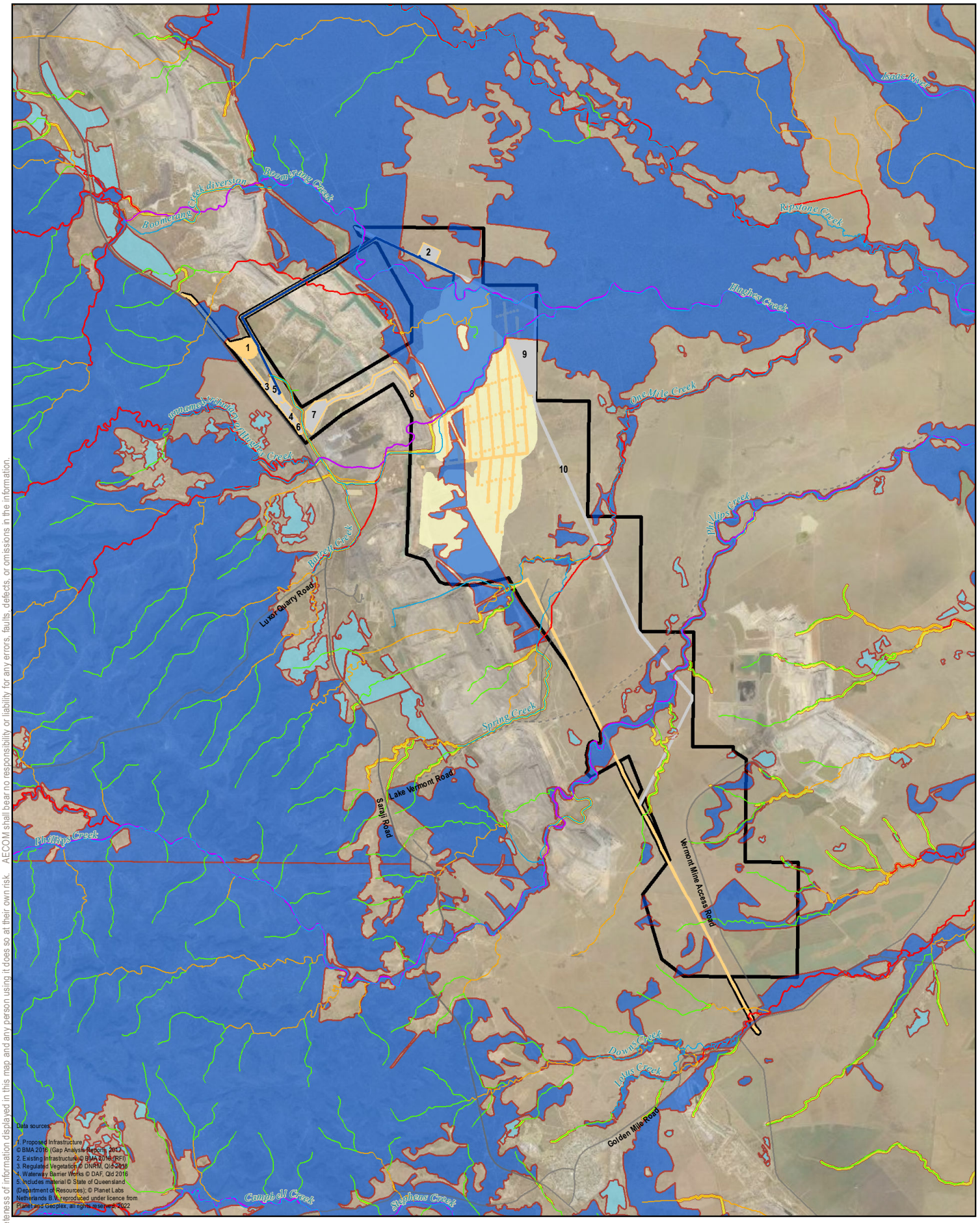
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Data sources:
1. Proposed Infrastructure © BMA 2016 (Gap Analysis Report, 2017
2. Existing Infrastructure © BMA 2016 (RFI)
3. Regulated Vegetation © DNRM, Qld 2016
4. Waterway Barrier Works © DAF, Qld 2016
5. Includes material © State of Queensland (Department of Resources), © Planet Labs Netherlands B.V. reproduced under licence from Planet and Geoplex, all rights reserved 2022

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LEGEND

- Project Site
- Project Footprint - Direct Impact
- Project Footprint - Indirect Impact
- Surface Infrastructure
- Private Access Road
- Public Road
- Pipeline
- Watercourse

Risk of Impact

- 1 - Low
- 2 - Moderate
- 3 - High
- 4 - Major

Regulated Vegetation

- Category B area
- Category C area
- Category R area

Surface Infrastructure

1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

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Figure A6

Regulated Vegetation and Fish Passage

Environmental Impact Statement Saraji East Mining Lease Project

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Kilometres

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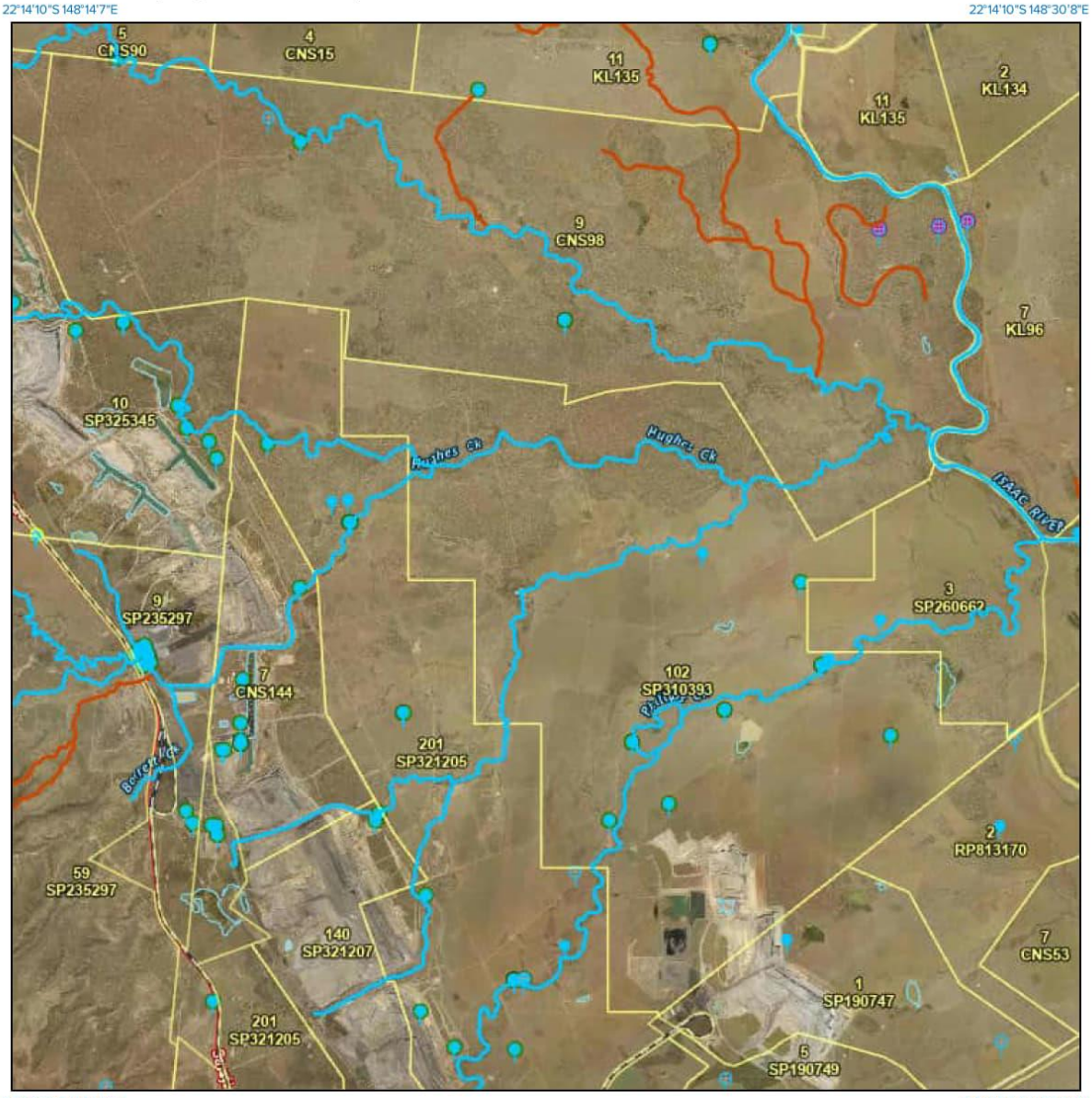
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Appendix B

Queensland Globe Mapping

Saraji - EIS

Watercourses, Registered Bores, Inland Waters - Features



A product of Queensland Globe



Legend located on next page

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0 2.5 km

Scale: 1:150000

Printed at: A4

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Saraji - EIS

Watercourses, Registered Bores, Inland Waters - Features

Legend

Coastline
- Coastline

Dam
- Dam

Rockpool or rockhole
- Rockpool
- Rockhole

Waterhole
- Waterhole

Waterfall

Flat or swamp
- Land subject to inundation
- Saline coastal flat
- Swamp

Pondage area
- Aquaculture
- Salt evaporator
- Settling pond

Lake
- Lake

Reservoir
- Reservoir

Canal line
- Canal

Canal area
- Canal area

Watercourse line
- Major - perennial
- Major - non perennial
- Minor - perennial
- Minor - non perennial

Watercourse area
- Watercourse area

Water area edge

Watercourse stream order

Current water level monitoring bores [RDMW]

Past water monitoring and investigation bores [RDMW]

Attribution

Earthstar Geographics

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Legend

Registered water bores [RDMW and private]

- Artesian bore
- Artesian bore (abandoned but useable)
- Artesian bore (abandoned and destroyed)
- Artesian bore, ceased to flow
- Artesian bore, ceased to flow (abandoned but useable
- Artesian bore, ceased to flow (abandoned and destroyed)
- Sub-artesian facility
- Sub-artesian facility (abandoned but useable)
- Sub-artesian facility (abandoned and destroyed)
- Surface water facility
- Surface water facility (abandoned but useable)
- Surface water facility (abandoned and destroyed)

Water monitoring bores with near real time data [RDMW]

All mine monitoring water bores [RDMW and private]

Mine monitoring water bores with water levels [RDMW and private]

Surat CMA underground water impact reporting monitoring bores [RDMW and private]

CSG online monitoring bores [RDMW and private]

CSG net monitoring bores [Private]

Spring [defined by Water Act 2000]

Lake [defined by Water Act 2000]

Downstream limit [defined by Water Act 2000]

Watercourse [defined by Water Act 2000]

Drainage feature [defined by Water Act 2000]

Unmapped


Saraji - EIS
Legend
Land parcel
Parcel
Land parcel - gt 1 ha
Parcel
Land parcel - gt 10 ha
Parcel
Land parcel - gt 1000 ha
Parcel
Land parcel label
Land parcel label - gt 1 ha
Land parcel label - gt 10 ha
Land parcel label - gt 1000 ha
Cities and Towns
Railway
Road Crossing
Bridge
Tunnel
Road
Highway
Main
Local
Private

Appendix C

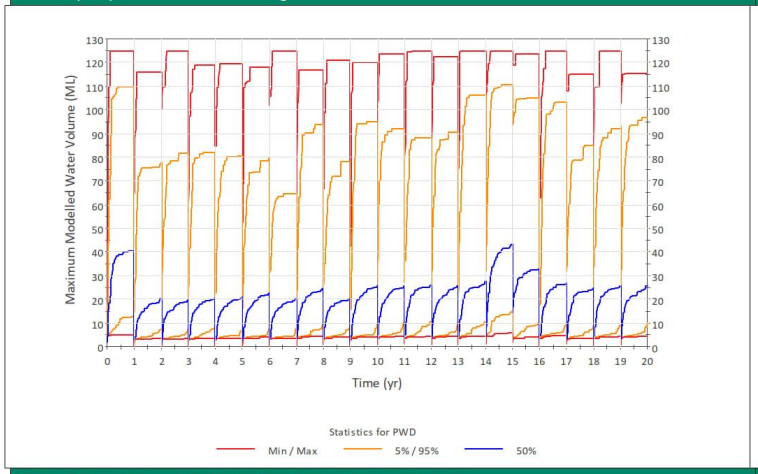
Additional WBM Plots

AECOM

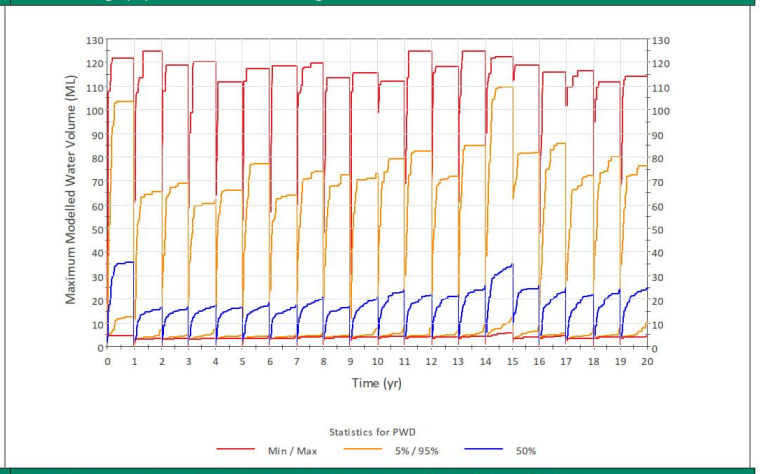
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Table 1 Process Water Dam

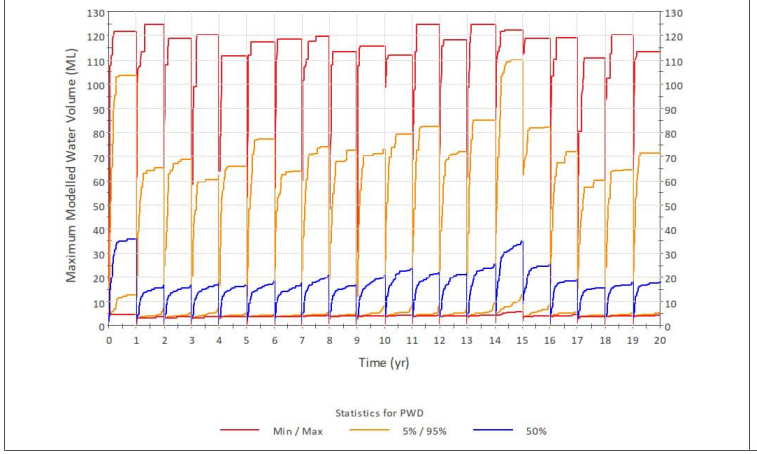
Baseline (BaU) – Modelled Water Storage Volume



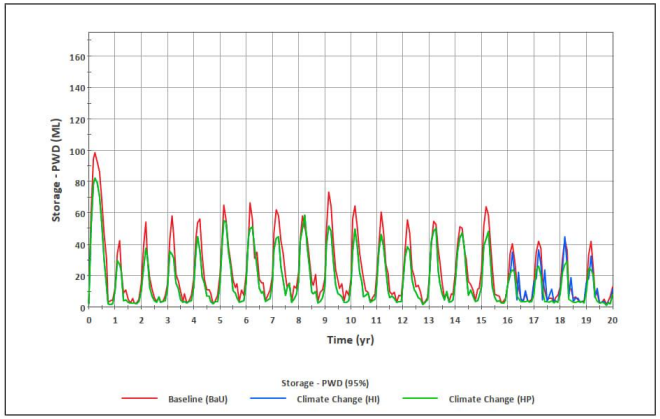
Climate Change (HI) – Modelled Water Storage Volume



Climate Change Scenario (HP) – Modelled Water Storage Volume



Climate Sequence Comparison (95th Percentile) – Modelled Water Storage Volume

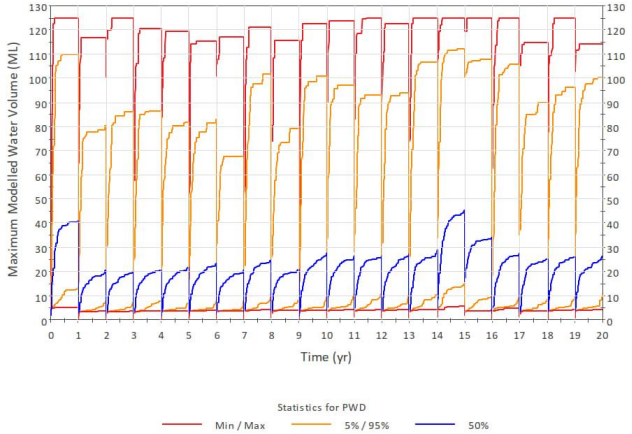


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Prepared for – BMA Alliance Coal Operations Pty Ltd – ABN: 67 096 412 752

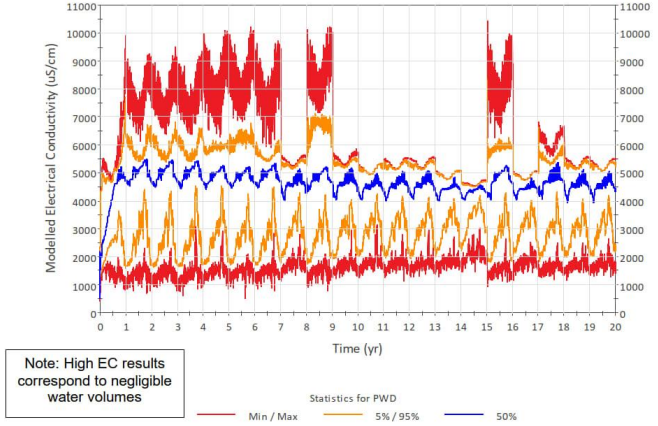
AECOM

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Pump Failure – Temporary – Modelled Water Storage Volume



Baseline (BaU) – Modelled Electrical Conductivity (uS/cm)

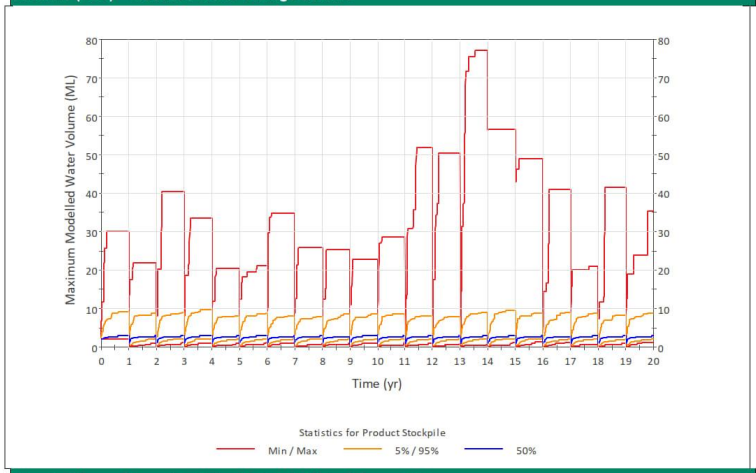


Note: High EC results correspond to negligible water volumes

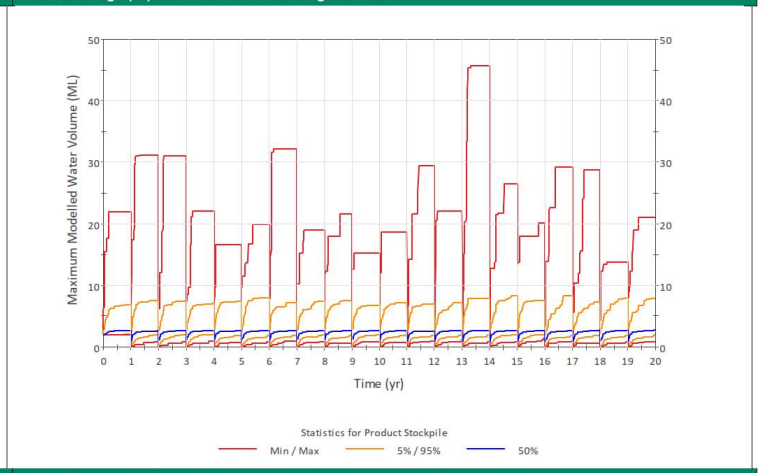
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Table 2 Product Stockpile Dam

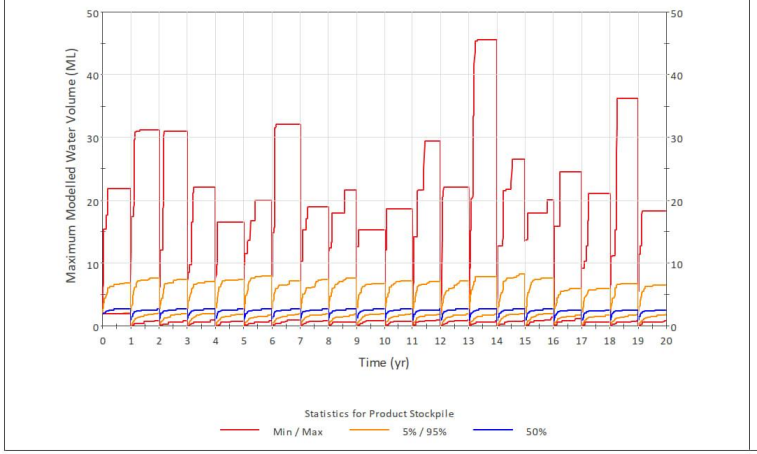
Baseline (BaU) – Modelled Water Storage Volume



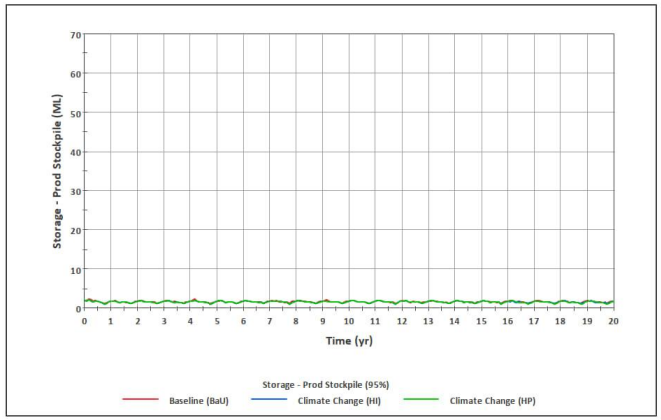
Climate Change (HI) – Modelled Water Storage Volume



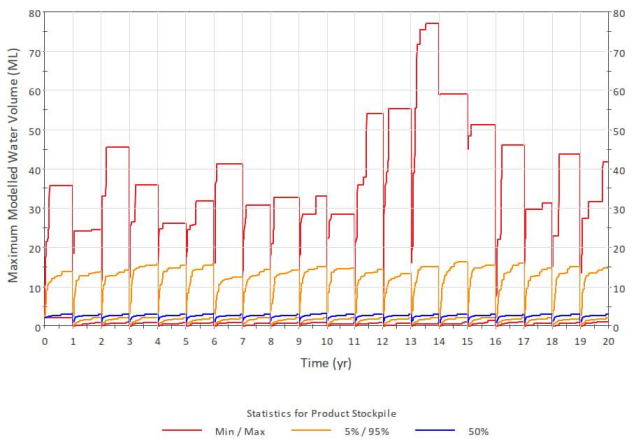
Climate Change Scenario (HP) – Modelled Water Storage Volume



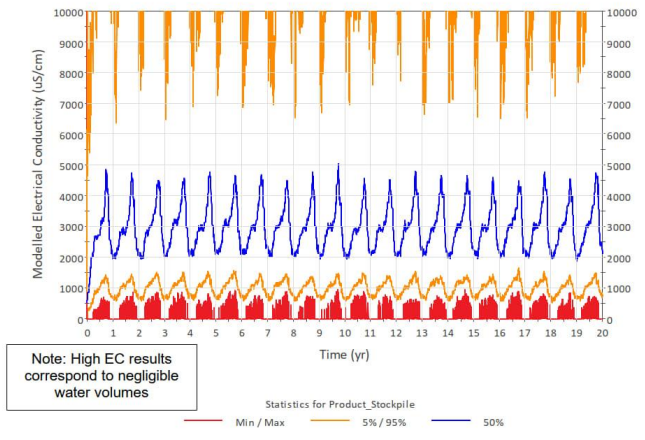
Climate Sequence Comparison (95th Percentile) – Modelled Water Storage Volume



Pump Failure – Temporary – Modelled Water Storage Volume



Baseline (BaU) – Modelled Electrical Conductivity (uS/cm)

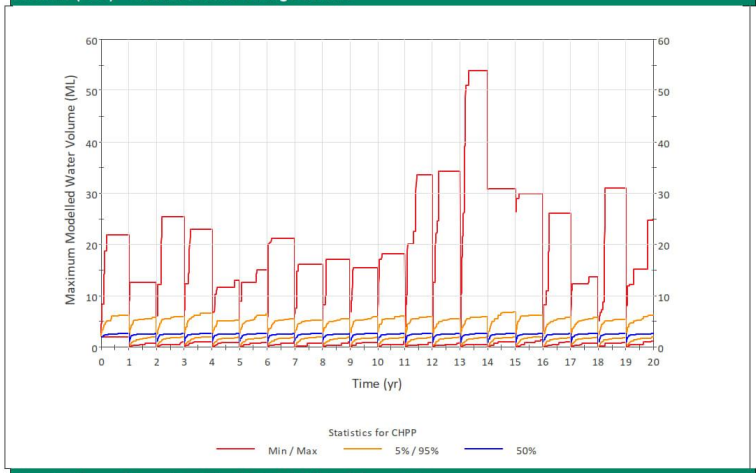


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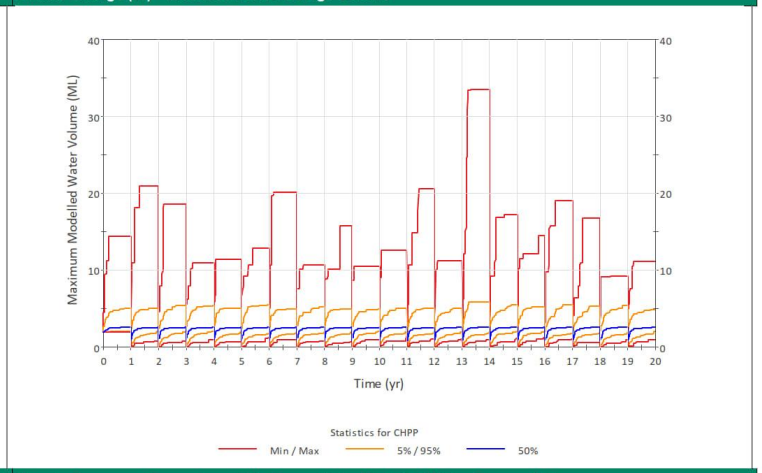
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Table 3 CHPP Dam

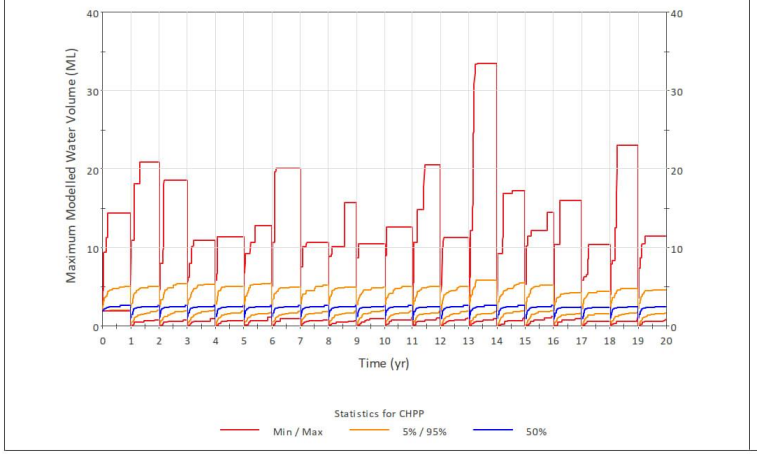
Baseline (BaU) – Modelled Water Storage Volume



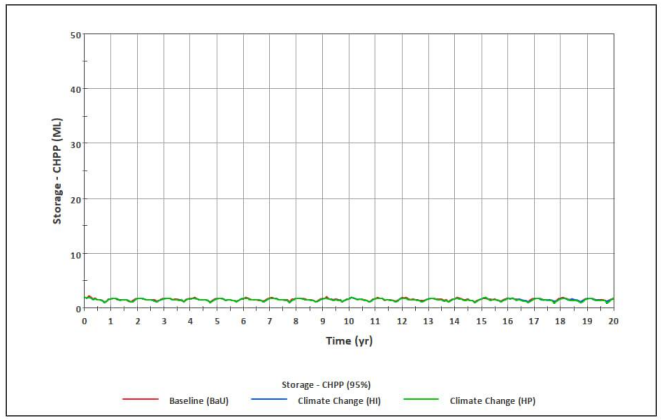
Climate Change (HI) – Modelled Water Storage Volume



Climate Change Scenario (HP) – Modelled Water Storage Volume

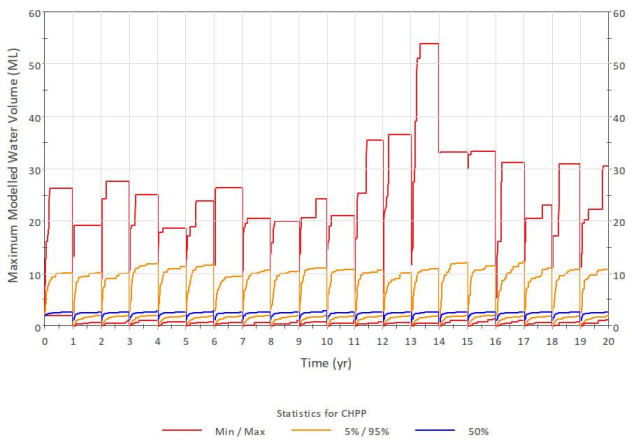


Climate Sequence Comparison (95th Percentile) – Modelled Water Storage Volume

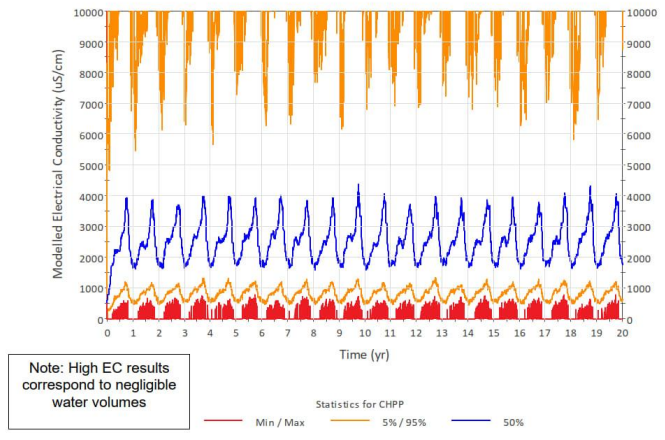


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Pump Failure – Temporary – Modelled Water Storage Volume



Baseline (BaU) – Modelled Electrical Conductivity (uS/cm)



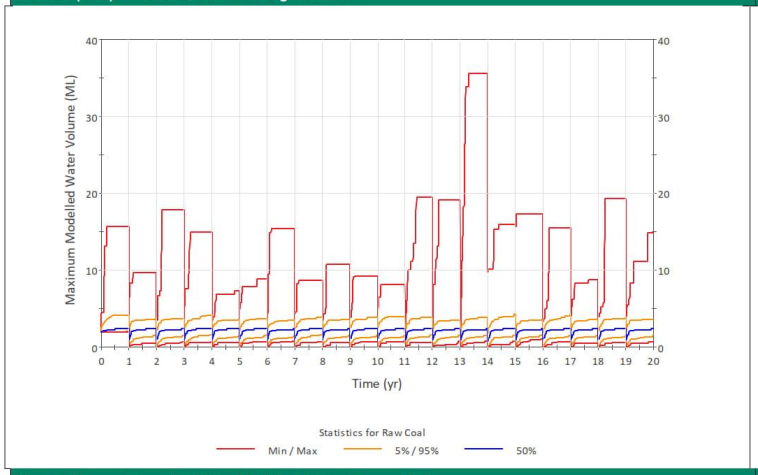
Note: High EC results correspond to negligible water volumes

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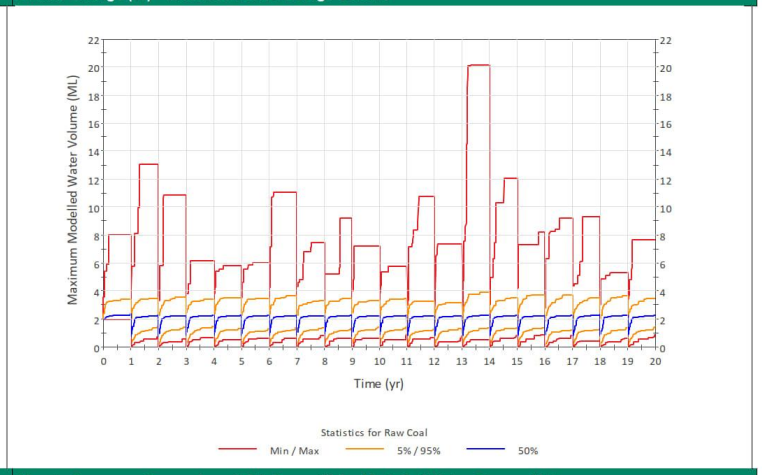
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Table 4 ROM Pad Dam

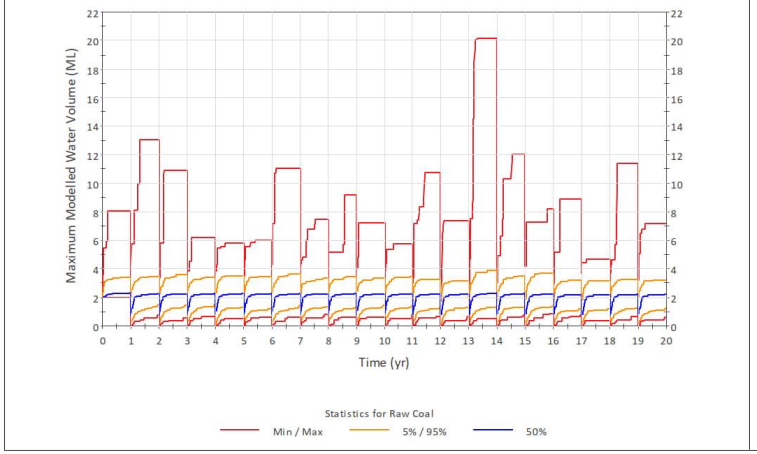
Baseline (BaU) – Modelled Water Storage Volume



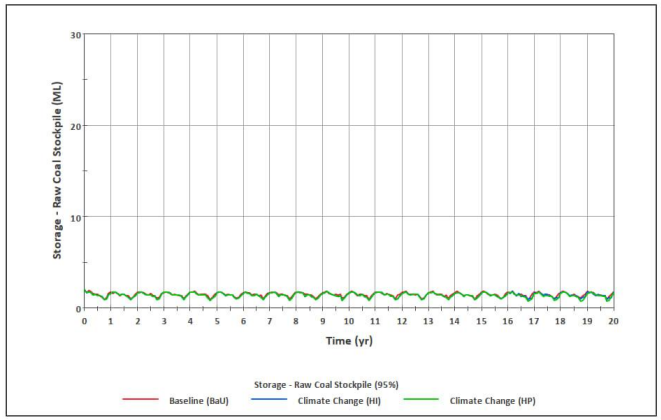
Climate Change (HI) – Modelled Water Storage Volume



Climate Change Scenario (HP) – Modelled Water Storage Volume

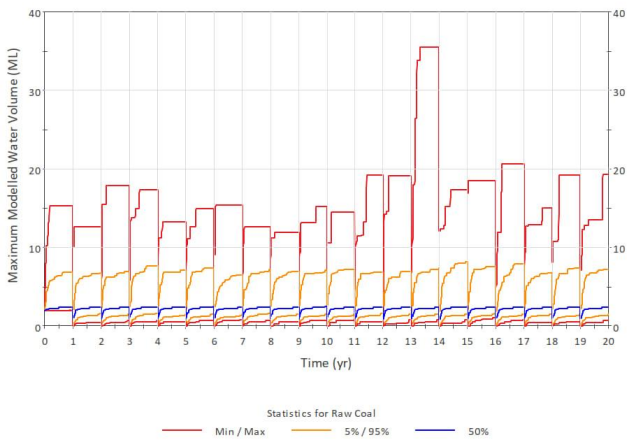


Climate Sequence Comparison (95th Percentile) – Modelled Water Storage Volume



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Pump Failure – Temporary – Modelled Water Storage Volume



Baseline (BaU) – Modelled Electrical Conductivity (uS/cm)

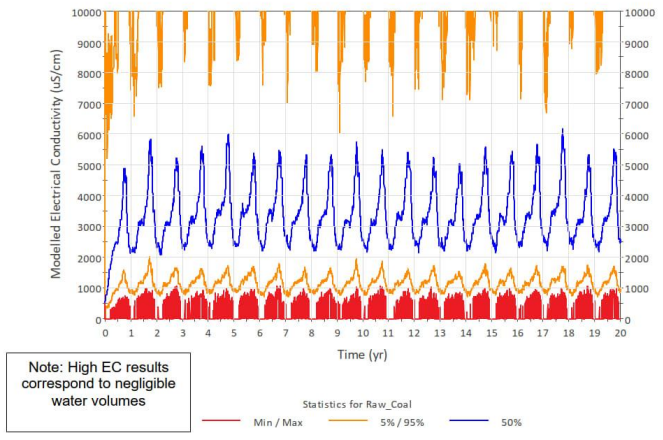
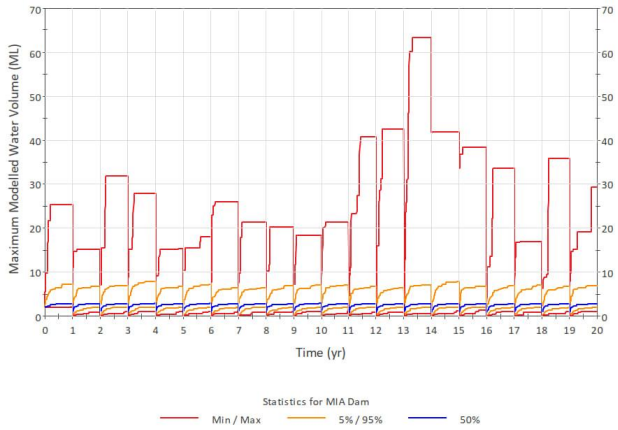
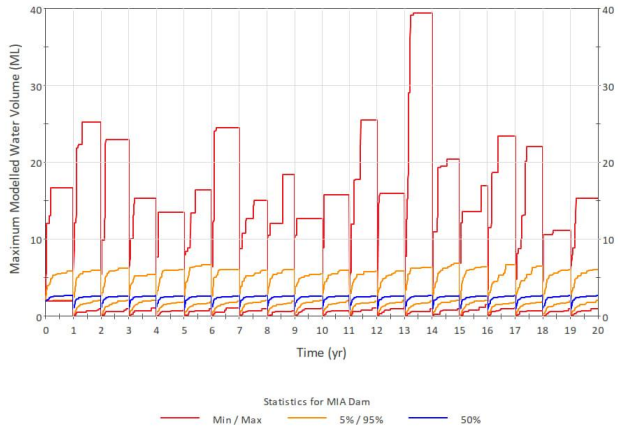


Table 5 MIA Dam

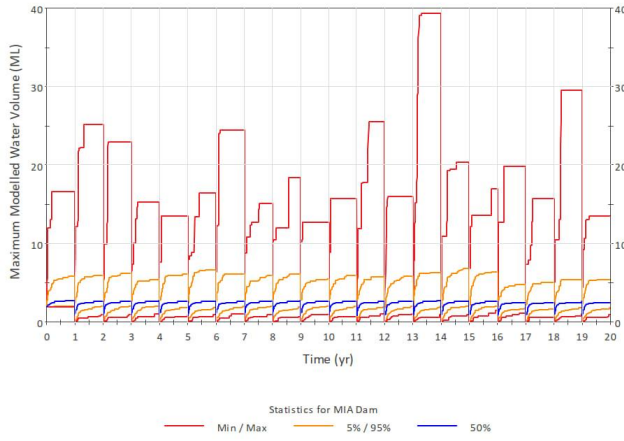
Baseline (BaU) – Modelled Water Storage Volume



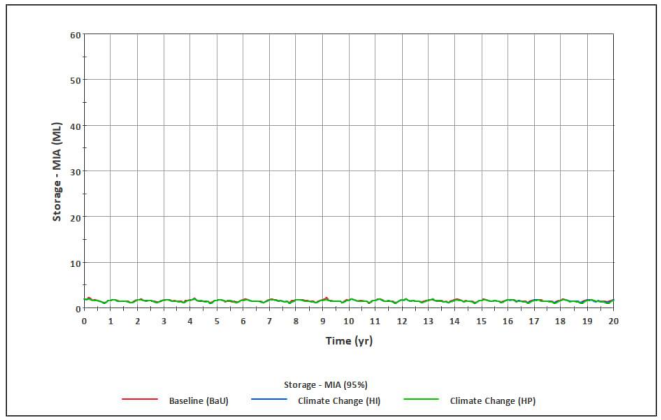
Climate Change (HI) – Modelled Water Storage Volume



Climate Change Scenario (HP) – Modelled Water Storage Volume



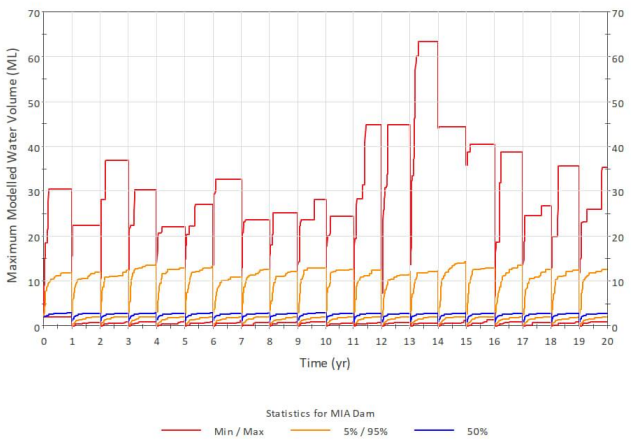
Climate Sequence Comparison (95th Percentile) – Modelled Water Storage Volume



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Pump Failure – Temporary – Modelled Water Storage Volume



Baseline (BaU) – Modelled Electrical Conductivity (uS/cm)

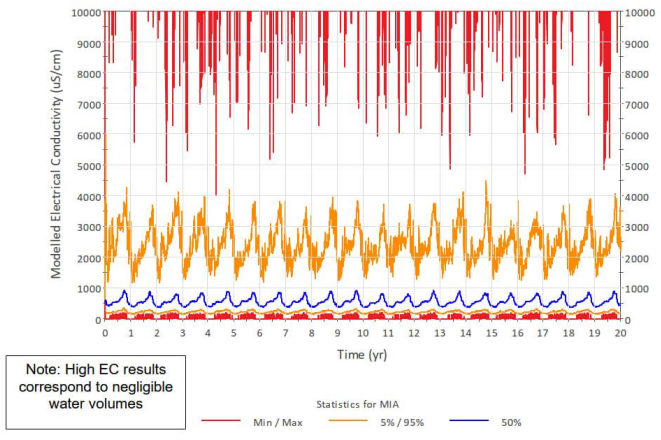
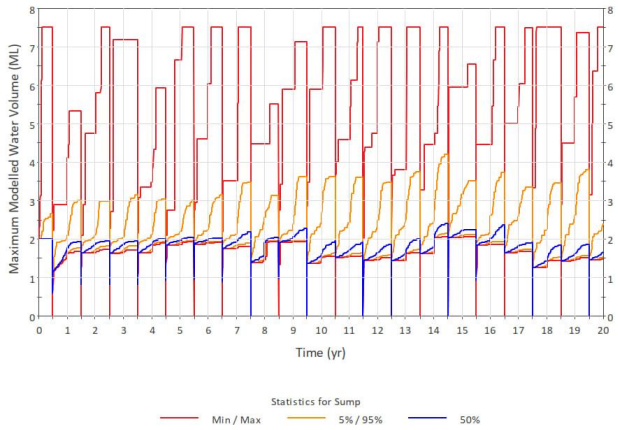
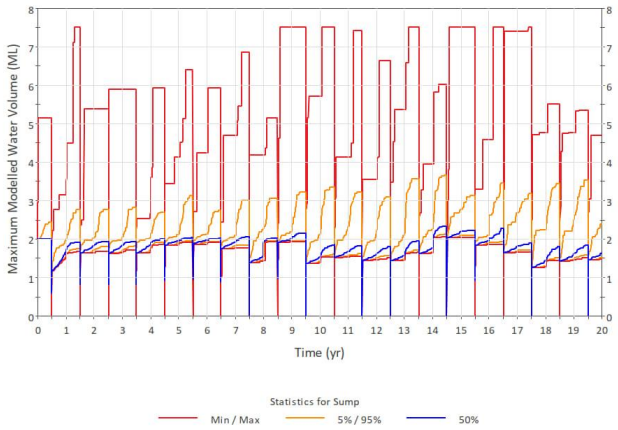


Table 6 Underground Mine Portal Area Sump

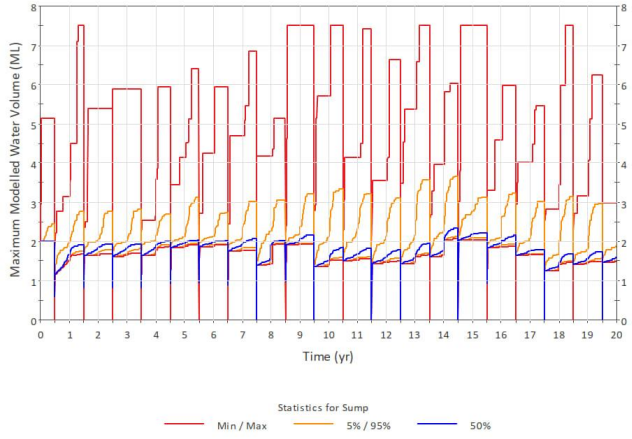
Baseline (BaU) – Modelled Water Storage Volume



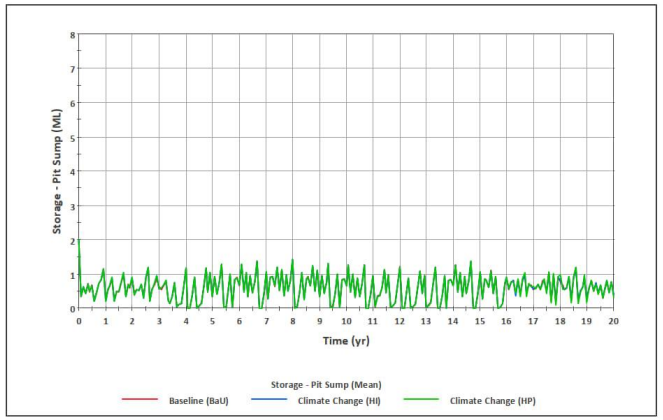
Climate Change (HI) – Modelled Water Storage Volume



Climate Change Scenario (HP) – Modelled Water Storage Volume

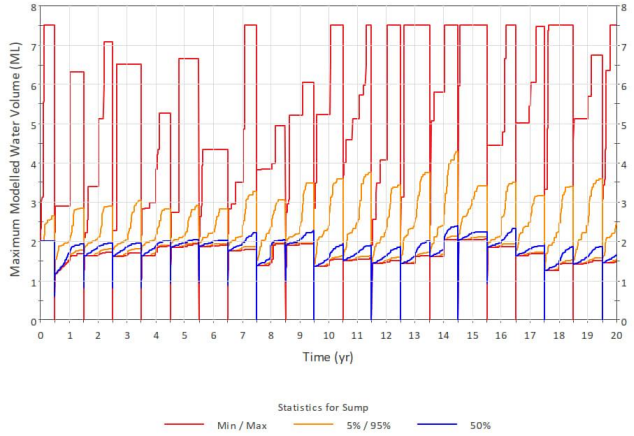


Climate Sequence Comparison (95th Percentile) – Modelled Water Storage Volume



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Pump Failure – Temporary – Modelled Water Storage Volume

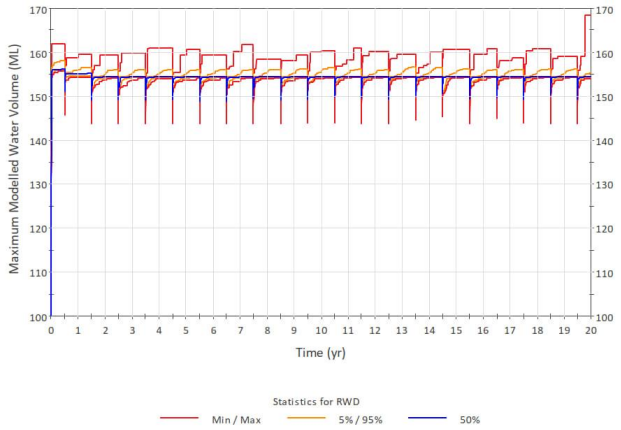


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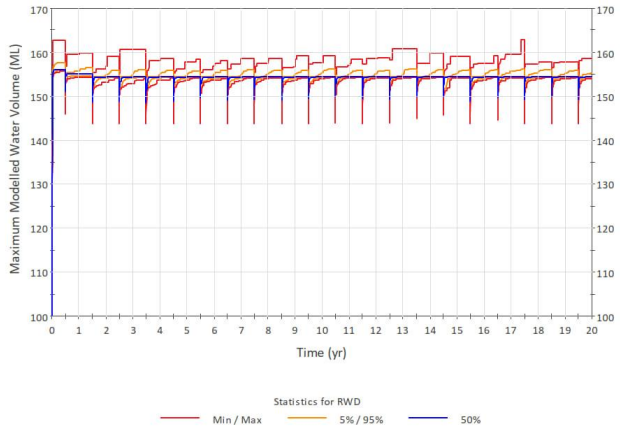
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Table 7 Raw Water Dam

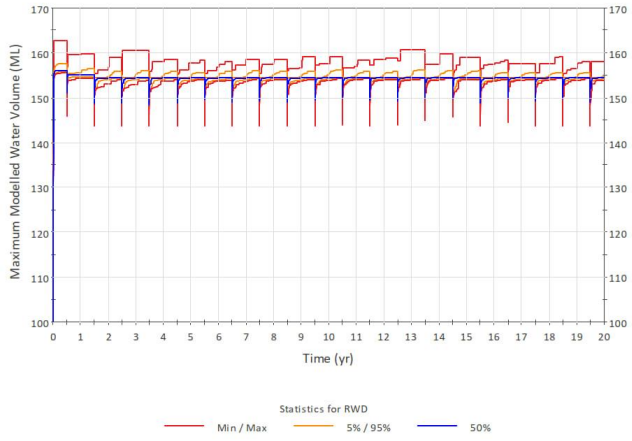
Baseline (BaU) – Modelled Water Storage Volume



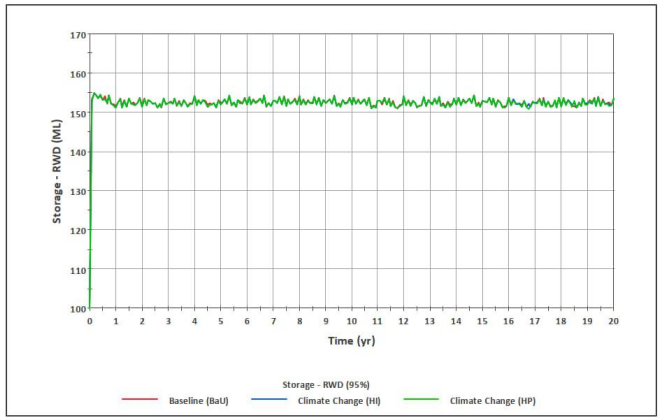
Climate Change (HI) – Modelled Water Storage Volume



Climate Change Scenario (HP) – Modelled Water Storage Volume



Climate Sequence Comparison (95th Percentile) – Modelled Water Storage Volume

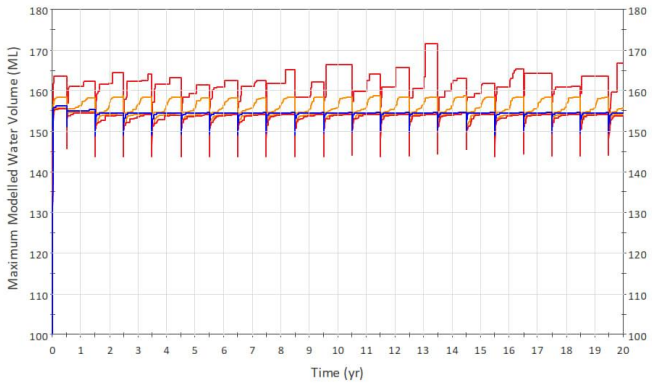


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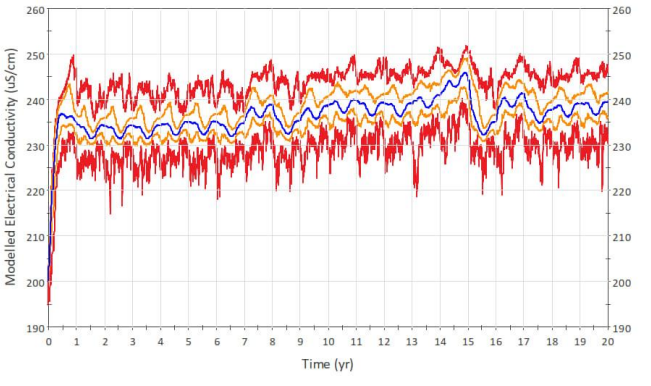
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Pump Failure – Temporary – Modelled Water Storage Volume



Baseline (BaU) – Modelled Electrical Conductivity (uS/cm)



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