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Metals

Capricorn Copper

EA Amendment Application Supporting Report

Esperanza Pit Design Storage Allowance and Interim Tailings Storage Capacity

EXECUTIVE SUMMARY

Application Context

The Capricorn Copper Mine (CCM) has a long operating history, characterised by a wide range of operating activities, numerous periods of CCM being placed in care and maintenance, various changes in ownership, and changes in environmental management practices. This history contributes to the historic compliance performance of the site.

Capricorn Copper Pty Ltd (CCPL), the current owner of the site, has invested (and continues to invest) heavily to implement improvements at CCM to put the site on a sustainable long-term footing, in the interests of all stakeholders. CCPL's investment has included a focus on developing a long-term plan for key regulatory approvals.

CCPL's two priorities for CCM are:

- Water management – seeking to address issues for the site and put CCM on a sustainable long-term footing for compliance and environmental risk management; and
- Tailings management – formulating and implementing a long-term plan for tailings capacity to support mining operations.

This application intersects with both these priorities.

The amendments to the CCM Environmental Authority EPML00911413 (the EA) proposed within this application will:

- Assist with ongoing water management; with a clear pathway to compliance by implementing changes to the prescribed hydraulic performance criteria for the Esperanza Pit (the EPit), calculated by strict application of the published *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* Version 5.02 (the Manual), incorporating layers of conservatism to ensure environmental risks are managed, calibrated against 44 months of *actual* site data and informed by the performance of established water management infrastructure and management systems during a more than 1:200-year event (which occurred in March 2023); and
- To extend previously approved tailings deposition in the EPit, providing tailings storage capacity for an interim period as CCPL transitions to the life-of-mine (LOM) tailings storage strategy involving a new engineered tailings storage facility (to be called TSF3), with staged capacity of more than 12 years.

Proposed Amendment

An updated Water Balance Model (WBM) has been prepared for the site to reflect updates to the site water management system, and the latest bathymetric and LiDAR survey data acquired in 2022 and 2023. Modelling was undertaken for the combined integrated water storage system on site which comprises the Esperanza Tailings Storage Facility (ETSF), EPit, and Mill Creek Dam (MCD), which share a combined DSA.

Through the updated modelling, the combined DSA volume that allows sufficient freeboard and safe storage levels over the 2024/2025 wet season has been calculated as 599 ML. Conservatism has been applied to this value in accordance with the requirements of the Manual, through application of a Design Simulation Margin (DSM) of 25% or 150 ML. This results in a combined calculated DSA of 749 ML which is distributed between the EPit and the MCD.

In order to apply an additional layer of conservatism (beyond that which is already incorporated into the calculated DSA), CCPL has determined to keep the DSA level for the MCD the same as currently approved within the EA. In so doing, the calculated combined DSA for the application is further raised to 852.6 ML, which results in the final DSM applied to the calculated DSA being equivalent to 42%.

The calculation of DSA in accordance with the Manual, along with the additional conservatism applied by CCPL and allocation between EPit, MCD and ETSF for the purposes of the application is summarised below:

Calculated DSA volume	**599 ML**	
25% DSM	150 ML	
Revised calculated DSA volume	**749 ML**	
Applied additional conservatism via maintaining MCD DSA level	103.6ML (+~14%)	
Application DSA volume	**852.6 ML**	
- DSA volume allocated to EPit	496.8 ML	(217.2 m AHD)
- DSA volume allocated to MCD	355.8 ML	(216.1 m AHD)

The multiple levels of conservatism incorporated into the modelling to calculate the DSA are:

- A final adopted DSM of 42% has been applied even though the Seasonal Simulation Margin (SSM), which is used to derive the DSM, was calculated as 4.4%
- No water releases assumed in DSA calculation, though the Environmental Authority (EA) allows for a release of up to 500 ML/annum, and a TEL application is underway to allow for 1,500 ML to be released during the 2023/2024 wet season
- The model was calibrated using 44 months of actual data from the site
- Excellent correlation between historic data and modelled outcomes was demonstrated, with a mean difference of < 5% observed
- Model accounts for all inputs based on actual operating practices:
    - Dewatering of ~ 500 ML to the EPit from the Esperanza South underground mine, which was flooded during the March 2023 extreme weather event
    - Tailings deposition to the EPit from 1 May 2024
    - The reduction of capacity that results from deposition of tailings and sludge from treatment of mine-affected water (MAW).

Changes to the MCD DSA volume and the MRL for both the EPit and the MCD are purely a function of the updated modelling and reflect the current bathymetry of the two structures as identified in survey undertaken in 2023. These changes do not represent a material change to the operating methodology.

Tailings deposition into the EPit occurred between 2017 and 2022. This tailings deposition was approved via an EA Amendment approved as a minor amendment in 2017.

Through the current application, CCPL seeks approval to recommence tailings deposition to the EPit for an interim period of 9 - 11 months and to a maximum average level of 215.7 m AHD. If the proposed EA Amendment is approved, tailings deposition into EPit will recommence following completion of the current wet season and will not occur during any wet season if the water level in the EPit exceeds MOL. Tailings deposition in the EPit will cease upon commissioning of the proposed new TSF3.

Potential Environmental Impacts

The potential environmental impacts and risks that may arise from the proposed amendment are well understood; informed by extensive technical work.

The proposed amendment will not require any additional disturbance and will be conducted wholly within the mine site and authorised disturbance footprints. As a result, the primary risks to environmental values that have been identified from this assessment are identified as:

- Impacts to Gunpowder Creek from groundwater seepage of contaminated waters; and
- Impacts to Gunpowder Creek from an uncontrolled spill due to overtopping.

This report and the appended technical studies demonstrate how the level of environmental harm from the proposed amendment will be managed, and how the proposed mitigation measures and controls are effective in mitigating the risks (which are well understood). Residual risks have been assessed as low due to a moderate consequence of harm, but a low likelihood. This has been based on the following conclusions from the technical studies undertaken for the site:

- The potential for seepage to groundwater from the EPit occurs once water levels in the structure reach 222 m AHD, which is the MOL for this structure. Up to this level it has been determined that permeability is so low as to be effectively watertight.
- Any seepage from the EPit above the MOL reports to the MCD, which subsequently reports to Hoover Dam. There is no demonstrated or observed pathway directly to Gunpowder Creek from the EPit or MCD.
- Historically, the EPit has stored MAW above the MOL after storm events, and seepage has not been observed to impact the MCD containment as the return pumping rate and process water demands from the MCD are consistently higher than the seepage inflow rate.
- The level at which actual overtopping of the EPit would be expected to occur is once water levels reach 240 m AHD, however the spill risk assessment demonstrates that the EPit does not overflow in any scenario, and that there is only an approximate 1% chance of an external spill event occurring from Hoover Dam as a result of an overflow from MCD.

It is concluded that the placement of tailings into the EPit to the proposed level does not interfere with a clear pathway to compliance with the required hydraulic performance parameters will not result in any change in the environmental risk profile for the site.

The site has an established water management system including system design rules which provide several options for reducing water levels in both the EPit and MCD, providing for more than one level of control for effectively mitigating risks of environmental harm to Gunpowder Creek.

Mitigation Measures

Risks associated with tailings and water management will be subject to controls and mitigation measures documented in the following operational documents:

- Tailings Management Plan
- Operation, Maintenance and Surveillance Manuals
- Water Management Plan.

The mitigation measures to be implemented to manage risks of environmental harm include:

- 18[1] high-efficiency mechanical evaporators are already in use on the site to reduce water levels within the EPit;
- CCPL has invested in site infrastructure to allow for treatment and re-use of mine-affected water, up to 8 ML per day extracted from MCD, within the processing operations on site, thus limiting the import of raw water from Waggaboonya Lake to only the mine accommodation and critical health and safety purposes;
- A bulk water treatment system is being established on the site to allow for efficient bulk release of treated water to Gunpowder Creek from MCD when background requirements are met under the conditions of the EA; and
- The bulk treatment and release system has been designed to enable simultaneous release of treated water to Gunpowder Creek and transfer of mine-affected water from EPit to MCD.
- Duty/standby pumping arrangement of diesel-powered high-volume pumps that direct water from the MCD to EPit, should MCD level exceed MRL. These pumps have previously been shown to outpace ingress of water to MCD even during a 1-200 high fall events with level in the EPit well above MOL. These pumps are not affected by power outages and are accessible even under flood conditions.

As the potential for impacts to groundwater only commence when water levels exceed the MOL for the EPit, and seepage from the MCD reports to the Hoover Dam, the mitigation and management measures used by the site to manage water levels within the EPit and MCD are appropriate for managing any adverse effects on groundwater (as was demonstrated in the March 2023 extreme weather event, with no uncontrolled releases from regulated structures occurring).

Requirements

The application to amend the EA has been prepared having regard to, and accordance with the requirements prescribed in the *Environmental Protection Act 1994* (Qld) (the EP Act), the *Environmental Protection Regulations 2019* (Qld) and published guidelines, including: the Manual; *Application requirements for activities with impacts to air (ESR/2015/1840)*; *Application requirements for activities with noise impacts (ESR/2015/1838)*; *Application requirements for activities with impacts to land (ESR/2015/1839)*; *Application requirements for activities with waste impacts (ESR/2015/1836)*; and *Application requirements for activities with impacts to water (ESR/2015/1837)*.

Table 1 provides a checklist of the regulatory requirements for the application and cross references to the responsive sections and supporting materials in this document.

[1] Certain technical reports accompanying this document refer to the total number of evaporators as "14". This is because four of the new evaporators implemented by CCPL are dual fan evaporators (i.e., two units for mechanical evaporation). The RPEQ has preferred to refer to each of these dual-fan units as a single unit. This distinction has no practical impact on the modelling undertaken, or the information presented in these documents supporting the application.

Table 1 EA Amendment Requirements

Requirement	Supporting Information Reference
Environmental Protection Act 1994	
S227 (1) An amendment application must-	
a) Be made to the administering authority;	This report has been prepared for the Department of Environment and Science (DES), who is the administering authority.
b) Be made in the approved form;	The application is being made using the approved form *Application to amend an environmental authority (ESR/2015/1733)*.
c) Be accompanied by the fee prescribed under a regulation;	The fee prescribed by regulation has been paid alongside the application submission.
d) Describe the proposed amendment;	Refer **Section 5.**
e) Describe the land that will be affected by the proposed amendment; and	Refer **Section 2** and **Section 4.**
f) Include any other document relating to the application prescribed by regulation.	This document and technical reports included as Appendices.
S226A (a) Describe any applicable development permits.	Not applicable
S226A (b) and S226A (c) State whether the activity will comply with the eligibility criteria	Not applicable
S226A (d) State whether the application seeks to change a standard condition	This application does not propose changes to any standard conditions.
S226A (e) State if the activity relates to a new relevant resource tenure for an exploration permit or GHG permit and contains standard conditions.	This application does not relate to new relevant resource tenure for an exploration permit or GHG permit.
S226A (f) Assess impacts to environmental values, including – i. a description of values ii. details of emissions or releases iii. a description of the risk and likely magnitude iv. details of the management practices v. if a PRCP schedule does not apply for each relevant activity— details of how the land the subject of the application will be rehabilitated after each relevant activity ends	Refer **Section 4** for a description of environmental values. Refer **Section 6** for details of likely emissions or releases. Refer **Section 8** for the assessment of risk relating to impacts. Refer **Section 7** for description of mitigation measures. A Progressive Rehabilitation and Closure Plan (PRCP) does not apply for the activity. Refer **Section 9**.
S226A (g) Describe measures for minimising and managing waste.	Refer **Section 6.7**.
S226A (h) Include details of any site management plan or environmental protection order that relates to the land the subject of the application.	Not applicable
Environmental Protection Regulation 2019	
Part 3, Division 1 Operational Assessment	
Air Environmental Objective The activity will be operated in a way that protects the environmental values of air.	Refer **Section 6.5**.
Water Environmental Objective The activity will be operated in a way that protects environmental values of waters.	Refer **Section 6.2**, **Appendix 1** and **Appendix 3**.
Wetlands Environmental Objective The activity will be operated in a way that protects the environmental values of wetlands.	Refer **Section 4.3.2**.
Groundwater Environmental Objective The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems.	Refer **Section 6.3**, **Appendix 1** and **Appendix 3**.
Noise Environmental Objective The activity will be operated in a way that protects the environmental values of the acoustic environment.	Refer **Section 6.6.**

Requirement	Supporting Information Reference
Waste Environmental Objective Any waste generated, transported, or received as part of carrying out the activity is managed in a way that protects all environmental values.	Refer **Section 6.7**, **Appendix 1** and **Appendix 3**.
Land Environmental Objective The activity is operated in a way that protects the environmental values of land, including soils, subsoils, landforms and associated flora and fauna.	Refer **Section 6.1** and **Appendix 3**.
Part 3, Division 2 Land Use Assessment	
Site Suitability Environmental Objective The choice of the site, at which the activity is to be carried out, minimises serious environmental harm on areas of high conservation value and special significance and sensitive land uses at adjacent places.	Refer **Section 4**.
Location on Site Environmental Objective The location for the activity on a site protects all environmental values relevant to adjacent sensitive uses.	Refer to **Section 7**.
Critical Design Requirements Environmental Objective The design of the facility permits the site at which the activity is to be carried out to operate in accordance with best practice environmental management.	Refer to **Section 7, Appendix 1** and **Appendix 3**.

Outline of How Previous EPit DSA Application Refusal Concerns are Addressed

CCPL previously submitted an application to amend the EA in relation to the EPit DSA (A-EA-AMD-100331903) (the Previous Application). That EA Amendment application was refused, and the application decision has been referred to the Land Court for determination.

CCPL has reviewed the reasons given for the decision on the Previous Application. To assist DES, **Table 2** provides a response to the statement of reasons, including (where applicable) identifying changes and improvements that have been made in this application.

In this regard, it should be noted that CCPL has invested in developing and implementing water management measures which provide several options for reducing water levels in both the EPit and MCD, providing for more than one level of control for effectively mitigating risks of environmental harm to Gunpowder Creek, including:

- Additional infrastructure has been implemented to allow for the treatment and re-use of mine-affected water, which is extracted from Mill Creek Dam, within the processing operations on site. This limits the import of raw water from Waggaboonya Lake to only what is required for the mine accommodation and critical health and safety purposes.
- A bulk water treatment system is being commissioned to allow for efficient bulk release of treated water to Gunpowder Creek when the background requirements are met under the conditions of the EA. This has been designed to enable simultaneous release of treated water to Gunpowder Creek and transfer of mine-affected water from EPit to MCD.
- CCM have increased the number of evaporators in operation from 7 to 18, and modelling informing the DSA has been based off actual site operational data for the evaporators including operational efficiency, reliability, and flow rates.

The current EA Amendment Application and supporting technical studies demonstrate the robustness of the assessment undertaken to justify the proposed amendments and how potential impact to environmental values will be managed.

Table 2 Refusal Statement of Reasons Response

Summarised Key DES Concern	Response	Section Reference
1 Risk of environmental harm as a result of overtopping.	• The calibrated water balance model (site and Gunpowder Creek Catchment) demonstrates that the EPit does not overflow in any scenario, and that an external spill event occurring from Hoover Dam as a result of an overflow from MCD only occurs in a 1% AEP (1 in 100-year event). • CCPL further submits that the DES should have regard to the *actual* risk event constituted by the extreme weather event in March 2023 (> 1:200-year event; far in excess of the regulatory requirement) in respect of which there was no uncontrolled release of mine-affected water from any regulatory structure despite water levels in the EPit being ~215.1 m AHD at the commencement of the 2022 wet season (MCD was below its prescribed DSA).	**Section 6.2** **Section 8.2**
2 Level of conservatism built into DSA model and accuracy of assumptions	• Additional conservatism has been built into recalculation of the DSA. • Model has been calibrated with 44 months of actual site data and shows excellent correlation. • Multiple sensitivity analyses have been undertaken on varying scenarios (reduced evaporator efficiency, reduced production, increased runoff, increased seepage) within the Water Balance Model, demonstrating the conservatism of the adopted DSA to these scenarios.	**Section 5.2.4** **Section 5.4**
3 Assumed efficiency of evaporators	• 18 high-efficiency mechanical evaporators are deployed at the site, and the operational data for these has been included and used to inform the modelling in this EA Amendment Application (as opposed to assuming performance metrics). • The site previously operated only 7 evaporators which had much lower throughput, and the previous application only considered 3 evaporators. • The new high-efficiency mechanical evaporators are designed to be quick maintenance and nozzle changeover and are appropriate for the EPit water quality. • The operating efficiency, reliability, and flow rates of the evaporators has been modelled using actual site data, providing a high level of accuracy. The new units deployed to site would be expected to achieve better performance than previous older units, however, that improved performance has not been included in the model (i.e., it should be taken as representing performance upside and, inversely, additional conservatism). • Mean evaporator efficiency modelled at 30%, with deviation linearly applied in line with Bureau of Meteorology (BOM) data for the region. • The use of 30% evaporation efficiency was reviewed and approved by two independent technical experts, and is significantly lower than the value suggested by the manufacturer.	**Section 5.2.6** **Section 5.4**
4 Effective and reliable operation of mechanical equipment	• The operation of the equipment and the integrated water management system will be undertaken as specified in the relevant Operation, Maintenance and Surveillance (OMS) Manuals. • Equipment relied upon is all standard and not unusual or complex to operate. • The Operation, Maintenance and Surveillance Manuals include maintained and inspection regimes for plant and equipment to ensure the effective and reliable operation. • The operation and maintenance of pipes and pumps across the site is undertaken by a dedicated specialist local contractor based in Mt Isa who has access to additional pumps and critical spares as required. The contractor maintains permanent staff on the site. • An additional 3 specialist maintenance personnel have been hired who will work back-to-back • There is a program of preventative maintenance for pump units across the site. • In total, the site has over 20 skid mounted pumps comprising permanent and temporary pumping measures, including pumps which are standby only. The main pumps for return of water to MCD are designed to be a duty/standby pumping arrangement. • Multiple pump units and pipelines are available in MCD, and multiple coinciding pump and pipeline failures is unlikely, which reduces the risk of a total failure in capacity to transfer water from MCD. • Model has been calibrated with 44 months of actual site data and shows excellent correlation.	**Section 7**

Summarised Key DES Concern	Response	Section Reference

5 Adequacy of contingency and management measures implemented to mitigated environmental harm	• The operation of the equipment and the integrated water management system will be undertaken as specified in the relevant Operation, Maintenance and Surveillance (OMS) Manuals
	• A number of new and/or additional mitigation measures have been implemented on the site to manage water levels within the EPit and MCD, including:
	  ◦ Operation of 18 high-efficiency mechanical evaporators (EPit)
	  ◦ Treatment and re-use of MAW in processing activities (MCD)
	  ◦ No import of raw water from Waggaboonya Lake (MCD)
	  ◦ Increased dedicated maintenance teams for water infrastructure
	• These mitigation measures are already in place on the site to minimise the risks to environmental values from uncontrolled releases or seepage.
	• These measures enhance and/or increase measures reflected in the previous application. In this regard, these additional measures are on top of the measures that were in place for the 2022/23 wet season during which a greater than 1:200-year event occurred, and the then measures were effective in mitigating the risk of uncontrolled release of mine-affected water from the EPit and the MCD.
		Section 7

6 Water inventory at CCM	• A number of new mitigation measures have been implemented in response to the unprecedented storm event in early 2023 to return water levels within the EPit and MCD, with a clear path to compliance. • A TEL application is underway to allow for a 1,500 ML release in the 2023/2024 wet season. • An EA Amendment application is underway for releases in the 2024/2025 wet season and beyond.	**Section 5.1** **Section 8.2**

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1. Introduction

The Capricorn Copper Mine (CCM) has a long operating history, characterised by a wide range of operating activities, numerous periods of CCM being placed in care and maintenance, various changes in ownership, and changes in environmental management practices. This history contributes to the historic compliance performance of the site.

Capricorn Copper Pty Ltd (CCPL) acquired the CCM in 2015 and recommenced operations in late 2017. CCPL was acquired by 29Metals Limited (29Metals) in June 2021.

CCM is located wholly within the Mt Isa City Council local government area (LGA), approximately 2.5 kilometres (km) north-west of the town of Gunpowder in the Mount Isa Mining District and approximately 120 km north of Mount Isa (**Figure 1**). CCM is operated under the approval of Environmental Authority EPML00911413 (the EA) (dated 6 December 2023) managed by the Department of Environment and Science (DES). This EA Amendment Application Supporting Report has been prepared for DES as supporting information for a proposed amendment under Chapter 5, Part 7 of the *Environmental Protection Act 1994* (EP Act), and to assist the administering authority in making an assessment level decision under Chapter 5, Part 7, Division 3 of the EP Act.

The EA covers the following mining leases (ML): ML5407, ML5412, ML5413, ML5418, ML5419, ML5420, ML5429, ML5430, ML5441, ML5442, ML5443, ML5444, ML5451, ML5454, ML5457, ML5459, ML5467, ML5485, ML5486, ML5489, ML5500, ML5548, ML5549, ML5550, ML5562, ML5563, ML90190, ML90181 and ML90182.

1.1. Context

CCPL has invested (and continues to invest) heavily to implement improvements at CCM to put the site on a sustainable long-term footing, in the interests of all stakeholders. CCPL's investment has included a focus on developing a long-term plan for key regulatory approvals.

CCPL's two priorities for CCM are:

- Water management – seeking to address issues for the site and put CCM on a sustainable long-term footing for compliance and environmental risk management; and
- Tailings management – formulating and implementing a long-term plan for tailings capacity to support mining operations.

This application intersects with both these priorities.

The amendments to the CCM Environmental Authority EPML00911413 (the EA) proposed within this application will:

- Assist with ongoing water management; with a clear pathway to compliance by implementing changes to the prescribed hydraulic performance criteria for the Esperanza Pit (the EPit), calculated by strict application of the published *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* Version 5.02 (the Manual), incorporating layers of conservatism to ensure environmental risks are managed, calibrated against 44 months of *actual* site data and informed by the performance of established water management infrastructure and management systems during a more than 1:200-year event (which occurred in March 2023); and
- To extend previously approved tailings deposition in the EPit, providing tailings storage capacity for an interim period as CCPL transitions to the life-of-mine (LOM) tailings storage strategy involving a new engineered tailings storage facility (to be called TSF3), with staged capacity of more than 12 years.

1.2. Proposed Amendment Summary

CCM operate three (3) regulated structures on the site as part of the water storage system: the Esperanza Tailings Storage Facility (ETSF), the EPit, and the Mill Creek Dam (MCD) (**Figure 1**). The three structures are operated as an integrated containment system with a shared Design Storage Allowance (DSA) volume across the system. Though the DSA and Mandatory Reporting Level (MRL) for this system are shared, individual DSA and MRL levels for the EPit and MCD are prescribed by the EA.

The EPit is a decommissioned former open pit that ceased mining in 2005 and is now a regulated dam for water and tailings storage (2017-2022). The MCD is a valley embankment dam and provides is the main water source for operational water demands. The ETSF is an engineered tailings storage facility (TSF) currently used for the storage of tailings. The ETSF is not used for water storage with minimal decant water storage situated at least 100 m from the embankments. While the ETSF is a part of the integrated containment system, it is not the subject of this application.

CCPL are seeking an amendment to the EA to change the shared DSA, based on the results of updated water balance modelling for the site. The proposed amendment (the amendment) is to change the combined DSA from 1903.2 ML to 852.6 ML. This will be reflected in the individual DSA levels as follows:

- EPit DSA will change from 1,409.2 ML (207.7 m AHD) to 496.8 ML (217.2 m AHD)
- MCD DSA will change from 494 ML (216.1 m AHD) to 355.8 ML (216.1 m AHD)

The change to the volume of the DSA in the MCD is necessitated only by the updated storage curve that has been calculated based on latest site bathymetric and LiDAR surveys captured during June 2023, and is presented and discussed within the Water Balance Model report (Appendix A of the System Design Plan (**Appendix 1**)).

CCM currently stores tailings in the ETSF approved within the EA and has available storage capacity that is expected to last until early 2024. Once this capacity has been reached, it is intended to recommence deposition of tailings into the EPit while obtaining approval for TSF3. The amendment will enable CCPL to recommence tailings deposition to the EPit, to a maximum level of 215.7 m AHD, whilst still achieving DSA requirements. Based on current projections, the storage of tailings within the EPit to a maximum level of 215.7 m AHD will provide capacity for approximately 960 ML of tailings, which equates to 11 months of storage.

Allowance for tailings deposition into the EPit to 202 m AHD was previously approved as a part of an EA Amendment approved in 2017. This approval authorised storage of tailings in the EPit up to a level of 202 m AHD, which was limited by the (then) modelled DSA (204 m AHD) and allowing for an average of 2 m of water cover over the tailings.

The deposition of tailings into the EPit ceased in 2022. Bathymetric surveys show that the floor level of the EPit currently has a lowest elevation of 200.8 m AHD. The deposition of tailings into the EPit is already an authorised activity in Schedule A – Table 1 (Authorised Disturbance) of the EA and does not require any changes to this table in the EA to enable CCPL to recommence this activity. However, tailings management plans have been updated for the purposes of this application.

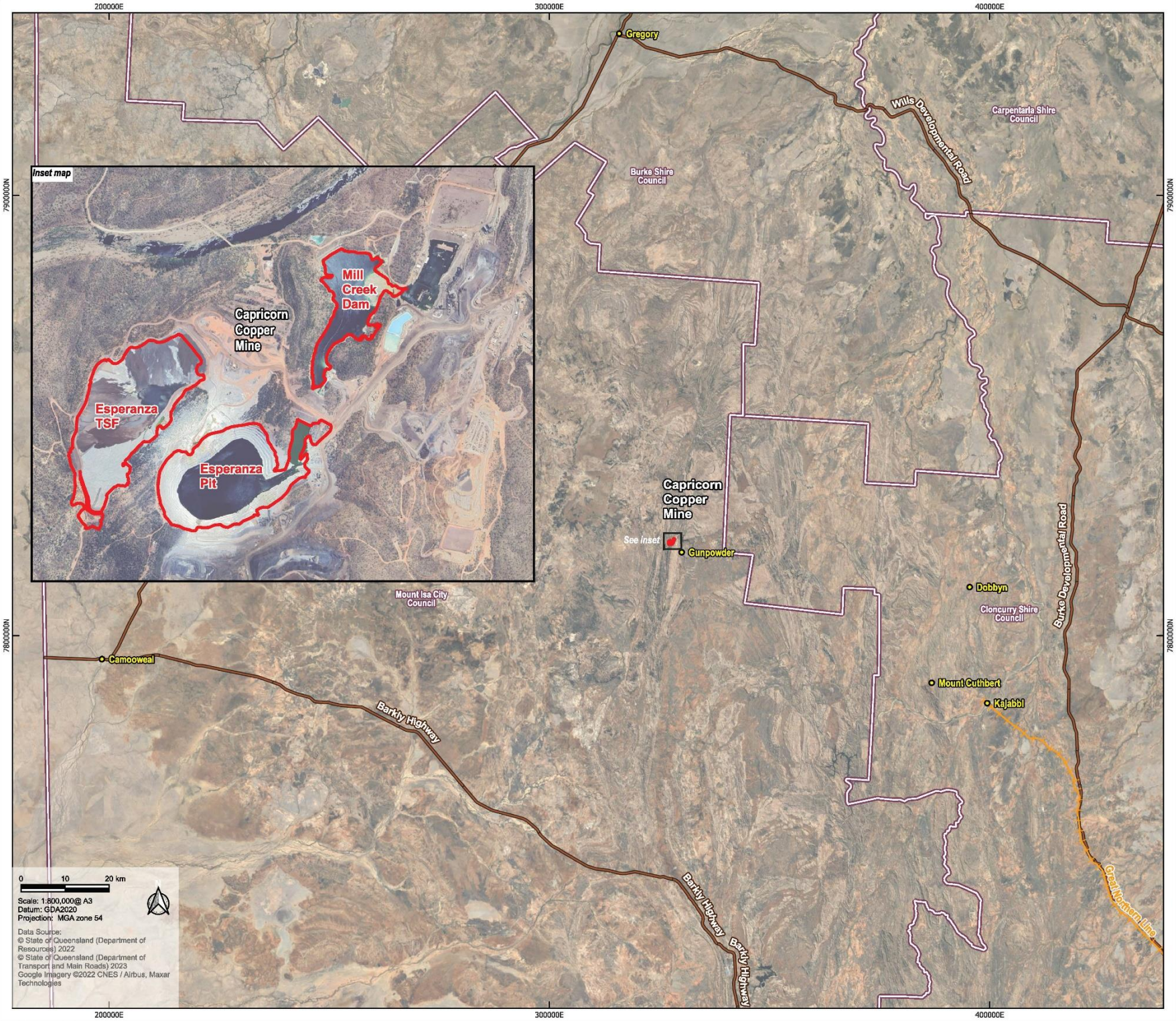
The three regulated structures operating as the integrated containment system require a certified System Design Plan (SDP) in accordance with the requirements of the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* Version 5.02 (DES, 2016) (the Manual) and the EA.

The proposed amendments are supported by the SDP for the regulated structures that comprise the integrated containment system, which has been certified by a suitably qualified and experienced person in accordance with the Manual. The SDP demonstrates how the regulated structures will be managed as part of an integrated containment system for the purpose of sharing the DSA volume and managing risks to environmental values.

The following supporting technical assessments, including design, modelling and management of the regulated structures to support the EA Amendment application, demonstrate that risks associated with the change to the DSA and tailings deposition within the EPit are well understood and will be adequately managed:

- *System Design Plan* (SDP) (**Appendix 1**), which contains the following key documents referred to in this report:
  - Appendix A - Water Balance Model Report (WBM)
  - Appendix B - *Operation, Maintenance and Surveillance Manuals (OMS Manuals)*
- *Esperanza Pit, Esperanza TSF and Mill Creek Dam Consequence Category Assessment (CCA)* (**Appendix 2**)
- *Tailings Management Plan (TMP)* (**Appendix 3**)

No changes are proposed to the MOL or the prescribed hydraulic criteria for the ETSF.



Legend

- Site boundary
- Local Government Areas
- State controlled roads
- Railways

Capricorn Copper Pty Ltd
Capricorn Copper Mine, Queensland
EA Amendment Supporting Report

Figure 1
Regional context

2. Administrative Matters

2.1. Application Particulars

The particulars of the EA Amendment Application (the subject of this report) are summarised in **Table 3.**

Table 3 EA Amendment Application Particulars

Aspect	Application Details
Applicant	Capricorn Copper Pty Ltd
EA Holder	Capricorn Copper Pty Ltd
Project Name	Capricorn Copper Mine
Applicant Contact	Dr. Geraldine McGuire Capricorn Copper Mine C-\ NQX Depot. North Ridge Rd Mt Isa QLD 4825
Site Location	Gunpowder, Queensland
EA Number	EPML00911413
Environmental Authority (EA) application type	Application to amend a site-specific environmental authority
Authorised Environmentally Relevant Activities (ERAs)	▪ Schedule 3 17: Mining copper ore ▪ Ancillary 08 - Chemical Storage 1: Storing a total of 50t or more of chemicals of dangerous goods class 1 or class 2, division 2.3 under subsection (1)(a) ▪ Ancillary 08 - Chemical Storage 3: Storing more than 500 cubic metres of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3 under subsection (1)(c) ▪ Ancillary 31 - Mineral processing 2: Processing, in a year, the following quantities of mineral products, other than coke (b) more than 100,000t ▪ Ancillary 33 - Crushing, milling, grinding or screening Crushing, grinding, milling or screening more than 5000t of material in a year

2.2. Assessment Level

CCPL and its technical advisers have reviewed the minor EA amendment thresholds outlined within Section 4.1.1 of the *Major or minor amendments' guideline* (ESR/2015/1684 Version 11.00). On this basis, and consistent with the successful 2017 EA amendment application that previously authorised deposition of tailings in the EPit, CCPL considers that the current application should be assessed as a *minor amendment*. CCPL's consideration of the assessment level is outlined in **Table 4**.

Table 4 Cross reference of Section 4.1.1 Minor EA Amendment (threshold criteria)

Section 4.1.1 A minor amendment (threshold) for an EA is an amendment that:	
a) is not a change to a condition identified in the authority as a standard condition, other than – i) a change that is a condition conversion; or ii) a change that is not a condition conversion but that replaces a standard condition of the EA with a standard condition for the ERA to which the EA relates; or iii) a change that will not result in a change to the impact of the relevant activity on an environmental value; and	The application includes no changes to any standard conditions.
b) does not significantly increase the level of environmental harm caused by the relevant activity; and	The amendment will not result in a significant increase in the level of environmental harm caused by the relevant activity as described within this document. The amendment will be contained within the existing disturbance footprints of the site. Key risks associated with water management and tailings will be managed through the proposed operational documents: ▪ Tailings Management Plan (**Appendix 3**) ▪ Operation, Maintenance and Surveillance Manuals (Appendix B of the System Design Plan (**Appendix 1**))

Section 4.1.1 A minor amendment (threshold) for an EA is an amendment that:	
	The potential impacts to environmental values have been discussed in **Section 6**, and a risk assessment provided in **Section 8**.
c) does not change any rehabilitation objectives in the EA in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the EA; and	The amendment does not change any rehabilitation objectives in the EA.
d) does not significantly increase the scale or intensity of the relevant activity; and	The amendment does not significantly increase the scale or intensity of the relevant activity. The volume of material being processed will not materially change, with tailings production volumes estimated to remain in the order of 1.5 Mtpa to 2 Mtpa.
e) does not relate to a new relevant resource tenure for the EA that is – i) a new mining lease; or ii) a new petroleum lease; or iii) a new geothermal lease under the *Geothermal Energy Act 2010*; or iv) a new greenhouse gas injection and storage lease under the *Greenhouse Gas Storage Act 2009*; and	The amendment does not relate to a new relevant resource tenure and will be conducted on the existing mining leases (MLs).
f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area; and	The amendment does not increase the surface area for the relevant activity. It is to be undertaken within existing approved disturbance footprints.
g) for an EA for a petroleum activity: i) involves constructing a new pipeline that does not exceed 150km in length; and ii) involves extending an existing pipeline by no more than 10% of the existing length of the pipeline; and	Not applicable.
h) if the amendment relates to a new relevant resource tenure for the EA that is an exploration permit or greenhouse gas permit - the amendment application seeks an EA that is subject to the standard conditions for the relevant activity, to the extent it relates to the permit.	Not applicable.

3. Site Description

3.1. Location

CCM is located wholly within the Mount Isa City Council local government area (LGA), approximately 2.5 kilometres (km) north-west of the town of Gunpowder in the Mount Isa Mining District and approximately 120 km north of Mount Isa. The subject of this application is the EPit and the MCD, which are shown in the context of the mine in **Figure 2**.

3.2. Tenure

The tenures associated with the amendment are outlined in **Table 5**.

Table 5 Tenure Associated with the Amendment

Infrastructure	Area (ha)	Location (GDA94)	Mining Lease	Lot on Plan	Tenure
Esperanza Pit and Tailings Disposal	26.19	Latitude S 19° 41' 56.93" Longitude E 139° 21' 26.56"	ML5486, ML5443, ML5430, ML5442, ML5485, ML5412, ML5549, ML5420, ML5457 & ML 5548	Lot 5 on CP865892	Lands Lease
Mill Creek Dam	10.59	Latitude S 19° 41' 32.13" Longitude E 139° 21' 45.32"	ML5429, ML5486, ML5467, ML5407, ML5485, ML5419 & ML5563		

3.3. Surrounding Land-Use

The amendment relates to the EPit and MCD, which are located within the CCM. The surrounding land uses to the mine site are rural in nature, and the land is predominantly used for cattle stations.

As described in **Section 4**, the primary environmental values in the vicinity of CCM are Gunpowder Creek and Waggaboonya Lake.

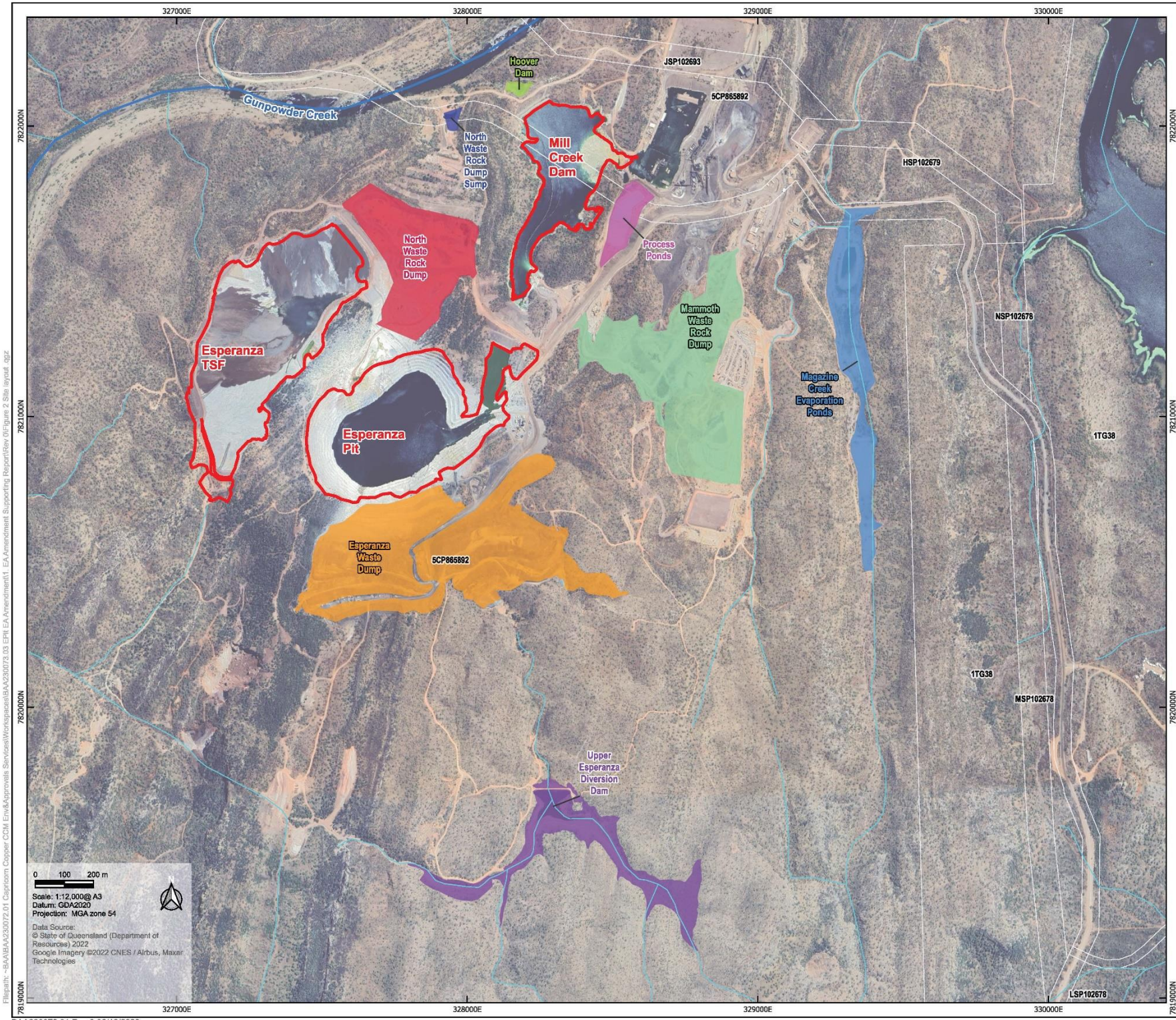
3.4. Sensitive Receptors

Mining operations are located within Gunpowder Creek catchment. Gunpowder Creek runs adjacent to CCM and 100 km north-east joins the Leichhardt River before flowing into the Gulf of Carpentaria. The accommodation camp associated with the mine is located approximately 3 km to the south-east of the site and is the closest receptor.

The nearest sensitive receptors to the site are identified in **Table 6** and shown **Figure 3**.

Table 6 Nearby Sensitive Receptors

Sensitive Receptor	Approximate Distance from Site	Direction
Mine accommodation camp	3 km	South-east
Bortala Homestead	12 km	East
Bar Creek Homestead	12 km	North-west
New Chidna Homestead	21 km	North



epic ENVIRONMENTAL

Legend

- Site boundary
- Cadastre (DCDB)
- Esperanza Waste Dump
- Hoover Dam
- Magazine Creek Evaporation Ponds
- Mammoth Waste Rock Dump
- North Waste Rock Dump
- North Waste Rock Dump Sump
- Process Ponds
- Upper Esperanza Diversion Dam

Watercourses

- Major
- Minor

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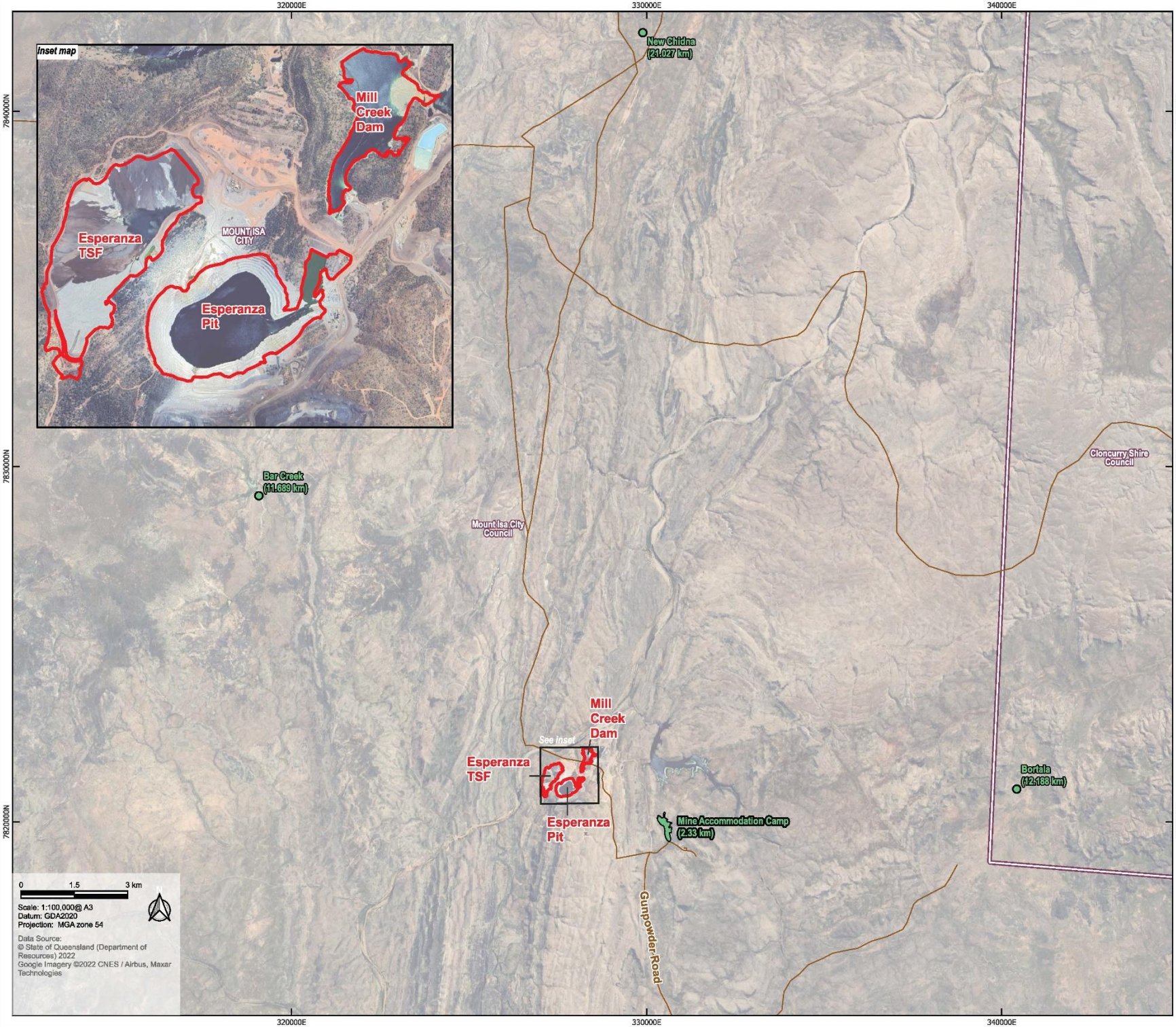
Figure 2
Site layout



epic ENVIRONMENTAL

Legend

- Site boundary
- Local Government Areas
- Mine Accommodation Camp
- Roads and tracks
- Homesteads

Note: Distance in brackets indicates each sensitive receptor's proximity to Esperanza Pit.

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Figure 3
Sensitive receptors

4. Existing Environmental Values

The following section describes the existing environmental values and the surrounding environment relevant to the amendment activities.

The EPit and MCD are enclosed within the mine site on existing MLs, and reside within 1 km of two drainage networks: Gunpowder Creek, approximately 880 m to the north at its closest point; and the ephemeral Magazine Creek, approximately 1 km to the east. Waggaboonya Lake is located approximately 2 km to the north-east.

No additional disturbance is proposed, and the activity will be contained completely within the authorised disturbance footprint under the EA.

4.1. Climate

The climate for the CCM area is typical of the region, with high daytime temperatures in the summer months and mild winters. The climate is classified as sub-tropical and semi-arid.

The closest long term synoptic weather station to CCM is the Mount Isa Aero (Station 29127), located south-east of the mine and has been in operation from 1966 to present. Temperature and rainfall data have been obtained from the Mount Isa Aero Weather Station using the latest available data (from 9 November 2023) (BoM 2023). This data has been analysed to determine indicative temporal fluctuations in weather patterns outlined in **Table 7**. Key climate observations include:

- Mean annual rainfall is 460.7 mm
- January has the highest mean monthly rainfall with 115.2 mm
- Mean maximum temperature ranges from 24.9°C in July to 36.6°C in January and November, with a annual mean temperature of 32°C
- Mean minimum temperature ranges from 8.7°C in July to 23.9°C in January

Table 7 Long Term Climate Data from the Mount Isa Aero Weather Station

Month	Temperature (°C)		Relative humidity (%)		Wind speed (km/h)		Rainfall (mm)		
	Mean Max	Mean Min	9am	3pm	9am	3pm	Mean Monthly	Highest Daily	Highest Monthly
Jan	36.6	23.9	52	35	11.8	14.3	115.2	213.0	535.2
Feb	35.5	23.3	58	38	11.0	13.9	101.9	123.2	278.2
Mar	34.5	21.8	49	32	12.0	14.3	66.9	130.0	276.6
Apr	32.1	18.5	42	27	13.3	14.0	13.3	44.6	167.8
May	27.9	13.9	46	29	11.4	12.8	11.4	106.4	176.4
Jun	25.0	10.0	50	28	10.2	13.1	6.7	54.8	111.8
Jul	24.9	8.7	45	25	10.1	13.0	7.5	78.4	84.2
Aug	27.5	10.2	37	20	12.1	13.8	3.3	26.6	41.8
Sep	31.5	14.2	31	18	15.1	13.4	8.7	70.3	117.0
Oct	34.9	18.5	29	18	16.2	13.8	19.1	39.2	91.4
Nov	36.6	21.5	33	22	15.2	13.8	38.8	102.4	205.6
Dec	37.4	23.1	41	27	13.4	13.6	72.0	115.0	275.2
Annual	**32.0**	**17.3**	**43**	**27**	**12.6**	**13.6**	**460.7**	**92.0**	**1092.4**

4.1.1.Rainfall

Rainfall at CCM is highly seasonal causing the area to have a distinctive wet season that occurs between November and March, with approximately 85% of the annual rainfall in the area falling within these months. This is further demonstrated through the comparison of a monthly mean rainfall of 3.3 mm in August to the monthly mean rainfall of 115.2 mm in January. The winter months tend to have a monthly mean rainfall of below 10 mm.

4.1.2.Wind

A wind rose of measured wind data from December 1966 to August 2023 at Mount Isa is shown in **Figure 4**. It indicates that the CCM area is dominated by south-easterly winds.

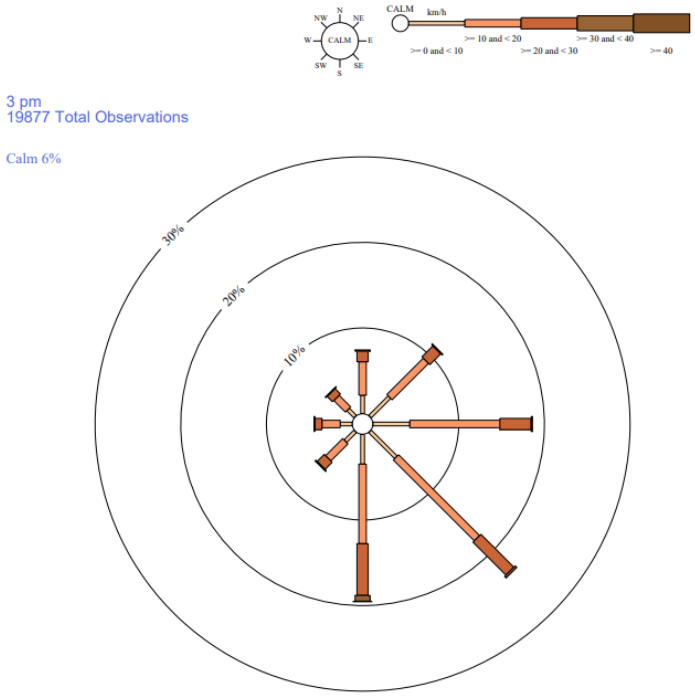


Figure 4 Wind Rose for Average 3pm Observations at Mount Isa (1966 to 2023)

4.2. Land

4.2.1. Topography

CCM is located in the mountainous Mt Isa highlands with the elevation ranging from 190 m AHD at Gunpowder Creek to 310 m AHD at the mine site (**Figure 5**).

4.2.2. Geology

The geology of the area comprises of Eastern Creek Volcanics, which include meta-basalts interbedded with sandstone, siltstone and quartzite (**Figure 6**). The Eastern Creek Volcanics are structurally confined by the Wedgetail Fault to the west and the Esperanza Fault to the east. Quartzite ridges bound the eastern and western sides the CCM. Rock strata found within the CCM area are steeply dipping to the north-west (GHD, 2021).

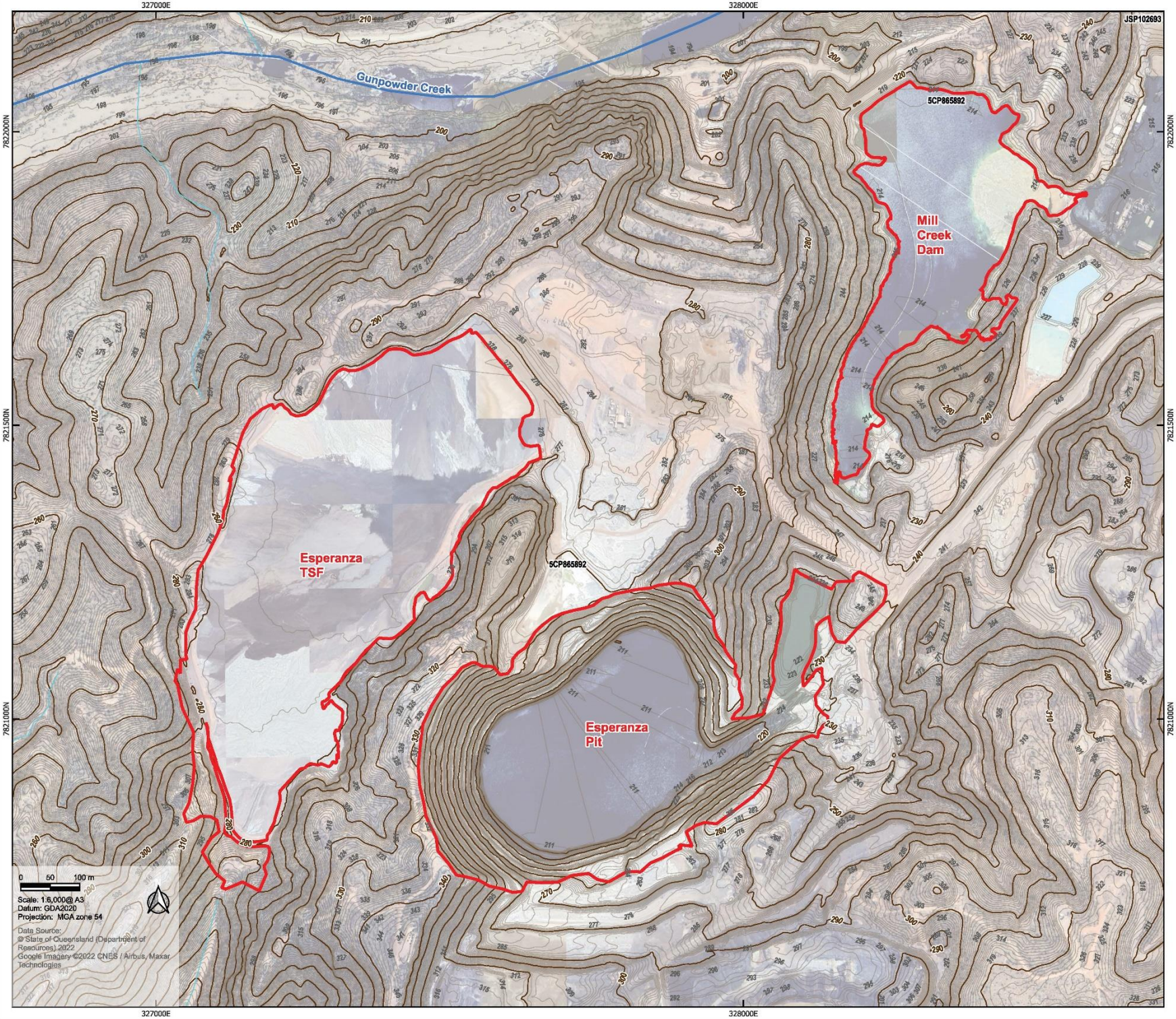
The EPit specifically lies within an area of regionally metamorphosed sedimentary rocks, (originally mudstones to sandstones with some limestone) and igneous rocks (metabasalts) (GHD, 2017b). The EPit is also situated over the Mammoth extended fault, with the Esperanza fault and Mammoth fault residing along the north and south of the EPit, respectively.

The MCD lies within the Paradise Formation, which is dominated by siltstone, dolomite and dolomitic siltstone.

Fracturing due to tectonic stress is present within the metasediments and metavolcanics has resulted in various faults at the surface and intersecting the EPit. Due to post-tectonic metamorphism and alteration, however, these tectonic fractures have been almost totally sealed by haematite/chlorite/quartz mineralisation (GHD, 2017a). This has been noted in the Mammoth underground workings (M. Thomas, 2013 pers. comm.), where faults are filled with soft chlorite/haematite mineralisation, and groundwater inflow is distributed throughout the workings as general seepage with no significant areas or preferential inflow.

Observations of short-term flows from some faults for a few days immediately after rain indicate that any connectivity of the faults with shallow aquifers or surface is local only. It is also considered likely that there is localised interconnection of the faults immediately adjacent to the mine to the surface through the numerous exploration holes drilled through the ore body.

Another significant observation from previous studies is that the shallow bores show a rapid response to rainfall events but with a water level range of approximately 1 m. The deep bores also show only a limited change in water levels over time, but with a significant lag time after rainfall, of approximately 2-3 months, suggesting very low permeability (GHD, 2013).



epic ENVIRONMENTAL

Legend

- Site boundary
- Cadastre (DCDB)

Watercourses

- Major
- Minor

Elevation contour (mAHD)

- 1 m interval
- 10 m interval

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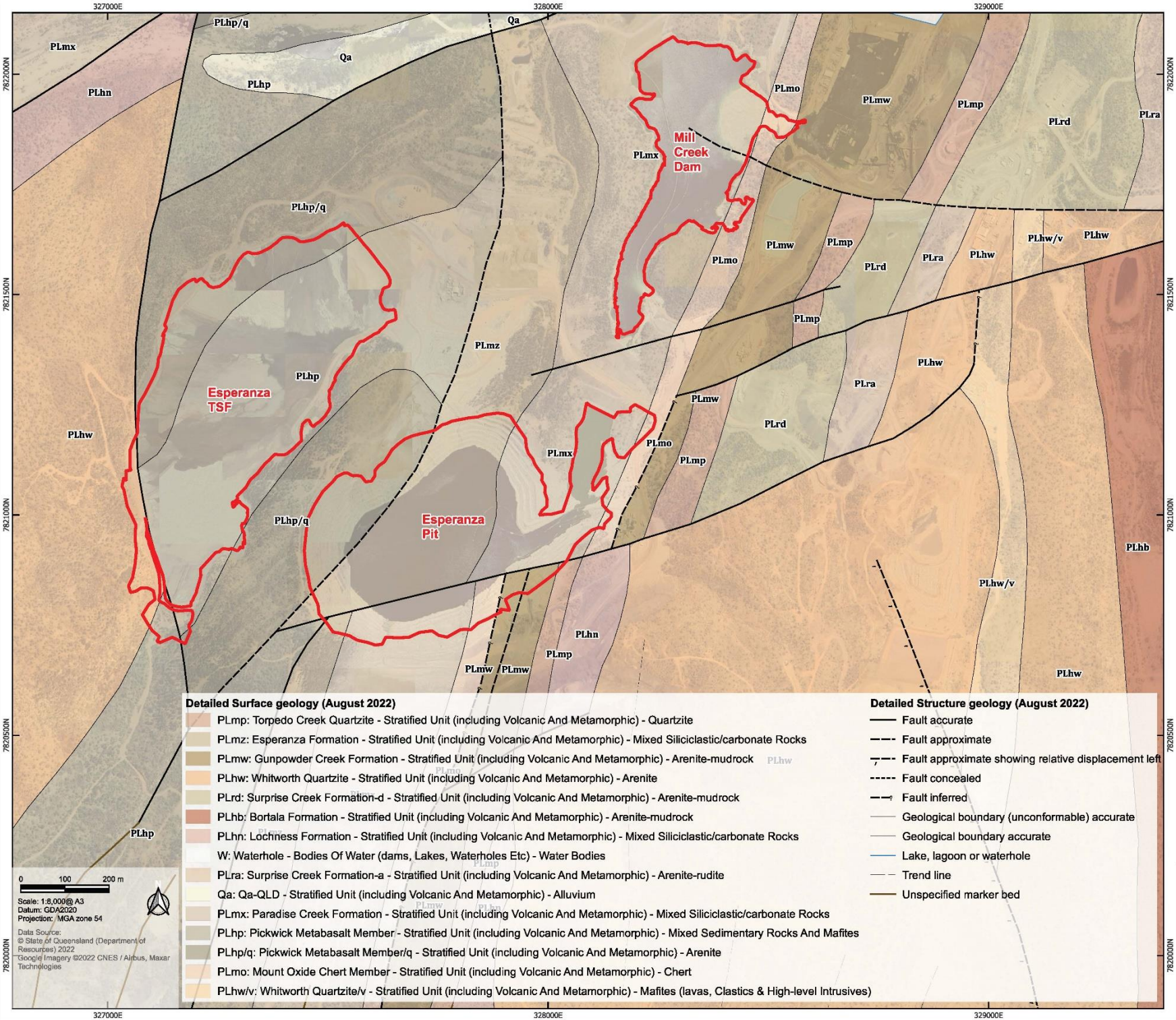
Figure 5
Topography



epic ENVIRONMENTAL

Legend

Site boundary

Capricorn Copper Pty Ltd
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Figure 6
Geological setting

4.2.3. Areas of Regional Interest

The *Regional Planning Interests Act 2014* (RPI Act) establishes four areas of regional interest managed under the Act: Priority agricultural areas (PAAs); Priority living areas (PLAs); Strategic environmental areas (SEAs); and Strategic cropping areas (SCAs). There are no areas of regional interest mapped near CCM. The closest is a Strategic Environmental Area 18 km to the north-west of the site.

4.3. Surface Water

4.3.1. Catchment Overview

CCM is located within the Gunpowder Creek Catchment comprising of a series of small ridges and dissected hills, drained by small stream channels, which follow in a northerly direction into Gunpowder Creek (**Figure 7**).

Gunpowder Creek is the major drainage network in the region and joins the Leichhardt River approximately 100 km north-east of the mine before flowing into the Gulf of Carpentaria. Gunpowder Creek flows around the western side of CCM and cuts across to the north-east, coming to within 200 m of the MCD wall.

Wagaboonya Lake is on a tributary, discharging to Gunpowder Creek from the east about 900 m downstream of the site.

All the creeks and drainage lines are ephemeral and only flow during the wet season after rainfall events, with the possible exception of Gunpowder Creek, which could be either ephemeral or non-perennial in nature, depending on the season. The upper reaches of Gunpowder Creek adjacent to the mine are typically ephemeral with permanent rock pools which flow during the wet season.

The EPit and MCD catchments have been identified within the WBM (Appendix A to the SDP (**Appendix 1**)). These catchment areas have been considered within the modelling and underpin the assumptions that have gone into the determination of the proposed DSA amendment.

4.3.2. Watercourses and Wetlands

CCM is located in the Leichardt River sub-basin and is situated along Gunpowder Creek. Greenstone Creek runs adjacent to CCM and flows into Waggaboonya Lake. Gunpowder Creek flows into the Leichardt River approximately 100 km downstream from CCM, which ultimately drains into the Gulf of Carpentaria.

The sections of Gunpowder Creek and Greenstone Creek that run adjacent to the mine were classified by NRA (2021) as highly disturbed. Downstream from CCM, Gunpowder Creek is considered moderately disturbed.

The most recent Receiving Environment Monitoring Program (REMP) Report prepared by Hydrobiology (2023) demonstrates that there has been no notable impact from CCM on the habitat, stream flow, or macroinvertebrate communities of the adjacent and downstream aquatic environment.

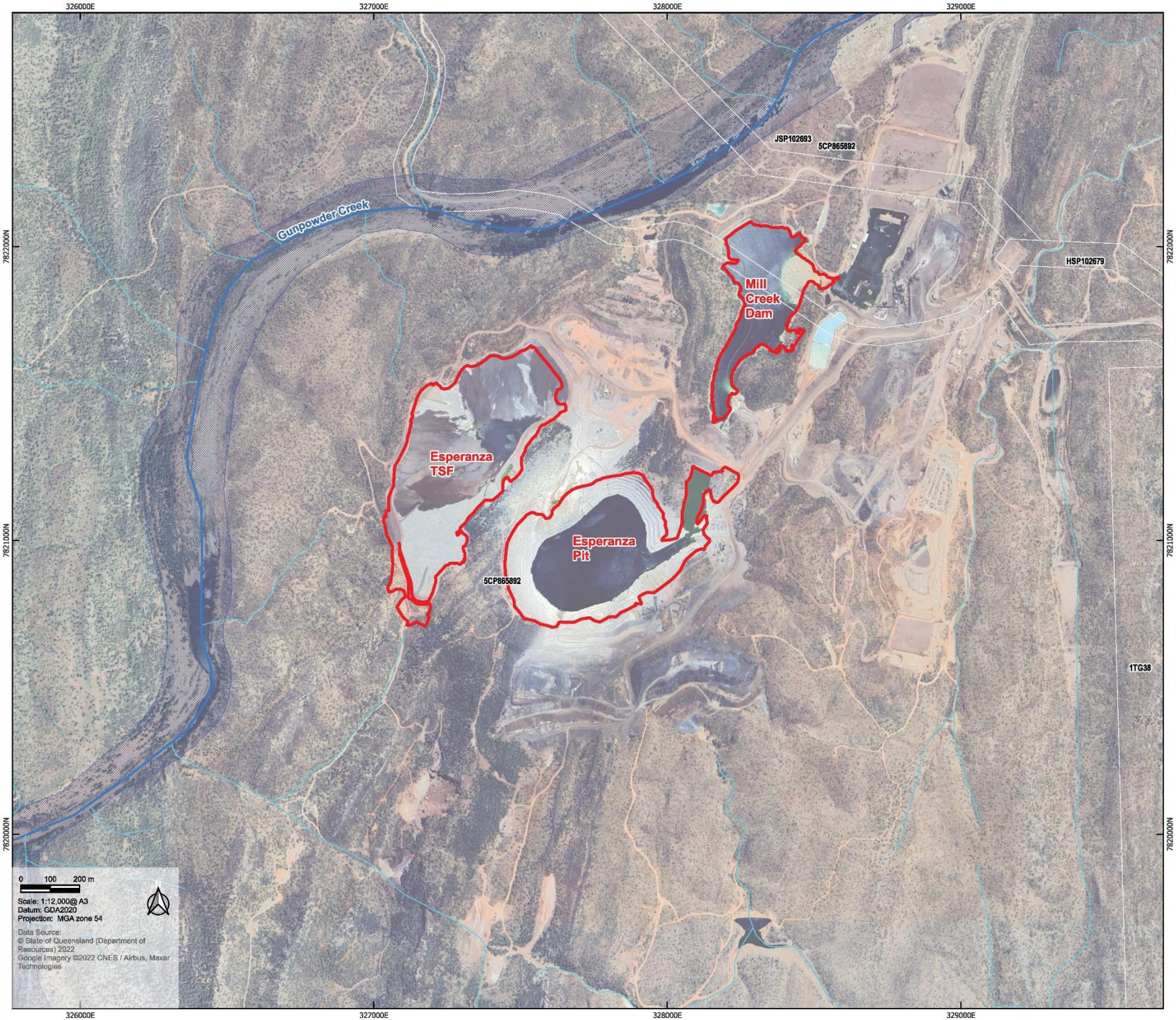
Figure 7 shows the location of the watercourses and mapped wetlands in relation to the site. The only mapped wetlands in the vicinity of CCM relate to the riparian areas of Gunpowder Creek.

EVs are not nominated under the Queensland *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* for the Leichhardt River basin. However, EVs for the CCM receiving environment were nominated in an Environmental Evaluation (NRA, 2012) and have been reported against in the annual REMP Report (Hydrobiology, 2023). The EVs for Gunpowder Creek and Greenstone Creek are presented in **Table 8**.

Table 8 Nominated EVs for Gunpowder Creek (adjacent to and downstream of CCM) and Greenstone Creek

Environmental Value	Gunpowder Creek (adjacent to CCM)	Gunpowder Creek (downstream of CCM)	Greenstone Creek (downstream of confluence with Magazine Creek)
Aquatic Ecosystems	Highly disturbed	Moderately disturbed	Highly disturbed
Primary Industries (Stock Watering)	Livestock drinking water	Livestock drinking water	Livestock drinking water
Recreation and Aesthetics	Visual recreational use	Secondary recreational use	Visual recreational use
Industrial	Mining	Mining	Mining
Cultural and Spiritual	Cultural and Spiritual	Cultural and Spiritual	Cultural and Spiritual

Source: NRA (2012). The EVs in the table were nominated as part of an Environmental Evaluation for CCM.



epic ENVIRONMENTAL

Legend

- Site boundary
- Cadastre (DCDB)

Wetland areas (Qld Wetland Mapping v6.0)

- Riverine Wetlands (hydrologically natural)

Watercourses

- Major
- Minor

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Figure 7
Watercourses and wetlands

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4.4. Groundwater

There are three main types of groundwater occurrences in the vicinity of CCM: shallow perched aquifers; fractured rock aquifers; and solution cavity aquifers. The shallow perched aquifers are found in the surficial sediments along the sides and floor of valleys and are small and ephemeral. These aquifers generally only contain water following significant rain events prior to infiltration to the underlying rock aquifers.

The fractured rock aquifers are best developed in the near-surface zone with a depth of up to 30 m. The solution cavity aquifers are locally developed in the dolomitic siltstones and in the deeply weathered zone above the Esperanza ore deposit.

The main groundwater system is hosted within the fractured rock aquifers at depths up to 100 m below the surface. This aquifer generally hosts the water table, with groundwater elevation influenced by factors such as topography and site infrastructure.

The interaction of water in the EPit with groundwater has been assessed and discussed in detail in previous studies and is well-defined. Descriptions of the groundwater values have previously been presented in GHD (2013 and 2020). These reports describe a range of analyses of the groundwater regime around the EPit and an analysis of groundwater quality data to determine the following conclusions:

- Ambient groundwater levels around the EPit are relatively high comparative to the DSA for the EPit, providing a hydraulic barrier to outward flow up to 222 m AHD.
- The permeability of the deep bedrock surrounding the EPit is so low that, even in the absence of a hydraulic barrier and with elevated pit water levels, deep seepage from the EPit to Gunpowder Creek would not be measurable, nor would it result in a significant increase in contaminant loading to Gunpowder Creek.
- Seepage through the surficial aquifer, were it to occur, would discharge to the MCD and cannot discharge untreated below the MCD embankment due to the hydraulic barrier formed by the ponded water behind the dam. Additional safety is provided by the Hoover dam downstream.
- If seepage can flow through some as yet unidentified pathway to the north of the EPit, it would be intercepted by the North Rock Dump interception trench (sump).

Technical studies regarding groundwater and seepage undertaken by GHD, Engeny, and ATC Williams have concluded that raising the water levels to the MOL in the EPit up to 222 m AHD was not a significant risk, in terms of both likelihood and consequence, to water quality in Gunpowder Creek.

CCM is not located within a mapped groundwater management area and there are no mapped groundwater dependent ecosystems or potential groundwater dependent ecosystems over or near the site (GHD, 2021b).

4.5. Surface Water and Groundwater Monitoring

A monitoring program is in place at CCM which includes:

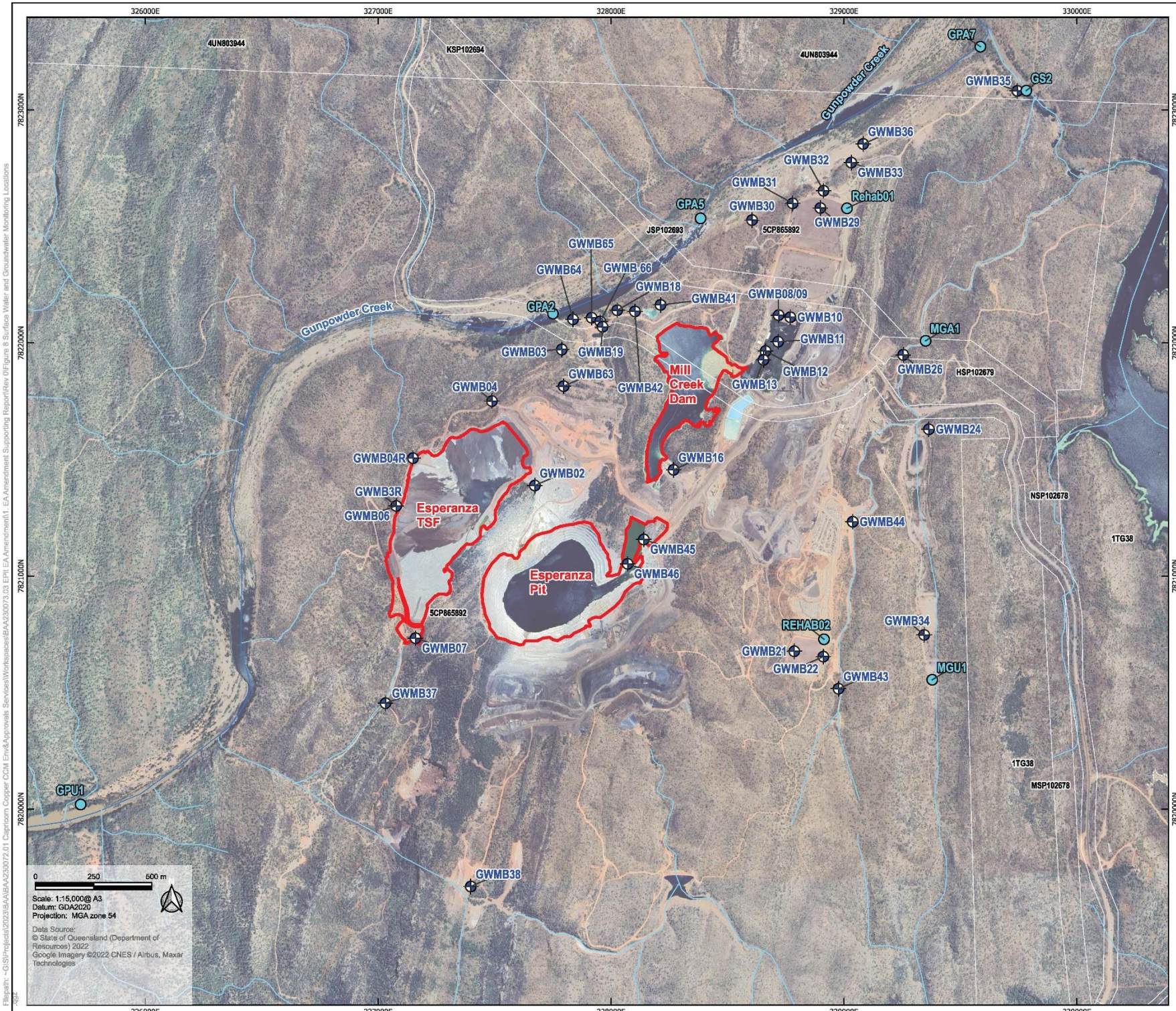
- Regular groundwater level monitoring
- Surface and groundwater quality
- Various seepage management and water treatment systems

The site is required under the conditions of its EA to provide annual monitoring reports discussing the results of the monitoring and potential impacts to the environment. These are undertaken as below:

- Condition C4-3 - annual monitoring and reporting undertaken by a suitably qualified person and discussed in a Receiving Environment Monitoring Program (REMP) report
- Condition C6-1 - annual monitoring and reporting undertaken by a suitably qualified person and discussed in a Groundwater Monitoring Report

CCM has approximately 35 compliance monitoring bores as referenced in Schedule C – Table 5 of the EA. Monitoring for groundwater quality characteristics is undertaken quarterly, with a typical water quality analysis included the standard in situ water quality parameters, and laboratory analysis inclusive of metals, nutrients, major ions, and alkalinity. Standing water levels (SWL) are measured monthly.

The current groundwater monitoring bores and surface water monitoring locations are provided in **Figure 8**. The existing groundwater monitoring network is proposed to be significantly enhanced, adopting the same monitoring parameters and frequency as defined in the EA for compliance groundwater monitoring bores.



Filepath: ~G:\S\Projects\2023\BAA\BAA230072.01 Capricorn Copper COM Env&Approvals Services\Workspaces\BAA230073.03 EPI EA Amendment\1 - EA Amendment Supporting Report\Rev 0\Figure 8 Surface Water and Groundwater Monitoring Locations

epic ENVIRONMENTAL

Legend

- Site boundary
- Cadastre (DCDB)

Watercourses

- Major
- Minor
- Groundwater monitoring well
- Surface water monitoring location

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Figure 8
Surface water and groundwater monitoring locations

4.6. Flora and Fauna

4.6.1. Matters of National Environmental Significance

A Protected Matters Search Report under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was undertaken for CCM (**Appendix 4**). No protected places, protected areas, protected wetlands and/or listed threatened ecological communities were identified by the search within the 2 km of the mine site.

A number of listed threatened species and migratory were identified as potentially occurring within 2 km of the mine site. However, given that CCM has previously been in operation and subjected to significant ground disturbance, and that there will be no additional disturbance as, it is considered unlikely that listed threatened species will be impacted.

4.6.2. Matters of State Environmental Significance

A Matters of State Environmental Significance Search (MSES) Report was requested for CCM to establish biodiversity state interests under the State Planning Policy (SPP) (**Appendix 5**). No protected areas, strategic environmental areas, high ecological significance wetlands or waters, threatened species and / or iconic species, or legally secured offset areas were identified by the search occurring in the vicinity of the amendment area.

The search identified the following MSES in proximity to CCM:

- 8e Regulated Vegetation – intersecting a watercourse
- 8f Regulated Vegetation – within 100 m of a Vegetation Management wetland (Category B Map Number 6758)

The regulated vegetation intersecting a watercourse is associated with Gunpowder Creek, and the regulated vegetation within 100 m of a wetland is associated with Waggaboonya Lake. However, given that CCM has previously been in operation and subjected to significant ground disturbance, and that there will be no additional disturbance as, it is considered unlikely that listed threatened species will be impacted.

4.7. Cultural Heritage

4.7.1. Indigenous Cultural Heritage

CCM is located on the lands of the Kalkadoon Nation family clans, who are recognised as the Traditional Owners over 38,719 km^2 of land and waters awarded by a consent determination in 2011. The Kalkadoon Nation family clans are represented by the Kalkadoon Prescribed Body Corporate (PBC).

In 2017, Capricorn Copper and the Kalkadoon Native Title Aboriginal Corporation entered into an agreement titled 'Agreement Relating to Native Title and Mining'. The agreement covers the entire Determination Area including areas where native title rights and interest exists.

4.7.2. Non-Indigenous Cultural Heritage

CCM is a highly disturbed area and there is no non-indigenous cultural heritage in the vicinity of the amendment area. The EPit is an existing surface disturbance.

4.8. Social and Economic

4.8.1. Stakeholder Identification

CCPL respects the rights and interests of individual citizens, relevant organisations, and the communities in which it operates. Integral to the development of a stakeholder engagement is identifying stakeholders, understanding their concerns and areas of interest, and engaging with stakeholders to ensure they have a good understanding of CCM. Key stakeholder groups/categories important to the operation of CCM are identified in **Table 9.**

Table 9 Key Stakeholders

Stakeholder Group	Stakeholders
Landholders	Calton Hills Station Barr Creek Station Bortala Pastoral Chidna Station Others – not direct neighbours of the mine
Communities (local surrounding)	Mt Isa Region
Indigenous groups and organisations	Kalkadoon Native Title Aboriginal Corporation RNTBC (Kalkadoon PBC
State Government Departments	Department of State Development, Infrastructure, Local Government and Planning Office of Coordinator-General [1] Department of Environment and Science Department of Resources Department of Regional Development, Manufacturing and Water
State Government Ministers and Members	Deputy Premier and Minister for State Development, Infrastructure, Local Government and Planning Minister for Environment & Science Minister for Mining & Resources Local Member for Traegar
Regional Council elected members (Mt Isa City Council, Cloncurry Shire Council)	Mayor Divisional Councillor
Regional Council Officers	CEO Relevant Council Officers
Non-government organisations, environmental groups, special interest groups	Southern Gulf Natural Resource Management Northwest Wildlife Carers
Local business	Cattle Stations Steelcon Cava RJD Trucking
Industry Groups	Mount Isa to Townsville Economic Development Zone Inc (MITEZ) Australasian Institute of mining and metallurgy (AUSIMM) Commerce Northwest (formerly, Mt Isa Chamber of Commerce) Women in Mining and Resources Qld (WIMARQ) Association of Mining and Exploration Companies (AMEC) International Copper Association Australia
Neighbouring industry	True North Lady Lorretta Mine Lady Annie Mine Osborne Mine Mt Oxide Mine Mt Isa Mines George Fisher Mine Century Mine
School, childcare and training	Primarily those based in Mt Isa

[1] The Capricorn Copper "Recovery and Extension Project" is a declared *Prescribed Project* and *Critical Infrastructure Project*.

4.8.2.Community and Stakeholder Consultation

CMM has a Stakeholder Engagement Plan (the CCMSEP) which has been prepared to outline key objectives, performance indicators and methods adopted for engagement with relevant stakeholders and the surrounding community. The key objectives of the CCMSEP are:

- Building awareness, understanding and acceptance of the CCM operation by the community
- Developing an understanding of community and other stakeholder needs, concerns and expectations of CCM
- Establishing and maintaining community partnership that address/mitigate areas of concern

Effective stakeholder consultation involves exchanging information in a way that enables stakeholders the opportunity to participate in the decision-making process. For CCM, face-to-face engagement is the preferred method of contact for the community and stakeholders, where possible.

Recent Community Consultative Committee Meetings were held on 3, 11, and 26 October 2023. Discussion in these meetings included:

- Site water recycling and reduction improvements
- Bulk water treatment process and wet season releases
- Clean water diversion update
- Progress on the life-of-mine tailings strategy
- EPit tailings deposition plan
- Available community programs.

A focus of these discussions, consistent with CCPL's priorities for the site, was water management and tailings capacity, and the progress of CCM recovery activities following the extreme weather event in March 2023.

4.9. Air Quality

Environmental values associated with air quality are an airshed that is typical of a rural area impacted by agricultural activities; mining and exploration activities; and transport activities on unsealed roads. Existing potential sources of particulate emissions from the surrounding environment primarily comprise:

- Mining and exploration activities
- Grazing activities
- Sporadic traffic on unsealed roads
- Smoke from bushfires or controlled burning

Particulates are released to the environment from a range of mining activities. Sources include vehicle exhaust emissions, vehicles travelling on unsealed roads, loading and unloading ore and waste into haul trucks, transfer of stockpiled ore into crushers, crushing of ore, waste rock stockpile construction, rehabilitation earthworks and wind erosion on bare earth surfaces. Emissions (carbon monoxide, carbon dioxide, sulphur oxides and nitrous oxides) are emitted from vehicle/equipment exhaust emissions, hydrocarbon storage and use of reagents.

Potential impacts to air quality have been discussed in **Section 6.5**.

4.10. Noise

Environmental values associated with acoustic quality are typical of a rural area impacted by agricultural activities, mining and exploration activities, and transport activities on unsealed roads. There are no sources of noise or vibration above ambient levels except for sporadic cattle movement and the operation of the mine (including transport to the mine by road and air).

Potential impacts to acoustic quality have been discussed in **Section 6.6**.

5. Proposed Amendment

This section provides further information and justification regarding the specific amendments being sought through the current Application.

5.1. Description of Amendment

5.1.1. DSA and MRL Amendment

CCPL are seeking to undertake an amendment to the EA to change the DSA that applies to two (2) of the regulated structures in the site water storage system. This is an integrated containment system that shares an overall combined DSA, and the amendment proposes to change this combined DSA to 852.6 ML. This will be reflected in the individual DSA levels as follows and as shown in **Table 10**:

- EPit DSA will change from 1,409.2 ML (207.7 m AHD) to 496.8 ML (217.2 m AHD)
- MCD DSA will change from 494 ML (216.1 m AHD) to 355.8 ML (216.1 m AHD)

The change to the volume of the DSA in the MCD is necessitated only by the updated storage curve that has been calculated based on latest site bathymetric and LiDAR surveys captured during June 2023, and is presented and discussed within the WBM report (Appendix A of the SDP (**Appendix 1**)).

Proposed changes to the MRL are based on recalculation of the Extreme Storm Storage (ESS) allowance and consideration of wave runup for a 1:10 AEP.

The integrated containment system will be manged in accordance with the SDP (**Appendix 1**) and the supporting OMS Manuals.

Table 10 Proposed Changes to EA Table G – Table 1 (Regulated Dams)

Name of Regulated Dam	Consequence Category	Max Operating Level (m AHD)	Spillway Capacity Design Criteria	Design Storage Allowance (DSA)			Mandatory Reporting Level (MRL)		
				Design Criteria	Volume (ML)	Level (m AHD)	Design Criteria	Volume (ML)	Level (m AHD)
Esperanza TSF (ETSF)	High	284	1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind OR Probable Maximum Flood (PMF)	1:20 AEP 2 month wet-season plus process inputs during period.	DSA is provisioned within the Esperanza Pit. Excluding the ETSF decant sump area, the ETSF structure is to contain no surface water as at 1st November each year.		1:10 AEP, 72 hr duration	1:10 AEP, 72hr duration storm event containment is provisioned within the Esperanza Pit.	
Esperanza Pit	High	222	1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind OR Probable Maximum Flood (PMF)	1:20 AEP 2 month wet-season plus process inputs during period.	~~1409.2~~ **496.8**	~~207.7~~ **217.2**	1:10 AEP, 72 hr duration	~~443.4~~ **496.8**	~~217.9~~ **217.2**
Mill Creek Dam	High	219	1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind OR Probable Maximum Flood (PMF)	1:20 AEP 2 month wet-season plus process inputs during period.	~~494~~ **355.8**	216.1	1:10 AEP, 72 hr duration	~~234.6~~ **227.7**	~~217.7~~ **217.2**

5.1.2. EPit Tailings Deposition Amendment

Under the current EA the EPit is authorised for storage of mine-affected water and tailings – tailings deposition in the EPit was approved via an EA Amendment application in 2017 and approved by DES authorised storage of tailings in the EPit up to a level of 202 m AHD, which was limited by the DSA at the time (204 m AHD) while still allowing for an average of 2 m of water cover over the tailings.

From bathymetric surveys it has been estimated that the current level of tailings within the EPit is 200.8 m AHD (**Appendix 2**). The proposed amendment to the shared DSA, refer above, will accommodate additional tailings deposition up to a maximum level of 215.7 m AHD whilst still maintaining an average of 2 m of water cover over the tailings. Based on the production estimates, the EPit is expected to have a storage life of up to approximately 11 months.

The deposition of tailings into the EPit is already authorised within the EA (Schedule A – Table 1 (authorised Disturbance) and no amendments are required.

5.2. Description of Activities - Water Management System

5.2.1. Water Management System

CCM maintain and operate a water management system with the following principal objectives:

- Containment and storage of mine affected water runoff and seepage.
- Containment and dewatering of tailings stored in the ETSF.

- Maintaining reliable supply to operational water demands, including the improvements in the efficiency of mine water recycling to operational water demands to reduce reliance on external water supplies.
- Avoiding mine water accumulation through enhanced evaporation and authorised controlled releases of treated MAW.
- Clean water diversions dams and drains to improve performance of the mine water containment system.
- Sediment control.

The CCM water management system (WMS) consists of:

- Mine water storages.
- Tailings storage facilities (currently, ETSF).
- Underground workings and storages.
- Water transfer infrastructure, including pipelines and pumps.
- External (third party) water supplies.
- Primary Water Treatment Plant (WTP).[2]

Further details of the water management system are provided in the System Design Plan (**Appendix 1**).

5.2.2. Integrated Containment System

The three regulated structures at CCM - the EPit, ETSF and MCD - form the integrated containment system for CCM for the purpose of sharing the DSA volume across the system. Key features of each of the regulated structures are provided in **Table 11**. Further details of each structure are provided in the System Design Plan (**Appendix 1**).

Table 11 Capricorn Copper Mine Water Infrastructure

Storage	Maximum Operating Level (m AHD)	Maximum Operating Volume (ML)	Functional Description
Esperanza Pit	222	1,677.9	• Used to store mine affected water and tailings. • Receives pumped inflows from ETSF, Mammoth and Esperanza South Underground Mines. • Previously received brine from the RO plant – RO plant removed from site August 2023. • Storage of sludge from Pond 3 and 4 (expected to be online from Feb 2024) • Storage of sludge dredged from MCD following bulk treatment and release of MAW. • Transfers pumped outflows to MCD with option for in line water treatment. • Pump supply to high-efficiency mechanical evaporators (enhanced evaporation) • Receives seepage from Esperanza WRD • Receives seepage from Mammoth WRD
Mill Creek Dam (MCD)	219	756	• Used to store treated MAW • Receives pumped inflows from Sump 6, Hoover Dam and EPit • Supplies Pond 3 and 4 for water treatment via pumped outflows • Transfers pumped outflows to EPit • Receives seepage from EPit above 222 m AHD • Storage of sludge from water treatment (pumped from Pond 4) (cease early 2024) • Authorised pumped release of treated MAW to Gunpowder Creek
Esperanza TSF	284	Negligible water storage volume	• Used for tailings storage until exhaustion of ETSF Lift 1 (expected April 2024) • Receives pumped inflows from Saddle Dams 2 and 3 and tailings slurry from the Processing Plant • Transfers pumped outflows of decant water to EPit or Pond 3

[2] The existing primary WTP is offline following inundation and damage caused by the extreme weather event in March 2023. CCPL will replace the primary WTP with the new WTP planned to be in service before the end of 2025. An interim water treatment strategy has been successfully implemented since August 2023.

5.2.3. Hydraulic Performance Criteria

The three regulated structures are all assessed as having a significant consequence category for 'Failure to Contain – Spill' and a high consequence category for 'Dam breach' (**Appendix 2**). Therefore, all three storages are required to achieve the hydraulic performance criteria shown in **Table 12**.

Table 12 Hydraulic Performance Criteria

Hydraulic Performance Criteria	
Design Storage Allowance (DSA):	• 1:20 AEP 2 month wet-season plus process inputs during period.
Extreme Storm Storage (ESS) and Mandatory Reporting Level (MRL) is the greater of:	• The runoff from a 1:10 Annual Exceedance Probability (AEP) 72-hour duration storm; or • A wave allowance at 1:10 AEP
Spillway Capacity:	• 1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind; or • Probable Maximum Flood (PMF)

The combined system DSA for the integrated containment system is allocated between EPit and MCD.

The assessment of DSA, ESS and MRL requirements for the integrated containment system is further detailed in the WBM report (Appendix A of the SDP (**Appendix 1**)).

5.2.4. Design Storage Allowance

DSA is the available volume, estimated in accordance with the Manual, that must be provided for in relevant regulated structures on 1 November each year (CCM EA Conditions G5-1 to G5-4).

The DSA for the CCM integrated containment system has been calculated using the method of operational simulation for performance-based containment in accordance with Appendix A.2 of the Manual. The modelled maximum increases in the system storage volumes were analysed to determine the 1:20 AEP wet season increase volume.

In accordance with the Manual a Design Simulation Margin (DSM) of 25% was conservatively applied to account for uncertainty in the performance of the model used for the assessment, even though calibration of the model demonstrated a very high level of correlation with site observations; a mean difference of 5% between model and actual data.

The assessed system 1:20 AEP wet season containment volumes (no DSM applied) for ETSF, EPit and MCD is summarised as:

- The 2023/24 wet season year = **264 ML**
- The 2024/25 wet season year = **599 ML**

For the purposes of assigning a DSA, the results from the 2024/25 wet season year have been adopted as the larger of the two calculated DSAs.

The DSA assessment and proposed allocation of DSA across the integrated containment system is summarised as follows:

- Combined 1:20 AEP (95th percentile or 5% AEP) wet season inventory increase in EPit, ETSF, and MCD – **599 ML**
- Applied DSM – 25% (**150 ML**)
- Calculated combined DSA for EPit, ETSF, and MCD including DSM – **749 ML**
    - In order to apply an additional layer of conservatism beyond that which is already incorporated into the calculated DSA, CCPL have determined to keep the DSA *level* for the MCD the same. This results in a combined applied DSA volume of **852.6 ML**, a further 14% greater than the calculated DSA volume (which itself already has a 25% buffer, as outlined above)
- DSA volume allocated to MCD – **355.8 ML (216.1 m AHD)**
- DSA volume allocated to EPit – **496.8 ML (217.2 m AHD)**
- DSA volume allocated to ETSF – **0 ML**

The multiple levels of conservatism incorporated into the modelling to calculate the DSA are:

- A final adopted DSM of 42% has been applied even though the Seasonal Simulation Margin (SSM), which is used to derive the DSM, was calculated as 4.4%
- No water releases assumed in DSA calculation, though the Environmental Authority (EA) allows for a release of up to 500 ML/annum, and a TEL application is underway to allow for 1,500 ML to be released during the 2023/2024 wet season
- The model was calibrated using 44 months of actual data from the site

- Excellent correlation between historic data and modelled outcomes was demonstrated, with a mean difference of < 5% observed
- Model accounts for all inputs based on actual operating practices:
    - Dewatering of ~ 500 ML to the EPit from the Esperanza South underground mine, which was flooded during the March 2023 extreme weather event
    - Tailings deposition to the EPit from 1 May 2024
    - The reduction of capacity that results from deposition of tailings and sludge from treatment of mine-affected water (MAW)

The detailed assessment of DSA and documentation of the water balance model used for the assessment is provided in the WBM (Appendix A of the SDP (**Appendix 1**)). This provides a RPEQ-certified technical justification for the proposed amendments to DSA outlined in **Section 5.1.1**.

5.2.5. Mandatory Reporting Level

MRL is defined in the Manual as a level at which the dam has a remaining available volume equivalent to the Extreme Storm Storage (ESS) allowance. The ESS is defined as the highest volume, or lowest level, that is required to allow the following to be retained within a *Significant Consequence* dam:

- The runoff from a 1:10 Annual Exceedance Probability (AEP) 72-hour duration storm

  plus
- A wave allowance at 1:10 AEP

The MRL across the integrated containment system has been calculated as follows:

- EPit – **496.8 ML (217.2 m AHD)**
- MCD – **227.2 ML (217.2 m AHD)**
- ETSF – provisioned within the EPit

The ESS volumes for the regulated structures, and determination of MRL requirements for the structures, are provided in the WBM (Appendix A of the SDP (**Appendix 1**)). This provides a RPEQ-certified technical justification for the proposed amendments to MRL outlined in **Section 5.1.1**.

5.2.6. Sensitivity Analysis

A number of sensitivity scenarios that would result in an increased DSA volume were assessed using the water balance modelling to assess whether the adopted DSM of 42% is appropriate and sufficiently conservative (in accordance with the requirements of the Manual).

The following sensitivity scenarios were assessed for the 2024/2025 wet season:

1. Increased rainfall runoff – AWBM soil store depth parameters conservatively reduced by 50% for all land uses (this change corresponds to an increase in the average annual runoff volume of approximately 2% to 34% for the land uses that have the most impact on the DSA volume).
2. Reduced mechanical evaporation – EPit and ETSF evaporator availability reduced by 30% (i.e. availability reduced from 54% to 38%).
3. Ceased production (i.e. no mining or processing) – No processing water demands, tailings water return or underground demands however Mammoth underground continues to dewater groundwater inflows.
4. Increased seepage inflows to the containment system – assumed seepage inflow rates to Sump 6 (from the old Mammoth TSF) and to the North Waste Rock Dump Sump (from the North Waste Rock Dump) have been doubled from 70 and 329 kL/d respectively to 140 and 658 kL/d respectively.

The sensitivity assessment results show that the modelled 1:20 AEP (95th percentile) wet season combined inventory increase was between -46% smaller and 24% larger for the various scenarios and are less than the adopted effective DSM of 42%. All of these are lower than the DSA of 865.8ML proposed.

This demonstrates that there is a high level of confidence in the proposed hydraulic performance criteria and ability to achieve the amendments to DSA and MRL for the EPit and MCD.

The sensitivity assessment is described in further detail in the WBM (Appendix A of the SDP (**Appendix 1**)).

5.3. Description of Activities – EPit Tailings Deposition

5.3.1. EPit Tailings Deposition

The EPit was operated as an open cut mine until 2005 and has served as a mine-affected water (MAW) and tailings storage facility since that time.

The EPit floor level has been raised due to the previous deposition of tailings and currently has a lowest elevation of 200.8m AHD. The EPit floor is at approximately 90 m AHD and daylights at the original surface at approximately 225 m AHD, although the maximum operating level has been set at 222 m AHD (known as the rock bar).

Water stored in the EPit above the MOL reports to the MCD via seepage from the EPit overflow pond which is elevated a further 18 m to 240 m AHD by the EPit access ramp. Should water rise in the EPit to 240 m AHD it would spill over an effective natural spillway into MCD.

The tailings deposition process and strategy are described in the TMP (**Appendix 3**), and is summarised as:

- Deposit tailings into the EPit from the planned discharge points (**Figure 9)** up to a maximum tailings level of 215.7 m AHD, achieving an average level of 215.2 m AHD
- Maintain a tailings beach gradient towards the EPit access ramp (east) for decant water reclamation
- Maintain an average of 2 m water cover over the tailings beach.

5.3.2. EPit Tailings Delivery Infrastructure

The tailings discharge into EPit is proposed to be sub-aqueous, initially from a single line from the EPit ramp, and then from a pontoon mounted discharge point to optimise settling of tailings.

The tailings delivery system will consist of the following infrastructure:

- Two trains of tailings thickener underflow pumps trains (three pumps in series in each train) at the Ore Processing Plant.
- One HDPE tailings delivery pipeline which runs from tailings thickener underflow pumps to the EPit TSF via the EPit Access Ramp. The delivery pipeline travels across existing disturbance areas.
- Tailings are discharged into the EPit via the tailings delivery pipeline, currently from a discharge point on the EPit ramp, to be extended into the storage on pipeline floats.

5.3.3. EPit Decant Return Water System

The water level in the EPit will be controlled via the existing decant infrastructure to ensure buffer storage is available to reduce the risk of an uncontrolled discharge. The decant return water system maintains the decant pond in a minimum condition whilst maintaining an average of 2 m water cover to reduce the oxidation of sulphides and the subsequent leaching of harmful substances.

The presence of a decant system also minimises the storage volume that is required for the supernatant water whilst maximising the storage volume available for tailings and rainfall runoff.

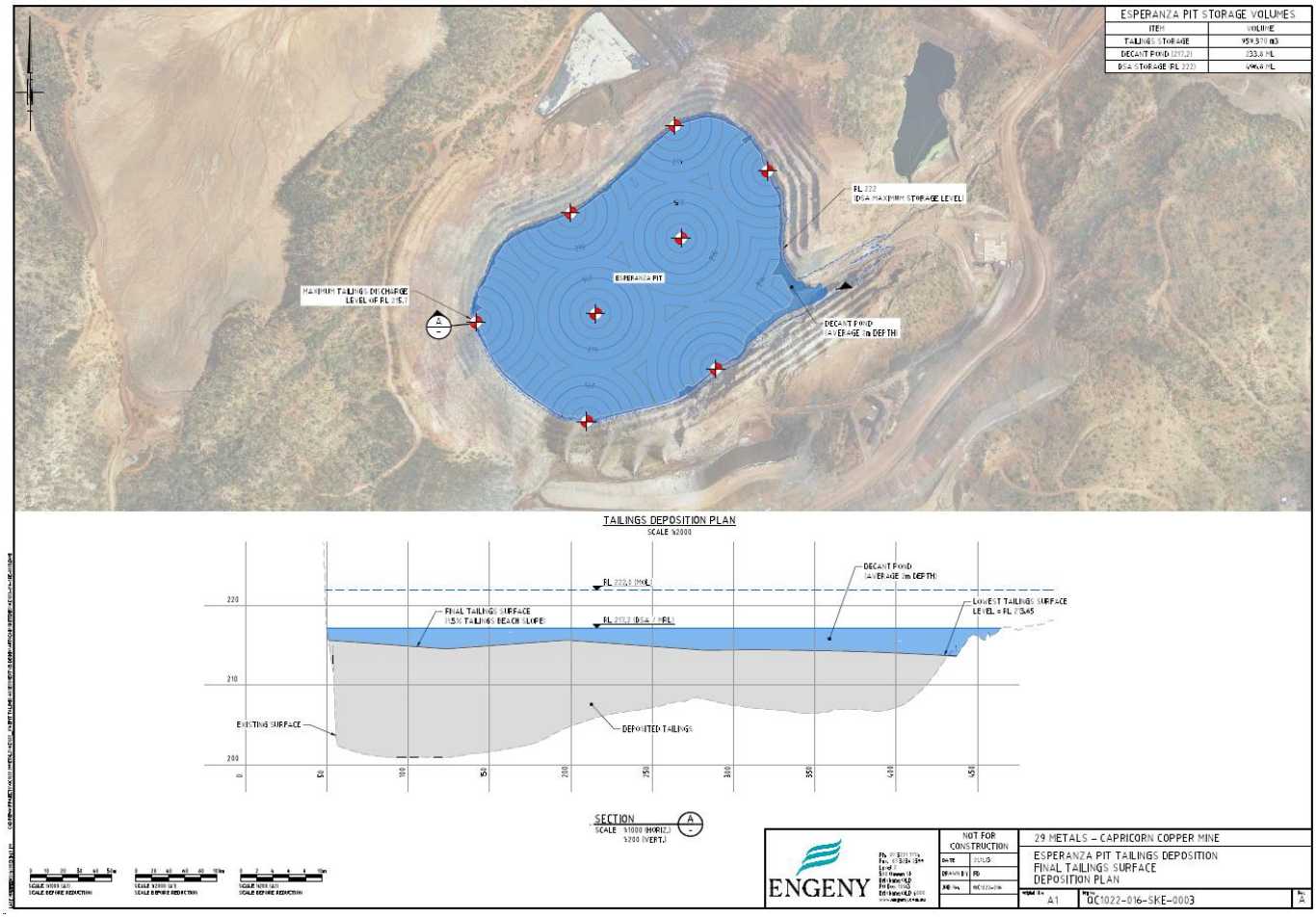

Figure 9 EPit Tailings Deposition Strategy

5.3.4. Tailings Geotechnical Properties

Geotechnical testing of the tailings has been undertaken at CCM, and has been described in the following assessments:

- Raising of Esperanza Tailings Dam – Feasibility Assessment, (Maunsell, 2008).
- Final Interim Raise Design Report (GHD, 2008).
- Scope of Further Raising (GHD, November 2009).
- Esperanza TSF Raise to RL 283 (GHD, 2012).
- Advanced laboratory testing reported in Esperanza Tailings Storage Facility Design Report to RL 284 (GHD, January 2022).

A review of the previous assessments indicate that the tailings geotechnical properties comprise:

- Sandy silty clay with low to moderate plasticity.
- Dried on the surface of Esperanza TSF to a density of 1.4 to 1.6 t/m3 which is approximately 78%-87% maximum dry density, indicating further density would be achievable with compaction. This is noted to be in contrast to previous historic data which showed that density has been as low as 0.7 t/m3 when excessive surface water had been stored on the TSF.
- Hydraulic conductivity is low.

Geotechnical property results from all previous studies are further described in the TMP (**Appendix 3**).

5.3.5. Tailings Geochemical Properties

Geochemical testing previously undertaken for CCM has shown that the tailings exhibit high concentrations of total S and sulphide-S, hence have a high Maximum Potential Acidity (MPA), with limited Acid Neutralising Capacity (ANC) (Environmental Earth Scientists, 2012). This correlates to strongly positive Net Acid Production Potential (NAPP) values indicating a high probability of being acid-forming. This characterisation is further supported by low Net Acid Generation (NAG) pH test results.

Multi-element testing previously undertaken also indicates that tailings samples are significantly enriched (Geochemical Abundance Indices (GAI) of 3 or greater) in silver (Ag), arsenic (As), bismuth, (Bi), copper (Cu), lead (Pb), antimony (Sb) and thallium (TI) (GHD 2017b). Recent testing of core samples by Core Metallurgy for CCM showed the ore to comprise approximately 1.5-2% copper, 30-35% iron and 5-10% sulphur.

Additional tailings analysis was undertaken in late 2022 and early 2023 and all tailings were reported as potentially acid forming, with pH following oxidation ranging between 2.2 and 3.0, with elevated calculated MPA between 57-356 kg H_2SO_4 per tonne.

Tailing deposited into the EPit will remain fully saturated with an average of a 2 m water cover water cover. This will reduce the potential for oxidation of sulphides and the generation of acid.

Geochemical characterisation results from all previous studies are further described in the TMP (**Appendix 3**).

5.4. System Operating Rules

CCM have established system operating rules for the integrated containment system under wet-season and contingency conditions. The rules include the distribution of excess water between the EPit and MCD to prevent overflow during wet weather events and maintaining minimal water inventory in ETSF.

An overview of the operating rules include:

- Maintain low decant pond inventory in ETSF via pumped decant to EPit or pumped transfers to evaporators (return water to EPit).
- Maintain MCD below the MRL (217.2 m AHD) through supply to site water demands.
- Store excess water in EPit and maintain supply to site water demands and transfer to MCD when MCD is below the MRL (217.2 m AHD).
- Transfer water from MCD to EPit when MCD exceeds MRL to reduce the risk of immediate overflow.
- Maintain current site operations.

The operating rules for the integrated containment system under wet-season and contingency conditions are described in detail within the SDP (**Appendix 1**).

5.5. System Design Plan Certification

The SDP for the integrated containment system and assessment of the hydraulic performance criteria has been certified by a Registered Professional Engineer of Queensland (RPEQ). The certification provided in Section 7 of the SDP (**Appendix 1**) states that the SDP has been prepared in accordance with Condition G3-2(a) in the EA and in accordance with the Manual.

5.6. Timing of Activities

CCM was impacted by an extreme weather event in early March 2023. The event has been characterised as a greater than 1:200-year rainfall event and resulted in the highest recorded rainfall for the site – more than 560 mm of rainfall was recorded over the seven-day period 6-12 March 2023; including consecutive days of 204 mm and 198 mm of rainfall (respectively).

If the proposed EA Amendment is approved, tailings deposition will recommence no earlier than 1 May 2023, and deposition of tailings will not occur during any wet season if water levels in the EPit are higher than MOL.

6. Potential Environmental Impacts

The potential environmental impacts from the proposed amendment are outlined in this **Section 6**. Management strategies identified to mitigate these risks have been provided in **Section 7**, and the results of the comprehensive full risk assessment that has been undertaken is presented in **Section 8.**

6.1. Land

The proposed change to the DSA and recommencement of tailings deposition to the EPit will not result in any additional surface disturbance. Tailings deposition has previously been approved within the EPit, and 'Esperanza Pit and Tailings Deposition' has an approved disturbance footprint within Schedule A – Table 1 of the EA.

As the activity will be undertaken within the existing disturbance area there will be no additional disturbance of land, and no direct impacts to flora or fauna.

Any unplanned release of tailings to land through a leak or rapture of tailings would be contained within the existing disturbance footprint and water management infrastructure.

6.2. Surface Water

There is no proposed discharge directly to water as a part of the proposed amendment.

Water quality monitoring data from 2014 – 2022 shows that mine-affected water contained within the EPit contains levels of metals/metalloids, sulphate, fluoride, total dissolved solids (TDS) and pH all in exceedance of either the contaminant release limits in the EA or the Australian and New Zealand Guideline for Fresh and Marine Water Quality (ANZECC) guideline for livestock (cattle) drinking water. The results indicate that an uncontrolled release of MAW held in the EPit to Gunpowder Creek would have the potential to result in environmental harm.

The three regulated structures spill to each other before discharging offsite, with ETSF spilling into EPit, and EPit into the MCD. If MCD were to overflow, water would discharge firstly to Hoover Dam, and subsequently into Gunpowder Creek.

Tailings decant water and rainfall runoff from ETSF is transferred to EPit and bidirectional water transfers can occur between EPit and MCD.

A spill risk assessment for the 2023-2024 wet season has been undertaken for regulated structures (EPit, ETSF and MCD) and site storages that are at risk of overflowing offsite, including the Hoover Dam. Overflow events only occur in results above the 95th percentile. Further analyses of overflow results (i.e., assessment of the number of realisations in which an overflow occurs) indicate that the EPit does not overflow in any scenario, and there is only a ~1% chance of an external spill event occurring from Hoover Dam as a result of an overflow from MCD.

Over the 2022 – 2023 monitoring period, there were 15 treated water releases that occurred, some of which exceeded trigger values defined in the EA for pH, suspended solids, total dissolved solids, sulphate and total and dissolved copper. Despite this, the results from the latest REMP undertaken by Hydrobiology (2023) showed that there has been no notable impact from CCM on the habitat, stream flow, or macroinvertebrate communities of the adjacent and downstream aquatic environment. Specifically, it was concluded that:

- All test sites were in good or excellent condition for the habitat assessment.
- There was no evident impact to human use EVs.
- While concentrations of a number of parameters were above the guideline values defined for aquatic ecosystem values, there were no impacts observed to macroinvertebrate assemblages.
- Copper concentrations in sediment had reduced since the previous reporting period, while nickel concentrations were slightly higher.
- Macroinvertebrate communities were either similar or more diverse at downstream sites than control sites, despite elevated metal/metalloid concentrations
- Assimilative capacity for copper had not yet been reached in the receiving environment, but cobalt, manganese, nickel and zinc had reached assimilative capacity within Gunpowder Creek and Magazine Creek at test sites downstream from CCM.

6.3. Groundwater

Groundwater modelling updates have been ongoing throughout the life of the operations and represent a substantial investment in the knowledge base of the groundwater system. These studies provide a high level of confidence in the conceptualisation of groundwater for the site, which includes ongoing calibration against groundwater observations.

Previous studies conducted to assess the risk to groundwater from the EPit and other potential sources, include:

- Esperanza Pit DSA and MRL Revision (GHD, 2013) - steady-state model representing the northern half of the site and pit with a focus on the Esperanza TSF area.
- Life of Mine (LOM) Tailings Groundwater Modelling Report (GHD, 2019a) - transient model focussing on the Old TSF (Mammoth TSF) area incorporating data from 15 key bores and flow at a sump downstream of the facility.
- Life of Mine Project 2020 Groundwater Modelling (GHD, 2020) - calibration of the site wide groundwater model and providing estimates of seepage.
- ETSF TSF Conceptual Model and Seepage Assessment Report (ATC, 2023) – conceptual hydrological model to define the hydrological system, identify changes in the system and seepage potential from the ETSF.

These studies have demonstrated that storage of tailings and water up to the MOL would not result in significant seepage from the EPit. Up to this level it has been determined that permeability of EPit is so low as to be effectively watertight.

Any seepage from the EPit above this level (i.e., above MOL) reports to the MCD, which subsequently reports to Hoover Dam. There is no observed pathway directly to Gunpowder Creek from the EPit or MCD.

It is also noted that additional tailings deposited within the EPit would consolidate over time to a density approaching 1.5t/m^3, further reducing the permeability of the EPit and the risk of seepage (GHD, 2017b) below the known seepage pathway to MCD at MOL.

An assessment of groundwater quality in terms of interactions and impacts to surface water quality undertaken as a part of the annual REMP concluded that ground and surface water interaction is not suspected at Gunpowder Creek (Hydrobiology, 2023). This was due to considerable variation between surface and groundwater sites regarding major ion contributions, supporting the conclusion that no obvious link was apparent.

With any seepage from the EPit above the MOL captured within the MCD firstly, then within Hoover Dam secondly, the site effectively has a multiple containment system which provides layers of control and opportunities for CCPL to mitigate the risk of releases to environmental receptors, most notably to Gunpowder Creek.

6.4. Cultural Heritage

There will be no impacts to any indigenous or non-indigenous cultural heritage as the amendment will be undertaken within previously disturbed areas in the mine site and will result in no additional disturbance.

6.5. Air Quality

There is no discharge to air of contaminants that may cause an adverse effect on the environment from the activities associated with deposition of tailings to the EPit. The tailings material is pumped in a slurry form, reducing the potential for dust generation when moving the material, and deposition is subaqueous.

6.6. Noise and Vibration

Noise associated with tailings deposition to the EPit will be limited to standard operating noise from pumps and ancillary equipment. This will be uniform with noise from existing mine operations and will not result in any additional noise impacts and sound will not be audible at any sensitive receptors.

There will be no vibration impacts from the activity.

6.7. Waste

The only waste relating to this application is the tailings itself, which is proposed to be deposited in the EPit and covered with water as a part of the permanent closure strategy for the site. There is no feasible alternative for management of the tailings, and placement within a pit would be expected to have much reduced risk to placing in a surface storage with respect to structural failure. Filling of pits can also be a key aspect of remediation of a site by preventing oxygen access to pit walls, associated with diversion of clean water (GHD, 2017b).

7. Mitigation Measures

The key documents that have been developed to manage risks associated with the deposition of tailings and water management in the EPit include:

- OMS Manuals (Appendix B of the SDP (**Appendix 1**))
- TMP (**Appendix 3**)
- Water Management Plan (provided separately at frequencies specified within the EA)

A summary of the key controls relating to environmental values are provided in **Table 13**.

Table 13 Mitigation Measures

Aspect	Mitigation Measure	Description
Surface Water Groundwater	OMS Manuals (Appendix B of the SDP (**Appendix 1**))	The purpose of the OMS Manuals is to adequately prepare all employees in the operation, maintenance, and surveillance of the regulated structures. The OMS Manuals documents the following: • Overview and description of the regulated structures • Roles, responsibilities and contact information for key personnel • Regulatory and corporate governance requirements • Operational requirements for deposition of tailings and water management • Routine and event-driven maintenance requirements and schedules • Dam safety surveillance protocols enabling assessment relative to performance expectations • Relevant risks associated with the regulated structures and appropriate controls and management action to prevent the occurrence, or mitigate the impact, of such risk • Emergency indicators and the protocols to follow in the event of an emergency
Surface Water Groundwater Land Waste	TMP (**Appendix 3**)	The purpose of the TMP is to outline the measures for minimising any potential impacts associated with additional tailings disposal into EPit on the environmental values at the site, in accordance with the EA. The TMP applies to all EPit tailings disposal activities conducted within the CCM mining tenure and includes the following: • Outlines tailings deposition management and delivery infrastructure • Outlines the tailings deposition strategy • Outlines the management of the decant pond to maintain an average of 2m of cover • Describes the water management system comprised of the EPit, ETSF and the MCD which form the integrated containment system. • Describes the Water Management Strategy to prevent overflow and maintain sufficient capacity for extreme rainfall events. • Outlines monitoring and surveillance inspections required to be undertaken to monitor the condition and ultimately safety of the dams and structures within the TSF. The purpose of scheduled inspections is to identify visual or monitoring data deficiencies that either require maintenance or trigger a response under the Trigger Action Response Plan (TARP)
Surface Water Groundwater	Water Management Plan (WMP)	The purpose of the Water Management Plan (WMP) outlines the pump and transfer maintenance requirements and responsibilities to reduce the risk of failure and manage actual or potential impacts to surface water and groundwater values. The WMP will be updated following the wet season (1 April 2024) in accordance with Condition C7-3 of the EA
Flora and Fauna	Standard Mitigation Measures	• All site personnel must be aware of any fauna on the site and not interact or harm with them in any way • Any injured fauna should be reported to the site Environment Team immediately
Noise and Vibration	Standard Mitigation Measures	• Equipment will be maintained and operated in accordance with manufacturer's specifications, and switched off when not in use
Air Quality	Standard Mitigation Measures	• Equipment will be maintained and operated in accordance with manufacturer's specifications • The tailings material is pumped in a slurry form, reducing the potential for dust generation when moving the material • Maintain an average of 2 m water cover over the tailings

8. Risk Assessment

8.1. Method

A desktop risk assessment has been undertaken to assess the risks to environmental values from the proposed amendment, and to demonstrate how the documented mitigation measures reduce the consequence or likelihood of environmental harm. This has been undertaken in accordance with the consequence and likelihood ratings taken from CCPL's Risk Assessment Criteria (**Appendix 6**).

8.2. Risk Assessment

Table 14 Risk Assessment

Aspect	Potential Impact	Description/Comments	Inherent Risk Rating			Controls	Residual Risk Rating		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Land	Release of mine-affected water (MAW) to land resulting in environmental harm.	Any uncontrolled release from the Esperanza Pit (EPit) will be directed to the Mill Creek Dam (MCD) once water levels reach 240 m AHD, which would subsequently spill to Hoover Dam and Gunpowder Creek. There is no reasonable pathway for release of MAW to land.	A	2	3 - Low	• OMS Manuals (Appendix B of the SDP (**Appendix 1**)) • TMP (**Appendix 3**) • Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of the EPit relative to dam safety, containment, and operational performance objectives	A	1	1 - Low

	Accidental release of tailings waste to land resulting in environmental harm.	Pathway of accidental release of tailings to land outside the EPit is through a leak or rupture at some point along the tailings discharge pipeline.	C	2	8 - Medium	• OMS Manuals (Appendix B of the SDP (**Appendix 1**))
						• TMP (**Appendix 3**)
						Specific controls outlined in the relevant management plans and procedures include:
						• Flushing or de-silting tailings deposition pipelines and removal of accumulated debris
						• Perform visual inspections of major wear components during scheduled maintenance for potential damage
						• Inspect all pipework, bends and fittings for wear, abrasion, corrosion, ground erosion or leaks. Replace components as required
						• Servicing of decant pumps
						• Event Drive Maintenance Activities, including:
						  ◦ Inspect entire pipeline and repair or replace affected components
						  ◦ Excavate any breached tailings and return to impoundment areas
						• Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of regulated structures relative to dam safety, containment, and operational performance objectives
							B	2	5 - Low

Surface Water	Changes to existing flow regime in Gunpowder Creek.	No changes are expected to the existing flow regime in Gunpowder Creek.	B	3	9 - Medium	• OMS Manuals (Appendix B of the SDP (**Appendix 1**)) • TMP (**Appendix 3**) • Water Management Plan (WMP)	A	2	3 - Low

	Reduction in surface water quality resulting from increased seepage expression from EPit.	The potential for seepage to groundwater from the EPit occurs once water levels in the structure reach 222 m AHD which represents the MOL. Up to this level it has been determined that permeability is so low as to be effectively watertight. Above the MOL, seepage could occur into the EPit access ramp pond and subsequently into the MCD. This level has been set as the maximum desirable water level to mitigate seepage.
		
		Existing seepage controls (Mill Creek Dam and NRWD seepage sump) are expected to manage any seepage where the EPit MAW inventory exceeds the MOL.
		
		The duty/standby pumps at MCD have enough capacity to pump back seepage inflows into MCD at a higher rate than seepage from EPit, and are diesel-powered so are not affected by power outages, and are accessible even during flooding.
			C	2	8 - Medium	• OMS Manuals (Appendix B of the SDP (**Appendix 1**))
						• TMP (**Appendix 3**)
						• WMP
						Specific controls outlined in the relevant management plans and manuals include but are not limited to:
						• Existing seepage controls (MCD and NRWD seepage sump) are expected to manage any potential seepage where the EPit MAW inventory exceeds the MOL
						• Decant water from the EPit is to be pumped into MCD where it will be re-used in the processing plant
						• Release of MAW in accordance with the EA to manage surplus water inventories accumulated over the wet season
						• Monitoring of groundwater bores installed to monitor seepage impacts and phreatic surface in the EPit
						• Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of the EPit relative to dam safety, containment, and operational performance objectives
						• Water levels within EPit and MCD are managed to mitigate the risk of exceeding MOL through:
						  ◦ Operation of 18 high-efficiency mechanical evaporators (EPit)
						  ◦ Treatment and re-use of ~ 8 ML of MAW in processing activities (MCD)
						  ◦ No import of raw water from Waggaboonya Lake for mining or mineral processing operations (MCD)
							B	2	3 - Low

	Uncontrolled release event	A spill risk assessment for the 2023-2024 wet season was undertaken for regulated structures (EPit, ETSF and MCD) and site storages that are at risk of overflowing offsite (Hoover Dam). Overflow events only occur in results above the 95th percentile. Further analyses of overflow results (i.e., assessment of the number of realisations in which an overflow	A	4	10 - Medium	• OMS Manuals (Appendix B of the SDP (**Appendix 1**)) • TMP (**Appendix 3**) • WMP Specific controls outlined in the relevant management plans and manuals include but are not limited to:	A	3	6 - Low

Aspect	Potential Impact	Description/Comments	Inherent Risk Rating			Controls	Residual Risk Rating		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
		occurs) indicate that there is around a 1% chance of an external spill event occurring from Hoover Dam as a result of an overflow from MCD. The EPit does not overflow in any scenario.				• Water levels within EPit and MCD are managed to mitigate the risk of an uncontrolled release through: ◦ Operation of 18 high-efficiency mechanical evaporators (EPit) ◦ Treatment and re-use of up to 8 ML of MAW in processing activities (MCD) ◦ No import of raw water from Waggaboonya Lake (MCD) • Undertake daily water level monitoring • Release of MAW in accordance with the EA to manage surplus water inventories accumulated over the wet season • Servicing of decant pumps • Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of regulated structures relative to dam safety, containment, and operational performance objectives			
	Failure of water management equipment	Failure of equipment leads lead to inadequate water management to maintain water below the MOL in the EPit including • MCD pumping infrastructure • EPit Evaporator Pumping • Failure of evaporator units • Power failure	C	3	13 - Medium	• OMS Manuals (Appendix B of the SDP (**Appendix 1**)) • WMP Specific controls outlined in the relevant management plans and manuals include but are not limited to: • Daily, monthly, and annual inspections to be undertaken of mechanical equipment • Perform visual inspections of major wear components during scheduled maintenance for potential damage • Inspect all pipework, bends and fittings for wear, abrasion, corrosion, ground erosion or leaks. Replace components as required Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of the EPit relative to dam safety, containment, and operational performance objectives • Redundancy in equipment: ◦ Operation of 18 high-efficiency mechanical evaporators ◦ Treatment and re-use of MAW system has redundancy in pumping arrangement to ensure limitation of import of raw water from Waggaboonya Lake to the MCD ◦ MCD treatment and bulk release system has redundancy to allow for breakdown of equipment ◦ Duty/standby pumping arrangement of diesel-powered high-volume pumps that direct water from the MCD to EPit, should MCD level exceed MRL. These pumps have previously been shown to outpace ingress of water to MCD even during a 1-200 high fall events with level in the EPit well above MOL. These pumps are not affected by power outages and are accessible even under flood conditions.	B	2	5 - Low
	Acid rock drainage affecting surface water quality	Tailings are characterised as potentially acid forming (PAF) that can potentially impact water quality of the EPit during operations and closure.	B	3	9 - Medium	• TMP (**Appendix 3**) • The current closure plan is for the EPit to stay as a residual void and to maintain an average of 2 m water cover, as defined in the Capricorn Copper Post Mine Land Use Plan • The retention of a water cover will prevent drying and exposure of tailings to atmosphere. This is expected to maintain saturated, oxygen deficient conditions in the tailings and prevent oxidation of sulphides	B	2	5 - Low
	Loss of water storage in EPit from tailings deposition above the proposed 215.7 m AHD	Deposition of tailings above 215.7m AHD can reduce the system containment performance leading to an uncontrolled release event.	C	3	13 - Medium	• TMP (**Appendix 3**) • OMS Manuals (Appendix B of the SDP (**Appendix 1**)) • Bathymetry to monitor the progression of the tailings beach every three (3) months	C	1	4 - Low
	Loss of water storage capacity in MCD from deposited solids from the WTP effluent	Solids deposition from the WTP occurs at a very slow rate near the western wall (near the WTP) and has not historically impacted the containment standard of MCD.	C	3	13 - Medium	• The OMS Manual for MCD requires review of water storage capacity and reinstatement of storage capacity if containment is impacted	B	2	5 - Low
Groundwater	Changes to the existing flow regime (including baseflow) in Gunpowder Creek	No changes are expected to the existing groundwater flow regime. The EPit is effectively watertight up to 222 m AHD, with deep drainage limited by the parent material in the pit and the significant volume of consolidated tailings which is of low hydraulic conductivity.	C	2	8 - Medium	• TMP (**Appendix 3**) • OMS Manuals (Appendix B of the SDP (**Appendix 1**)) • WMP	C	1	4 - Low
	Reduction in groundwater quality resulting from	The potential for seepage to groundwater from the EPit occurs once water levels in the structure reach	C	2	8 - Medium	• TMP (**Appendix 3**) • OMS Manuals (Appendix B of the SDP (**Appendix 1**))	C	1	4 - Low

Aspect	Potential Impact	Description/Comments	Inherent Risk Rating			Controls	Residual Risk Rating		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
	increased seepage expression from EPit.	222 m AHD which represents the MOL. Up to this level it has been determined that permeability is so low as to be effectively watertight. Above the MOL, seepage could occur into the EPit access ramp pond and subsequently into the MCD. This level has been set as the maximum desirable water level to mitigate seepage.				• WMP Specific controls outlined in the relevant management plans and manuals include but are not limited to: • Water level in the EPit and MCD shall be maintained below the MRL • Existing seepage controls (MCD and NRWD seepage sump) are expected to manage any potential seepage where the EPit MAW inventory exceeds the MOL • Decant water from the EPit is to be pumped into MCD where it will be re-used in the process plant • Release of treated MAW from the MCD in accordance with the EA to manage surplus water inventories accumulated over the wet season • Monitoring of groundwater bores installed to monitor seepage impacts and phreatic surface in the EPIT • Additional groundwater monitoring bores to be installed to monitor seepage pathways			
	Failure of water management equipment	Failure of equipment leads lead to inadequate water management to maintain water below the MOL in the EPit.	C	3	13 - Medium	• OMS Manuals (Appendix B of the SDP (**Appendix 1**)) • WMP Specific controls outlined in the relevant management plans and manuals include but are not limited to: • Daily inspections, monthly, annual to be undertaken of mechanical equipment • Perform visual inspections of major wear components during scheduled maintenance for potential damage • Inspect all pipework, bends and fittings for wear, abrasion, corrosion, ground erosion or leaks. Replace components as required • Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of regulated structures relative to dam safety, containment, and operational performance objectives • Redundancy in equipment: ◦ Operation of 18 high-efficiency mechanical evaporators ◦ Treatment and re-use of MAW system has redundancy in pumping arrangement to ensure limitation of import of raw water from Waggaboonya Lake to the MCD ◦ MCD treatment and bulk release system has redundancy to allow for breakdown of equipment ◦ Duty/standby pumping arrangement of diesel-powered high-volume pumps that direct water from the MCD to EPit, should MCD level exceed MRL. These pumps have previously been shown to outpace ingress of water to MCD even during a 1-200 high fall events with level in the EPit well above MOL. These pumps are not affected by power outages and are accessible even under flood conditions.	B	2	5 - Low
	Acid rock drainage affecting groundwater quality	Tailings are characterised as potentially acid forming (PAF) that can potentially impact water quality of the EPit during operations and closure.	A	4	10 - Medium	• TMP (**Appendix 3**) • The current closure plan is for the pit to stay as a residual void and to maintain an average of 2 m water cover • The retention of a water cover will prevent drying and exposure of tailings to atmosphere. This is expected to maintain saturated, oxygen deficient conditions in the tailings and prevent oxidation of sulphides. Addition of high pH water via the tailings thickener will also assist in keeping the pH >7.0	B	2	5 - Low
Flora and Fauna	Impact to flora from land disturbance	The area is already disturbed from historical mine activities, and the proposed amendment will be contained with authorised disturbance footprint. No additional disturbance to land is proposed. No impact is predicated.	A	1	1 - Low	• All site personnel must be aware of any fauna on the site and not interact or harm with them in any way • Any injured fauna should be reported to the site Environment Team immediately	A	1	1 - Low
	Impact to fauna from habitat loss	The area is already disturbed from historical mine activities, and the proposed amendment will be contained with authorised disturbance footprint. No additional disturbance to land is proposed. No impact is predicated.	A	1	1 - Low	• No controls proposed.	A	1	1 - Low
Cultural Heritage	Impact to Indigenous cultural heritage	The area is already disturbed from historical mine activities, and the proposed amendment will be contained with authorised disturbance footprint. No additional disturbance to land is proposed.	A	1	1 - Low	• No controls proposed.	A	1	1 - Low
	Impact to non-Indigenous cultural heritage	The area is already disturbed from historical mine activities, and the proposed amendment will be	A	1	1 - Low	• No controls proposed.	A	1	1 - Low

Aspect	Potential Impact	Description/Comments	Inherent Risk Rating			Controls	Residual Risk Rating		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
		contained with authorised disturbance footprint. No additional disturbance to land is proposed.							
Air Quality	Emissions to air from vehicles and equipment	Exhaust emissions from equipment and vehicle movements associated with tailings deposition will not result in significant increases above current levels.	A	1	1 - Low	• Exhaust emissions from equipment and vehicle movements associated with tailings deposition will not result in significant increases above current levels	A	1	1 - Low
	Emissions to air from tailings dust	An average of 2 m of water cover is proposed to be maintained over the tailings, which will prevent drying and exposure of tailings to atmosphere.	A	1	1 - Low	• TMP (**Appendix 3**) • OMS Manuals (Appendix B of the SDP (**Appendix 1**))	A	1	1 - Low
Noise	Noise from equipment will be from the operation of pumps that will run during tailings deposition.	The predicted levels of noise emissions will be commensurate with day-to-day mine activities and will not result in any impacts to sensitive receptors or impact the acoustic environment.	A	1	1 - Low	• Vehicles and equipment will be maintained as required and operated in accordance with correct operating procedures	A	1	1 - Low

Waste	Release of tailings waste to land.	Pathway of accidental release of tailings to land outside the EPit is through a leak or rupture at some point along the tailings discharge pipeline.	C	3	13 - Medium	• TMP (**Appendix 3**)
						• OMS Manuals (Appendix B of the SDP (**Appendix 1**))
						Specific controls outlined in the relevant management plans and manuals include but are not limited to:
						• Flushing or de-silting tailings deposition pipelines and removal of accumulated debris
						• Perform visual inspections of major wear components during scheduled maintenance for potential damage
						• Inspect all pipework, bends and fittings for wear, abrasion, corrosion, ground erosion or leaks. Replace components as required
						• Servicing of decant pumps
						• Event Drive Maintenance Activities, including:
						  ◦ Inspect entire pipeline and repair or replace affected components
						  ◦ Excavate any breached tailings and return to impoundment areas
						• Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of regulated structures relative to dam safety, containment, and operational performance objectives
							B	2	5 - Low

9. Rehabilitation

CCPL plans to progressively rehabilitate the mine site as part of mining operations. An updated PRCP is required to be submitted for CCM by 1 June 2024, which will detail the methodology for progressive rehabilitation of the site and the closure strategy.

It is anticipated that EPit will be left as a residual void and groundwater sink following the cessation of mining activities, as defined in the Capricorn Copper Post Mine Land Use Plan (PMLUP).

Water cover over the tailings will be retained at closure to maintain saturated, oxygen deficient conditions in the tailings and prevent oxidation of sulphides. Engeny have undertaken modelling to ensure that the EPit lake can be maintained following closure considering the recommencement of tailings deposition to a final maximum beach level of 215.7 m AHD. The findings have been presented in the TMP (**Appendix 3**). It is concluded that with a starting average water cover of 2 m over the tailings, the void water level will gradually increase and reach a mean equilibrium level around 217.6 m AHD. The void water levels will continue to fluctuate seasonally with changes in rainfall and evaporation, but there is no risk of overtopping or increased groundwater seepage under the modelled scenarios.

The void will be left in a safe and stable condition with no ongoing maintenance required. This is subject to review based on the proposed deposition of tailings to the EPit but the approach to closure is not expected to change.

Safety barriers (bund and fence) will be installed around the pit to limit human and livestock/animal access. There will be no release of material from the pit to the receiving environment (surface or groundwater).

10. Conclusion

This EA Amendment Application Supporting Report has assessed the risks of environmental harm from the proposed amendment to the DSA and MRL for the EPit and MCD as shown in **Table 15**, and the recommencement of tailings deposition into the EPit (which is already authorised under Schedule A – Table 1 of the EA).

The assessment of DSA, ESS and MRL requirements for the integrated containment system is detailed in the Water Balance Model Report (Appendix A of the System Design Plan (**Appendix 1)**). The sensitivity analysis undertaken for the WBM demonstrates that there is a high level of confidence in the proposed hydraulic performance criteria and ability to achieve the amendments to DSA and MRL for the EPit and MCD.

The SDP for the integrated containment system and the associated assessment of the hydraulic performance criteria has been certified by a Registered Professional Engineer of Queensland (RPEQ).

Multiple levels of conservatism have been incorporated into the modelling to calculate the DSA, which include:

- A final adopted DSM of 42% has been applied even though the Seasonal Simulation Margin (SSM), which is used to derive the DSM, was calculated as 4.4%
- No water releases assumed in DSA calculation, though the Environmental Authority (EA) allows for a release of up to 500 ML/annum, and a TEL application is underway to allow for 1,500 ML to be released during the 2023/2024 wet season
- The model was calibrated using 44 months of actual data from the site
- Excellent correlation between historic data and modelled outcomes was demonstrated, with a mean difference of < 5% observed
- Model accounts for all inputs based on actual operating practices:
    - Dewatering of ~ 500 ML to the EPit from the Esperanza South underground mine, which was flooded during the March 2023 extreme weather event
    - Tailings deposition to the EPit from 1 May 2024
    - The reduction of capacity that results from deposition of tailings and sludge from treatment of mine-affected water (MAW)

Table 15 Proposed Changes to EA Conditions

Name of Regulated Dam	Consequence Category	Max Operating Level (m AHD)	Spillway Capacity Design Criteria	Design Storage Allowance (DSA)			Mandatory Reporting Level (MRL)		
				Design Criteria	Volume (ML)	Level (m AHD)	Design Criteria	Volume (ML)	Level (m AHD)
Esperanza TSF (ETSF)	High	284	1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind OR Probable Maximum Flood (PMF)	1:20 AEP 2 month wet-season plus process inputs during period.	DSA is provisioned within the Esperanza Pit. Excluding the ETSF decant sump area, the ETSF structure is to contain no surface water as at 1st November each year.		1:10 AEP, 72 hr duration	1:10 AEP, 72hr duration storm event containment is provisioned within the Esperanza Pit.	
Esperanza Pit	High	222	1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind OR Probable Maximum Flood (PMF)	1:20 AEP 2 month wet-season plus process inputs during period.	~~1409.2~~ **496.8**	~~207.7~~ **217.2**	1:10 AEP, 72 hr duration	~~443.4~~ **496.8**	~~217.9~~ **217.2**
Mill Creek Dam	High	219	1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind OR Probable Maximum Flood (PMF)	1:20 AEP 2 month wet-season plus process inputs during period.	~~494~~ **355.8**	216.1	1:10 AEP, 72 hr duration	~~234.6~~ **227.7**	~~217.7~~ **217.2**

The proposed amendment will not require or result in any additional disturbance, and will be conducted wholly within the mine site and authorised disturbance footprints. As a result, the primary risks to environmental values that have been identified from this assessment are identified as:

- Impacts to Gunpowder Creek from groundwater seepage of contaminated waters
- Impacts to Gunpowder Creek from an uncontrolled spill due to overtopping.

This report and the accompanying technical studies demonstrate how environmental harm from the proposed amendment will be managed, and how the proposed mitigation measures and controls effectively reduce the level of risk. Residual risks have been assessed as low due to a moderate consequence of harm, but a low likelihood. This has been based on the following conclusions from the technical studies undertaken for the site:

- The potential for seepage to groundwater from the EPit occurs once water levels in the structure reach 222 m AHD, which is the MOL for this structure. Up to this level it has been determined that permeability is so low as to be effectively watertight.
- Any seepage from the EPit above the MOL reports to the MCD, which subsequently reports to Hoover Dam. There is no observed pathway directly to Gunpowder Creek from the EPit or MCD.
- Historically, the EPit has stored MAW above the MOL after storm events, and seepage has not been observed to impact the MCD containment as the return pumping rate and process water demands from the MCD are consistently higher than the seepage inflow rate.
- The level at which actual overtopping of the EPit is expected to occur is once water levels reach 240 m AHD, however the spill risk assessment demonstrates that the EPit does not overflow in any scenario, and that there is only a ~1% chance of an external spill event occurring from Hoover Dam as a result of an overflow from MCD.
- Risks associated with tailings and water management will be manged through the following operational documents:
  - Tailings Management Plan (**Appendix 3**)
  - OMS Manuals (Appendix B of the SDP (**Appendix 1**))
- CCPL has implemented the following water management systems to control water levels within the EPit and MCD:
  - 18 high-efficiency mechanical evaporators are already in use on the site to reduce water levels within the EPit

- CCPL has invested in site infrastructure to allow for treatment and re-use of mine-affected water, up to 8 ML per day extracted from MCD, within the processing operations on site, thus limiting the import of raw water from Waggaboonya Lake to only the mine accommodation and critical health and safety purposes
- A bulk water treatment system has been established and is in operation on the site to allow for efficient bulk release of treated water to Gunpowder Creek from MCD when the background requirements are met under the conditions of the EA
- The bulk treatment and release system has been designed to enable simultaneous release of treated water to Gunpowder Creek and transfer of mine-affected water from EPit to MCD
- Duty/standby pumping arrangement of diesel-powered high-volume pumps that direct water from the MCD to EPit, should MCD level exceed MRL. These pumps have previously been shown to outpace ingress of water to MCD even during a 1-200 high fall events with level in the EPit well above MOL. These pumps are not affected by power outages and are accessible even under flood conditions.

As the potential for impacts to groundwater only commence when water levels exceed the MOL for the EPit, and seepage from the MCD reports to the Hoover Dam, the mitigation and management measures used by the site to manage water levels within the EPit and MCD are appropriate for managing any adverse effects on groundwater.

It is concluded that the placement of tailings into the EPit to the proposed level that allows compliance with the required hydraulic performance parameters will not result in any change in the environmental risk profile for the site. The site has an established water management system including system design rules which provide several options for reducing water levels in both the EPit and MCD, providing for more than one level of control for effectively mitigating risks of environmental harm to Gunpowder Creek.

If the proposed EA Amendment is approved, tailings deposition will recommence into the EPit once water levels are reduced below the proposed MRL (217.2 m AHD), and once tailings storage in the ETSF reaches capacity.

11. References

ATC Williams, 2023, *ETSF TSF Conceptual Model and Seepage Assessment Report*

Capricorn Copper Pty Ltd, 2023, *Capricorn Copper Mine Annual Groundwater Report July 2021- December 2022*

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GHD, 2013, *Birla Mount Gordon Esperanza Pit DSA and MRL Revision Hydrogeological Response to DEHP Notice of Decision*

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GHD, 2017(b), *Tailings Management Plan for Recommencement of Operations*

GHD, 2020, *Capricorn Copper Pty Ltd Life of Mine Project 2020 Groundwater Modelling*

GHD, 2021a, *Capricorn Copper Pty Ltd Esperanza TSF, Esperanza Pit and Mill Creek Dam Consequence Category Assessment July 2021*

GHD, 2021b, *Capricorn Copper Mine EA Amendment Application for Esperanza TSF Raise*

Hydrobiology, 2023, *Capricorn Copper Mine 2023 Post-Wet REMP Report*

Maunsell, *2008, Raising of Esperanza Tailings Dam – Feasibility Assessment*

NRA, 2012, *Birla Mt Gordon Pty Ltd Environmental Evaluation Report 3 For Environmental Evaluation Notice*

NRA, 2021, *Capricorn Copper Mine Receiving Environment Monitoring Program Design Report*

NRA 2022, *Capricorn Copper Mine Receiving Environment Monitoring Program Report*

12. Acronyms

Acronym	Description
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Guideline for Fresh and Marine Water Quality
AWBM	Australian Water Balance Model
CCA	Consequence Category Assessment
CCM	Capricorn Copper Mine
CCPL	Capricorn Copper Pty Ltd
DES	Department of Environment and Science
DSA	Design Storage Allowance (ML)
DSM	Design Simulation Margin
EA	Environmental Authority
EP Act	Environmental Protection Act 1994
EPit	Esperanza Pit
ERA	Environmentally Relevant Activities
ETSF	Esperanza Tailings Storage Facility
FSL	Full Supply Level
km	Kilometres
LGA	Local Government Area
LOM	Life of Mine
m	Metres
MCD	Mill Creek Dam
ML	Mining Lease
ML	Megalitres
MNES	Matter of National Environmental Significance
MOL	Maximum Operating Level (m AHD)
MRL	Mandatory Reporting Level
MSES	Matter of State Environmental Significance
NWRD	North Waste Rock Dump
PMLU	Post Mining Land Use
PRCP	Progressive Rehabilitation and Closure Plan
ROM	Run of Mine
RPEQ	Registered Professional Engineer of Queensland
SDP	System Design Plan
SWL	Standing Water Level
t	Tonnes
TARP	Trigger Action Response Plan
TSF	Tailings Storage Facility
WBM	Water Balance Model
WMP	Water Management Plan

APPENDIX 1 SYSTEM DESIGN PLAN

APPENDIX 2 CONSEQUENCE CATEGORY ASSESSMENT

ENGENY

CAPRICORN COPPER PTY LTD

Capricorn Copper Mine

Esperanza Pit, Esperanza TSF and Mill Creek Dam Consequence Category Assessment

QC1022_013-REP-001-0

14 DECEMBER 2023

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Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
0	14/12/2023	Client Issue	Bennet Hume	Travis Warren	Travis Warren	Miles Tremlett - Johnstone
Signatures:						

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Tables

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1. INTRODUCTION

1.1 General

Capricorn Copper Pty Ltd (CCPL), a wholly owned subsidiary of 29Metals Limited, owns and operates the Capricorn Copper Mine (CCM) located in Gunpowder, North Queensland. CCM is operated under the approval of Environmental Authority EPML00911413 (EA) (dated 30 September 2022) managed by the Department of Environment and Science (DES).

The site manages mine affected water (MAW) through the use of water management infrastructure, including regulated structures licensed under the site's EA. CCM operate three (3) regulated structures including Esperanza Tailings Storage Facility (ETSF), Esperanza Pit (EPit), and Mill Creek Dam (MCD) in an integrated containment system for the purpose of sharing the Design Storage Allowance (DSA) volume across the system. The operation of the integrated containment system is described in the System Design Plan (SDP).

An update of the SDP has recently been completed (Engeny, 2023c). As part of the SDP update, Engeny has been engaged to update the consequence category assessment(s) (CCA) for the existing regulated structures comprising the integrated containment system. The CCA has been undertaken in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures Version 5.02* (DES, 2016) herein referred to as 'the Manual'. RPEQ Certification of the CCAs in accordance with the requirements of the EA and the Manual is provided in Appendix B.

A previous CCA was undertaken by GHD in 2021, a summary of key changes since the previous CCA are provided in Section 4.4.

A general arrangement showing the location of the regulated structures is shown in Figure 1.1.

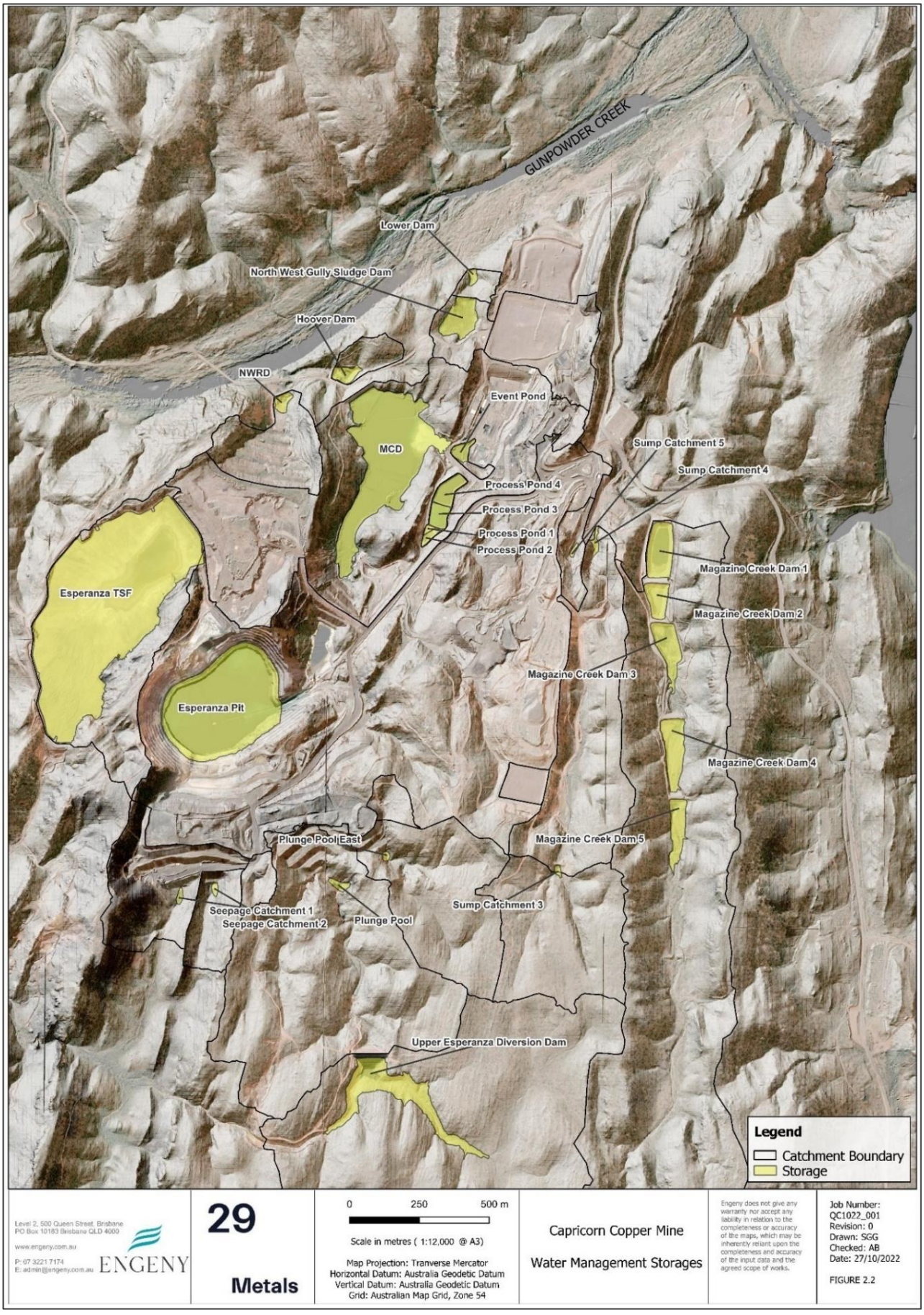

Figure 1.1: CCM General Arrangement Plan

1.2 DES / Environmental Authority Requirements

The requirements for consequence category assessment of structures at the CCM are defined in Conditions G1-1 to G1-3 of the *EPML00911413* (dated 30 September 2022).

(G1-1) The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933) at the following times:

(a) prior to the design and construction of the structure, if it is not an existing structure; or,

(b) prior to any change in its purpose or the nature of its stored contents.

(G1-2) A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.

(G1-3) Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (ESR/2016/1933).

2. REGULATED STRUCTURE DETAILS

2.1 Overview

The three regulated structures EPit, ETSF and MCD form the integrated containment system for CCM for the purpose of sharing the DSA volume across the system. A summary of the structures includes:

- ETSF is an operational tailings storage facility and is required to maintain minimal volumes of water stored in the decant pond to minimise the risk of seepage. Therefore, ETSF containment requirements are shared between EPit and MCD. Tailings water and rainfall runoff from ETSF is transferred to EPit and bidirectional transfers can occur between EPit and MCD.
- EPit is a historical mining pit that has been used for tailings storage and bulk storage of MAW and has the largest capacity of the three regulated structures.
- MCD is a valley embankment dam and is the main water supply source for operational water demands.

The three storages also spill to each other before discharging offsite, with ETSF spilling into EPit, and EPit into MCD. If MCD were to overflow, water would be conveyed into Hoover Dam, and finally Gunpowder Creek.

Key features of each structure are provided in Table 2.1 below. Further details of each structure are provided in subsequent sections of this report.

TABLE 2.1: ETSF, EPIT AND MCD KEY FEATURES

	ETSF	EPit	MCD
Purpose	Tailings settlement and storage	Bulk storage for tailings and MAW (runoff and seepage)	Containment dam for mine affected runoff and MAW
Configuration	Zoned Earth and Rockfill embankments with filters	Former open cut mine workings	Earth and rockfill embankment with clay core with filters
Spill Level	280.9 m AHD	240 m AHD	219 m AHD
Maximum Operating Level (MOL) as per EA	284 m AHD	222 m AHD (Level where EPit Seeps to MCD)	219 m AHD (Spillway)
Available Storage to MOL at final tailings surface	Negligible water storage volume	1677.9ML (existing) 730.6 ML (post final tailings deposition)	771.5 ML (original capacity 1400 ML)
Floor Level	Varies from tailings deposition	Level of final tailings surface: 215.7 m AHD (varies) Level of deposited tailings: 200.8 m AHD (varies) Original pit floor: 90.0 m AHD	206.85 m AHD
Spillway			
Type	Broad crested weir	No Engineered Spillway, spill point at EPit Ramp	Excavated by wash
Crest Width	8 m	N/A - Natural Ground Profile	6 m

	ETSF	EPit	MCD
Spillway Capacity	24.32 m3/s for PMF AEP storm event while maintaining 1.05 m dry freeboard.	PMF	1:100,000 AEP + 1:10 AEP wave
Inflows and Outflows			
Inflows	• Direct rainfall and catchment runoff • Tailings slurry from the Processing Plant • Pumped seepage from the ETSF Saddles Dams 1 and 2	• Rainfall and catchment runoff • Overflows from ETSF • Groundwater inflows • Evaporators return water • Pumped seepage from NWRD sump • Underground Dewatering (Mammoth Underground and Esperanza Underground) • Saddle Dam 3 return water • Previously received brine from the RO plant – RO plant removed from site August 2023 • Seepage from Esperanza WRD • Seepage from Mammoth WRD • Pumped flows from MCD	• Rainfall and catchment runoff • Groundwater inflows • Overflow from EPit • Pumped inflows from EPit • Mammoth WRD and EPit Retention Pond seepage via Bat Cave • Previously received waste from WTP – WTP unserviceable since March 2023 flooding event • Pumped flows from Hoover Dam • Pumped seepage from Sump 6
Outflows	• Evaporation and seepage losses • Overflow to EPit • Pumped flows from decant pond to EPit	• Evaporation • Enhanced evaporation • Overflow and Seepage to MCD • Authorised pumped release to Gunpowder Creek • Pumped flows to MCD	• Evaporation and seepage losses • Supplies Pond 3 for water treatment via pumped outflows. • Overflow to Gunpowder Creek via Hoover Dam • Pumped flows to EPit

2.2 Esperanza Pit (EPit)

The EPit was operated as an open cut mine until 2005 and has served as a MAW storage facility since that time. In addition, during the period 2017 to early 2022, the EPit also served as a tailings deposition site.

The EPit is located approximately 2 km south-west of the CCM processing facility. The EPit floor is at approximately 90 mAHD elevation and daylights at the original surface at the lowest level at approximately 225 m AHD, although the maximum operating level has been set at 222 m AHD (known as the rock bar), as water above this level would be able to report to MCD via seepage via the EPit Overflow Pond (also known as EPit RAMP) which is elevated a further 18 m to 240 m AHD by the EPit Ramp. Should water rise in the EPit to 240 mAHD it would spill over an effective natural “spillway” into MCD, however the paste plant and adjacent vent shaft are below this level at approximately RL 230m AHD.

The EPit floor level rose due to the deposition of tailings between 2017 and early 2022 and currently has a lowest elevation of 200.8m AHD.

Previous works undertaken by GHD (2021a) reviewed seepage risk of the EPit, concluding that:

- The deep bedrock around the EPit had low permeability as evidenced by the lack of significant groundwater inflow to underground workings.

- Groundwater outflow was effectively prevented by a groundwater mound around the EPit; and,
- If any of the geological features through the site were more permeable than general bedrock (as seems not the case) then seepage would either be intercepted by the North Waste Rock Dump (NWRD) seepage interception trench or, more likely, the MCD.

Previous ground water modelling undertaken by GHD indicates that no physical evidence of seepage can be traced to the EPit (GHD, 2021a). Therefore, it is concluded that the EPit is effectively watertight up to the rock bar at RL 222. If water were to be stored above RL 222, seepage through the shallow fractured surface rock would enter MCD, after first passing through the EPit Overflow Pond. Historically, the EPit has stored MAW above RL 222m, and seepage rates did not impact MCD containment as the return pumping rate, and process demands are higher than the seepage inflow rate reported by CCM (13ML/day).

Engeny have recalculated the DSA for he regulated structures, with a reduction to DSA volumes to be applied to EPit. CCM propose to recommence deposition of tailings into the EPit, which ceased in January 2022. The DSA and MRL levels have been varied to RL217.2m (from RL207.7m and RL217.9m respectively), increasing the current tailing storage capacity by approximately 960,000m^3. The available tailings decant water storage below the DSA / MRL level is 233.8 ML and there is 496.8 ML water storage available above the decant storage to the MOL (RL 222, below the rock bar) for DSA/MRL.

The decant water on average is 2m depth and acts as a water cover across the tailings which are characterised as potentially acid forming (PAF). This water cover will prevent oxidation of the tailing's material, and generation of acid and metalliferous drainage.

The existing EPit storage characteristics developed from bathymetric and LiDAR Survey captured during June 2023 are presented in Figure 2.1., while the general arrangement plan of EPit is provided in Figure 2.2. Figure 2.2

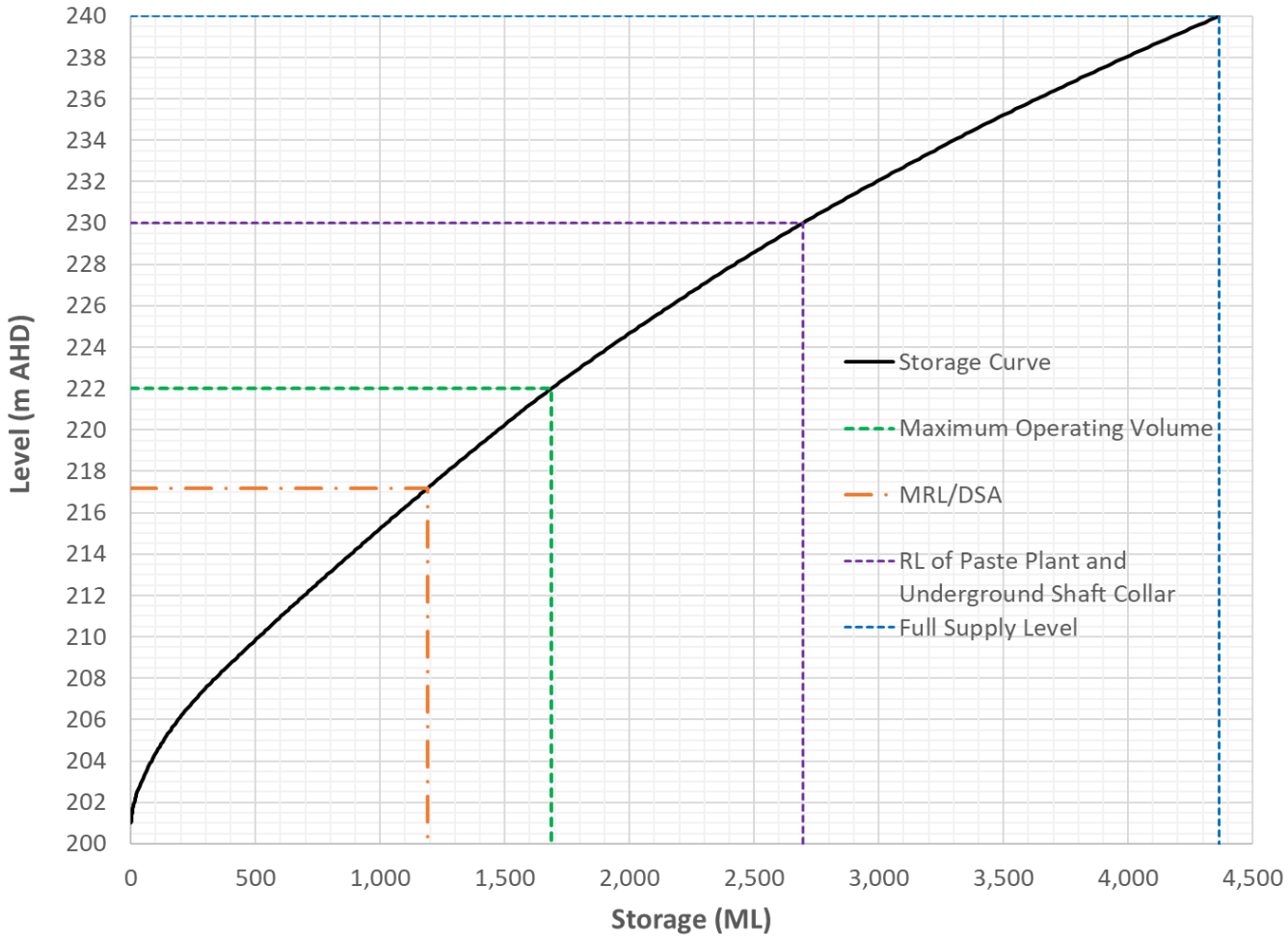

Figure 2.1:Esperanza Pit (EPit) Storage Characteristics

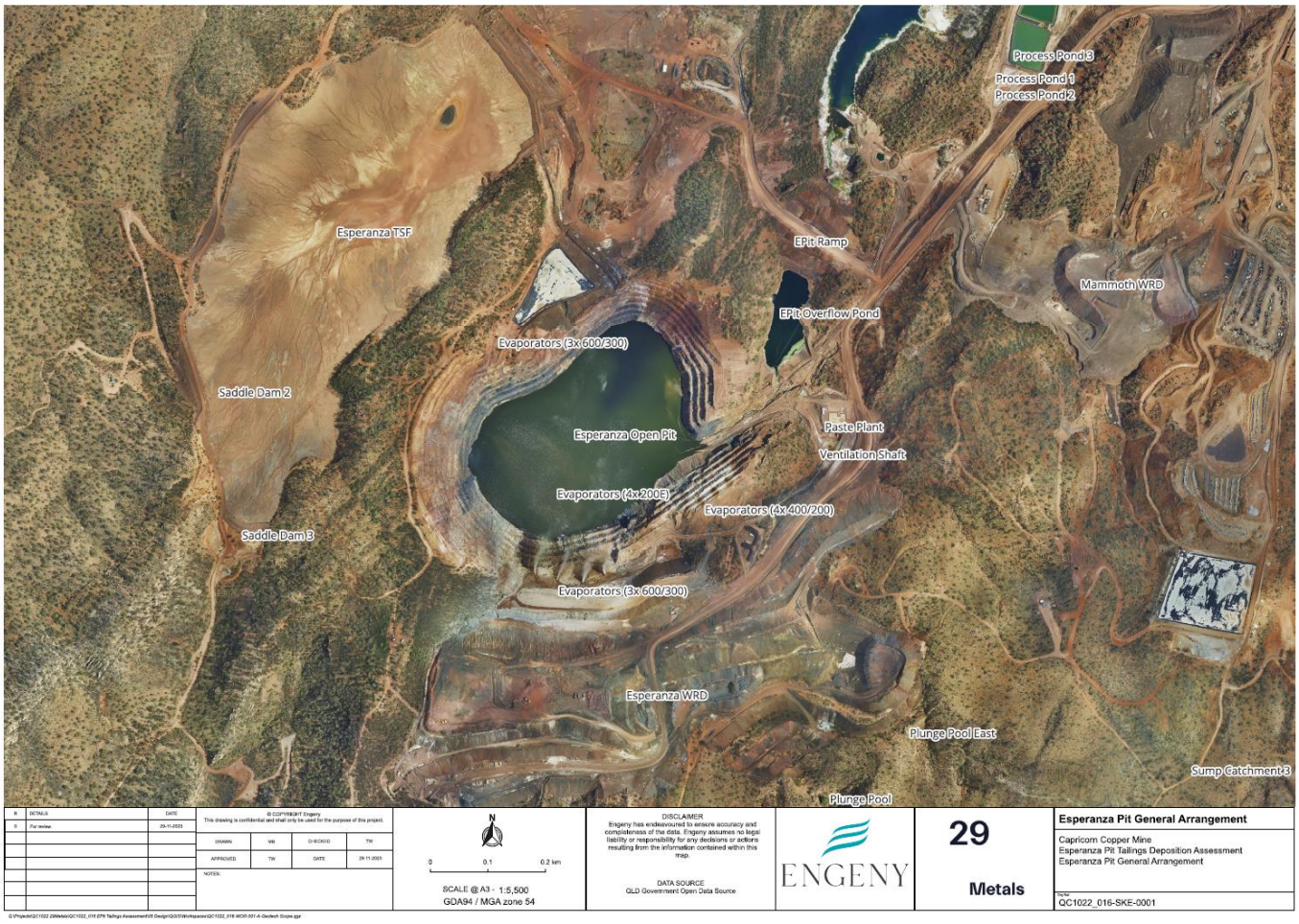

Figure 2.2: EPit General Arrangement Plan

2.3 Mill Creek Dam (MCD)

MCD is a purpose designed water management structure with an original design storage capacity of ~1,400 ML. The capacity of the MCD has been reduced to ~776ML through construction of an upstream saddle and the generation of sludges and sediment from the water treatment plant (WTP). The dam features a clay core with rockfill shells and includes a cement grout curtain in the foundations.

The MCD storage characteristics developed from bathymetric and LiDAR Survey captured during June 2023 are presented in Figure 2.3. A general arrangement plan of MCD is provided in Figure 2.5.

Since original construction, an embankment has been constructed to separate the MCD from the adjacent infrastructure (Workshop Area) from the main storage area. Relevant infrastructure has included the (now unserviceable) WTP, (no longer operational) process plant and a workshop/warehouse facility. However, the crest of this wall is lower than the MCD spillway, such that the Workshop Area floods before MCD spills. Overflows from MCD are controlled by an excavated spillway on the right abutment. Flow would first enter Hoover Dam then, (if sufficient flow continued) overtop Hoover Dam, and enter Gunpowder Creek. Seepage from MCD is minor (estimated at approximately 2mm/day (Engeny, 2023c)) and is intercepted by the downstream Hoover Dam and returned to MCD. If not collected it would flow to Gunpowder Creek.

In the event of a dam breach the total contents of MCD would report to Gunpowder Creek.

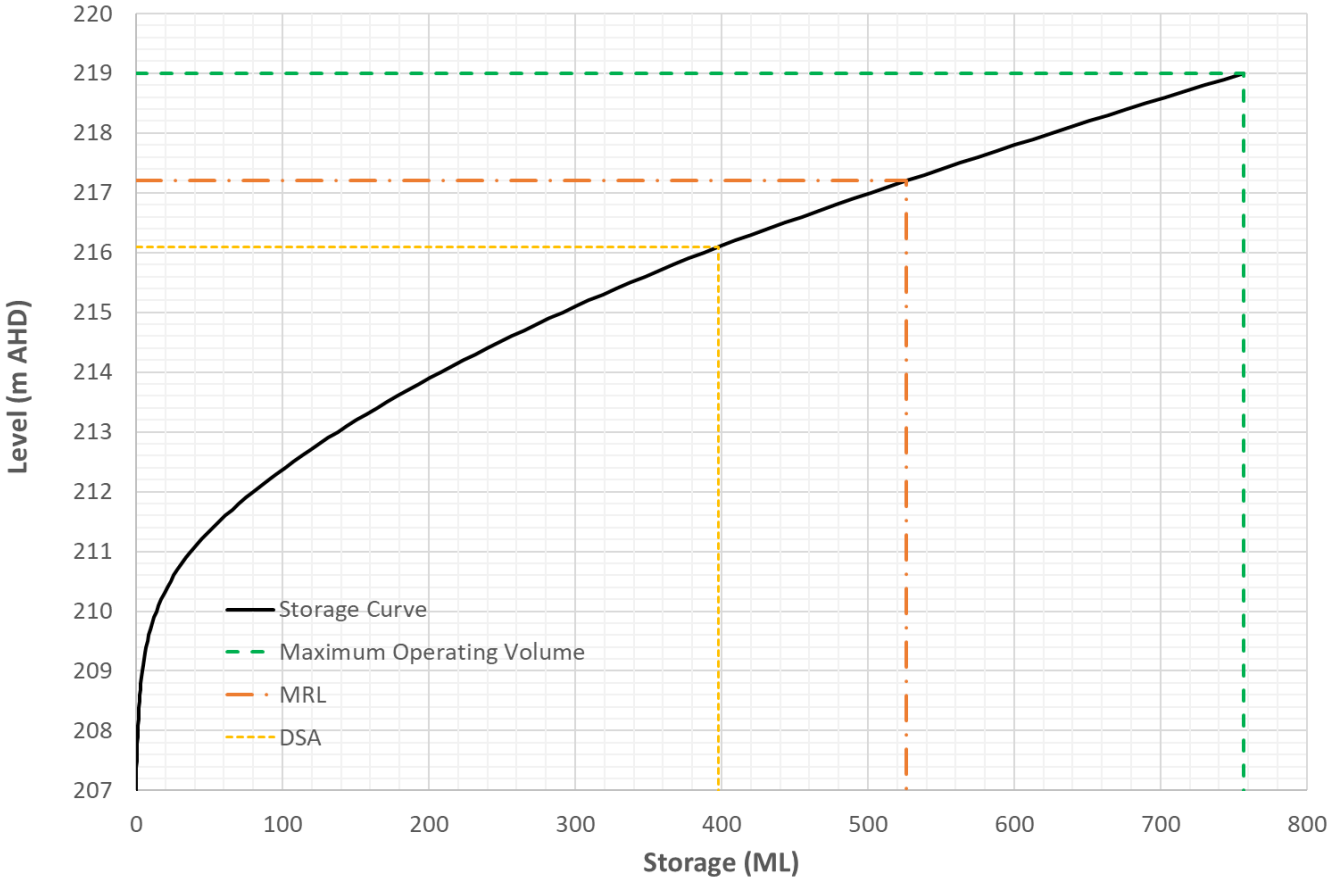

Figure 2.3: Mill Creek Dam (MCD) Storage Characteristics

Since original construction, an embankment has been constructed to separate the MCD from the adjacent infrastructure (Workshop Area) from the main storage area. Relevant infrastructure has included the (now unserviceable) WTP, (no longer operational) process plant and a workshop/warehouse facility. However, the crest of this wall is lower than the MCD spillway, such that the Workshop Area floods before MCD spills. Overflows from MCD are controlled by an excavated spillway on the right abutment. Flow would first enter Hoover Dam then, (if sufficient flow continued) overtop Hoover Dam, and enter Gunpowder Creek. Seepage from MCD is minor (estimated at approximately 2mm/day (Engeny, 2023c)) and is intercepted by the downstream Hoover Dam and returned to MCD. If not collected it would flow to Gunpowder Creek.

In the event of a dam breach the total contents of MCD would report to Gunpowder Creek.

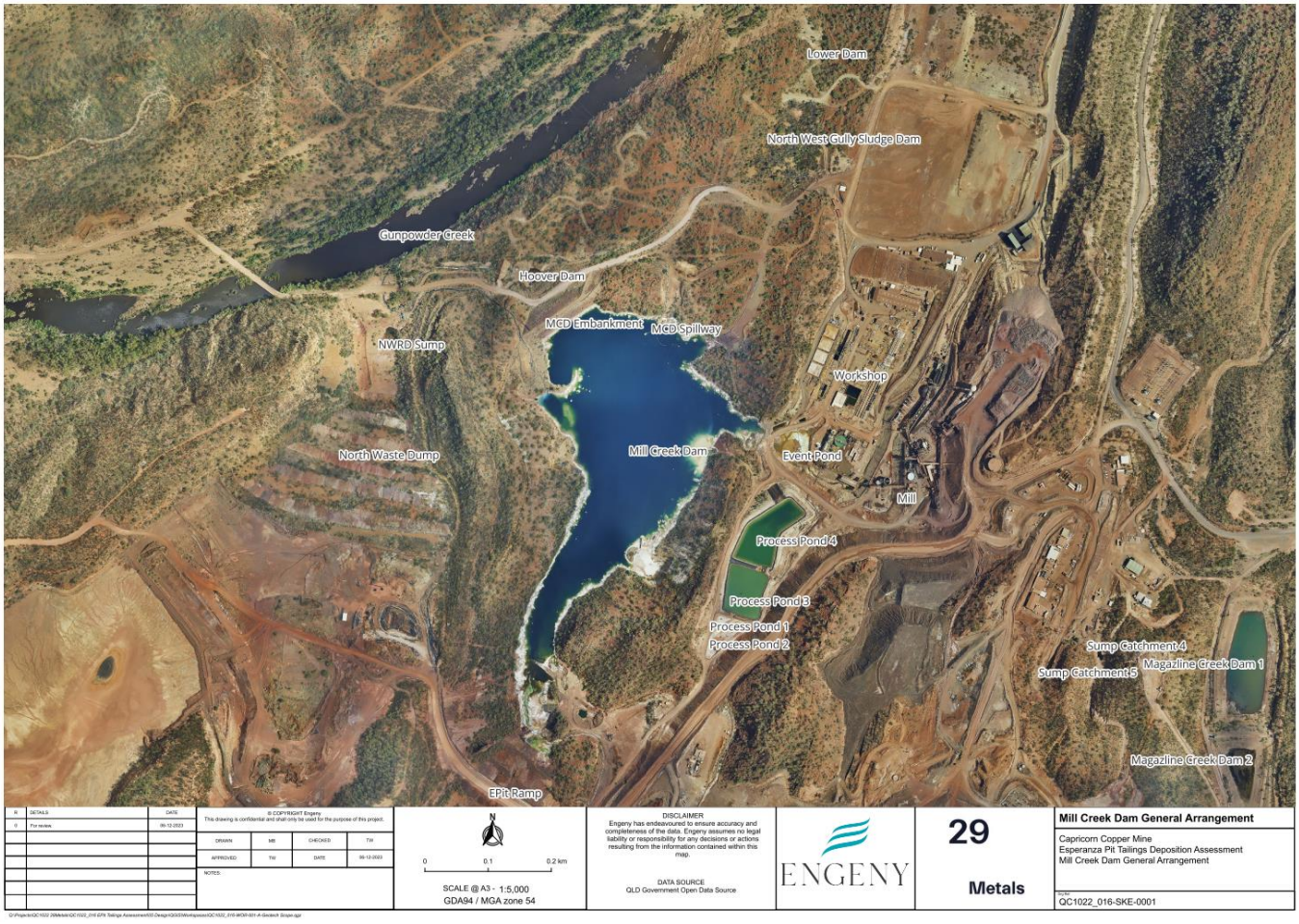

Figure 2.4: MCD General Arrangement Plan

2.4 Esperanza Tailings Storage Facility (ETSF)

The ETSF is located to the southwest of the CCM plant site in a valley to the east of Gunpowder Creek and to the west of EPit. The ETSF was originally constructed in 1998 and was used to store the tailings generated from the site under a previous owner, until 2013 when operations were suspended and the site placed in care and maintenance.

Multiple lifts of ETSF have taken place since its original construction, including raising of Saddle Dams 2 and 3 to RL277m in 2003, to RL280m in 2009, and to RL283m in 2012-2013 under a previous owner, and a further lift, referred to as Lift 1, in 2021 by CCPL.

Lift 1 comprised the construction of a raise of the Northern Embankments and Saddle Dams to provide approximately 12 months storage at the forecast production rate. The raise involved increasing the Northern Embankment and Saddle Dam 1 crest levels to 284 m AHD, Saddle Dam 1A crest level to 284.5 m AHD, and Saddle Dam 2 and Saddle Dam 3 crest level to 286 m AHD.

In 2013, seepage interception systems were installed to collect seepage from Saddle Dams 2 and 3, and from the NWRD. It is understood that seepage from the facility occurs through the fractured rock zone underneath Saddle Dams 2 and 3 and the main embankment wall. These seepage interception trenches intercept, recover, and return seepage water to the ETSF to prevent it interacting with Gunpowder Creek.

Groundwater modelling indicate that the main control on infiltration and seepage from the ETSF is the level of the pond on the ETSF and interception of seepage at the NWRD sump (Engeny & Pendragon, 2024) A higher pond level leads to a higher contact surface for infiltration and higher levels of saturation in the ETSF; hence a low (minimum) pond level is crucial to maintaining hydraulic conditions in the ETSF so that seepage cannot occur through the shallow, weathered and fractured shallow lithologies, while also reducing seepage underneath the northern embankment (Engeny & Pendragon, 2023).

During 2018-2019, the ETSF was used to enhance evaporation by transferring water from other structures and utilising the structure for water storage. This was found to cause a significant increase in seepage intercepted in NWRD Sump and the practice was subsequently ceased (GHD, 2021b). Following the cessation of use of the ETSF for additional evaporation, minimal decant water is stored in ETSF and the decant pond is situated at least 100m from the embankments, resulting in significant seepage reduction.

The estimated volume of tailings above the natural surface level of the saddles at 280.9m AHD to the 286m AHD is predicted to be approximately 1.4 million m^3 (based on previous GHD (2019) CCA) with limited water storage capacity. It is noted that no dam break study or failure modes analyses has been undertaken on this structure. However, in the event of dam-break tailings will be discharged to Gunpowder Creek.

A layout plan showing the ETSF embankment locations and spillway is presented in Figure 2.5.

Figure 2.5: ETSF Embankment Layout Plan

2.5 Water Quality Data

Historical (2014 to 2023) water quality monitoring data for the EPit, MCD and ETSF is summarised below in Table 2.2. For comparison purposes, the water quality monitoring data is presented alongside the following:

- Receiving Waters Contaminant Trigger Levels in the EA (Schedule C – Table 4 of EA).
- Stock watering (lower) limits from the ANZECC water quality guidelines (ANZECC, 2000).
- Background historical water quality data from the following upstream and downstream monitoring points (displayed in Figure 2.6)[1]:
  - Upstream monitoring points:
    - GPU1

[1] Data displayed in Tables 2.2 and 2.3 for this CCA is extracted from the Surface Water Quality Impact Assessment and Groundwater Impact Assessment undertaken by Engeny (Engeny, 2023a & Engeny & Pendragon, 2023), as well as client supplied water quality data.

- GPU2
  - GPU3
  - Gunpowder Creek Reference Site
  - Gunpowder Creek EPO
  - SS1
  - SW44
- Downstream monitoring points
  - GPD1
  - GPD2
  - GPD3
  - GPD5
  - SW45
  - WC04

The water quality monitoring data is also presented alongside the Groundwater contaminant trigger levels in the EA (Schedule C – Table 6) in Table 2.3. For the purpose of this assessment, non-detect values for analytes are reported as zero (due to the data provided containing data presented as zero concentrations).

The water quality parameters and analytes of the MCD, EPit and ETSF generally exceed trigger limits, contaminant limits and stock watering limits. This indicates that the water stored on site is of poor quality and has potential to negatively impact waterways and the environment downstream of the mine in the event of release to the environment.

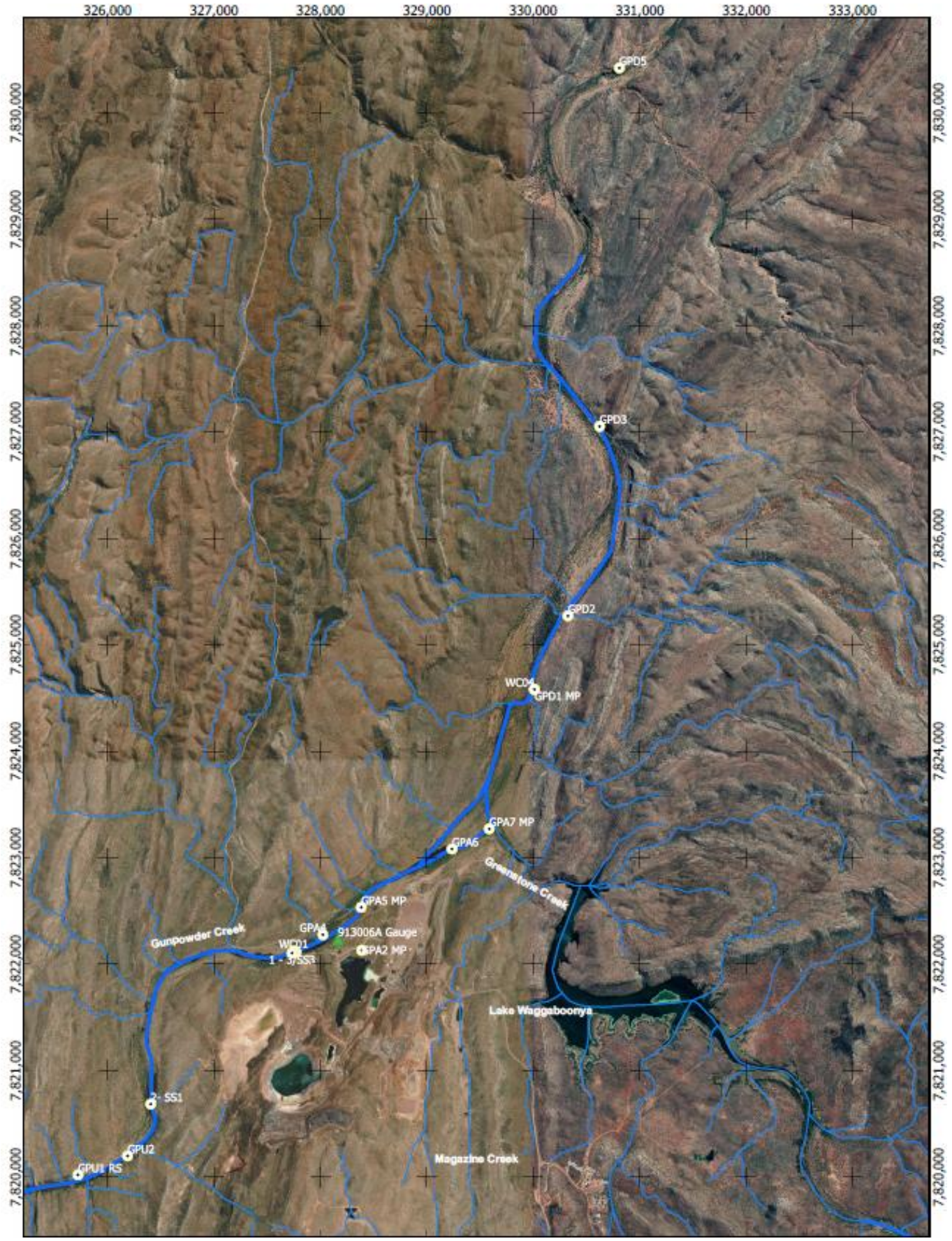

Figure 2.6: Monitoring Locations

Table 2.2: Water Quality (WQ) Monitoring Data vs Receiving Water Trigger Levels

Contaminant	Water Quality Monitoring Data 2014 - 2023												Surface Water Upstream Monitoring Points	Surface Water Downstream Monitoring Points	Trigger Level (TL) (µg/L) unless otherwise specified)	Contaminant Limit (CL) (µg /L unless otherwise specified)	Stock Water (SW) Trigger Level (ANZECC, 2000) (µg /L unless otherwise specified)
	EPit	Compliance (✗/✓)			ETSF	Compliance (✗/✓)			MCD	Compliance (✗/✓)							
		TL	CL	SW		TL	CL	SW		TL	CL	SW					
pH (pH units)	2.78 - 8.18 Average - 4.42	✗	✗	✗	2.5 - 8.85 Average - 4.67	✗	✗	✗	3.05 - 8.3 Average - 4.08	✗	✗	✗	5.1 – 10.0 Average – 7.57	4.54 – 9.69 Average – 7.64		6.0 - 8.5	6.5 – 9.0
EC (uS/fcm)	2840 - 8110 Average - 4622.78	✗	-	✗	2640 - 9340 Average - 4557.78	✗	-	✗	1620 - 7400 Average - 5463.33	✗	-	✗	56.00 – 2024.00 Average – 192.08	151 - 1390 Average – 691.19	435 uS/fcm	-	2000 uS/fcm
Sulphate (mg/l)	1780 - 7450 Average - 3961.18	✗	✗	-	1310 - 22000 Average - 6898.38	✗	✗	-	894 - 10900 Average - 5390.8	✗	✗	-	1 – 3156 Average – 19.46	0 – 5281 Average – 251.07	250 mg/L	1000 mg/l	-
Fluoride (mg/l)	0.1 - 6.4 Average - 1.29	-	✓	✓	0.1 - 13.5 Average - 2.48	-	✗	✗	0.1 - 17.2 Average - 2.22	-	✗	✗	-	-	-	2 mg/l	2 mg/l
Aluminum (µg/L)	10 - 252000 Average - 37662.3	✗	✗	✗	30 - 1700000 Average - 226338.62	✗	✗	✗	10200 - 150000 Average - 66525.42	✗	✗	✗	-	-	55	5000	5000
Arsenic (µg/L)	1 - 2260 Average - 42.64	✗	✓	✓	1 - 229000 Average - 13773.06	✗	✗	✗	2 - 11 Average - 4.18	✓	✓	✓	-	-	13	500	500
Boron (µg/L)	50 - 140 Average - 84.8	✓	✓	✓	50 - 400 Average - 140.45	✓	✓	✓	50 - 210 Average - 93.18	✓	✓	✓	-	-	370	5,000	5,000
Cadmium (µg/L)	0.1 - 3.3 Average - 0.99	✗	✓	✓	0.1 - 3.8 Average - 1.81	✗	✓	✓	0.1 - 3.8 Average - 1.58	✗	✓	✓	-	-	0.2	10	10
Chromium (µg/L)	1 - 129 Average - 21.77	✗	✓	✓	1 - 4050 Average - 526.08	✗	✓	✓	1 - 12 Average - 4.08	✗	✓	✓	-	-	1	1,000	1,000
Cobalt (mg/l)	0.055 - 34.5 Average - 5.44	-	✗	✗	0.005 - 36.5 Average - 13.03	-	✗	✗	0.023 - 28.7 Average - 12.1	-	✗	✗	-	-	-	1 mg/L	1 mg/L
Copper (µg/L)	14 - 298000 Average - 45965.21	✗	✗	✗	11 - 798000 Average - 146918.03	✗	✗	✗	2 - 219000 Average - 89873.82	✗	✗	✗	0.01– 0.114 Average – 0.01	0.002 – 20.9 Average – 0.14	1.4	1,000	40
Lead (µg/L)	1 - 8 Average - 2.5	✓	✓	✓	1 - 12 Average - 4.44	✗	✓	✓	1 - 3 Average - 1.66	✓	✓	✓	-	-	3.4	10	10
Manganese (µg/L)	282 - 108000 Average - 17822.72	✗	-	-	51 - 176000 Average - 56736.1	✗	-	-	111 - 109000 Average - 43305.92	✗	-	-	-	-	1900	-	Not sufficiently toxic
Nickel (µg/L)	24 - 7000 Average - 1340.57	✗	✗	✗	2 - 14700 Average - 4183.73	✗	✗	✗	5 - 5620 Average - 2699.34	✗	✗	✗	-	-	11	1,000	1000
Uranium (mg/l)	0.001 - 0.13 Average - 0.02	-	✓	✓	0.001 - 0.177 Average - 0.07	-	✓	✓	0.008 - 0.103 Average - 0.04	-	✓	✓	-	-	-	0.2 mg/l	0.2 mg/l
Zinc (µg/L)	6 - 6200 Average - 1165.94	✓	✓	✓	6 - 7740 Average - 2580.24	✗	✓	✓	15 - 6610 Average - 2687.71	✗	✓	✓	-	-	8	20,000	20,000

✓ *– Complies*

✗ *– Exceeds*

TABLE 2.3: WATER QUALITY (WQ) MONITORING DATA VS GROUNDWATER CONTAMINANT TRIGGER LEVELS

Contaminant	Water Quality Monitoring Data 2014 - 2023																
	EPit	Compliance (✕/✓)			ETSF	Compliance (✕/✓)			MCD	Compliance (✕/✓)			Groundwater Upstream Monitoring Points	Groundwater Downstream Monitoring Points	Groundwater Trigger Level (TL) (µg/L) unless otherwise specified)	Groundwater Contaminant (CL) Limit (µg /L unless otherwise specified)	Stock Water (SW) Trigger Level (ANZECC, 2000) (µg /L unless otherwise specified)
		TL	CL	SW		TL	CL	SW		TL	CL	SW					
pH (pH units)	2.78 - 8.18 Average - 4.42	✕	✕	✕	2.5 - 8.85 Average - 4.67	✕	✕	✕	3.05 - 8.3 Average - 4.08	✕	✕	✕	5.1 – 10.0 Average – 7.57	4.54 – 9.69 Average – 7.64		6.0 - 8.5	6.5 – 9.0
EC (uS/fcm)	2840 - 8110 Average - 4622.78	✕	-	✕	2640 - 9340 Average - 4557.78	✕	-	✕	1620 - 7400 Average - 5463.33	✕	-	✕	56.00 – 2024.00 Average – 192.08	151 - 1390 Average – 691.19	435 uS/fcm	1000 uS/fcm	2000 uS/fcm
Sulphate (mg/l)	1780 - 7450 Average - 3961.18	✕	✕	-	1310 - 22000 Average - 6898.38	✕	✕	-	894 - 10900 Average - 5390.8	✕	✕	-	1 – 3156 Average – 19.46	0 – 5281 Average – 251.07	250 mg/L	1000 mg/l	-
Fluoride (mg/l)	0.1 - 6.4 Average - 1.29	-	✓	✓	0.1 - 13.5 Average - 2.48	-	✕	✕	0.1 - 17.2 Average - 2.22	-	✕	✕	-	-	-	2 mg/l	2 mg/l
Aluminum (µg/L)	10 - 252000 Average - 37662.3	✕	✕	✕	30 - 1700000 Average - 226338.62	✕	✕	✕	10200 - 150000 Average - 66525.42	✕	✕	✕	-	-	55	5000	5000
Arsenic (µg/L)	1 - 2260 Average - 42.64	✕	✓	✓	1 - 229000 Average - 13773.06	✕	✕	✕	2 - 11 Average - 4.18	✓	✓	✓	-	-	13	500	500
Boron (µg/L)	50 - 140 Average - 84.8	✓	✓	✓	50 - 400 Average - 140.45	✓	✓	✓	50 - 210 Average - 93.18	✓	✓	✓	-	-	370	5,000	5,000
Cadmium (µg/L)	0.1 - 3.3 Average - 0.99	✕	✓	✓	0.1 - 3.8 Average - 1.81	✕	✓	✓	0.1 - 3.8 Average - 1.58	✕	✓	✓	-	-	0.2	10	10
Chromium (µg/L)	1 - 129 Average - 21.77	✕	✓	✓	1 - 4050 Average - 526.08	✕	✓	✓	1 - 12 Average - 4.08	✕	✓	✓	-	-	1	1,000	1,000
Cobalt (mg/l)	0.055 - 34.5 Average - 5.44	-	✕	✕	0.005 - 36.5 Average - 13.03	-	✕	✕	0.023 - 28.7 Average - 12.1	-	✕	✕	-	-	-	1 mg/L	1 mg/L
Copper (µg/L)	14 - 298000 Average - 45965.21	✕	✕	✕	11 - 798000 Average - 146918.03	✕	✕	✕	2 - 219000 Average - 89873.82	✕	✕	✕	0.01– 0.114 Average – 0.01	0.002 – 20.9 Average – 0.14	1.4	1,000	40
Lead (µg/L)	1 - 8 Average - 2.5	✓	✓	✓	1 - 12 Average - 4.44	✕	✓	✓	1 - 3 Average - 1.66	✓	✓	✓	-	-	3.4	10	10
Manganese (µg/L)	282 - 108000 Average - 17822.72	✕	-	-	51 - 176000 Average - 56736.1	✕	-	-	111 - 109000 Average - 43305.92	✕	-	-	-	-	1900	-	Not sufficiently toxic
Nickel (µg/L)	24 - 7000 Average - 1340.57	✕	✕	✕	2 - 14700 Average - 4183.73	✕	✕	✕	5 - 5620 Average - 2699.34	✕	✕	✕	-	-	11	1,000	1000
Uranium (mg/l)	0.001 - 0.13 Average - 0.02	-	✓	✓	0.001 - 0.177 Average - 0.07	-	✓	✓	0.008 - 0.103 Average - 0.04	-	✓	✓	-	-	-	0.2 mg/l	0.2 mg/l
Zinc (µg/L)	6 - 6200 Average - 1165.94	✓	✓	✓	6 - 7740 Average - 2580.24	✕	✓	✓	15 - 6610 Average - 2687.71	✕	✓	✓	-	-	8	20,000	20,000

✓ – *Complies*

✕ – *Exceeds*

3. DESCRIPTION OF RECEIVING ENVIRONMENT

3.1 Surface Waters

CCM is located in the Leichhardt River drainage sub-basin area in the Leichhardt Drainage Basin. The Leichhardt Drainage Basin has a total catchment area of 32,882.2 km^2.

The Leichhardt River rises in the Selwyn Ranges, 40 kilometres southeast of Mount Isa. It flows in a northerly direction, through the city of Mount Isa and Lake Moondarra, before passing through Julius Dam. It is joined by its major tributary, Gunpowder Creek, 15 kilometres downstream of Kamilaroi homestead. Another major tributary, Fiery Creek, joins the river 70 kilometres downstream of Lorraine. The Alexandra River enters the river from the east, just below Floraville, before the Leichhardt River finally passes through a vast coastal plain and enters the Gulf of Carpentaria 30 kilometres northeast of Burketown.

CCM is located directly east of Gunpowder Creek, which is an ephemeral system in the upstream reaches that receives licensed releases of mine-affected water that enters the creek system at the EA-nominated release point. At CCM dam break and or spillway flows from the ETSF report to the EPit which flows into MCD. Any overflows from MCD report to Hoover Dam then to Gunpowder Creek and toward Leichardt River.

Magazine Creek flows into Greenstone Creek, which flows into Gunpowder Creek downstream of the mining activities.

Gunpowder Creek flows into Leichhardt River, approximately 100 km north-east of CCM.

Receiving waterways downstream of CCM are shown in Figure 3.1 below.

Figure 3.1:CCM Receiving Waterways

3.2 Groundwater

Based on published data (Queensland Government, 2023), it is understood there are multiple bores within a 5km radius of CCM. CCM maintains approx. 35 monitoring bores on site.

Mapping indicates bores within a 5 – 10km are not listed as extraction bores for drinking purposes. It is understood that Lake Waggaboonya (the source of potable water for CCM) is not impacted by CCM operations.

Water bores located within 10km of CCM is displayed in Figure 3.2 below.

Figure 3.2: Ground Water Bores Located within a 10km radius to CCM (Queensland Government, 2023)

3.3 Environmental Values

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP) does not list environmental values (EV) or water quality objectives (WQO) for the Leichardt River Basin, however, the *Capricorn Copper Mine 2023 Post-wet REMP Report* (Hydrobiology, 2023) reports on relevant environmental values for receiving waters in the vicinity of CCM (adopted from the 2022 REMP Report (NRA, 2022)) and are displayed Table 3.1.

TABLE 3.1: NOMINATED ENVIROMENTAL VALUES FOR GUNPOWDER CREEK AND GREENSTONE CREEK AS DEFINED IN PREVIOUS REMP (NRA, 2022) (TABLE ADAPTED FROM HYDROBIOLOGY, 2023)

Label	Environmental Value	Description	Gunpowder Creek (adjacent to CCM) [1]	Gunpowder Creek (downstream of CCM) [2]	Greenstone Creek (downstream of confluence with Magazine Creek)
	Aquatic ecosystem	The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways, waterholes and riparian areas. For example, biodiversity, ecological interactions, plants, animals, key species and their habitat, food and drinking water.	Highly disturbed [3]	Moderately disturbed	Highly disturbed [3]
	Stock watering	Suitability of water supply for production of healthy livestock.	✓ [3]	✓	✓ [3]
	Secondary recreation	Health of humans during recreation which involves indirect contact and a low probability of water being swallowed. For example, wading, boating, rowing and fishing.	-	✓	-
	Visual appreciation	Amenity of waterways for recreation which does not involve contact with water. For example, walking and picnicking adjacent to a waterway.	✓ [3]	-	✓ [3]
	Industrial	Suitability of water supply for industrial use. For example, food, beverage, paper, petroleum and power industries, mining and minerals refining/processing. Industries usually treat water supplies to meet their needs.	Mining [3]	Mining	Mining [3]
	Cultural and spiritual values [4]	Cultural, spiritual and ceremonial values of water means its aesthetic, historical, scientific, social or other significance, to the past, present or future generations.	✓ [3]	✓	✓ [3]

Notes:

[1] Adjacent sites include GPA2, GPA4, GPA5 and GPA6. Although GPA2 is upstream of the causeway and the Mill Creek Dam release point, this site is likely to have been impacted by mining activities. This is likely to be due to backflow (Wood (1996) notes backflow occurs about 40 m upstream of the causeway – GPA2 is approximately 120 m upstream of the causeway) and/or pooling of mine-affected waters upstream of the causeway. For the purpose of EVs, site GPA2 is considered to be adjacent to the mine.

[2] The listed environmental values are subject to research and consultation with the Administering Authority and, as required, other stakeholders. Indications suggest the end of the mixing zone is nearer to 1 km downstream of the confluence of Greenstone Creek with Gunpowder Creek (NRA 2016).

[3] ANZG (2018) defines the mixing zone as an explicit area around effluent discharges where the management goals of the ambient waters do not need to be achieved and hence designated EVs may not be applied. The mixing zone for Greenstone Creek is considered to be from the confluence with Magazine Creek downstream to the confluence with Gunpowder Creek. The mixing zone for Gunpowder Creek is considered to extend from around the causeway to a point downstream of the confluence with Greenstone Creek. Impacts within this zone have occurred since the early 1970s, with seepage from the Old (Mammoth) TSF and contaminated flows into Gunpowder Creek via Mill Creek. It is not considered appropriate to assign aquatic ecosystem EVs in the context of regulatory compliance (although it is appropriate to derive relevant guidelines to serve as trigger values) to the Gunpowder Creek and Greenstone Creek mixing zones.

Environmental values are site-specific and dependent on local factors, including land use and the pre-existing condition of the catchment relative to its position on the pristine-to-highly degraded continuum.

3.4 Receiving Environment Monitoring Program (REMP)

Capricorn Copper Mine 2023 REMP Report, prepared by Hydrobiology for Capricorn Copper Pty Ltd, dated 4 August 2023 (Hydrobiology, 2023) considers groundwater quality in terms of interactions between surface water and groundwater, and influences of surface water quality on the receiving environment at CCM. The REMP report describes the annual results (July 2022 to June 2023) of the Receiving Environment Monitoring Program (REMP) and addresses conditions C4-1 to C4-3 of the EA for CCM.

The REMP report assesses stream flow, routine and release monitoring data for data collected during in the annual survey (undertaken in May). Data collected includes but is not limited to aquatic habitat, stream flow, water quality and biological indicators (macroinvertebrates). Survey sampling occurred at a series of test (located upstream, adjacent and downstream) and control (outside any influence from CCM) sites along Gunpowder, Magazine and Greenstone Creek.

The extract below summarises the conclusion of the 2023 REMP report (Hydrobiology, 2023):

Overall, the trends displayed in the current REMP period do not indicate any notable impact from CCM operations to the environmental values (EVs) (human use - livestock drinking and recreational aesthetics; and aquatic ecosystems) of the receiving environment. As such the current release limits stipulated in the EA are considered suitable to protect the EVs of the CCM receiving environment. Based on the chelex-labile and macroinvertebrate results, there is evident assimilative capacity within Gunpowder Creek.

The REMP therefore considers that current site operations are unlikely to be significantly impacting the environmental values of the receiving environment, with reported exceedances consistent with previous exceedances, indicating no new or emerging trends in impacts.

3.5 Land Use and Habitable Dwellings

There are two habitable dwellings approx. 22km downstream of CCM and 8 – 10 km westward of Gunpowder Creek (no evidence of extraction) (Queensland Government, 2023). The closest known potential receptors within the Gunpowder Creek flow path are located on the Leichhardt River approximately 150 km downstream of the site, being the Lorraine Airport (and associated residential land uses) and the nearby irrigated agricultural development (and associated residential land uses). There are no visible bridges, infrastructure or observed Population at Risk (PAR) in the Gunpowder Creek flow path for over 25 km downstream (considered conservatively the maximum extent of any credible breach scenario for loss of life, refer Table 4.5), excluding Gunpowder Road which is not trafficable during wet weather and for which CCPL can control access.

What appears to be lightly trafficked roads were observed in the area, however these are considered to have a transient PAR, with likely infrequent use.

Grazing is the dominant land use within the area between the mine and Leichardt River. Land use and habitable dwellings located downstream of CCM are displayed in Figure 3.3.

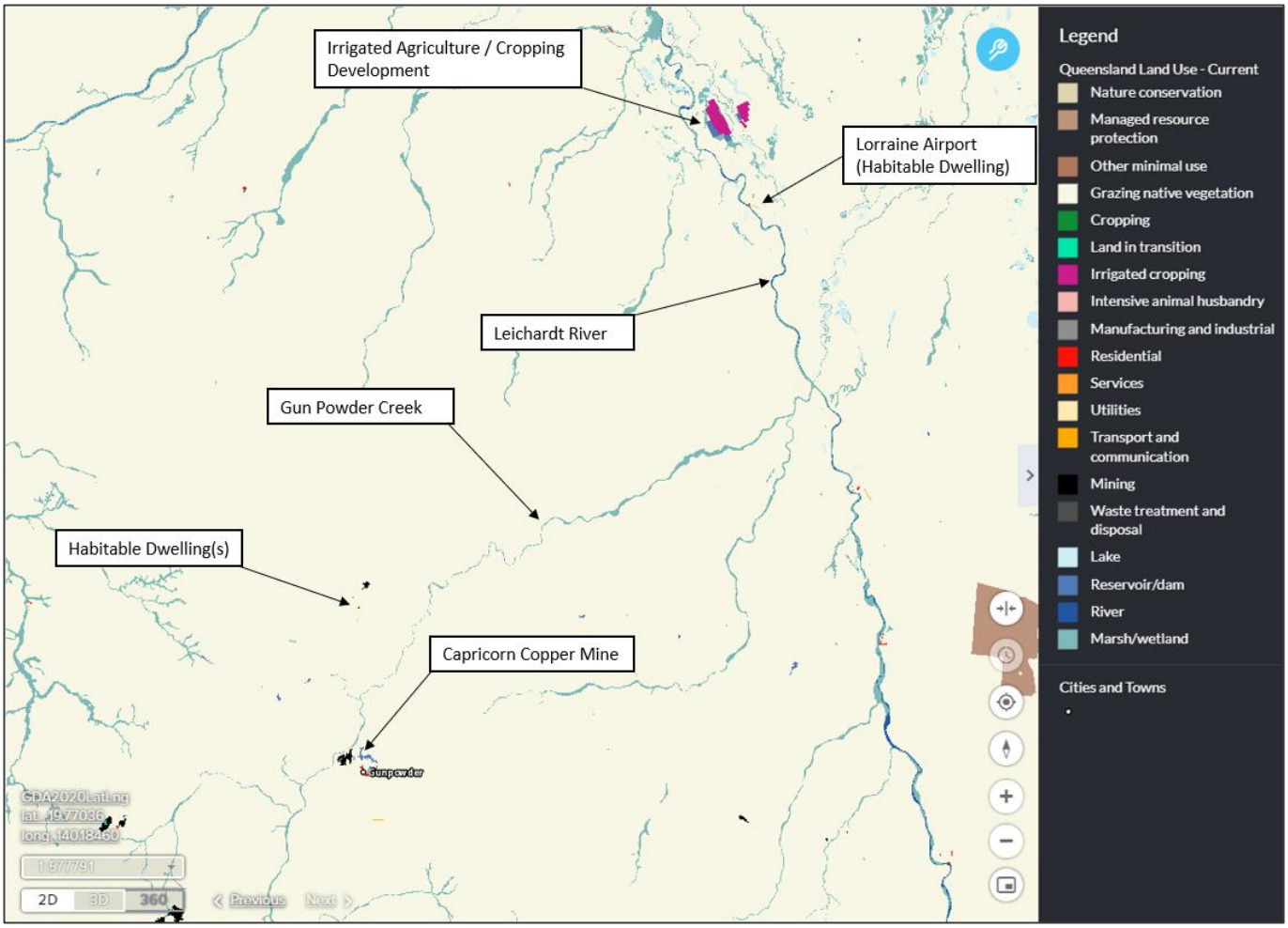

Figure 3.3: Downstream Land Use and Habitable Dwellings (Queensland Government, 2023)

3.6 Matters of State Environmental Significance

Matters of State Environmental Significance (MSES) are a component of the biodiversity state interest that is defined under the State Planning Policy (SPP). MSES include certain environmental values that are protected under Queensland legislation.

The matters given protection under Queensland environment laws and included as criteria for MSES are:

- Protected areas (all classes except coordinated conservation areas) – *Nature Conservation Act 1992.*
- Marine Parks (Marine National Park, Marine Conservation Park, Scientific Research, Preservation and Buffer zones) – *Marine Parks Act 2004.*
- Fish Habitat Areas (A and B) and Dugong Protection Areas – *Fisheries Act 1994.*
- High Conservation Value wetlands – *Environmental Protection Act 1994.*
- Wild River high preservation areas – *Wild Rivers Act 2005.*
- Threatened species (listed as 'endangered' or 'vulnerable') – *Nature Conservation Act 1992.*
- Threatened species essential habitat ('endangered' or 'vulnerable') – *Nature Conservation Act 1992* and *Vegetation Management Act 1999.*
- Regulated vegetation – Category A, B or C areas containing regional ecosystems (classified as 'endangered' or 'of concern'), wetlands and watercourses. Vegetation in Category R areas – *Vegetation Management Act 1999.*
- Legally secured offset areas – protected by a registered covenant, easement, agreement, or a development approval condition.

The following MSES are located within, and downstream of, the boundary of CCM mining leases and along the overflow path:

- Wildlife Habitat:

- Endangered or vulnerable wildlife.
- Regulated Vegetation:
  - Essential Habitat.

MSES located downstream of CCM in Figure 3.4 below.

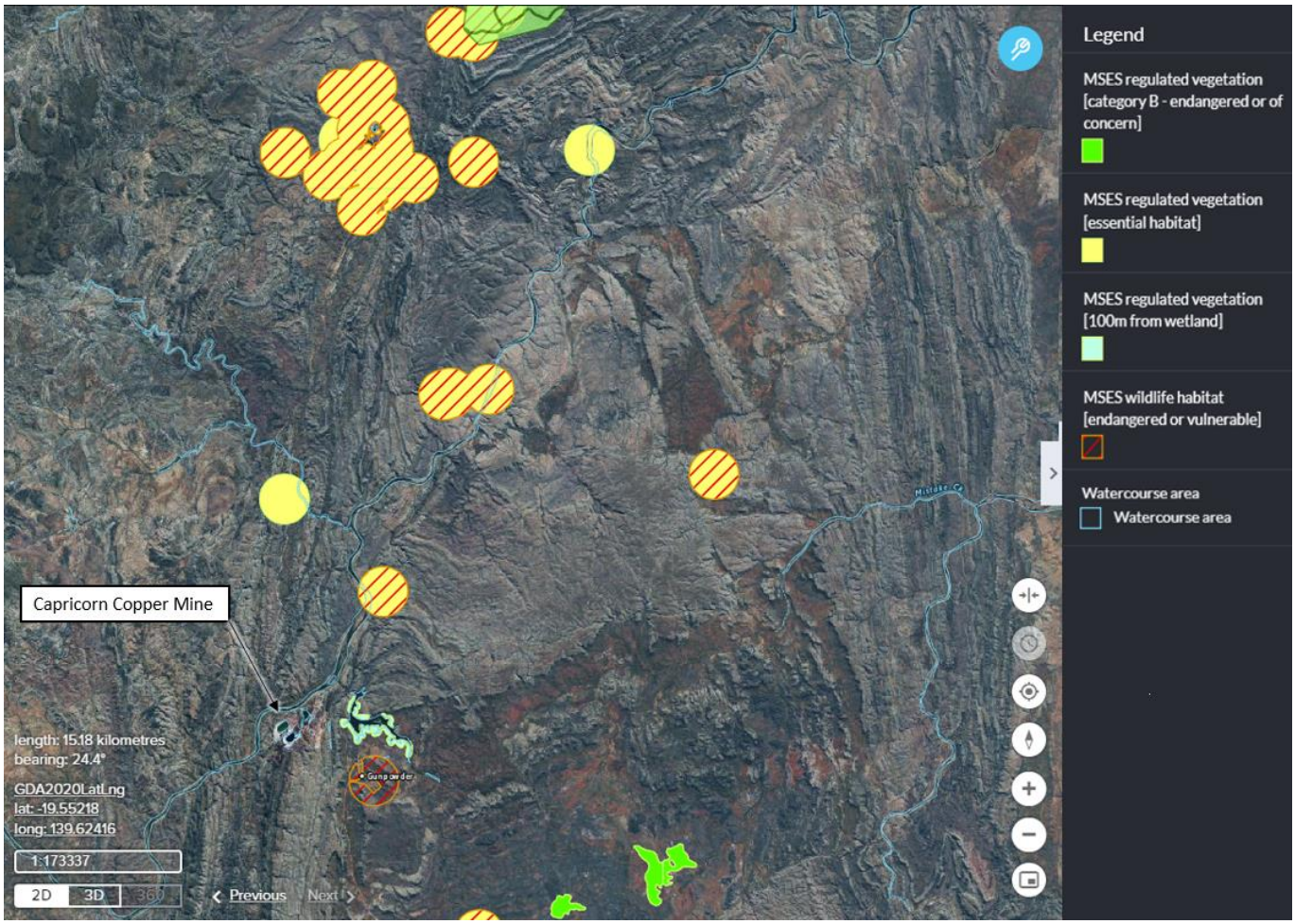

Figure 3.4: Matters of State and Environmental Significance (Queensland Government, 2023)

3.7 Matters of National Environmental Significance

For the purposes of the SPP biodiversity state interest, Matters of National Environmental Significance (MNES) are those natural matters given statutory protection under Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, including (DEHP, 2013a):

- World Heritage Areas properties listed for natural values.
- National Heritage Areas places listed for natural values.
- Wetlands of international importance (listed under the Ramsar convention).
- Migratory species (protected under international agreements).
- Listed threatened species.
- Listed threatened ecological communities.
- Great Barrier Reef Marine Park.
- Commonwealth marine areas.

Use of the Australian Government Department of the Environment Protected Matters Search Tool (http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf) indicates the following MNES are located within a 25km radius of CCM:

- 13 Listed Threatened Species, including the critically endangered Curlew Sandpiper (Calidris ferruginea).
- 12 Listed Migratory Species, including the critically endangered Curlew Sandpiper (Calidris ferruginea) and vulnerable Freshwater Sawfish (Pristis pristis).

4. CONSEQUENCE CATEGORY ASSESSMENT

4.1 Overview

A consequence category assessment was undertaken for the EPit, MCD and ETSF in accordance with Version 5.02 of the *Manual.* The Manual sets out requirements for consequence category assessment and certification of the design of regulatory structures, constructed as part of environmentally relevant activities (ERAs) under the *Environmental Protection Act 1994* (Qld). The term regulated structures includes land-based containment structures, levees, bunds and voids, but not a tank or container designed and constructed to an Australian Standard that deals with strength and structural integrity. Structures may be assessed using this Manual as being in one of three consequence categories: low, significant, or high. Where categories as a significant or high consequence, the structure is referred to as a regulated structure.

4.2 Methodology

The Manual for Assessing Consequence Categories and Hydraulic Performance of Structures requires the assessment of the consequences of the following failure event 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.

For each failure event scenario, the consequences need to be assessed for the following categories of harm:

- Harm to humans.
- General environmental harm.
- General economic loss or property damage.

The consequence category for each type of harm is assigned based on the severity of harm as defined in Table 4.1.

TABLE 4.1: CONSEQUENCE CATEGORY ASSESSMENT CRITERIA[1] (TABLE 1 OF THE MANUAL)

Environmental Harm	Consequence Category		
	High	Significant	Low
Harm to Humans	Location such that people are routinely present in the failure path and if present loss of life to greater than 10 people is expected[2]. Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.	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[1]. Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.	Location such that people are not routinely present in the failure path and loss of life is not expected[1]. Note: The requirement to consider the location of people in the failure path is only relevant to the 'dam break' scenario.
	Location such that contamination of waters (surface and/or groundwater[3]) used for human consumption could result in the health of 20 or more people being affected[4].	Location such that contamination of waters (surface and/or groundwater[2]) used for human consumption could result in the health of 10 or more people but less than 20 people being affected[3].	Location such that contamination of waters (surface and/or groundwater[2]) used for human consumption could result in the health of less than 10 people being affected[3].
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[5] on Significant Values are likely; and c) The adverse effects[4] are likely to cause at least one of the following: i) Loss or damage or remedial costs greater than $50,000,000; or ii) Remediation of damage is likely to take 3 years or more; or iii) permanent alteration to existing ecosystems; or iv) The area of damage (including downstream effects) is likely to be at least 5 km^2.	Location such that contaminants may be released so that adverse effects[4] (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[4] 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 caused to environmental values classed as slightly or moderately disturbed waters[6], wetland of general ecological significance[7], riverine areas, springs or lakes and associated flora and fauna (Moderate Values), and the adverse effects[4] 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[4].
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[8].	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[7].	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 less than $1 million in rehabilitation, compensation, repair or rectification costs[7].

1.To be used for all failure event scenarios

2.'People routinely present in the failure path' could be considered to be people who occupy buildings or other places of occupation that lie within the failure impact zone. For the purposes of this Manual, this should refer to people other than site personnel engaged by the resource operation and located on the tenements and tenure associated with the resource operation; for other ERAs, it would be the 'premises referred to in the authority'. It should be noted that while this is appropriate for the assessment of consequence categories in accordance with this Manual, adherence to the requirements of this Manual does not limit, amend or change in any way, any other requirements to be complied with under relevant health and safety acts or legislation that requires the safety of site personnel to be considered.

3. When considering potential impacts on groundwater, it is not envisaged that a full hydrogeological assessment will be required in all cases. Any consideration of potential impacts on groundwater systems should consider the water quality of the potential receiving aquifer as well as the quality of fluid stored in the regulated dam. Existing groundwater drawdown in areas surrounding resource operations (e.g., drawdown as a result of mine pit or underground mine dewatering) can also be considered when assessing the consequence of dam seepage on groundwater systems.

4. 'An adverse effect on human health means a physiological effect on human health and does not include an impact on the quality of downstream water that merely negatively affects taste, and which is unlikely to cause persons to become physically ill.

5. Adverse effects includes chronic and acute effects where an acute effect is on living organism/s which results in severe symptoms that develop rapidly, and a chronic effect is an adverse effect on a living organism/s which develops slowly. In some instances, it may be necessary to carry out or reference existing ecological/toxicological studies to assess the impacts of contaminants on living organisms.

6. See Environmental Protection (Water and Wetland Biodiversity) Policy 2019 for definitions

7. Wetland of general ecological significance' means a wetland shown on a map of referable wetland as a 'general ecologically significant wetland' or 'wetland of other environmental value'.

8. This does not include the holder's own mine or gas production, on-site industrial or commercial assets, the holder's workers' accommodation, agricultural facilities on the holder's land such as a farm shed or farm dam or infrastructure solely for servicing the holder.

4.3 Assessment of Failure Scenarios

The failure event scenarios considered for the consequence category assessment for ETSF, EPit and MCD are summarised in Table 4.2, Table 4.3, and Table 4.4 respectively.

TABLE 4.2: FAILURE EVENT SCENARIOS CONSIDERED FOR ETSF

Failure Event Scenario	Potential Failure Causes	Comments
Failure to Contain - Seepage	Seepage through impoundment floor	Seepage from the ETSF is controlled and monitored.
	Seepage through perimeter walls and saddle dams.	Seepage occurs through the fractured rock zone underneath Saddle Dams 2 and 3 and the main embankment wall. Seepage losses are expected to be captured by the seepage interception system minimising impact to the surrounding environment. If discharge were to occur, MAW would be contained within local pools in Gunpowder Creek and concentrated by evaporation until being flushed out during significant flow events.
Failure to Contain – Overtopping	Large rainfall event causing overflow discharge.	Spillway discharge is possible and will report to the EPit, and any spill from the EPit would report to MCD. Therefore, the consequence of ETSF needs to be considered in respect of a spill from MCD.
	Operational failure of decant / dewatering pumping infrastructure during large rainfall event causing overflow discharge	Pump failure is possible. Spillway discharge will report to the EPit and any spill from the EPit would report to MCD. Therefore, the consequence of ETSF needs to be considered in respect of a spill from MCD.
Dam Break	Piping (internal erosion) failure through perimeter embankment	Stability or piping failure is possible through perimeter embankments and pit wall.
	Large rainfall events causing overtopping failure of the perimeter embankment	Overtopping failure is possible. Dam break flows will report to Gunpowder Creek.

TABLE 4.3: FAILURE EVENT SCENARIOS CONSIDERED FOR EPIT

Failure Event Scenario	Potential Failure Causes	Comments
Failure to Contain - Seepage	Seepage through impoundment floor	Seepage from the EPit is captured within the MCD.
	Seepage through perimeter walls and saddle dams.	The MOL of structure is set below the rock bar at RL 222 m. However, if water were to be stored above RL 222, it would report to the MCD or NWRD seepage interception trench. There has been no physical evidence of seepage that can be traced to EPit below RL 222, and this is supported by groundwater modelling which demonstrates that EPit is unlikely to be a source of seepage to Gunpowder Creek.
Failure to Contain – Overtopping	Large rainfall event causing pit overflow discharge.	Spillway discharge is possible and would report to MCD. Therefore, the consequence of EPit needs to be considered in respect of a spill from MCD.
	Operational failure of decant / dewatering pumping infrastructure during large rainfall event causing pit overflow discharge	Pump failure is possible. Spillway discharge would report to MCD. Therefore, the consequence of EPit needs to be considered in respect of a spill from MCD.
Dam Break	Piping (internal erosion) failure through perimeter embankment	Stability or piping failure is not considered credible if water is stored below RL222. If water is stored above this level, there is potential for the EPit Ramp to fail and water to release to the MCD, then Hoover Dam and subsequently Gunpowder Creek.
	Large rainfall events causing overtopping failure of the perimeter embankment	Overtopping failure is possible. Dam break flows will report to the MCD, then Hoover Dam and subsequently Gunpowder Creek.

TABLE 4.4: FAILURE EVENT SCENARIOS CONSIDERED FOR MCD

Failure Event Scenario	Potential Failure Causes	Comments
Failure to Contain - Seepage	Seepage through impoundment floor	Seepage losses are expected to be captured by the Hoover Dam and prevent interaction with Gunpowder Creek. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events.
	Seepage through perimeter walls and saddle dams.	
Failure to Contain – Overtopping	Large rainfall event causing pit overflow discharge.	Spillway discharge is possible and would report to Hoover Dam and subsequently report to Gunpowder Creek.
	Operational failure of decant / dewatering pumping infrastructure during large rainfall event causing pit overflow discharge	Pump failure is possible. Spillway discharge would report to Hoover Dam and subsequently report to Gunpowder Creek.
Dam Break	Piping (internal erosion) failure through perimeter embankment	Stability or piping failure is possible through perimeter embankments. Dam break flows would report to Hoover Dam and subsequently report to Gunpowder Creek.
	Large rainfall events causing overtopping failure of the perimeter embankment	Overtopping failure is possible. Dam break flows would report to Hoover Dam and subsequently report to Gunpowder Creek.

4.4 Summary of Changes from previous CCA

Consequence categories have been determined based on the Manual, and updating the previous CCA (GHD, 2021).

Since the previous CCA the following changes have been implemented and/or are proposed:

- MCD has reduced storage capacity from 1400 ML to 771.5 ML at full supply level (refer above).
- CCPL proposes to re-commence deposition of tailings to EPit (subject to regulatory approvals).
- CCPL has applied to modify the DSA and MRL for the EPit to RL217.2m.
- For the purposes of the aforementioned proposal to re-commence tailings deposition in the EPit, the EPit tailings deposition plan has been updated, to reflect the proposed DSA and MRL (refer above), increasing the current tailing storage capacity by approximately 0.96 million m^3. The available tailings decant water storage below the DSA / MRL is 233.8 ML and there is 496.8 ML water storage available above the decant storage to the MOL (RL 222, below the rock bar).

As part of the previous CCA by GHD (2021) a dam break assessment was undertaken to determine an estimated inundation extent and total PAR in the event of dam failure. The assessment was carried out by utilising an estimated discharge volume and qualitatively estimating the inundation extent (i.e., maximum credible breach scenario), and was used to inform the CCA in consideration to impacts downstream of the mine site.

A summary of the assessment with consideration to storage changes as of 2023 is displayed in Table 4.5 below:

TABLE 4.5: ETSF, EPIT TSF & MCD DAM BREACH ESTIMATED IMPACT

Structure	Volume	Material	Flow path
ETSF	1.4 million m³ (Ref. note 1)	Tailings (and decant water)	West, north-west or north, north-west via Saddle Dam(s) failure to Gunpowder Creek.
EPit	2,677.7 ML	EPit tailings (and decant water)	EPit Ramp wall failure (water stored above RL 222) with release to MCD. Spill from MCD to Gunpowder Creek (assumes MCD is at Full Supply Level of RL 240).
EPit TSF with MCD cascade failure	2,677.7 ML	EPit tailings (and decant water)	EPit Ramp wall failure (water stored above RL 222) with release to MCD. Spill from MCD to Gunpowder Creek (assumes MCD is at FSL).
	771.5ML	MCD (water)	
MCD	771.5ML	MCD (water)	MCD failure with release to Gunpowder Creek.

Notes:

[1] Assumed no changes have occurred in storage characteristics since previous CCA undertaken by GHD (2021).

It is noted that since 2021 the material stored and flow path remains the same, however, there has been changes to the volume of water and / or tailings for each structure.

For the purpose of this CCA, assessment of the maximum extent of any credible breach scenario for loss of life remains at 25km downstream of Gunpowder Creek, as per the previous CCA undertaken by GHD (2021).

4.5 Assessment Results

4.5.1 General

The consequence category assessment is detailed in Appendix A.

A summary of the consequence category assessment results is provided in Table 4.6.

Certification of the consequence category assessment by the suitably qualified and experienced person who performed the assessment is provided in Appendix B.

The overall consequence category of ETSF, EPit and MCD is ‘high’. All three structures are considered ‘regulated’ structures. Based on this assessment all three structures are required to comply with spillway hydraulic capacity criteria and containment hydraulic criteria (DSA / MRL) stipulated in The Manual.

TABLE 4.6: SUMMARY OF CONSEQUENCE CATEGORIES

Structure	Failure to Contain Seepage	Failure to Contain – Overtopping	Dam Break	Overall
ETSF	Significant	Significant	High	**High**
EPit	Significant	Significant	High	**High**
MCD	Significant	Significant	High	**High**

4.5.2 Spillway Capacity

Based on the outcomes of the DES consequence category assessments, the required spillway capacity of each structure is summarised below:

- 1:1,000 AEP to 1:100,000 AEP + 1:10 AEP wave run-up.

4.5.3 Containment Storage

Based on the outcomes of the DES consequence category assessments, the required containment of each structure is summarised below:

- Wet Season Containment (DSA): 1:20 AEP.
- Storm Event Containment (ESS): 1:10 AEP 72 hr duration.

5. REFERENCES

Capricorn Copper Pty Ltd (2022). OMS Manual: Esperanza Tailings Storage Facility.

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6. QUALIFICATIONS

(a) In preparing this document, including all relevant calculation and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

(b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

(c) Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

  (i) Additional sources of information not presently available (for whatever reason) are provided or become known to Engeny; or

  (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

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(g) This report does not provide legal advice.

APPENDIX A: CONSEQUENCE CATEGORY ASSESSMENT

Dam Consequence Category Assessment

Site: Capricorn Copper Mine
Structure Name: Esperanza TSF (ETSF)

Storage Details	
Current Dam Function	Store tailings, tailings supernatant water and rainfall
Type of Dam Construction	Zoned Earth and Rockfill embankments with filters
Storage capacity	Negligible water storage capacity
Maximum Embankment Height	~56 m
Catchment area	39.5 Ha
Water Quality	Mine Affected Water - elevated pH, Salinity, non - metal and metal concentrations. Water quality parameters generally exceed trigger limits, contaminant limits and stock water limits.
Receiving Waterways: Overtopping	EPit → Mill Creek Dam → Gunpowder Creek → Leichardt River → Gulf of Carpentaria

Scenario	Category of Harm	Details	Consequence Category	Scenario Consequence Category
Failure to Contain - Seepage	Harm to Humans	There is no known human consumption of groundwater within the vicinity of CCM. Seepage losses are expected to be captured by the seepage interception system minimising impact to surrounding groundwater.	Low	Significant
	General Environmental Harm	Seepage losses are expected to be captured by the seepage interception system and prevent interaction with Gunpowder Creek as long as the system is maintained. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Seepage to the environment could cause adverse effects on the Significant Values of the receiving waterways. However, is considered unlikely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage, cause permanent alteration to surrounding ecosystems or exceed 5km2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the Significant consequence category in Table 1 of the manual.	Significant	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events, minimising health effects on stock. Despite some historic seepage and spill incidents, neither historic nor current mine operators have been required to pay 3rd party damages for any economic losses from downstream stakeholders. Compensation / rehabilitation costs due to adverse health effects on stock are unlikely to be significant, however could cause general economic loss or property damage that would require more than $1 million but less than $10 million in rehabilitation, compensation or repair.	Significant	
Failure to Contain - Overtopping	Harm to Humans	Overflows from the ETSF would report to the EPit and any spill from the EPit would report to MCD. Therefore the consequence of ETSF needs to be considered in respect of a spill from MCD. Any overflows from MCD would report to Hoover Dam and subsequently report to Gunpowder Creek. Beyond the MCD there is no there is no known human consumption of surface water between the mine and Leichardt River. The only potential receptor is Lorraine Airport and an industrial agricultural development located 150km downstream of CCM, however the impact of overflows from the dam on the water quality of the Leichardt River is likely to be negligible given the significant dilution capacity of the large Gunpowder and Leichardt River catchments.	Low	Significant
	General Environmental Harm	Overflows from the ETSF would report to the EPit and any spill from the EPit would report to MCD. Therefore the consequence of ETSF needs to be considered in respect of a spill from MCD. Any overflows from MCD would report to Hoover Dam and subsequently report to Gunpowder Creek Beyond Hoover Dam, the values of the receiving waterways from the area are Significant Values, due to the MSES of endangered or of concern wildlife and essential habitat along Gunpowder Creek. Any discharge during significant rainfall event would be highly diluted before reaching areas of environmental significance. Overflows to the environment could cause adverse effects on the Significant Values of the receiving waterways. However, is considered unlikely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage, cause permanent alteration to surrounding ecosystems or exceed 5km2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the Significant consequence category in Table 1 of the manual.	Significant	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Compensation / rehabilitation costs due to adverse health effects on stock are unlikely to be significant, however could cause general economic loss or property damage that would require more than $1 million but less than $10 million in rehabilitation, compensation or repair.	Significant	
Dam Break	Harm to Humans	A dam break scenario of the ETSF would result in mobilisation of approximately 2 million tonnes of tailings downstream to Gunpowder Creek. The location of dam and dam failure paths are such that people are not routinely present in the failure path, minimising risk of loss of life. Beyond the mine there is no known human consumption of surface water between the mine and the Leichardt River. The only potential receptor is Lorraine Airport and an industrial agricultural development located 150km downstream of CCM.	Low	High
	General Environmental Harm	A dam break scenario of the ETSF would result in mobilisation of approximately 2 million tonnes of tailings downstream to Gunpowder Creek. The values of the receiving waterways from the area are Significant Values, due to the MSES mapping of endangered or of concern wildlife and essential habitat along Gunpowder Creek. Any discharge during a dam break scenario has potential to cause adverse effects on significant values due to the poor water quality and mobilisation of tailings. It is likely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage and cause permanent alteration to surrounding ecosystems or exceed 5km2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the High consequence category in Table 1 of the manual.	High	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If dam break were to occur MAW and tailings would flow downstream toward Gunpowder Creek. Given the poor water quality of ETSF the compensation / rehabilitation costs due to adverse health effects on stock are likely to be significant and could cause general economic loss or property damage that would be greater than $10 million in rehabilitation, compensation, repair or rectification costs.	High	

Overall Consequence Category Assessment	**High**

Dam Consequence Category Assessment

Site: Capricorn Copper Mine
Structure Name: Esperanza Pit (EPit)

Storage Details	
Current Dam Function	Store tailings, tailings supernatant water and rainfall
Type of Dam Construction	Excavated mining void
Storage capacity	1677.9 ML - existing storage capacity up to MOL 730.6 ML - post final tailings deposition
Maximum Embankment Height	N/A - no embankments
Catchment area	139.2 Ha
Water Quality	Mine Affected Water - elevated pH, Salinity, non - metal and metal concentrations. Water quality parameters generally exceed trigger limits, contaminant limits and stock water limits.
Receiving Waterways: Overtopping	Mill Creek Dam → Gunpowder Creek → Leichardt River → Gulf of Carpentaria

Scenario	Category of Harm	Details	Consequence Category	Scenario Consequence Category
Failure to Contain - Seepage	Harm to Humans	There is no known human consumption of groundwater within the vicinity of CCM. Seepage losses are expected to be captured by MCD, or if seepage were to develop as a result of storing water above RL 222 seepage would likely report to NRWD collection system or MCD.	Low	Significant
	General Environmental Harm	Seepage losses are expected to be captured by MCD and NRWD collection system and prevent interaction with Gunpowder Creek. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Seepage to the environment could cause adverse effects on the Significant Values of the receiving waterways. However, is considered unlikely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage, cause permanent alteration to surrounding ecosystems or exceed 5km2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the Significant consequence category in Table 1 of the manual.	Significant	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Compensation / rehabilitation costs due to adverse health effects on stock are unlikely to be significant, however could cause general economic loss or property damage that would require more than $1 million but less than $10 million in rehabilitation, compensation or repair.	Significant	
Failure to Contain - Overtopping	Harm to Humans	Overflows from the EPit would report to MCD. Therefore the consequence of EPit needs to be considered in respect of a spill from MCD. Any overflows from MCD would report to Hoover Dam and subsequently report to Gunpowder Creek. Beyond the MCD there is no there is no known human consumption of surface water between the mine and Leichardt River. The only potential receptor is Lorraine Airport and an industrial agricultural development located 150km downstream of CCM, however the impact of overflows from the dam on the water quality of the Leichardt River is likely to be negligible given the significant dilution capacity of the large Gunpowder and Leichardt River catchments.	Low	Significant
	General Environmental Harm	Overflows from the EPit would report to MCD. Therefore the consequence of EPit needs to be considered in respect of a spill from MCD. Any overflows from MCD would report to Hoover Dam and subsequently report to Gunpowder Creek. Beyond Hoover Dam, the values of the receiving waterways from the area are Significant Values, due to the MSES of endangered or of concern wildlife and essential habitat along Gunpowder Creek. Any discharge during significant rainfall event would be highly diluted before reaching areas of environmental significance. Overflows to the environment could cause adverse effects on the Significant Values of the receiving waterways. However, is considered unlikely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage, cause permanent alteration to surrounding ecosystems or exceed 5km2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the Significant consequence category in Table 1 of the manual.	Significant	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Compensation / rehabilitation costs due to adverse health effects on stock are unlikely to be significant, however could cause general economic loss or property damage that would require more than $1 million but less than $10 million in rehabilitation, compensation or repair.	Significant	
Dam Break	Harm to Humans	Majority of the storage within the EPit is located below ground, with a MAOL of RL 222 and in this configuration the structure does not pose a dam break risk. However, if water and / or tailings is stored above approx. RL 222 against the ETSF Ramp, there is potential for approximately 2678ML of tailings and water to become mobilised. In this case dam break would result in spilling into the paste plant and flooded vent shaft area causing MCD to be overtopped, subsequently releasing contaminated water into Gunpowder Creek. It is noted if cascade failure of the MCD were to occur an additional 772ML of water would be mobilised to Gunpowder Creek. The location of dam and dam failure paths are such that people are not routinely present in the failure path, minimising risk of loss of life. Beyond the mine there is no known human consumption of surface water between the mine and the Leichardt River. The only potential receptor beyond the mine is Lorraine Airport and an industrial agricultural development located 150km downstream of CCM.	Low	High
	General Environmental Harm	Majority of the storage within the EPit is located below ground, with a MAOL of RL 222 and in this configuration the structure does not pose a dam break risk. However, if water and / or tailings is stored above approx. RL 222 against the ETSF Ramp, there is potential for 2678ML of tailings and water to become mobilised. In this case dam break would result in spilling into the paste plant and flooded vent shaft area causing MCD to be overtopped, subsequently releasing contaminated water into Gunpowder Creek. It is noted if cascade failure of the MCD were to occur an additional 772ML of water would be mobilised to Gunpowder Creek. The values of the receiving waterways from the area are Significant Values, due to the MSES of endangered or of concern wildlife and essential habitat along Gunpowder Creek. Any discharge during a dam break scenario has potential to cause adverse effects on significant values due to the poor water quality and mobilisation of tailings. It is likely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage and cause permanent alteration to surrounding ecosystems or exceed 5km^2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the High consequence category in Table 1 of the manual.	High	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If dam break were to occur MAW and tailings would flow downstream toward Gunpowder Creek. Given the poor water quality of EPit combined with cascade failure of the MCD, the compensation / rehabilitation costs due to adverse health effects on stock are likely to be significant and could cause general economic loss or property damage that would be greater than $10 million in rehabilitation, compensation, repair or rectification costs.	High	

Overall Consequence Category Assessment	High

Dam Consequence Category Assessment

Site: Capricorn Copper Mine
Structure Name: Mill Creek Dam (MCD)

Storage Details	
Current Dam Function	Store tailings, tailings supernatant water and rainfall
Type of Dam Construction	Cross Valley Embankment
Storage capacity	771.5 ML (original capacity 1400 ML reduced from upstream embankment)
Maximum Embankment Height	12 m
Catchment area	70.4 Ha
Water Quality	Mine Affected Water - elevated pH, Salinity, non - metal and metal concentrations. Water quality paramters generally exceed trigger limits, contaminant limits and stockwater limits.
Receiving Waterways: Overtopping	Gunpowder Creek → Leichart River → Gulf of Carpentaria

Scenario	Category of Harm	Details	Consequence Category	Scenario Consequence Category
Failure to Contain - Seepage	Harm to Humans	There is no known human consumption of groundwater within the vicinity of CCM. Seepage losses are expected to be captured by the hoover dam and returned to MCD.	Low	Significant
	General Environmental Harm	Seepage losses are expected to be captured by the Hoover Dam and prevent interaction with Gunpowder Creek. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Seepage to the environment could cause adverse effects on the Significant Values of the receiving waterways. However, is considered unlikely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage, cause permanent alteration to surrounding ecosystems or exceed 5km^2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the Significant consequence category in Table 1 of the manual.	Significant	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Compensation / rehabilitation costs due to adverse health effects on stock are unlikely to be significant, however could cause general economic loss or property damage that would require more than $1 million but less than $10 million in rehabilitation, compensation or repair.	Significant	
Failure to Contain - Overtopping	Harm to Humans	Overflows from MCD would report to Hoover Dam and subsequently report to Gunpowder Creek. Beyond the MCD there is no there is no known human consumption of surface water between the mine and Leichardt River. The only potential receptor is Lorraine Airport and an industrial agricultural development located 150km downstream of CCM, however the impact of overflows from the dam on the water quality of the Leichardt River is likely to be negligible given the significant dilution capacity of the large Gunpowder and Leichardt River catchments.	Low	Significant
	General Environmental Harm	Overflows from MCD would report to Hoover Dam and subsequently report to Gunpowder Creek Beyond Hoover Dam, the values of the receiving waterways from the area are Significant Values, due to the MSES of endangered or of concern wildlife and essential habitat along Gunpowder Creek. Any discharge during significant rainfall event would be highly diluted before reaching areas of environmental significance. Overflows to the environment could cause adverse effects on the Significant Values of the receiving waterways. However, is considered unlikely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage, cause permanent alteration to surrounding ecosystems or exceed 5km^2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the Significant consequence category in Table 1 of the manual.	Significant	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If discharge were to occur MAW would be contained within local pools and concentrate by evaporation until being flushed out during significant flow events. Compensation / rehabilitation costs due to adverse health effects on stock are unlikely to be significant, however could cause general economic loss or property damage that would require more than $1 million but less than $10 million in rehabilitation, compensation or repair.	Significant	
Dam Break	Harm to Humans	Dam break of MCD would result in mobilisation of approximately 772ML of water. Dam break flows are expected to mobilise downstream and be contained within Gunpowder Creek (overtopping Hoover Dam). The location of dam and dam failure paths are such that people are not routinely present in the failure path, minimising risk of loss of life. Beyond the mine there is no known human consumption of surface water between the mine and the Leichardt River. The only potential receptor beyond the mine is Lorraine Airport and an industrial agricultural development located 150km downstream of CCM.	Low	High
	General Environmental Harm	Dam break of MCD would result in mobilisation of approximately 772ML of water. Dam break flows are expected to mobilise downstream and be contained within Gunpowder Creek (overtopping Hoover Dam). The values of the receiving waterways from the area are Significant Values, due to the MSES of endangered or of concern wildlife and essential habitat along Gunpowder Creek. Any discharge during a dam break scenario has potential to cause adverse effects on significant values due to the poor water quality and mobilisation of tailings. It is likely that remedial costs will be greater than $50,000,000, take more than 3 years to remediate damage and cause permanent alteration to surrounding ecosystems or exceed 5km^2 area of damage. The adverse effects on the Significant Values are expected to be in the range of effects defined for the High consequence category in Table 1 of the manual.	High	
	General Economic Loss or Property Damage	Given the land use downstream of the mine, the potential for general economic loss or property damage to third party assets in the failure path is considered to extend only to potential adverse health effects on stock that have access to the downstream receiving waterways. It is noted that there is potential damage to gunpowder road (managed by CCM). However based on aerial imagery it appears to be unsealed with limited infrastructure value. If dam break were to occur MAW would flow downstream toward Gunpowder Creek. Given the poor water quality of MCD the compensation / rehabilitation costs due to adverse health effects on stock are likely to be significant and could cause general economic loss or property damage that would be greater than $10 million in rehabilitation, compensation, repair or rectification costs.	High	

Overall Consequence Category Assessment	High

APPENDIX B: CONSEQUENCE CATEGORY ASSESSMENT CERTIFICATION

Form of Certification

Consequence Category Assessment for Esperanza Pit, Esperanza TSF and Mill Creek Dam at Capricorn Copper Mine

Name of Registered Professional Engineer providing certification:

Miles Tremlett-Johnstone

Address of Registered Professional Engineer providing certification:

L1 500 Queen Street, Brisbane QLD 4000

Statement of relevant experience

I hereby state that I am a Registered Professional Engineer of Queensland and meet the requirements of the definition of 'suitably qualified and experienced person'.

Statement of certification

All relevant material relied upon by me, including subsidiary certifications of specialist components, where required by the environmental authority, is provided in the attached report "Esperanza Pit, Esperanza TSF and Mill Creek Dam Consequence Category Assessment - Rev 0"– dated 14 December 2023.

I hereby certify that the attached report "Esperanza Pit, Esperanza TSF and Mill Creek Dam Consequence Category Assessment - Rev 0" – dated 14 December 2023 provides an assessment of the consequence category of Esperanza Pit, Esperanza TSF and Mill Creek Dam at Capricorn Copper Mine in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures published by the administering authority (ESR/2016/1933 Version 5.02, effective March 2016).

I, Miles Tremlett-Johnstone, declare that the information provided as part of this certification is true to the best of my knowledge. I acknowledge that it is an offence under section 480 of the Environmental Protection Act 1994 to give the administering authority a document containing information that I know is false, misleading or incomplete in a material particular.

Signed: _____

Miles Tremlett-Johnstone, RPEQ No. 30225

Date: 14 December 2023

APPENDIX 3 TAILINGS MANAGEMENT PLAN

ENGENY

CAPRICORN COPPER PTY LTD

Esperanza Pit Tailings Management Plan

QC1022_016-RPT-002-0

15 DECEMBER 2023

DISCLAIMER

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Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
0	15/12/2023	Client Issue	Meggan Brown	Travis Warren	Travis Warren	Miles Tremlett-Johnstone
Signatures:						

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1. INTRODUCTION

1.1 Background

Capricorn Copper Pty Ltd (CCPL), a wholly owned subsidiary of 29Metals Limited, owns and operates the Capricorn Copper Mine (CCM), located in Gunpowder, Northwest Queensland. CCM is operated under the approval of Environmental Authority EPML00911413 (EA) (dated 30 September 2022) managed by the Department of Environment and Science (DES).

CCPL will recommence tailings deposition into the Esperanza Pit (EPit) at CCM, following cessation of previous tailings deposition into EPit in January 2022. Tailings deposition into the EPit will commence from May 2024, following the exhaustion of the Esperanza Tailings Storage Facility (ETSF) Lift 1. Tailings deposition will continue in EPit as described in this document, until the Tailings Storage Facility 3 (TSF3) located in the upper Esperanza catchments commissioned, planned to be early 2025.

Engeny has been engaged by CCPL to develop a Tailings Management Plan considering the additional tailings deposition proposed in EPit. This document supersedes the previous Tailings Management Plan (TMP) (GHD 2017).

The EPit was operated as an open cut mine until 2005 and has served as a mine affected water (MAW) and tailings storage facility (TSF) since that time. The EPit is located approximately 2 km south-west of the CCM processing facility.

1.2 Purpose

The purpose of this TMP is to outline the measures for minimising any potential impacts associated with additional tailings disposal into EPit on environmental values at the site, in accordance with the EA. The TMP applies to all EPit tailings disposal activities conducted within the CCM mining tenure.

1.3 Legal and other requirements

The following requirements apply to the development and implementation of this TMP.

1.3.1 Environmental Authority

Condition E4-1 of the EA requires CCM to develop and implement a Tailings Management Procedure. This EPit TMP has considered the EA requirements for a Tailings Management Procedure in its development. This document is not the Tailings Management Procedure which applies to the broader site.

1.3.2 ESR/2015/1839 Application Requirements for Activities with Impacts to Land

The *DES Guideline Application Requirements for Activities with Impacts to Land (ESR/2015/1839)* details the information to be provided to support an Environmental Authority Application (EAA) with impacts to land. This document has been considered during the development of this TMP for EPit, specifically section 5.1 which details management plans which may be relevant to include as supporting information to the EAA.

The requirements for Tailings Management specified in section 5.1 are shown in Table 1.1, and where they are addressed in this TMP.

TABLE 1.1:GUIDELINE REQUIREMENTS FOR ACTIVITIES WITH IMPACTS TO LAND

Section 5.1 Tailings Management	Report Section
Consideration for the manual for dams containing hazardous waste.	Section 3.9 and 3.10
Liners and basement preparations for any structure.	Section 2.3
How capillary rise in tailings storage facility will be managed (operationally and post closure e.g., capillary breaks).	Section 8
Proposed leak detection systems.	Section 7.2
Structural geology below dams and geotechnical and seepage implications.	Section 2.3
Fracturing and springs and potential to cause increase into structures and lift liners.	Section 2.3
Design storage allowance and design standard being adopted.	Section 3.10
Heap leach pads and carbon in pulp/leach treatment, and how the highly contaminated waters will be managed (i.e., cyanide and acid leach issues).	NA – No operational heap leach pads onsite
Pregnant/barren ponds management and risk of cascading water quality from these facilities impacting mildly contaminated dams	NA – No pregnant or barren ponds onsite
Proposed capping and closure design.	Section 8
Co-disposal options and risks.	NA – No co-disposal proposed
Geochemical characterisation	Section 4
Restriction of access of cattle and wildlife to contaminated waters in structures.	Section 3
Spillway location.	Section 2.1
Chemical storage on site (including explosives).	NA – not described in this document
Perimeter spigot—central discharge and coarse grind towards closure.	Section 3.7
Potential radionuclides and implications for environment and public health regarding radiation risks.	Section 2

1.4 System Design Plan for Regulated Structures

CCM operate three (3) *regulated structures* at the site, comprising the Esperanza Tailings Storage Facility (ETSF), the Esperanza Pit (EPit), and the Mill Creek Dam (MCD), in an integrated containment system for the purpose of sharing the Design Storage Allowance (DSA) volume across the system (as shown in **Error! Reference source not found.**).

Regulated Structures operating as an integrated containment system require a certified System Design Plan (SDP) in accordance with the requirements of the *Manual for assessing consequence categories and hydraulic performance of structures* (ESR/2016/1933, Version 5.02) (Manual) and the EA.

The *Capricorn Copper System Design Plan (QC1022_001-REP-003-2)* details relevant system operating rules for the three regulated structures, and this TMP has been developed in consideration of the SDP.

1.5 Other Relevant Documents

This TMP should be read in conjunction with the following relevant documents:

- The Operation, Maintenance & Surveillance Manual (OMS Manual) for Esperanza Pit Tailings Storage Facility (EPit TSF).
- Capricorn Copper Water Management Plan (Engeny 2023).

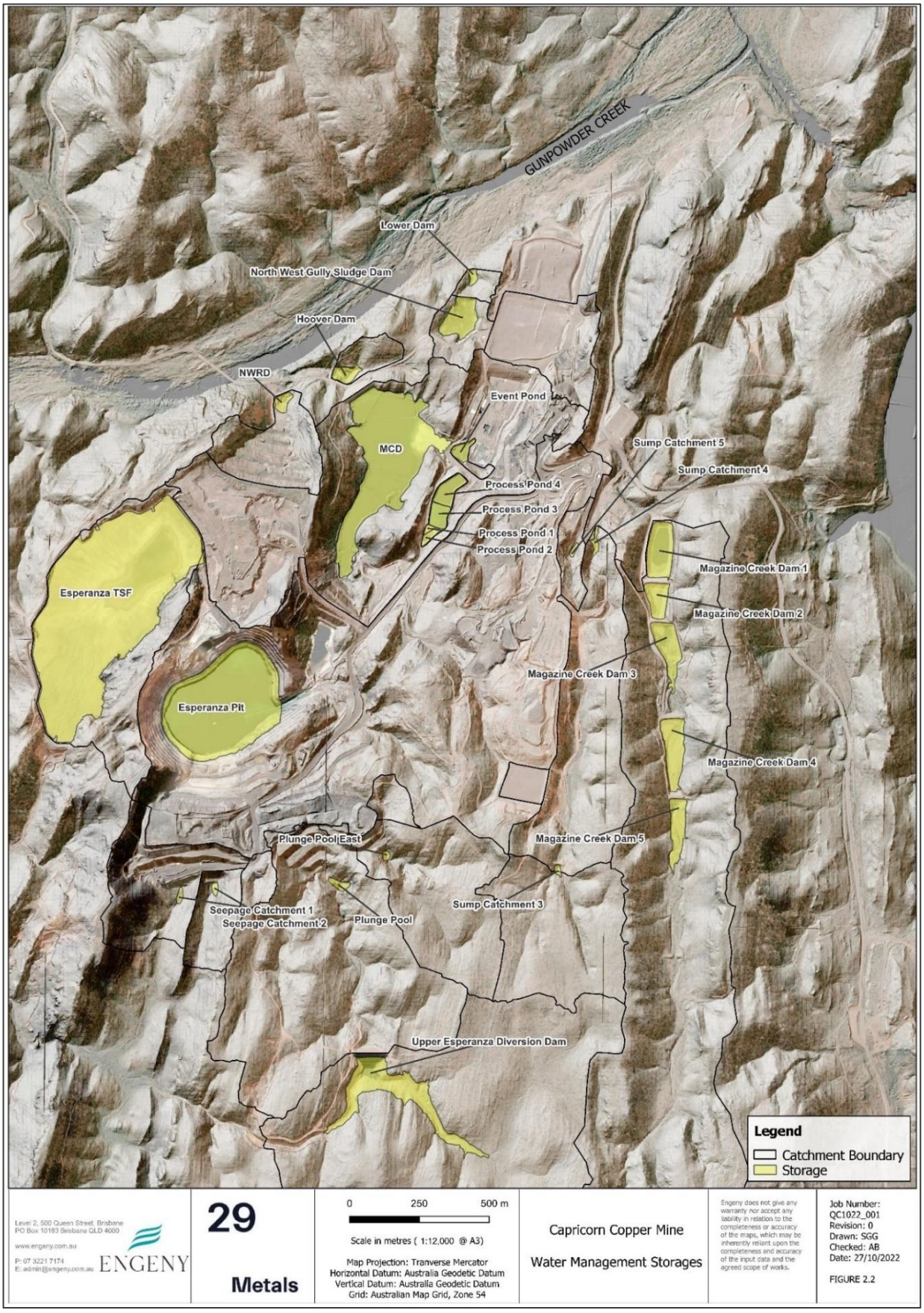

Figure 1.1:Site Plan Showing Water Storages and Surrounding Creeks

1.6 Assumptions

The following assumptions have been made in preparing this TMP:

- Tailings production volumes are estimated to remain in the range of 1.6 Mtpa to 1.7 Mtpa.
- Design parameters:
  - Consequence Category – High C.
  - Tailings Production – up to 1.4 – 1.6 Mtpa. Up to 13% of tailings to be utilised as paste backfill, 87% to TSF.
  - Settled Density – 1.4 t/m3.
- Tailings beach slope = 1.5%.
- Tailings as classified as potentially acid forming (PAF).
- Relevant information regarding current land-use and water management system can be summarised from existing data and reports.

2. EPIT SETTING

2.1 EPit Overview

The EPit was operated as an open cut mine until 2005 and has served as a MAW and tailings storage facility since that time. The EPit is located approximately 2 km south-west of the CCM processing facility. The EPit floor is at approximately 90mAHD elevation and daylights at the original surface at the lowest level at approximately 225 m AHD, although the maximum operating level has been set at 222m AHD (known as the rock bar) as water above this level would be able to report to MCD via seepage through the EPit overflow pond which is elevated a further 18m to 240m AHD by the EPit Ramp. Should water rise in the EPit to 240mAHD it would spill over an effective natural "spillway" into MCD, however the paste plant and adjacent vent shaft are below this level at approximately RL 230m AHD. The EPit floor level raised due to the deposition of tailings and currently has a lowest elevation of 200.8m AHD. Relevant EPit details are shown in Table 2.1

TABLE 2.1: EPIT DETAILS

Epit Details and Features		Reference
General		
Type	Former Open Cut Mine Workings	
Purpose	Bulk storage for tailings and mine affected water (runoff and seepage), and supply to site water demands	
Maximum Operating Level (MOL)	222 (mAHD)	Environmental Authority EPML00911413
Catchment	139.2 Ha	(Engeny, 2023)
Original Pit Floor	90 (mAHD)	(GHD, 2021)
Tailings Storage Capacity to final tailings surface	960,000 m^3	(Engeny, 2023)
Available Water Storage above final tailings surface to MOL	730.6 ML	(Engeny, 2023)
Consequence Category (DES, 2016)	High	(Engeny, 2023)
ANCOLD Risk Category	High C	(GHD, 2021)
Emergency Spillway		
Type	No Engineered Spillway, natural spillway at EPit TSF Ramp	
Crest Level	240 (mAHD)	
Design Storage Allowance		

Design Criteria	1:20 AEP 2 month plus process inputs for the 2-month wet season	(Engeny, 2023)
Volume	497 ML	
Level	EPit DSA Level – 217.2 (mAHD)	
Mandatory Reporting Level		
Design Criteria	1:10 AEP, 72 hr rainfall	(Engeny, 2023)
Volume	496.8 ML	
Level	EPit MRL – 217.2 (mAHD)	

The deposition of tailings into EPit was approved in 2017, and tailings deposition commenced in this same year, and ceased in January 2022. In the previous TMP (GHD 2017) tailings deposition in EPit was limited to RL 202 to maintain compliance with the DSA requirements which were in force at that time. The assumption in the TMP (GHD 2017) was for 4.1Mt of tailings to be deposited at a dry density of 1 t/m3. The actual observed settled density of the tailings in EPit was closer to 1.4 t/m3, as detailed in Table 4.1. this meant in as of late January 2022, an estimated volume of 6.6Mt of tailings had been generated and EPit had reached capacity (GHD 2021).

The lowest point of the tailings beach is at RL 200.8 confirmed from the latest site bathymetry results from acquired in June. The bathymetry shows significant beach in the centre of the EPit, with depressions to the north and west of the pit. It is expected without additional deposition, the tailings would continue to consolidate over time.

The EPit storage characteristics developed from bathymetric and LiDAR surveys captured during June 2023 are presented in Figure 2.1.

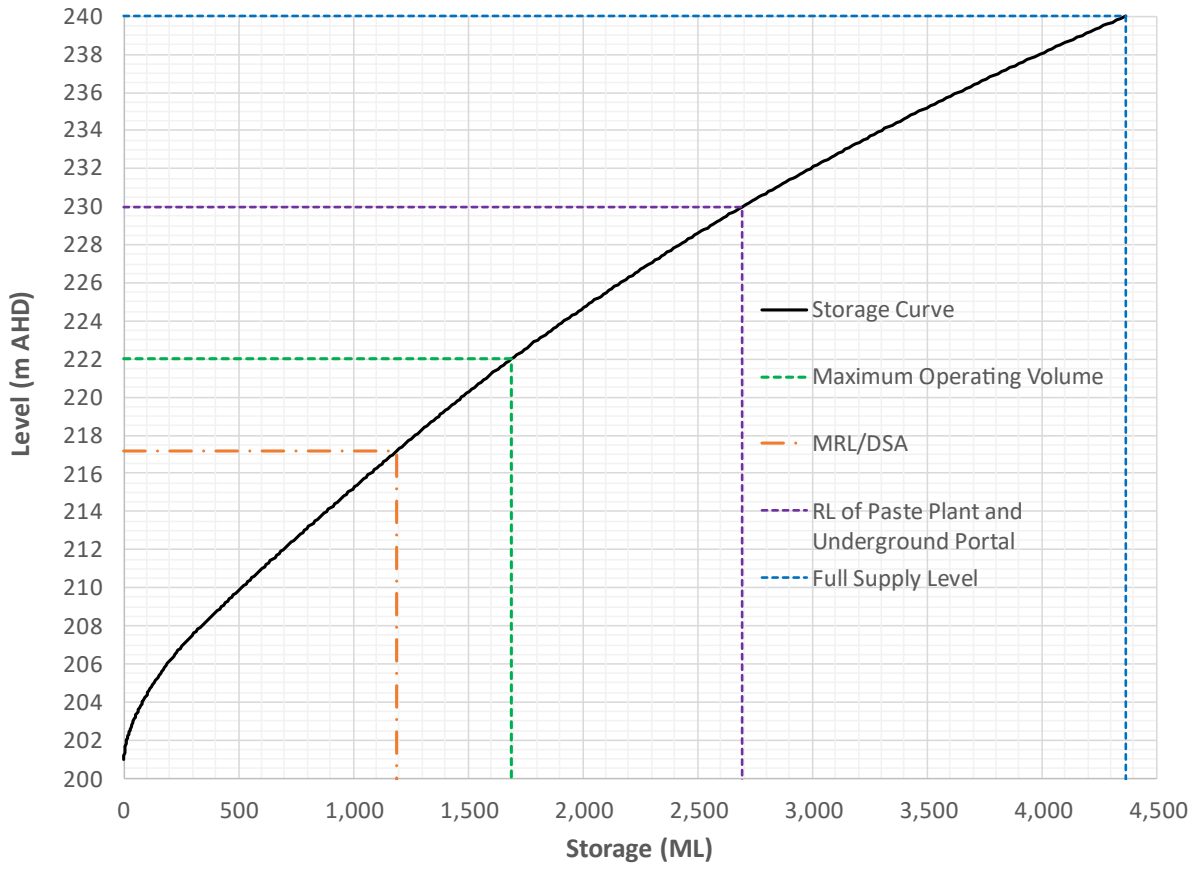

Figure 2.1: Esperanza Pit (EPit) Storage Characteristics

2.2 Climate

CCM is in a region of Northwest Queensland that experiences high rainfall events during summer and is predominantly dry in winter. Average annual rainfall for the region is approximately 500mm. Long-term climate data for the CCM water balance model was obtained from the Scientific Information for Land Owners (SILO) climate database facility hosted by the Department of Environment and Science (DES) using a Data Drill extracted at the site location (Lat -19.70 Long 139.35). The SILO climate data record produces 134 years of daily climatic data (1889-2023) at the site location based on historical nearby rainfall and weather gauging data. Rainfall and Morton's potential evapotranspiration are used to calculate rainfall-runoff with the Australian Water Balance Model (AWBM), while Morton's Lake evaporation is used to estimate evaporation losses from water storages. The SILO Data Drill rainfall data is interpolated from daily rainfall observations from regional Bureau of Meteorology rainfall stations, while the Morton's Lake evaporation and pan evaporation values are calculated from other interpolated observed climate data using industry-standard equations.

The SILO Data Drill is considered the best source of site specific long-term (greater than 100 years of data) daily climate data for the CCM given the only Bureau of Meteorology rainfall stations in the vicinity of the mine (e.g., Station Number 29094 Mammoth Mine) provide less than 35 years of daily rainfall data. On this basis, the use of this data is considered appropriate for the purpose of the modelling. Summary monthly average rainfall (SILO Data Drill) evapotranspiration and lake evaporation (all SILO Data Drill) for CCM are summarised in Table 2.2. Section **Error! Reference source not found.** summarises input climate data for the model calibration period. All input climate data are applied i n the water balance model on a daily basis using the source data (SILO Data Drill or site rainfall data) without modification.

TABLE 2.2: CCM LONG TERM AVERAGE CLIMATE DATA

Month	Rainfall (mm)	Lake Evaporation (mm)	Potential Evapotranspiration (mm)
January	127.2	213.8	295.7
February	117.9	185.2	256.2
March	76.8	186.4	281.3
April	14.9	155.6	260.8
May	11.3	124.5	213.3
June	9.1	103.1	175.9
July	5.1	112.2	192.5
August	1.8	141.8	243.4
September	6.7	172.0	291.9
October	16.3	209.6	347.3
November	37.5	217.7	343.7
December	73.4	225.3	331.6
Annual	**493.2**	**2,049.0**	**3,236.7**

2.3 Conceptual Hydrogeological Model

Previous works undertaken by GHD (2021a) reviewed hydrogeological conditions and seepage risk of the EPit, concluding that:

- The deep bedrock around the EPit had low permeability as evidenced by the lack of significant groundwater inflow to underground workings.

- Groundwater outflow was effectively prevented by a groundwater mound around the EPit; and
- If any of the geological features through the site were more permeable than general bedrock (as seems not the case) then seepage would either be intercepted by NWRD seepage interception trench or, more likely, MCD.

Previous groundwater modelling undertaken by GHD indicates that no physical evidence of seepage can be traced to the EPit (GHD, 2021a). Therefore, it is concluded that the EPit is effectively watertight up to the rock bar at RL 222. If water were to be stored above RL 222, seepage through the shallow fractured surface rock would enter MCD, after first passing through the EPit overflow pond. Historically, the EPit has stored MAW above RL 222m, and seepage rates did not impact MCD containment as the return pumping rate, and process demands are higher than the seepage inflow rate reported by CCM (13ML/day).

Engeny have recently recalculated the DSA and MRL levels and propose to recommence deposition of tailings into the EPit. The DSA and MRL have increased to RL217.2m, increasing the current tailing storage capacity by approximately 0.96 Mm^3. The available tailings decant water (the water cover) storage below the DSA / MRL is 233.8 ML and there is 496.8 ML water storage available above the decant storage to the MOL (RL 222, below the rock bar) for DSA/MRL.

The decant water should be maintained, on average, at 2m depth to act as a water cover across the tailings which are characterised as potentially acid forming (PAF). This water cover will reduce oxidation of the tailing's material, and generation of acid and metalliferous drainage.

2.3.1 General Stratigraphy

The EPit area lies within a region of regionally metamorphosed sedimentary rocks, (originally mudstones to sandstones with some limestone) and igneous rocks (metabasalts) as shown in Figure 2.2. The strata have been deformed by a long history of tectonic activity and now dips steeply to the west-northwest (GHD, 2013). This bedrock is overlain in some areas, such as the major drainage lines and Gunpowder Creek, by relatively thin layers of alluvium.

There are several areas of waste rock and tailings resulting from current and historical mining activities overlying both bedrock and alluvium.

Note there is no known risk of the presence of radionuclides within the geology at CCM.

2.3.2 Alluvium Characteristics

The frequent presence of bedrock outcrop in the creeks suggest that the alluvium is relatively thin – probably less than 10 m, although some thicker alluvium may be present above the stream bed in stranded river terraces. The alluvium appears to comprise a mix of sands and gravels, with thick silty deposits associated with river terraces and overbank flood deposits (GHD, 2013).

Given the elevation of the alluvium and relatively shallow bedrock depth, the saturated thickness of the alluvium is likely to be limited and it is unlikely that the alluvium represents a significant aquifer in the Esperanza area, although it represents pathway for some down-valley groundwater flow (GHD, 2013).

2.3.3 Bedrock Characteristics

Due to the pervasive recrystallisation associated with the post-tectonic regional metamorphism and alteration associated with mineralisation, any intergranular (primary) porosity has been sealed, with only secondary porosity, such as fracturing or dissolution remaining (GHD, 2013).

Fracturing occurs in crystalline rock due to two main processes:

- Stress relief fracturing caused by the expansion of the rock as overlying material is removed by erosion, which tends to result in sub-horizontal fracturing.
- Tectonic fracturing, which is caused by regional rock stresses, such as shearing which tends to result in sub-vertical fracturing and faulting, or compression or tension, which tends to result in moderately dipping faults and fractures.

In the Mt Gordon area, the zone of intense stress-relief fracturing tends to be limited to the upper 10 m, although may be thinner in some areas, with a fairly rapid transition to an intermediate zone of weaker fracturing to a depth of approximately 20-30 m. The stress relief fracturing is relatively permeable due to its geologically recent formation, with the exception of a shallow zone where the jointing and fracturing may be filled with clay formed from weathering of the rock mass. The permeability of the stress relief fracturing gradually decreases with depth as hydrostatic pressure keeps joints closed. AGE (1999) quoted hydraulic conductivity of siltstones and shales near the surface at 3x10-5m/s (2.6 m/d) with the highest permeability occurring in the upper 10 m, decreasing to 1x10-7 to 1x10-9 m/s (1x10-2 to 1x10-4 m/d) at about 30 m depth.

Fracturing due to tectonic stress is present within the metasediments and metavolcanics, which also caused the various faults mapped at surface and intersected within the EPit and underground workings. Due to post-tectonic metamorphism and alteration, however, these tectonic fractures have been almost totally sealed by haematite/chlorite/quartz mineralisation.

It has been noted by GHD (2013) that the Mammoth underground workings where faults are filled with soft chlorite/haematite mineralisation and groundwater inflow is distributed throughout the workings as general seepage, with no significant areas or preferential inflow. Observations of short-term flows from some faults for a few days immediately after rain, indicate that any connectivity of the faults with shallow aquifers or surface is local only. It is also likely that there is localised interconnection of the faults immediately adjacent to the mine to the surface through the numerous exploration holes drilled through the ore body.

In summary, the site is characterised by possible narrow alluvial aquifers along Gunpowder Creek and larger drainage channels, which are potentially connected to a surficial aquifer in bedrock with secondary porosity due to by stress relief fracturing, in the upper 10 – 20 m of bedrock below natural ground surface. There is no “deep aquifer”, as bedrock below the surficial aquifer, including faulted zones, is relatively impermeable, due to pervasive recrystallisation of primary porosity and mineralisation of fault zones and joints. There are, however, localised, disconnected voids and drillholes that are rapidly dewatered when pumped out or when intersected by mine development and as such do not result in long distance flow paths.

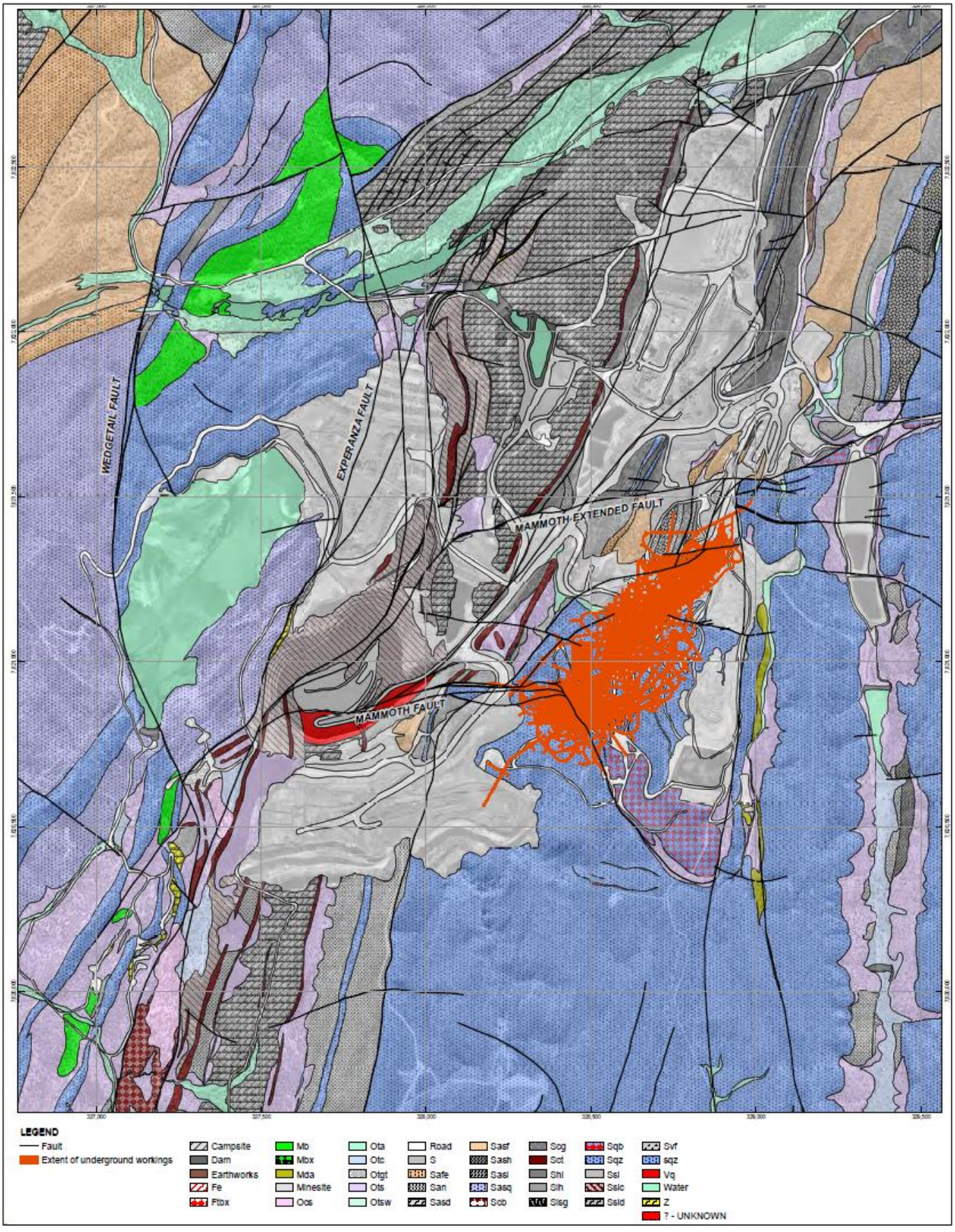

Figure 2.2: Esperanza Hydrogeology (GHD 2013)

3. MANAGEMENT MEASURES

3.1 Operation

The objectives of the EPit TSF tailings storage system are summarised as follows:

- Provide safe containment of tailings.
- Maximise tailings density from the plant to the EPit TSF through adequate dewatering and thickening.
- Maximise water recovery through the decant systems while maintaining the water cover.

This section outlines the management of tailings deposition and surface water within the EPit.

3.2 Environmental Management System

CCPL have an environmental management system (EMS) which is implemented to manage risk and impacts from activities at CCM, and to achieve compliance with relevant internal and external requirements. The EMS has established process for the monitoring and management of the site, including the ETSF and EPit TSF, and has detailed roles and responsibilities. The EMS is owned by the onsite Environment and Community Team, with suitably qualified professionals with significant relevant experience. The EMS is underpinned by the following 29Metals policies:

- Sustainability Policy (August 2021).
- Tailings Management Position Paper (October 2021).
- Responsible Use of Natural Resources Position Paper (October 2021).

29Metals reports on its environmental performance through the annual Sustainability and ESG Report.

3.3 Roles and Responsibilities

The roles and responsibilities associated with the operation, monitoring and maintenance of the EPit, and associated tailings delivery infrastructure are described below in Table 3.1.

Table 3.1: Key Personnel Responsibilities

Role	Responsibility
General Manager	• Oversee compliance with the requirements of the TMP • Ensure adequate resources are provided to meet requirements of the TMP
Processing Manager	• Ensure adequate processing and maintenance resources are provided to meet requirements of this plan • Ensure construction, operation and surveillance of the EPit in accordance with this TMP and the OMS Manual • Respond to out-of-tolerance conditions and manage responses in accordance with applicable trigger action response plan (TARP) outlined in this OMS Manual • Ensure change to tailings properties are identified and considered in the context of this TMP • Ensure communications processes are established to communicate relevant information with internal and external stakeholders • Ensure equipment used to monitor the performance of the EPit is appropriately maintained
Processing Superintendent	• Monitor, review and report on compliance with the requirements of this TMP and OMS Manual

	• Facilitate construction and operation of the facility in accordance with the TMP and OMS Manual • Ensure the required knowledgeable persons in the form of supervisors, workers or contractors are available to participate in management activities • Ensure tailings deposition strategy and infrastructure is in accordance with this TMP
Environment and Community Manager	• Maintain Regulated Dams Register • Ensure groundwater monitoring bores are monitored in accordance with the TMP and EA • Monitor, review and report on compliance with the requirements of this plan as it relates to EA compliance • Ensure Annual Regulated Dams Inspection completed as detailed in the EA
E&C Superintendent	• Ensure the requirements of the OMTMP are met during work activities where relevant • Co-ordinate inspections and ensure surveillance activities are completed and logged internally with actions assigned as required • Undertake monitoring activities related to environmental performance of the EPit as described in the TMP
Tailings Dams Engineer	• Undertake regulated structures inspections annually • Provide engineering input into issues and risk management • Conduct site inspections as required

3.4 Environmental Protection Measures

In considering the operation and management of tailings deposition in EPit, several measures exist which prevent or mitigate impacts to the receiving environment. A summary of these includes:

- **Seepage** - The existing EPit has been excavated into hard rock, with very low permeabilities. The EPit is considered watertight up to RL 222 (GHD 2020). The EPit is expected to be a sink for local groundwater flows, in addition to the underground workings (GHD 2020).
- **Seepage** - The existing tailings have continued to settle and consolidated over time, with the physical properties of the tailings exhibiting very low permeabilities. The achieved settled density from the previous campaign of tailings deposition was much higher than anticipated, improving tailings consolidation.
- **Seepage** – Where seepage occurs over RL222, it is intercepted by the MCD. The return pumping rate from MCD exceeds inflow rates of seepage, with pumping infrastructure including duty and standby pumping.
- **Water Quality** - The decant pond will operate as a water cover to prevent the oxidation of tailings materials. The decant pond will be managed to ensure MRL and DSA are provided in EPit.
- **Monitoring** - The existing groundwater monitoring network is proposed to be significantly enhanced, adopting the same monitoring parameters and frequency as defined in the EA for compliance groundwater monitoring bores.
- **Monitoring** – The EPit has daily inspections for water level and general conditions.
- **MAW Storage Volume** - The DSA for the integrated containment system, which includes EPit, significantly exceeds (by 47%) the EA required hydraulic performance of containing a 1 in 20 AEP wet season accumulation volume.
- **MAW Storage Volume** – CCM operate a substantial network of enhanced mechanical evaporators which reduce the inventory of MAW onsite. The evaporators and associated pumping network are maintained by dedicated resources onsite.
- **MAW Storage Volume –** CCM have infrastructure in place to treat up to 8ML a day of MAW for reuse in mining and processing. This reuse of water is in lieu of importing fresh water from Lake Waggaboonya, and results in drawdown of the MAW inventory.

3.5 Tailings Deposition Management

This TMP has been developed to achieve the following objectives with the discharge infrastructure:

- To meet the conditions of the EA.
- Minimise the risk of an uncontrolled/unauthorised discharge of water and tailings.
- Ensure efficient use of the available tailings storage capacity.
- Minimise risk of access by the public or wildlife.
- Reduce the oxidation of sulphides and the subsequent leaching of contaminants.

3.6 Tailings Delivery Infrastructure

The tailings delivery system comprises the following infrastructure:

- Two trains of tailings thickener underflow pumps trains (three pumps in series in each train) at the Ore Processing Plant.
- One HDPE tailings delivery pipelines which run from tailings thickener underflow pumps to the EPit TSF via the EPit Access Ramp.
- Tailings are discharged into the EPit via the tailings delivery pipeline which is extended into the storage on pipeline floats.

3.7 Tailings Deposition Strategy

The EPit TSF tailings deposition strategy is summarised below:

- The tailings discharge into EPit is proposed to be sub-aqueous, initially from a single line from the EPit ramp, and then from a pontoon mounted discharge point to maximise tailings deposition up to a maximum tailings level of RL 215.7 m as shown in Figure 3.1.
- Maintain a tailings beach gradient towards the EPit Access Ramp (east) for decant water reclamation.
- Maintain an average of 2 m deep water cover over the tailings beach.

The tailings discharge into EPit is proposed to be sub-aqueous, initially from a single line from the EPit ramp, and then from a pontoon mounted discharge point to maximise tailings deposition.

Based on the production figures below, the EPit TSF is expected to have a storage life of approximately 11 months.

3.8 Decant Pond Control

The purpose of the decant return water system is to maintain the decant pond in a minimum condition whilst maintaining an average of 2 m thick water cover to reduce the oxidation of sulphides and the subsequent leaching of harmful substances. The presence of a decant system also minimises the storage volume that is required for the supernatant water whilst maximising the storage volume available for tailings and rainfall runoff.

The decant pond should be closely monitored to check that it is forming in the proposed location and that it is maintained in a minimum condition. The water level in the EPit TSF should be controlled via the decant infrastructure to ensure buffer storage is available to reduce the risk of an uncontrolled discharge.

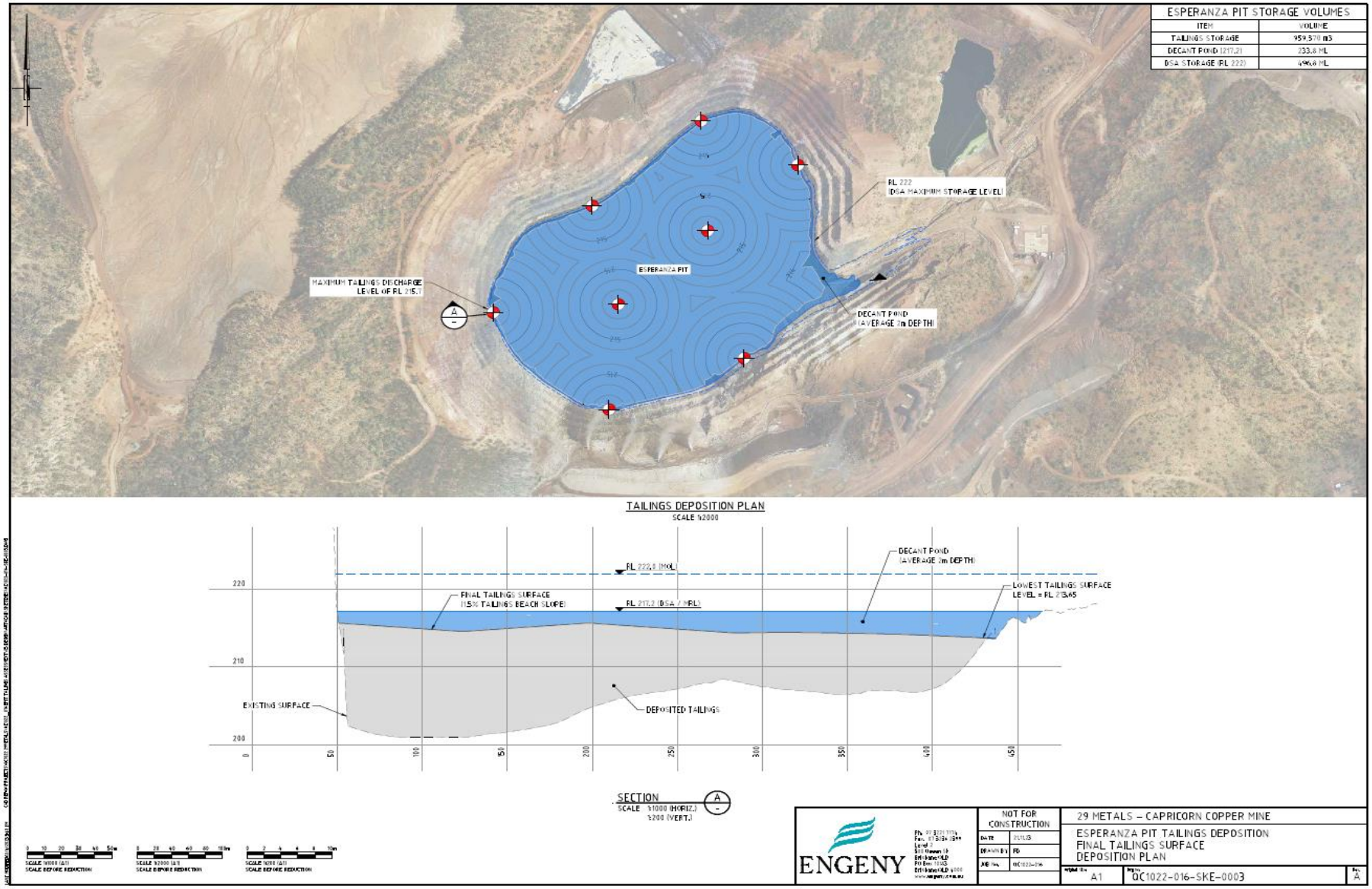

Figure 3.1: Esperanza Pit Tailings Deposition – Final Tailings Surface Deposition Plan

3.9 Consequence Category Assessment

The Consequence Category Assessment (CCA) for Esperanza Pit, Esperanza TSF and Mill Creek Dam Consequence Category Assessment (Engeny 2023) has been undertaken for EPit. A summary of the CCA is shown below in Table 3.2.

Table 3.2: EPit TSF CCA Summary (Engeny, 2023)

Component	Scenario	Consequence Category
EPit	Failure to Contain – Seepage	SIGNIFICANT
	Failure to Contain – Spill	SIGNIFICANT
	Dam Breach	HIGH
	Overall Consequence Category	**HIGH**

3.10 Hydraulic Performance Criteria

CCM have recalculated the DSA and MRL levels in EPit based on improvements to the water management system. The calculated DSA and MRL have been varied to RL217.2 m. The available tailings decant water storage below the DSA / MRL is 233.8 ML and there is 496.8 ML water storage available above the decant storage to the MOL (RL 222).

The detailed assessment for DSA and MRL for the integrated containment system is described in *The Capricorn Copper Water Balance Model Report (QC_001-REP-002-6).* The hydraulic performance criteria for EPit are shown in Table 3.3.

TABLE 3.3: EPITHYDRAULIC PERFORMANCE CRITERIA

Name of Regulated Dam	Consequence Category	Max Operating Level (mAHD)	Spillway Capacity Design Criteria	Design Storage Allowance (DSA)			Mandatory Reporting Level (MRL)		
				Design Criteria	Volume (ML)	Level (mAHD)	Design Criteria	Volume (ML)	Level (mAHD)
Esperanza Pit	High	222	1:100,000 AEP flood plus wave run-up allowance for 1:10 AEP wind **OR** Probable Maximum Flood (PMF)	95th Percentile (1:20 AEP) Wet Season Containment	496.8	217.2	1:10 AEP, 72 hr duration	496.8	217.2

3.10.1 DSA

The assessed 1:20 AEP wet season inventory increase for ETSF, EPIT and MCD is summarised as:

- The 2023/24 wet season – 264ML.
- The 2024/25 wet season – 599ML.

For the purposes of assigning a DSA, the results from the 2024/25 wet season have been adopted as the larger of the two calculated DSAs.

The containment system DSA assessment is summarised as follows:

- Combined 1:20 AEP (95th percentile or 5% AEP) wet season inventory increase in EPit, ETSF, and MCD – **599 ML.**
- Design Simulation Margin – **25% (150 ML).**
- Combined Design Storage Allowance for EPit, ETSF, and MCD – **749 ML.**

CCM have elected not to modify the MCD DSA level, to retain additional risk mitigation in the dam noting its importance in the integrated containment system and to further mitigate the risk of uncontrolled release. In addition, as the DSA cannot be less than the MRL (Section 3.5), the DSA volume is adopted as the MRL volume in EPit. This has resulted in a **combined DSA volume of 853ML**, which is 14% larger than the calculated DSA (modelled wet season increase volume of 599 ML with additional DSM volume of 150 ML, totalling 749 ML). DSA volume is apportioned to the regulated structures as follows:

- DSA volume allocated to MCD – **356 ML (RL 216.1 m).**
- DSA Volume allocated to EPit – **497 ML (RL 217.2 m).**
- DSA Volume allocated to ETSF – **0 ML.**

The DSA assessment is considered conservative for the following reasons:

- Water will still be contained in EPit above the maximum operating level of 222 m AHD however will start seeping to MCD which can be contained and pumped back to EPit at a much higher rate than the expected seepage flow rate.
- Although a DSM of 25% is considered more than adequate due to the high calibration accuracy achieved for the model, the adopted final DSM is equivalent to 42%.
- Authorised releases to Gunpowder Creek from EPit have been conservatively excluded from the DSA assessment; however, there is potential for 500ML/year release under current EA conditions (noting there are ongoing discussions with the DES regarding wet season release authority of up to 1.5GL/year).

3.10.2 MRL

MRL is defined in the Manual as a level at which the dam has a remaining available volume equivalent to the Extreme Storm Storage (ESS) allowance. The ESS is defined as the highest volume / lowest level required to allow the following to be retained within the dam (Significant Consequence dams):

- The runoff from a 1:10 Annual Exceedance Probability (AEP) 72-hour duration storm plus
- A wave allowance at 1:10 AEP

The ESS volumes for the regulated structures have therefore been determined as follows:

- Containment of runoff from the 1:10 AEP 72-hour duration storm (217mm).
- Wave runup has not been calculated for EPit as there is no credible spillway containment loss from wave runup whilst EPit is at the maximum operating level (MOL) (222 mAHD). MRL has been calculated assuming a MOL of 222m AHD and as such, 18m of freeboard is provided between the spillway RL (240 mAHD) and the MOL.
- No rainfall losses (i.e., 100% runoff).
- No allowance for process inflows or pumping out of the dams (these flows are small compared to the runoff inflows).
- ESS containment for the ETSF is provided in EPit (ETSF catchment area included in the EPit ESS estimation).
- Assumes the diversion sumps upstream of EWRD (plunge pool, plunge pool east, Seepage Catchment 1 and Seepage Catchment 2) are 50% effective and the Upper Esperanza diversion dam is 100% effective in diverting the upstream clean catchment reporting to EPit.
- EPit Catchment Area – 229.0 ha (includes ETSF catchment and 50% of the upper EWRD sumps catchment).

The ESS calculated for EPit is 496.8ML, corresponding to a 217.2mAHD.

3.11 Staged Development Plans

Relevant timing related to the staging of proposed tailings deposition into EPit is presented in Table 3.4. Note that the EPit deposition timelines are based on a settled density of 1.3 dmt/m^3.

TABLE 3.4: TAILINGS STORAGE PROPOSED DEVELOPMENT

Dates	Tailings Management Function
May 2024	ETSF Lift 1 exhaustion date, surface tailings not sent to paste redirected to EPit
April 2025	EPit tailings reach capacity.
April 2025	TSF 3 commissioned, surface tailings redirected to TSF 3 from EPit

4. TAILINGS CHARACTERISATION

4.1 Tailings Characteristics

The characteristics of the tailing's materials are described in detail in section 4. A summary of the relevant characteristics for relevance includes:

- The tailings providing a range of fine material (sieve 0.075 mm), between 74% and 84% of which are clay-like particle sizes (sieve (0.002 mm) range between 3.8% and 7.9% and the remaining being silt particle sizes.
- The permeability of the tailings is low, and with consolidation, tailings permeability decreases.

4.2 Settled Density

Tailings deposition into EPit commenced in 2017 and was ceased in January 2022. Engeny have undertaken an analysis of the approximate tailings deposited into EPit over the period, and the resultant settled density (dmt/m^3) as determined by bathymetry in 2019, 2020, 2022 and 2023.

Increased tailings density is typically achieved through initial settlement and longer-term consolidation. Improvements in density can be accelerated by passive processes such as drainage provisions and consolidation under self-weight or active processes such as dewatering and compaction. Tailings consolidation releases interstitial water and increases the mass of solids per unit volume, thereby increasing the volume of water required to mobilise the tailings.

This average settled density of 1.40 dmt/m^3 is significantly better than initial estimates of 1.0 dmt/m^3 (GHD 2017) for sub-aqueous deposition undertaken from late 2017 to early 2022 and means the tailings profile has continued to consolidate increasing the volume in EPit for MAW storage and reducing the permeability of underlying tailings.

A summary of the results is shown below in Table 4.1

TABLE 4.1: CALCULATED SETTLED DENSITY OF TAILINGS

Assessment Period	Settled Density (dmt/m^3)
June 2019 to July 2020	1.30
July 2020 to July 2022	1.41
July 2022 to July 2023	1.49
Average	**1.40**

4.3 Hydraulic Conductivity

In general, the hydraulic conductivity of the tailings at CCM are low, with decreasing hydraulic conductivity as the tailings consolidate, as shown in Table 4.3 - the consolidated tailings essentially form a barrier to groundwater flows.

TABLE 4.2:HYDRAULIC PARAMETRS OF TAILINGS

Name	Kxy (m/d)	Kz (m/d)	Porosity	Specific Storage	References
ETSF Tailings - Shallow	1	1	0.3	0.01	GHD (2020)

ETSF Tailings - Intermediate	0.01	0.01	0.2	0.001	Keller et al (2015); Smith (2021)
ETSF Tailings - Deep	0.0005	0.0005	0.1	0.001	Keller et al (2015); Smith (2021)

4.4 Geotechnical Properties

Geotechnical testing of the tailings has been undertaken at CCM, as described in the following assessments:

- Raising of Esperanza Tailings Dam – Feasibility Assessment, (Maunsell, 2008).
- Final Interim Raise Design Report (GHD, 2008).
- Scope of Further Raising (GHD, November 2009).
- Esperanza TSF Raise to RL 283 (GHD, 2012).
- Advanced laboratory testing reported in Esperanza Tailings Storage Facility Design Report to RL 284 (GHD, January 2022).

Results from the testing has been presented in Table 4.3, with the general observations made from the results:

- The tailings generally comprise sandy silty clay with low to moderate plasticity. The USCS classification of the tailing would be silty-clay/clayey-silt.
- Hydraulic conductivity is low.

TABLE 4.3: GEOTECHNICAL TEST RESULTS OF TAILINGS

Parameter	Sample 4 GHD (2008)	Sample 5 GHD (2009)	Sample 6 GHD (2009)	Sample 7 GHD (2009)	CPT01 GHD (2012)	CPT03 GHD (2012)	CPT05 GHD (2012)
MDD (t/m^3)	-	1.8	1.82	1.82	-	-	-
OMC (%)	-	16.5	16.5	16.5	-	-	-
Field MC (%)	-	20.5	33.5	31.5	40.5	23	29.7
Field DD (t/m^3)	-	1.57	1.41	1.43	-	-	-
Field Density Ratio (%)	-	87%	77.5%	78.5%	-	-	-
Linear Shrinkage (%)	-	3.5	3.5		-	-	-
Liquid Limit (%)	32	25	22	26	28	23	27
Plastic Limit (%)	28	16	13	16	24	20	23
Plasticity Index (%)	8	9	9	10	4	3	4
% Passing 75 µm	-	64	62.5	60	84	71	67
Permeability (m/s)	$2x10^{-8}$	-	-	-	-	-	-

Table 4.4 and Figure 4.1 outline the results of tailings characterisation and particle size distribution testing and analysis undertaken by ATC Williams Pty Ltd (ATCW)

TABLE 4.4: TAILINGS CHARACTERISTICS

Material	Parameter (LoM Estimate)	Unit	Value
Thickener Underflow (Flocculated)	As-received Solids Concentration, C_W	%	49.0
	Particle Density, ρ_{st}	t/m^3	2.82
	Atterberg Limits (LL / PL / PI) %	%	25 / 18 / 7
	Segregation Threshold	%	49.0
	Permeability, $k_{v,sat}$	m/s	2.96E-08 (e = 0.69) 1.96E-08 (e = 0.62) 1.67E-08 (e = 0.59)
	Maximum / Minimum Density	t/m^3	0.993 / 1.88
	Initial Settled Density (5 kPa suction)	t/m^3	1.525
	Shrinkage Limit Density	t/m^3	1.72

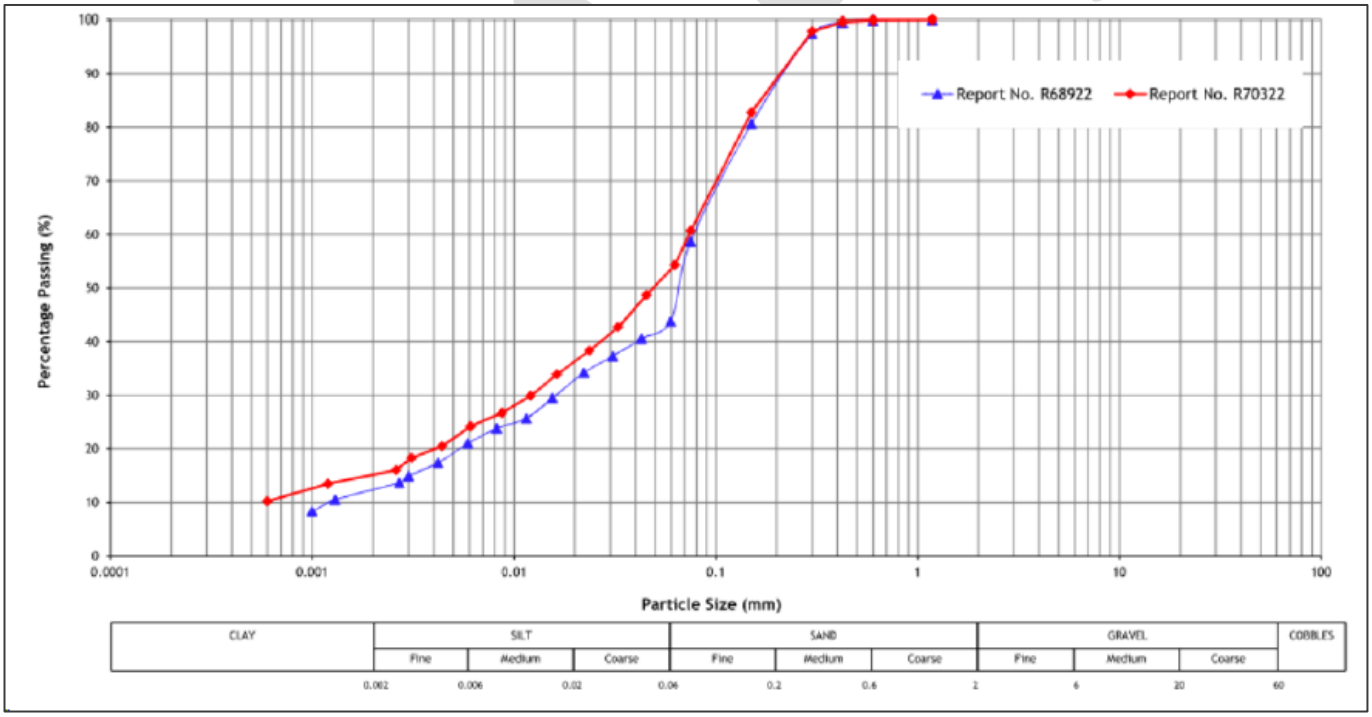

Figure 4.1: Tailings Particle Size Distribution (ATCW, 2023)

Advanced geotechnical laboratory testing results are presented in Esperanza Tailings Storage Facility, Design Report for Raise RL 284 (GHD, January 2022).

A total of ten (10) PSD tests were conducted for the tailings providing a range of fine material (sieve 0.075 mm), between 74% and 84% of which are clay-like particle sizes (sieve (0.002 mm) range between 3.8% and 7.9% and the remaining being silt particle sizes. The PSDs are shown in Figure 4.2.

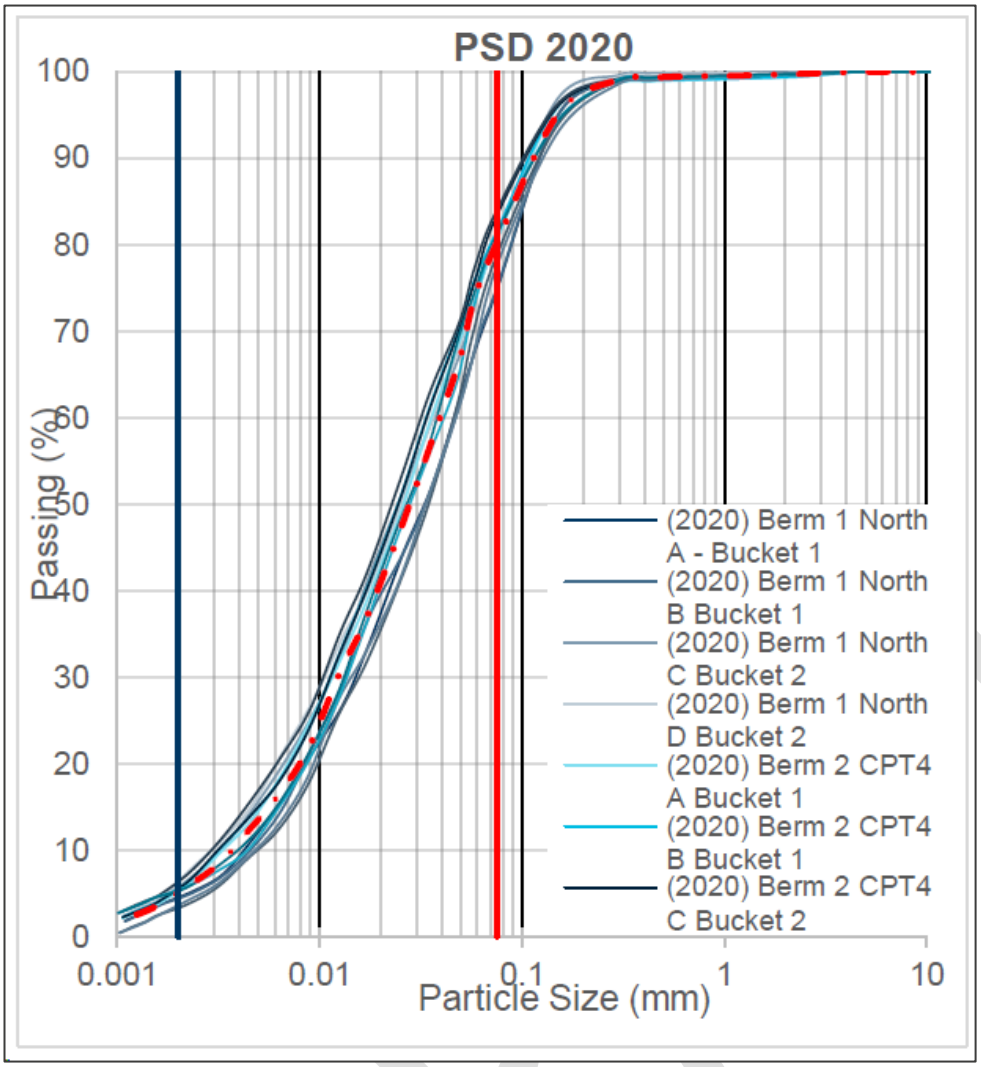

Figure 4.2: Particle Size Distribution (PSD) of Tailings (GHD, August 2022)

4.5 Geochemistry of Tailings

Limited geochemical characterisation of the tailings at CCM has been undertaken to date, although it is understood the tailings are categorised as potential acid forming (PAF) materials (GHD 2022).

All sulphide-containing material has the potential, when exposed to water and air, to produce run-off and/or leachate with increased concentrations of solutes. The key questions to be addressed are the extent to which this may occur and whether the risk to the environment is of a magnitude that needs to be mitigated to produce an acceptable outcome.

Past geochemical testing (Environmental Earth Scientists 2012, EMM 2015, GHD 2018, Earth Systems 2020) has shown that the historic tailings exhibit high concentrations of total S and sulfide S, hence have a high Maximum Potential Acidity (MPA), with limited Acid Neutralising Capacity (ANC). This correlates to strongly positive Net Acid Production Potential (NAPP) values indicating a high probability of being acid-forming. This suggestion is further supported by low Net Acid Generation (NAG) pH test results.

Multi-element testing indicates that tailings samples are significantly enriched (Geochemical Abundance Indices (GAI) of 3 or greater) in silver (Ag), arsenic (As), bismuth, (Bi), copper (Cu), lead (Pb), antimony (Sb) and thallium (TI) (Environmental Earth Scientists, 2012).

A summary of previous assessments is detailed below:

EMM (2015)

- EMM carried out excavation of 10 test pits through the Old Mammoth TSF, Total S of the tailings were generally over 1% and acid neutralising capacity was generally 0 kg H_2SO_4/t, indicating the tailings are potentially acid forming (PAF) with no lag, consistent with the low pH of less than 4 in water extracts.

GHD (2018)

- GHD carried out excavation of 10 test pits (TP01 to TP10) on the Old Mammoth TSF through the cover system into the tailings and drilled six boreholes (BH01 to BH06) to the full depth of the TSF and into natural ground.
- Geochemical results confirmed all tailings had high total S greater than 1%, had negligible ANC of generally less than 10 kg H_2SO_4/t, and were PAF.
- Multi-element data shows the tailings solids still contain high metal contents:
  - Ag 2-10ppm.
  - Co 60 to 380ppm.
  - Cu 0.1 to 1.2%.

Earth Systems (2020)

- Earth Systems (ES, 2020) was engaged to co-ordinate Quantitative X-Ray Diffraction (QXRD) analyses of 28 tailings samples to identify the presence of iron-oxide phases (e.g., goethite, hematite) that may facilitate sulfate removal from process water in the EPit via bacterially induced pyrite precipitation.
- dominant mineral in the tailing's samples analysed is quartz, with smaller proportions of pyrite, muscovite, kaolinite and siderite. The Maximum Potential Acidity (MPA) calculated from the mineralogy is elevated (16-109 kg H_2SO_4 per tonne) due to the presence of pyrite (0.8-6.5 wt.%). The calculated ANC is generally low (<6.2 kg H_2SO_4 per tonne). Therefore, the Net Acid Production Potential (NAPP; NAPP = MPA - ANC) of these samples ranges from 14 to 104 kg H_2SO_4 per tonne of tailings, and hence all samples are classified as PAF.

4.5.1 Laboratory Analysis

Engeny have reviewed recently supplied laboratory results (ALS reference BR23079597) from tailings testing conducted between 16/10/2022 and 19/02/2023, presented in Table 4.5, reporting all tailings as potentially acid forming, with reported pH following oxidation ranging between 2.2 and 3.0 and calculated MPA elevated between 57-356 kg H_2SO_4 per tonne.

TABLE 4.5: LABORATORY RESULTS (BR23079597)

SAMPLE	S	NAG @ pH 4.5	NAG @ pH 7.0	pH	Calc. MPA 30.6 x %S = MPA
UNIT	%	kg/t	kg/t	pH Unit	kgH_2SO_4/t
16/10/22 Final Tail DS	2.98	49.4	64.8	2.5	91.188
16/10/22 Final Tail NS	4.32	79.3	96.3	2.2	132.192
23/10/22 Final Tail DS	3.55	57.6	69.6	2.5	108.63
23/10/22 Final Tail NS	4.22	66.9	83.9	2.4	129.132
30/10/22 Final Tail DS	2.82	44.3	60.9	2.6	86.292
30/10/22 Final Tail NS	4.24	74.4	94.1	2.4	129.744
6/11/22 Final Tail DS	3.3	61.5	96	2.5	100.98
6/11/22 Final Tail NS	1.88	31.5	54.2	2.8	57.528
13/11/22 Final Tail DS	4.65	77.9	96.8	2.5	142.29
13/11/22 Final Tail NS	4.03	61.3	78.2	2.3	123.318

20/11/22 Final Tail DS	6.51	90.6	119	2.4	199.206
27/11/22 Final Tail DS	4.02	70.5	89.8	2.5	123.012
27/11/22 Final Tail NS	11.65	82.2	126	2.4	356.49
4/12/22 Final Tail DS	2.74	51	66.8	2.8	83.844
4/12/22 Final Tail NS	2.45	26.9	55.3	3	74.97
18/12/22 Final Tail DS	4.06	71.6	91.4	2.4	124.236
18/12/22 Final Tail NS	4.27	76.1	97	2.4	130.662
25/12/22 Final Tail DS	3.04	57.4	77.3	2.6	93.024
25/12/22 Final Tail NS	2.78	38.8	51.2	2.7	85.068
1/01/23 Final Tail DS	7	114	142	2.4	214.2
1/01/23 Final Tail NS	6.12	98	120	2.4	187.272
15/1/23 Final Tail DS	3.62	71.2	85.4	2.4	110.772
15/1/23 Final Tail NS	3.76	73.6	90.6	2.4	115.056
12/2/23 Final Tail DS	5.9	98.5	127	2.3	180.54
12/2/23 Final Tail NS	5.54	86.7	113	2.3	169.524
19/2/23 Final Tail DS	4.17	67.6	95.9	2.4	127.602
19/2/23 Final Tail NS	4.29	77.5	95.4	2.4	131.274
Mean Results	**4.36**	**68.75**	**90.29**	**2.47**	**133.63**
Min Results	**1.88**	**26.9**	**51.2**	**2.2**	**57.528**
Max Results	**11.65**	**114**	**142**	**3**	**356.49**

5. WATER MANAGEMENT

5.1 System Overview

The CCM water management system (WMS) consists of:

- Mine water storages (including the EPit and the MCD).
- Tailings storage facilities (ETSF, with EPit being proposed to again be used for tailings deposition).
- Underground workings and storages.
- Water transfer infrastructure including pipelines and pumps.
- External water supplies.
- Processing plant.

The purposes of the CCM WMS include:

- Containment and storage of mine affected water runoff and seepage.
- Containment and dewatering of tailings.
- Maintaining reliable supply to operational water demands, including the improvements in the efficiency of mine water recycling to operational water demands to reduce reliance on external water supplies.
- Avoiding mine water accumulation through enhanced evaporation and controlled releases of treated MAW.
- Reducing reliance of raw water from Lake Waggaboonya.
- Clean water diversions dams and drains to improve performance of the mine water containment system.
- Sediment control.

The CCM water management system is primarily made up of the EPit, the ETSF and the MCD which form the integrated containment system for CCM. The EPit, ETSF and MCD are classified as regulated structures.

The structures are operated as an integrated (shared) containment system for the purpose of sharing DSA. As required by condition G3-1 of the EA, the operation requirements of the CCM integrated containment system were detailed in the *System Design Plan (SDP) (Engeny, 2023).*

Water management at the site is governed by the *Capricorn Copper Water Management Plan (Engeny, 2023b).*

5.2 EPit Water Management

Water accumulated in the EPit is attributed to the following sources:

- Supernatant bleed from the tailings disposal.
- Catchment rainfall runoff.
- Groundwater inflows; and
- Pumped inflows from other storage / seepage collection areas.

Surface water management is undertaken to prevent overflow and maintain sufficient capacity for extreme rainfall events. The key objectives of the water management strategy are as follows:

- Meet the conditions of the Environmental Authority.
- Minimise the risk of an uncontrolled/unauthorised discharge (overflow or seepage).
- Maintain water cover that is an average of 2 m deep over the tailings beach.
- Operate seepage collection systems at the Northern Waste Rock Dump Sump, Hoover Dam Sump and Old Mammoth TSF/Sump 6.
- Operate high-capacity evaporators to manage pit inventories according to prevailing climatic conditions.
- Maximise the re-use of MAW in mining and processing, so as to limit raw water imports from Lake Waggaboonya.
- Maximise clean water flows away from site.

5.2.1 Return Water Infrastructure

The existing return water system in the EPit is summarised in Table 5.1.

Table 5.1: Return Water Infrastructure

Location	Description	Type	Pumping to	Pipe Size
EPit Ramp	Permanent installation Activation: Manual Start/Stop	1 x XH100 diesel pump	High-Capacity Evaporators located on Eastern embankment (400-200 evaporators)	355 mm HDPE
EPit Ramp	Permanent installation Activation: Manual Start/Stop	2 x Southern Cross pump with 200 kW motor	High-Capacity Evaporators located on Western embankment (600-300 evaporators)	355 mm HDPE
EPit Ramp	Permanent installation Activation: Manual Start/Stop	2 x Southern Cross pump with 200 kW motor	High-Capacity Evaporators located on Southern embankment (600-300 evaporators)	355 mm HDPE
EPit Ramp	Permanent installation Activation: Manual Start/Stop	1 x 18.5kW submersible pump per evaporator	Floating Evaporators located on EPit (200E evaporators)	N/A
EPit Ramp	Temporary installation Activation: Manual Start/Stop	400-40 electric pumps x 2 (one on standby) HV 1Kv trailing cable 20kL Fuel cell Poly and Floats 500x630mm 415V to 1000V Transformer 500kva generator x 2 (one on standby)	Mill Creek Dam	250 mm HDPE

5.2.2 Water Management Strategy

The key features of the EPit water management strategy are summarised below:

- The EPit will receive thickened tailings inflows from the Ore Processing Plant via the underflow from the final tails thickener.
- The EPit will receive rainfall runoff from approximately 139.2 ha of contributing catchment.
- The final tailings beach surface and operational decant pond levels will be kept below the regional groundwater table (~ RL 225m) so that EPit will act as a sink, rather than a source, and receive groundwater inflows during tailings disposal operations.

- Water level in the EPit shall be maintained below the MRL and shall provide at least the design DSA on 1 November each year.
- Decant water from the EPit is to be pumped into Mill Creek Dam and then to Pond 3 and 4 (in the interim) or to the new WTP, for treatment and then re-use around site as required.
- High-capacity mechanical evaporators are to be operated as much as possible to manage the water inventory where weather conditions permit.
- Decant water from ETSF is to be pumped to EPit to minimise water stored at ETSF.
- North Waste Rock Dump interception trench is transferred to EPit.
- Sump 6 seepage is transferred to the EPit when the water level.
- The EPit does not have a "constructed" spillway, however, there are various levels of control for outflow that facilitate compliance with the intent of the spillway requirements as per the EA. These include the following features (GHD, 2017):
  - Rock Bar at RL 222 m - above this level minor seepage could occur into the TSF access ramp pond area and subsequently into the downstream Mill Creek Dam. This level has been set as the maximum desirable water level to limit seepage from the EPit.
  - Hydraulic Divide at RL 225 – significant seepage is prevented by a hydraulic divide within the site groundwater system between EPit and the Mill Creek Dam at RL 225.
  - Access Ramp at approximate RL 229 m – unrestricted inflow to EPit would cause a significant amount of water to back up against the access ramp, which is likely to increase seepage into the downstream Mill Creek Dam through the hydraulic divide.
  - EPit ramp at RL 240 m – At this level in the Pit, there will be uncontrolled discharge from EPit along the haul road and into Mill Creek Dam. The discharge from the Pit will be determined by the cross-sectional area of flow on the eastern perimeter where the haul road enters the Pit.
- The level to which EPit could rise above the rock bar level RL 222 m to accommodate the design volume was assessed in the report (GHD, 2017). It was found that the peak level was extremely unlikely to exceed RL 222. From this assessment, it was determined that EPit does not require a formal spillway to facilitate its safe operation.
- Where the RL222 m(AHD) is exceeded, overflows and seepage are captured in Mill Creek Dam.

5.2.3 Decant Pond Control

The purpose of the decant return water system is to maintain the decant pond in a minimum condition whilst maintaining water cover of an average depth of 2m to reduce / prevent the oxidation of sulphides and the subsequent leaching of harmful substances. The presence of a decant system also minimises the storage volume that is required for the supernatant water whilst maximising the storage volume available for tailings and rainfall runoff.

The decant pond should be closely monitored to check that it is forming in the proposed location and that it is maintained in a minimum condition. The water level in the EPit TSF should be controlled via the decant infrastructure to ensure buffer storage is available to reduce the risk of an uncontrolled discharge.

5.3 Pit Water Quality During and Post Operations

Surface water runoff and seepage from mine landforms and disturbed areas can potentially contain a variety of contaminants, including sediment, low pH, heavy metals, and soluble salts. The EPit water quality is summarised in Table 5.2, with the mean for each parameter presented for the period of February 2023 to October 23.

The water quality parameters and analytes of the MCD, EPit and ETSF generally exceed trigger limits, contaminant limits and stock watering limits specified in the EA. This indicates that the water stored on site is of poor quality and has potential to negatively impact waterways and the environment downstream of the mine in the event of release to the environment.

Detailed water quality results are shown in Table 5.2. all results are presented as dissolved metals unless otherwise stated.

TABLE 5.2: EPIT WATER QUALITY

Parameter	Units	Result
pH	-	3.21
Conductivity	µS/cm	5324
Aluminium	mg/L	75.98
Total Arsenic	mg/L	0.06
Boron	mg/L	0.065
Cadmium	mg/L	0.0008
Calcium	mg/L	427
Chromium	mg/L	0.017
Cobalt	mg/L	7.71
Copper	mg/L	76.05
Iron	mg/L	16.45
Total Fluoride	mg/L	1.53
Lead	mg/L	0.0024
Magnesium	mg/L	283.36
Manganese	mg/L	22.58
Mercury	mg/L	0.0002
Molybdenum	mg/L	0.002
Nickel	mg/L	2.078
Sulphate as SO4	mg/L	3165.91
Total Anions	mg/L	66.54

Parameter	Units	Result
Total Cations	mg/L	55.59
TDS	mg/L	4294.31
Hardness CaCO3	mg/L	2232.72
Uranium	mg/L	0.035
Zinc	mg/L	1.85

5.4 Risk of Uncontrolled Releases

A spill risk assessment for the 2023-2024 wet season was undertaken for regulated structures (EPit, ETSF and MCD) and site storages that are at risk of overflowing offsite (Hoover Dam). Key results can be summarised as follows:

- Overflow events only occur in results above the 95th percentile. Further analyses of overflow results (i.e., assessment of the number of realisations in which an overflow occurs) indicate that there is around a 1% chance of an external spill event occurring from Hoover Dam as a result of an overflow from MCD.
- The EPit does not overflow in any scenario.

6. FUGITIVE EMISSIONS MANAGEMENT

6.1 General

The tailings being deposited into the EPit are pumped as slurry. There is no direct release of emissions from this process.

6.2 Dust

The tailings at CCM are deposited as a wet slurry which does not produce dust, and the initial deposition will be via sub-aqueous means. The potential for tailings to dry and produce dust for the EPit is limited, given the adoption of a 2m water cover to prevent oxidation of PAF tailings.

6.3 Gas

There is no known gas emitted from the EPit, or the tailings discharge.

7. MONITORING

7.1 General

Monitoring and surveillance of tailings storage facilities includes routine inspections on-site and a review of key monitoring information and data. This is in line with the requirements of the CCM EMS as described in section 3.2.

The main objectives of monitoring and surveillance are to:

- Ensure operations comply with relevant conditions as per the EA.
- Identify any dam safety risks.
- Ensure design intentions for all the facilities are met and that the construction is safe.
- Monitor and document dam performance, including instrumentation data.
- Understand and be ready to implement the Dam Safety Emergency Management Plan (ERP) if required.

7.2 Inspections

Monitoring and Surveillance inspections are required to be undertaken to monitor the condition and ultimately safety of the dams and structures within the EPit. The purpose of scheduled inspections is to identify visual or monitoring data deficiencies that either require maintenance or trigger a response under the Trigger Action Response Plan (TARP).

Based on the Consequence Category (ANCOLD, 2012) of 'High C', the following dam safety inspections will be completed for the EPit as part of the surveillance program as shown in Table 7.1.

TABLE 7.1: SURVEILLANCE INSPECTION

Inspection Type	Frequency	Responsible
Daily	Daily	Processing
Monthly	Monthly	Environment
Intermediate and Regulated Structures Inspection (same inspection)	Annually	Environment
Comprehensive	On first filling then 2-Yearly	Environment
Event Driven	As Required	Environment

A summary of task requirements for each inspection classification are listed in Table 7.2.

TABLE 7.2: SURVEILLANCE INSPECTION REQUIREMENTS

Task	Inspection Type						
	Daily	Monthly	Intermediate	Comprehensive	Regulated Dam	Event-driven	Dam Safety Review
Visual inspection to identify physical deficiencies or changes in observed conditions of the dams (Varying levels of assessment and inspector experience)	x	x	x	x	x		x
Collection and summary of monitoring data		x	x	x	x		x
Review and interpretation of monitoring data		x	x	x	x		x
Review of previous recommendations and progress on actions carried out to address these recommendations			x	x	x		x
Review of freeboard and operational activities that may influence dam safety	x	x	x	x	x		x
A review of conformance with conditions of the EA, as-constructed drawings and changing circumstances which may lead to a modification in consequence category			x	x	x		x
An assessment of adequacy of available storage in each regulated dam on the 1st of November of that year					x		
A review of evidence of conformance with the current OMS		x	x	x	x		
Provision of recommendations to address any deficiencies identified by the inspection			x	x	x		x
A review of the owner's whole dam safety management program (Dam Safety Review)							x

In the following sections the characteristics and requirement of CCM's inspection programs for the different inspection's levels are described. It is important to highlight that all routine inspections must be carried out by a competent operator/inspector with adequate knowledge about the facilities, their function, and their normal safety condition.

7.2.1 Daily Inspections

Daily routine inspections shall be undertaken by nominated Processing personnel. Daily inspections shall include:

- Highwall geotechnical stability.
- Water level.
- Spillways condition.
- Spigots and pipeline conditions.
- Return water pumps and pipelines conditions.
- High-capacity mechanical evaporators, and flow meters.
- Seepage collection systems.

The actions to be undertaken during the Daily Routine Inspection are detailed in Table 7.3.

TABLE 7.3: DAILY ROUTINE VISUAL INSPECTION

Issue	Action	Resource
Operation	Operation of decant and tailings discharge systems.	Daily Routine Visual Inspection Form
Surveillance	Identify and report any deficiencies by visual observation of the embankment. Prevent environmental issues.	Daily Routine Visual Inspection Form
Maintenance	Any deficiencies identified during routine surveillance to be reported to CCM Process Superintendent to determine and plan the appropriate maintenance action.	Maintenance Activities
Emergency Response	Identify and respond to any observed deficiency requiring emergency response by implementing the appropriate procedure.	ERP

The operator must have a good understanding of the Daily Routine Visual Inspection and Reporting procedure to perform efficient inspection and surveillance reporting. The operator must also be familiar with safety issues and operational performance to report any observation judged relevant concerning the safety and performance of the facility (not otherwise covered by the Inspection Report Form).

7.2.2 Monthly Inspections

Monthly surveillance inspections shall be undertaken by nominated Environment personnel. The purpose of the monthly inspection is to assess the status of the facility and its features in terms of its structural and operational safety and performance. Monthly inspections shall include:

- Highwall geotechnical stability.
- Water levels.
- Spillways conditions.
- Instrumentation monitoring.
- Spigots and pipeline conditions.
- Return water pumps and pipelines conditions.
- High-capacity evaporators, and flow meters.
- Seepage collection systems.
- EPit Ramp.
- Access Roads.

The actions to be undertaken during the monthly Routine Inspection are detailed in Table 7.4.

TABLE 7.4: MONTHLY ROUTINE INSPECTION PROGRAM

Issue	Action	Resource
Operation	Evaluate and report the tailings discharge and water management plans performance.	OMS Manual
Surveillance	Identify and report any deficiencies, by structured observation of the EPit and surrounds, with recommendations for corrective actions. Prevent environmental issues.	Monthly Routine Visual Inspection Form
Maintenance	Inspect maintenance actions undertaken during the last month and evaluate EPit and equipment status.	Maintenance Activities
Emergency Response	Analyse incident data and evaluate on the surveillance and maintenance management performance.	Emergency Response Team (ERT) Emergency Notification Emergency Response Plan ERT Scheduled TSF Emergency Simulation

The Environment personnel must have a good understanding of the Routine Inspection and Reporting procedure to perform efficient inspection and surveillance reporting.

7.2.3 Intermediate and Comprehensive Inspection Program

Intermediate and Comprehensive inspections must be generally carried out in accordance with the requirements of the ANCOLD guidelines (ANCOLD, 2012).

Intermediate inspections aim for the identification of deficiencies by visual examination of the dam and review of surveillance data against prevailing knowledge. Equipment is not necessarily operated. This inspection must be performed by a suitably qualified and experienced person.

For the case of comprehensive inspections, these aim to identify deficiencies by a thorough onsite inspection; by evaluating data; and by applying current criteria and prevailing knowledge. In addition, equipment should be test operated to identify deficiencies. This inspection must be performed a suitably qualified and experienced person.

7.2.4 RPEQ Annual Inspections

Annual inspections shall be conducted by a Registered Professional Engineer of Queensland (RPEQ) to evaluate the condition of the EPit relative to dam safety, containment, and operational performance objectives. The annual inspections are intended to be more thorough than a routine inspection. The annual inspection shall include:

- Visual inspection of the facility, any auxiliary infrastructure and monitoring instrumentation and operating practices.
- A review of routine inspection reports.
- A review of decant pond water levels and any instrumentation monitoring data.
- Review and reconciliation of available survey data to determine the tailings volume occupied and in situ tailings density achieved in the previous 12 months and how this compares with predicted values.
- Preparation of a report summarising the following:
  - Visual observations including inspection photographs.

- A summary of the current EPit TSF status including compliance with the design intent, this OMS, regulatory and internal governance requirements,
- Any recommendations to address observed defects or non-compliances and the status of previous recommendations. Recommendations may include changes to operating practices, maintenance, repairs and other works, investigation or assessment, or additional surveillance.

7.2.5 Other Inspections

Additional special / event driven inspections shall be undertaken on an as-required basis as follows:

- Seismic activity (Mw > 4.5) within 50km of the facility.
- Before the start of the wet season (31st October).
- Following an overflow event; and
- Following any significant rain event whereby greater than 100 mm of rain has fallen, during one (1) rain event.

7.2.6 Performance Data

Key operational performance criteria applicable to EPit should be recorded at the frequency specified in Table 7.5. This is to assist with identifying whether the facility is operating in accordance with the design intent and this OMS.

Table 7.5: Reporting Frequency for Typical Performance Data

Monitoring Type	Frequency
Rainfall	Daily
Tailings Tonnes Delivered (actual tailings tonnes delivered to EPit– Bathymetry) and tailings beach profile	Three-Monthly
Tailings Slurry Volume Delivered (actual tailings slurry volume from thickeners delivered to EPit)	Monthly
Decant Return Volume (volume of decant water pumped to MCD or HCME's)	Monthly
Decant pond water level and location	Daily
Monitoring of Downstream Monitoring Bores	Monthly
Highwall Geotechnical Stability	Daily
Seepage Collection System	Daily
Operation of High-Capacity Mechanical Evaporators	Daily

7.2.7 Monitoring Instrumentation

Groundwater quality and level (mbgl) are monitored by several groundwater bores across the site, some which are compliance bores with prescribed limits as per Schedule C Table 5 in the EA. CCM are proposing to install additional groundwater monitoring bores to increase the effectiveness of the groundwater monitoring network at CCM. The locations of existing groundwater bores and proposed additional bores are shown below in **Figure 7.1**.

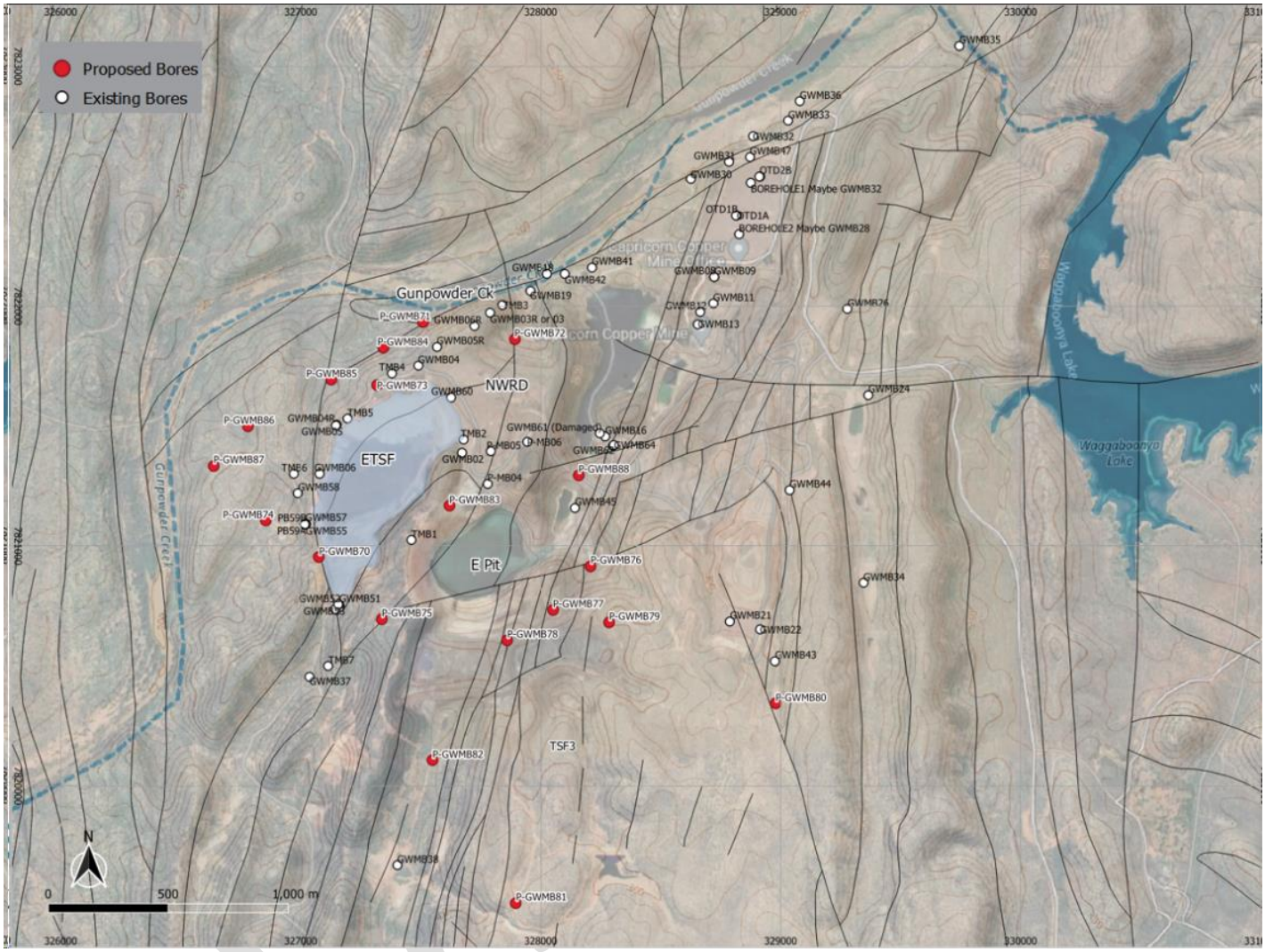

Figure 7.1: Groundwater Monitoring Bores

The monitoring points and their monitoring frequency are presented in **Error! Reference source not found.**.

The monitoring points and their monitoring frequency are presented in **Error! Reference source not found.**. As is observed, there are existing b ores, and additional monitoring bores proposed for installation to increase the monitoring of EPit TSF and the site more broadly.

Table 7.6: Groundwater Monitoring Bores

Monitoring Point	Purpose of Monitoring Bore	Monitoring Frequency
GWMB02	EPit	1 sample every 3 months for groundwater quality; and
TMB01	EPit	

GWMB45	EPit	1 measurement every month for groundwater level
GWMB83 (Proposed)	EPit	
GWMB75 (Proposed)	EPit	
GWMB78 (Proposed)	EPit	
GWMB77 (Proposed)	EPit	
GWMB76 (Proposed)	EPit	
GWMB72 (Proposed)	NWRD Seepage	
GWMB41	NWRD Seepage	

Groundwater monitoring must be completed in accordance with conditions C5-1 to C5-5 of the EA. Monitoring of compliance bores for groundwater quality must be completed quarterly, and monthly for groundwater level at locations specified in EA Schedule C – Table 5. It is proposed that all monitoring bores in Table 7.6 are monitored in line with the EA conditions.

The EA defines groundwater trigger levels and contaminants levels in Schedule C – Table 6, as shown in Table 7.7.

Table 7.7: EA Schedule C - Table 6 (Groundwater Trigger Levels and Contaminant Levels)

Parameter*	Trigger Level# (µg/L unless otherwise specified)	Contaminant Limit # (mg/L unless otherwise specified)
pH (pH units)	6.0 – 8.5	
EC (µS/cm)	435	1,000
Sulfate (SO42-)	80th percentile[1] of reference bore level[2] or 250 mg/L, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 1,000, whichever is lower
Fluoride (F-)	80th percentile[1] of reference bore concentration[2]	2
Major cations	For interpretive purposes only	
Major anions	For interpretive purposes only	
Aluminium	80th percentile[1] of reference bore[2] concentration[3] or 55, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 5, whichever is lower
Arsenic4	80th percentile[1] of reference bore[2] concentration[3] or 13, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 0.5, whichever is lower
Boron	80th percentile1 of reference bore2 concentration3 or 370, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 5, whichever is lower

Parameter*	Trigger Level# (µg/L unless otherwise specified)	Contaminant Limit # (mg/L unless otherwise specified)
Cadmium	80th percentile[1] of reference bore[2] concentration[3] or 0.2, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 0.01, whichever is lower
Chromium4	80th percentile[1] of reference bore[2] concentration[3] or 1.0, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 1, whichever is lower
Cobalt	80th percentile[1] of reference bore[2] concentration[3]	95th percentile[1] of reference bore[2] concentration[3] or 1, whichever is lower
Copper	80th percentile[1] of reference bore[2] concentration[3] or 1.4, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 1, whichever is lower
Lead	80th percentile[1] of reference bore[2] concentration3 or 3.4, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 0.01, whichever is lower
Manganese	80th percentile[1] of reference bore[2] concentration[3] or 1900, whichever is higher	95th percentile[1] of reference bore[2] concentration[3]
Nickel	80th percentile[1] of reference bore[2] concentration[3] or 11, whichever is higher	95th percentile[1] of reference bore[2] concentration[3] or 1, whichever is lower
Uranium	80th percentile[1] of reference bore[2] concentration[3]	95th percentile[1] of reference bore[2] concentration[3] or 0.2, whichever is lower
Zinc	80th percentile[1] of reference bore[2] concentration[3] or 8.0	95th percentile[1] of reference bore[2] concentration[3] or 20, whichever is lower
Total Hardness	For interpretive purposes only	

[1.] Must be determined in accordance with QWQG (2009) and ANZECC (2000) methodology.

[2.] Reference bores are specified in Schedule C - Table 5 (Groundwater Monitoring Locations and Frequency).

[3.] Where the 80th/95th percentile of a groundwater trigger level/contaminant limit is exceeded for a compliance bore and the reference bore also exceeds this concentration during the same sampling event, the value of the reference bore applies as the groundwater trigger level/contaminant limit for that sampling event.

[4.] Site specific trigger levels and contaminant limits for groundwater (80th and 95th percentile of reference site concentration) must be calculated in accordance with QWQG (2009) and ANZECC (2000) methodology if sufficient monitoring data is available. The environmental authority holder must maintain a database documenting all relevant groundwater monitoring data and calculation of 80th/95th percentiles adopted as groundwater trigger levels and contaminant limits.

[5.] Routine analysis for this parameter is based on combined/total species of the element, where the exceedance of a groundwater trigger level or contaminant limit is identified, an additional sample must be taken and analysed as soon as practicable to determine and quantify speciated forms of this element.

[6.] For all groundwater monitoring, metals and metalloids must be measured and reported as both total (unfiltered) and dissolved (field filtered) concentrations.

7.2.8 Geochemical Monitoring

In line with the requirements of the EA, characterisation of tailings to identify the potential to generate contaminated seepage or leachate must be undertaken at a minimum frequency of once every month during tailings deposition. Characterisation must include:

- Determining the acid producing potential through calculating both the 'Net Acid Producing Potential' and the 'Net Acid Generation test'.
- Determining the level of aluminium, arsenic, boron, cadmium, chromium, cobalt, copper, lead, manganese, nickel, uranium and zinc.
- Where the acid producing potential of tailings material has not been conclusively determined, tailings material must be considered as acid forming unless further geochemical testing demonstrates otherwise.

In addition to the above monitoring requirements from the EA, the following geochemical testing is recommended on the same monthly frequency:

- Total Sulfur (S).
- Total Sulfate (SO4).
- Chromium Reducible Sulfur (Scr).
- Total alkalinity.
- 1:5 pH and EC.
- 1:5 Soluble major cations (Ca, Mg, Na, K).
- 1:5 Soluble major anions (CI, SO4).
- 1:5 Water-soluble metals (15 metals).

8. CLOSURE STRATEGY

The existing closure strategy for the EPit is to remain as a residual void and groundwater sink, and for EPit to maintain a water cover, as defined in the Capricorn Copper Post Mine Land Use Plan (PMLUP). The retention of a water cover over the tailings beach in closure, which is reliant on the pit lake equilibrium level, prevents drying and exposure of tailings to atmosphere. This is expected to maintain saturated, oxygen deficient conditions in the tailings and prevent oxidation of sulphides.

Engeny have been engaged to undertake a final void water and solute balance model to determine how an increased tailings deposition strategy will impact the final void pit lake in the EPit at closure by:

- Determining the equilibrium pit lake level and recovery rate for the final void following the cessation of mining.
- Assessing the final void pit lake water quality over time (limited to salt as electrical conductivity (EC)).

The assessment will be completed for a base case (i.e., current conditions without additional tailings deposition in EPit) and an increased tailings deposition scenario with final tailings beach to RL 215.7. Sensitivity analysis will be undertaken on both scenarios to assess the impacts of changes to assumed groundwater inflow rates at closure.

The final void water balance model (WBM) was developed using the GoldSim software and simulates inflows from rainfall runoff over the residual final void catchment (including direct rainfall), groundwater and seepage inflows, and evaporative outflows. Subsequent sections of this report detail the methodology and inputs used to develop the final void WBM.

The following assumptions regarding the final void catchment and design were made, including:

- The current EPit catchment (as per the current site WBM) will be inclusive of proposed diversions post closure.
- Areas that are currently disturbed within the EPit catchment will be rehabilitated.
- The ETSF is capped and rehabilitated, with surface water diverted away from EPit in closure.
- The current EPit storage curve (as per the current site WBM) is assumed to be reflective of the base case modelling scenario final void design.
- The model adopted the existing AWBM parameters for relevant catchment as described in *The Capricorn Copper Water Balance Model Report* Engeny (2023).
- Groundwater inflow rates have been adopted from *Capricorn Copper Pty Ltd Life of Mine Project 2020 Groundwater Modelling* (GHD 2020).
- The starting pit lake level is assumed to be the top of the 2m water cover over the final tailings surface.

The final void catchments are shown in Figure 8.1 and Table 8.2.

TABLE 8.1: FINAL VOID CATCHMENT LANDUSE BREAKDOWN

Land Classification			Total Catchment Area (ha)
Natural Catchment (ha)	Rehab Catchment (ha)	Pit/Tailings Catchment ha)	
5.8	12.0	22.2	40.0

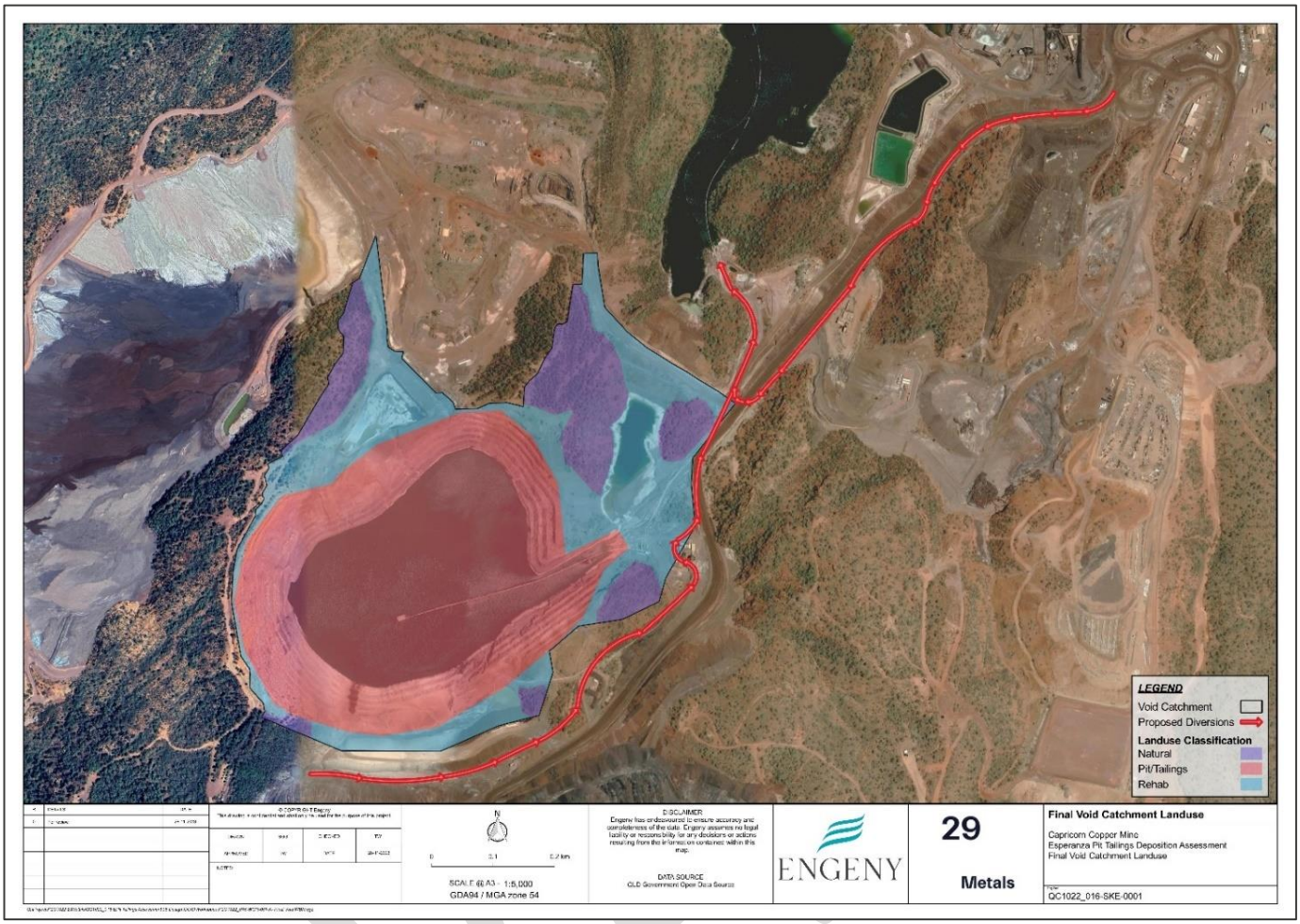

Figure 8.1: Final Void Design and Catchment Characteristics

The existing tailings surface and pit shell comprising the base case scenario, and the proposed final tailings surface comprising the increased tailings scenario are shown previously in Figure 3.1.

The void storage characteristics for both the base case and increased tailings deposition scenarios are provided in

Table 8.2.

TABLE 8.2: FINAL VOID CHARACTERISTICS

Scenario	Floor Level (mAHD)	Spill Level (mAHD)	Full Supply Volume (ML)	Overflows To
Base Case	200.8	240.0	4331.5	External
Increased Tailings Deposition	213.65 (lowest point of tailings surface) – 215.7 (highest point of tailings surface)	240.0	3357.7	External

The mean results as shown in Figure 8.2 for the base case scenario adoping the median range of predicted groundwater inflows from GHD 2020 show a gradual increase in pit lake level throughout the simulation period as shown in Figure 8.2. The EPit maintains significant freeboard under all modelled conditions. The void also stays below the assumed pre mining groundwtaer level of RL 225. These modelled outcomes do not significantly change using the minimum or maximum predicted groundwater inflows from GHD 2020.

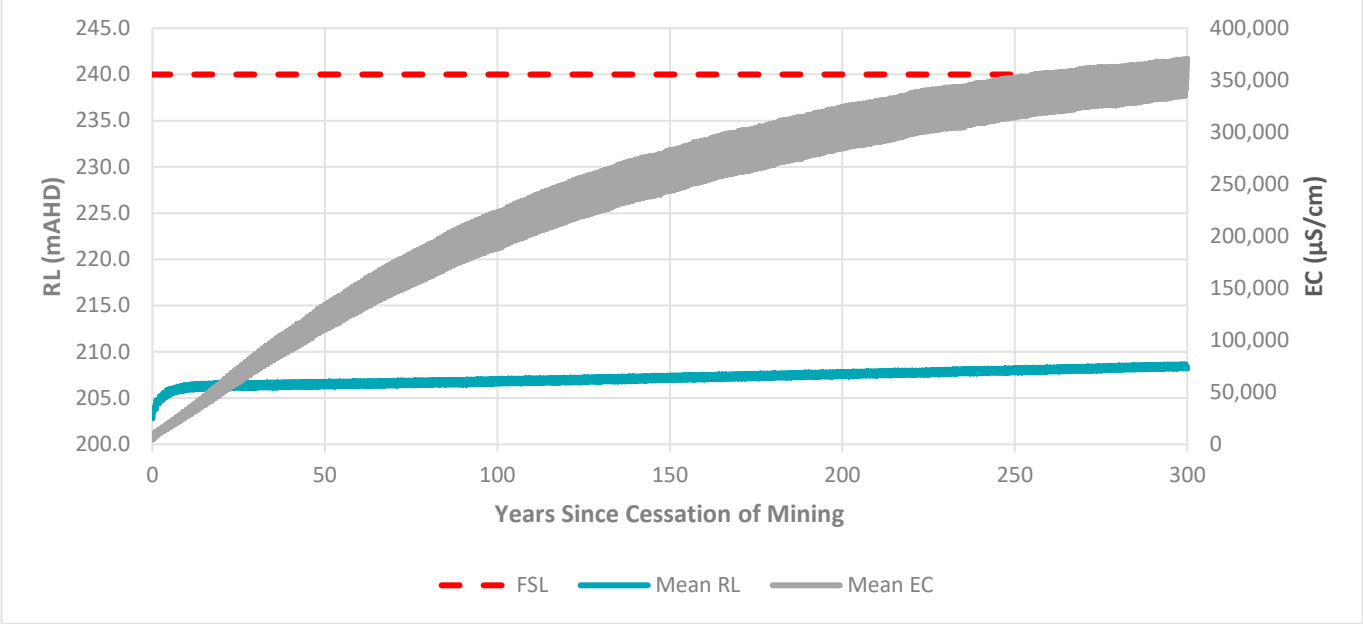

Figure 8.2: Predicted Mean Final Void Water Levels and Quality – Base Case

The mean results for the base case scenario adoping the median range of predicted groundwater inflows from GHD 2020 shows a gradual increase in pit lake level throughout the simulation period as shown in Figure 8.3. The EPit maintains significant freeboard under all modelled conditions. The void also stays below the assumed pre mining groundwtaer level of RL 225. These modelled outcomes do not significantly change using the minimum or maximum predicted groundwater inflows from GHD 2020.

The additional tailings deposition up to RL215.7 (top of tailings) does not impact the ability to maintain a water cover over tailings during closure, with the mean pit lake equilibrium level being 1.9m (RL 217.6) higher than the top of tailings.

It is noted the minimum pit lake equilibrium level modelled was RL 214.8, there may be some periods where very dry conditions prevail, where the tailings beach is partially exposed.

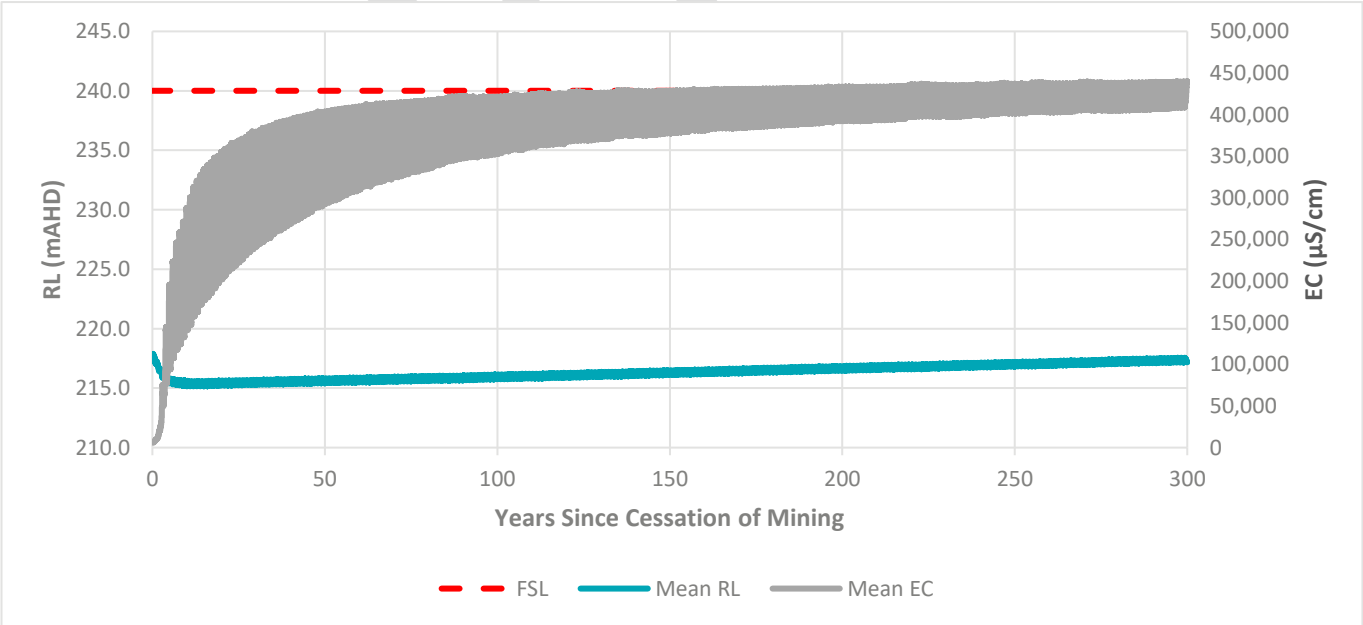

Figure 8.3: Predicted Final Void Water Levels and Quality – Increased Tailings Deposition Scenario

Based on this assessment, the following conclusions are noted:

- For all scenarios, the residual void did not reach equilibrium, with a gradual increasing trend continuing to be observed in modelled results.

- The mean pit lake equilibrium level under all scenarios exceeds the top of tailings, so it is reasonable to expect a water cover to be available post closure to prevent the oxidation of PAF tailings in the void.
- The void lake elevations for all scenarios remain below the assumed pre-mining groundwater level of RL225.0, and the void is likely to continue to act as a groundwater sink post closure.
- Due to evapo-concentration, the modelled salinity of the void water quality increases throughout the simulation period.
- All void lake elevations stay at least 19.3 metres below the void full supply level at the modelled maximum, and there are no modelled overflows. Pit lake levels continue to fluctuate seasonally with changes in rainfall and evaporation after reaching equilibrium level.
- Oscillation in pit lake levels for the void under the modelled scenarios (i.e., the difference between the minimum and maximum modelled levels) ranges between 5 and 8.9m.

9. RISK ASSESSMENT

An environmental risk assessment was undertaken for the proposed recommencement of tailings deposition into EPit considering potential impacts on surface and groundwater resources. Using the information presented in this document, and the likelihood of occurrence and consequence criteria (Table 9.1 and Table 9.2), the significance of the risks was identified using Table 9.3. This approach is consistent with AS/NZS 4360:2004: Risk Management and AS/NZS ISO 31000:2009 Risk Management - Principals and Guidelines (AS/NZS 2009; 2004).

The significance of the risks is defined as:

- High significance: a significant risk with a high likelihood of impact which is considered unacceptable or intolerable and may be irreversible or persistent.
- Moderate significance: a level of risk which is not acceptable with moderate severity with impacts persisting over time but that can be mitigated.
- Low significance: the risk is low with any impacts, short in duration and reversible.
- Insignificant: an insignificant risk and any potential impacts are acceptable, and no risk treatment is necessary with the impact restricted to the immediate area of activity.

TABLE 9.1: LIKELIHOOD CRITERIA

Rank	Likelihood	Description
E	Rare	An event that has not previously been experienced in the industry but may occur in exceptional circumstances
D	Unlikely	An event not likely to occur in the industry over 10 years
C	Possible	An event that may occur in the industry over 10 years
B	Likely	An event likely to occur more than once a year in the industry
A	Almost Certain	A common event that is likely to occur in industry multiple times per year

TABLE 9.2: CONSEQUENCE CRITERIA

Consequence	Description
1-Minor	Minimal impact on ecosystem; contained on mining lease, and/or reversible in one shift
2-Low	Moderate impact on ecosystem; contained on mining lease, and/or reversible in 1 to 5 years
3-Moderate	Significant impact on ecosystem; impact contained on mining lease, and /or reversible in ~10 years
4-Major	Significant harm or irreversible impact (for example to World Heritage area); widespread, catchment area, long term, greater than 10 years
5-Catastrophic	Significant harm or irreversible impact on high value receptors or environmental values (for example to World Heritage area); widespread, long term

TABLE 9.3: RISK MATRIX

Consequence	1-Minor	2-Low	3-Moderate	4-Major	5-Catastrophic
Likelihood					
A-Almost Certain	Moderate	Moderate	High	Catastrophic	Catastrophic
B-Likely	Moderate	Moderate	Moderate	High	Catastrophic
C-Possible	Low	Moderate	Moderate	High	High
D-Unlikely	Low	Low	Moderate	Moderate	High
E-Rare	Low	Low	Low	Moderate	High

As summarised in Table 9.4 below, the risk to both surface water and groundwater flow and quality as a result of the proposed recommencement of tailings deposition into EPit is considered low as:

- No uncontrolled discharges are expected from the CCM WMS resulting from EPit tailings deposition, and consequently no changes are expected to the existing surface water flow regime in Gunpowder Creek.
- The EPit is effectively watertight up to RL 222, with deep drainage limited by the parent material in the pit and the significant volume of consolidated tailings which is of low hydraulic conductivity.
- Existing seepage controls are expected to be sufficient to manage any potential seepage where MAW exceeds RL 222, including interception by Mill Creek Dam and the NWRD Sump.

TABLE 9.4: RISK OF POTENTIAL SURFACE WATER AND GROUNDWATER IMPACTS

Aspect	Risk Event	Consequence	Likelihood	Residual Risk	Justification and Control
Surface Water Flow	Changes to the existing flow regime (including baseflow) in Gunpowder Creek	1 - Minor	E - Rare	Low	EPit tailings deposition is not expected to result in any change to the existing flow regime in Gunpowder Creek, with no overflow events from the EPit under any modelled scenarios (Engeny 2023)
Surface Water Quality	Reduction in water quality in Gunpowder Creek resulting from increased seepage expression from EPit	1 - Minor	C - Possible	Low	The EPit is effectively watertight up to RL 222. Existing seepage controls (Mill Creek Dam and NRWD seepage sump) are expected to manage seepage where the EPit MAW inventory exceeds RL 222. Seepage from EPit is expected to drain to the underground workings or be intercepted by MCD. The pumps at MCD have enough capacity to pump back seepage inflows into MCD at a higher rate than seepage from EPit. The pumping system includes a duty and standby pumping infrastructure.
Release of Tailings	Failure of the EPit Ramp	4 - Major	D – Unlikely	Moderate	Failure of EPit Ramp is not credible under RL222 (Engeny 2022b). No tailings will be stored above RL222, so any failure would result in release of MAW only.
Groundwater Flow	Changes to the existing	1 - Minor	C - Possible	Low	No changes are expected to the existing groundwater flow regime.

Aspect	Risk Event	Consequence	Likelihood	Residual Risk	Justification and Control
(bore/aquifer yield and water levels)	flow regime (including baseflow) in Gunpowder Creek				The EPit is effectively watertight up to RL 222, with deep drainage limited by the parent material in the pit and the significant volume of consolidated tailings which is of low hydraulic conductivity.
Groundwater Quality	Reduction in groundwater quality resulting from increased seepage	1 - Minor	C - Possible	Low	The EPit is effectively watertight up to RL 222, with deep drainage limited by the parent material in the pit and the significant volume of consolidated tailings which is of low hydraulic conductivity.
Closure	Sink does not remain terminal sink post closure	3 – Moderate	D – Unlikely	Moderate	The EPit is modelled to remain a terminal sink, with the additional tailings deposition to RL 215.7 below the modelled pit lake equilibrium level of RL 217.6. The modelling has demonstrated a residual water cover will remain over the tailings beach post closure, preventing oxidation of tailings.

10. REFERENCES

- Department of Environment and Science (DES 2022), Environmental Authority EPML00911413, effective 30 September 2022.
- Engeny. (2023). System Design Plan - ETSF, MCD and EPit.
- Engeny (2023a). Esperanza Pit, Esperanza TSF and Mill Creek Dam Consequence Category Assessment.
- Engeny (2023b). Capricorn Copper Water Management Plan.
- GeoCompute Pty Ltd. (2001) Geochemical Evaluation: Water Quality and Storage Integrity of the Esperanza Tailings Dam and Esperanza Open Put (If used for water storage) and Sulphide Oxidation Processes with Specific Reference to Copper-Cobalt Ore Bodies.
- GHD Pty Ltd. (2012) Birla Mount Gordon Report for Esperanza Tailings Dam Raise: Master Seepage Report.
- *Esperanza Pit DSA and MRL Revision: Hydrogeological Response to DEHP Notice of Decision (GHD 2013).*
- GHD Pty Ltd (2020) Capricorn Copper Pty Ltd Life of Mine Project 2020 Groundwater Modelling.
- GHD (GHD 2021c), *NWRD and Esperanza TSF Investigation Geophysical Report Capricorn Copper Pty Ltd*, 12 May 2021.
- GHD Pty Ltd (2022) Esperanza Tailings Storage Facility Design Report for Lift 2 to RL 287.7.
- Hydrogeologist.com.au (2022) Draft Report on Hydrogeological Assessment of the Capricorn Copper Mine.
- Keller, J., Milczarek, M., Zhan, G. (2015) Water Balance Modelling of Preferential Flow in Waste Rock Materials. *10th International Conference on Acid Rock Drainage & IMWA Annual Conference Proceedings*, Santiago, Chile.
- Smith, L. (2021) Hydrogeology and Mineral Resource Development. *The Groundwater Project*, Guelph, Ontario, Canada.

11. QUALIFICATIONS

(a) In preparing this document, including all relevant calculations and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

(b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

(c) Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

  (i) Additional sources of information not presently available (for whatever reason) are provided or become known to Engeny; or

  (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

(d) Engeny does not give any warranty nor accept any liability in relation to the completeness or accuracy of the works, which may be inherently reliant upon the completeness and accuracy of the input data and the agreed scope of works. All limitations of liability shall apply for the benefit of the employees, agents and representatives of Engeny to the same extent that they apply for the benefit of Engeny.

(e) This document is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this Report.

(f) If any claim or demand is made by any person against Engeny on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the Report or information therein, Engeny will rely upon this provision as a defence to any such claim or demand.

(g) This Report does not provide legal advice.

APPENDIX 4 PROTECTED MATTERS SEARCH

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 08-Nov-2023

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	12
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Amytornis dorotheae Carpentarian Grasswren [558]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macrotis lagotis			
Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area	In feature area
REPTILE			
Acanthophis hawkei			
Plains Death Adder [83821]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Elseya lavarackorum			
Gulf Snapping Turtle [67197]	Endangered	Species or species habitat may occur within area	In feature area
SHARK			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
Hirundo rustica			
Barn Swallow [662]		Species or species habitat may occur within area	In feature area
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat likely to occur within area	In feature area
Migratory Wetlands Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat may occur within area overfly marine area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area	In feature area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat likely to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Reptile			
Crocodylus johnstoni			
Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
CopperString Project	2010/5581	Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

Department of Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111

APPENDIX 5 MATTERS OF STATE ENVIRONMENTAL SIGNIFICANCE SEARCH

Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
Longitude: 139.358153 Latitude: -19.696189 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

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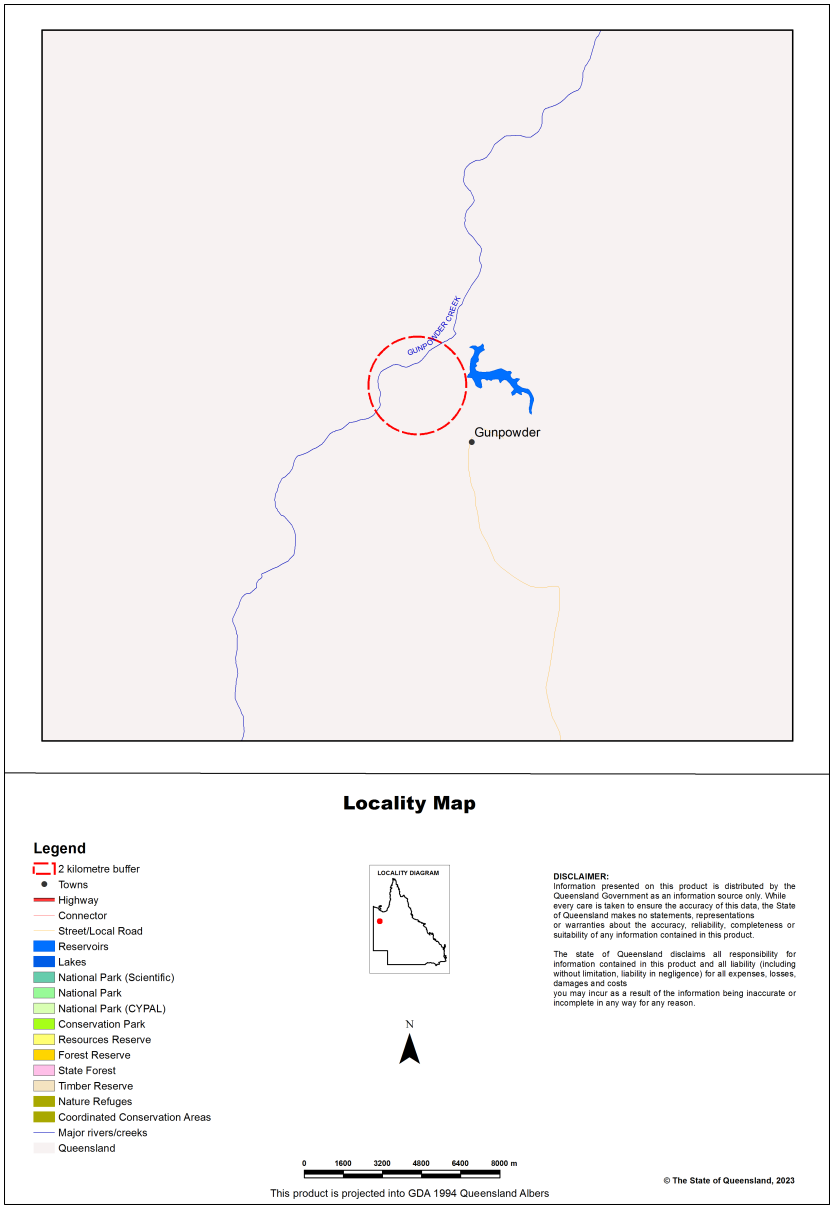
Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI Longitude: 139.358153 Latitude: -19.696189

Size (ha)	1,256.55
Local Government(s)	Mount Isa City
Bioregion(s)	Northwest Highlands
Subregion(s)	Mount Isa Inlier
Catchment(s)	Leichhardt



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

    • Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;

    • Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;

    • Category R areas on the regulated vegetation management map;

    • Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;

    • Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;

- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	0.0 ha	0.0 %
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
7d Sea turtle nesting areas	0.0 km	Not applicable
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	0.0 ha	0.0 %
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	0.0 ha	0.0 %
8e Regulated Vegetation - intersecting a watercourse	20.2 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	4.37 ha	0.3%
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

1c. Protected Areas - special wildlife reserves

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Not applicable

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

7d. Wildlife habitat (sea turtle nesting areas)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
Boronia keysii		V	None
Calyptorhynchus lathami	Glossy black cockatoo	V	None
Casuarius casuarius johnsonii	Sthn population cassowary	E	None
Crinia tinnula	Wallum froglet	V	None
Denisonia maculata	Ornamental snake	V	None
Litoria freycineti	Wallum rocketfrog	V	None
Litoria olongburensis	Wallum sedgefrog	V	None
Macadamia integrifolia		V	None
Macadamia ternifolia		V	None
Macadamia tetraphylla		V	None
Melaleuca irbyana		E	None
Petaurus gracilis	Mahogany Glider	E	None
Petrogale persephone	Proserpine rock-wallaby	E	None
Pezoporus wallicus wallicus	Eastern ground parrot	V	None
Phascolarctos cinereus	Koala - outside SEQ*	E	None
Taudactylus pleione	Kroombit tinkerfrog	E	None
Xeromys myoides	Water Mouse	V	None

**For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.*

Threatened (endangered or vulnerable) wildlife species records

(no results)

Special least concern animal species records

(no results)

Shorebird habitat (critically endangered/endangered/vulnerable)

Not applicable

Shorebird habitat (special least concern)

Not applicable

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals, Map 3b - MSES - Species - Koala habitat area (SEQ)** and **Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

https://environment.ehp.qld.gov.au/regional-ecosystems/

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Not applicable

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Not applicable

8d. Regulated Vegetation - Essential habitat

Not applicable

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Regulated vegetation map category	Map number
B	6758

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

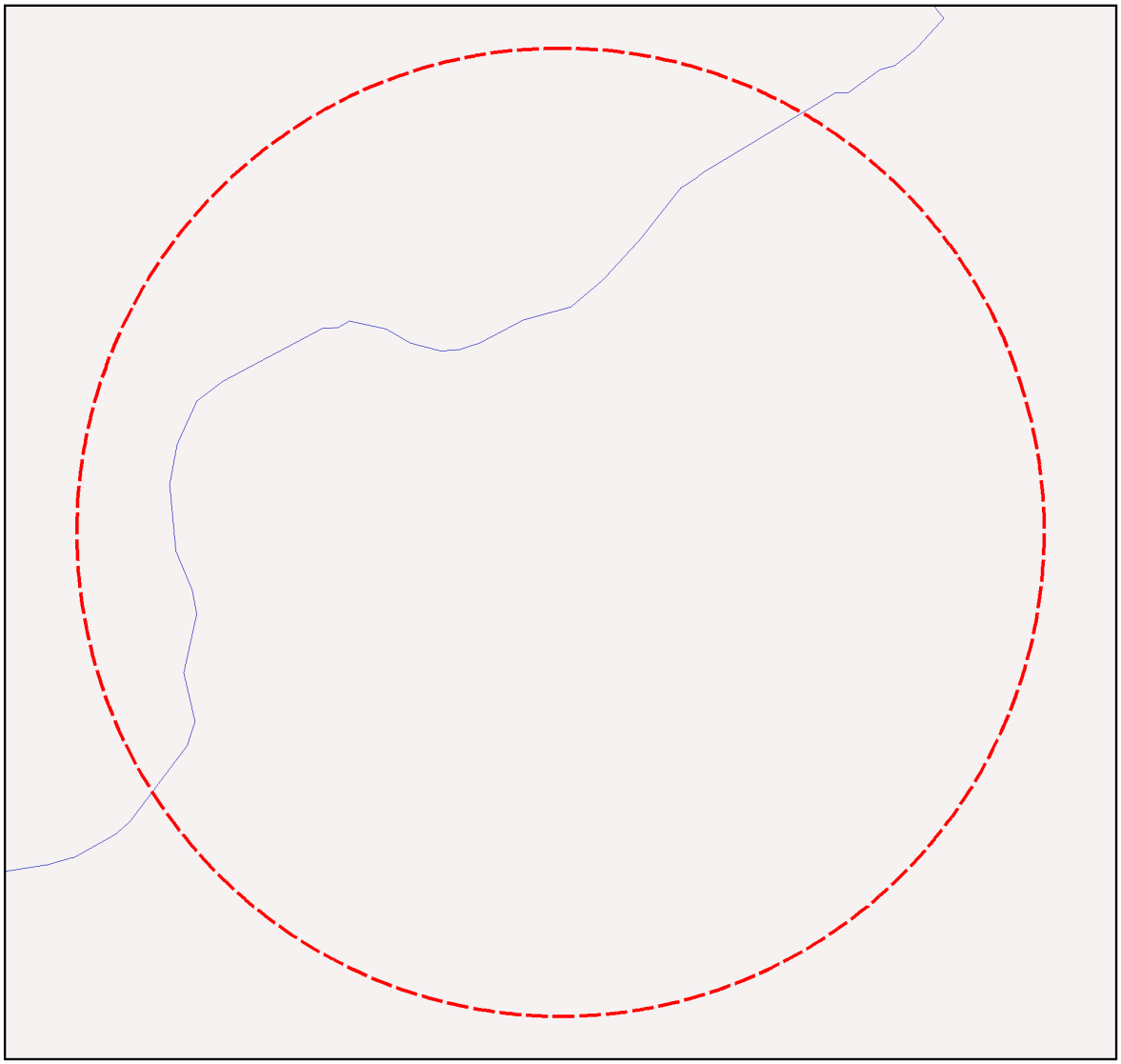
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas

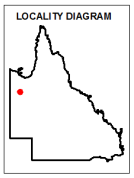


MSES - State Conservation Areas

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates, nature refuges, special wildlife reserves)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)

LOCALITY DIAGRAM



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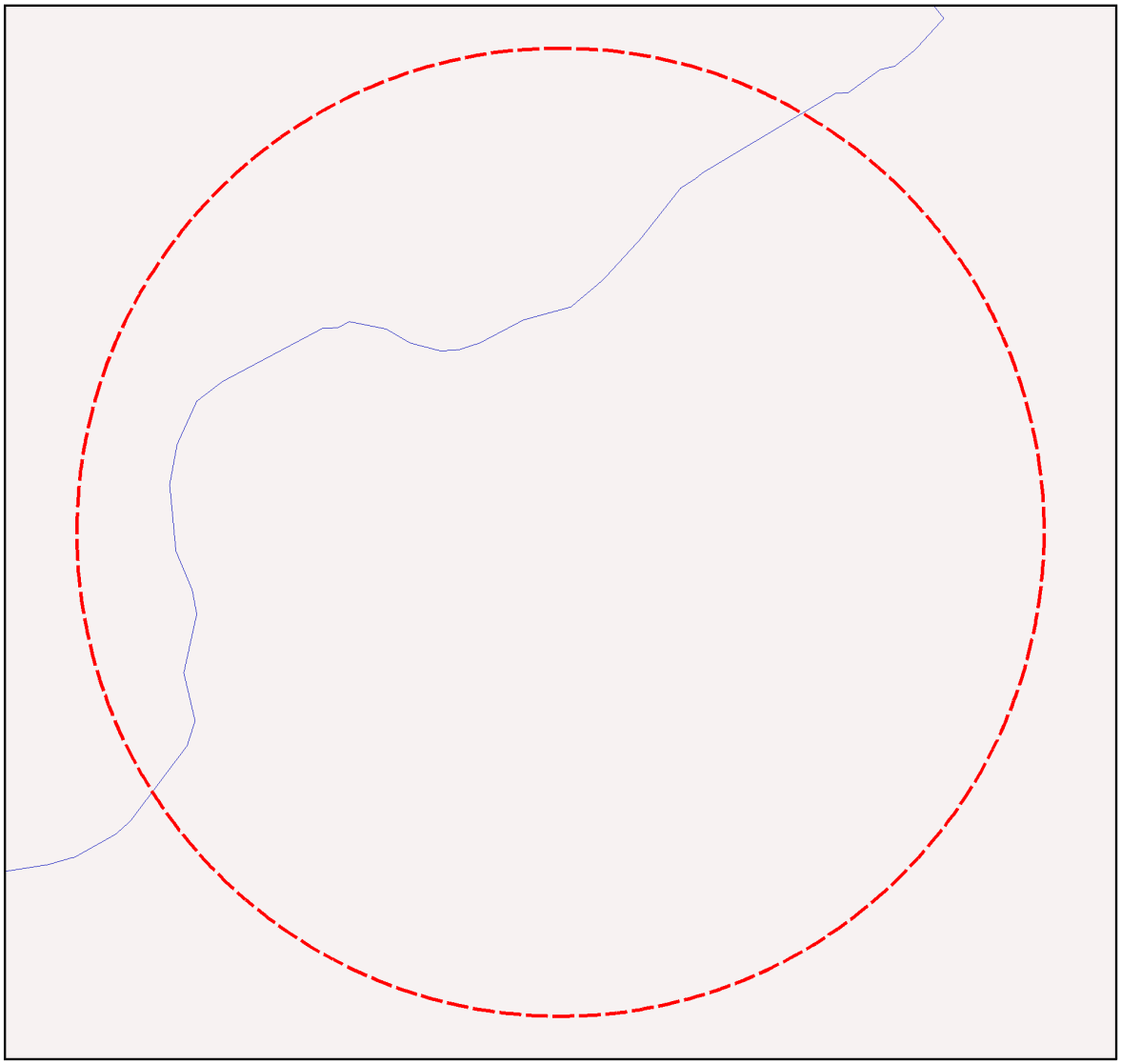
Map 2 - MSES - Wetlands and Waterways

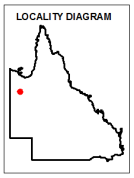


MSES - Wetlands and Waterways

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Declared high ecological value waters (watercourse)
- Strategic environmental area (designated precinct)
- Declared high ecological value waters (wetland)
- High ecological significance wetlands

LOCALITY DIAGRAM



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0 250 500 750 1000 1250 m

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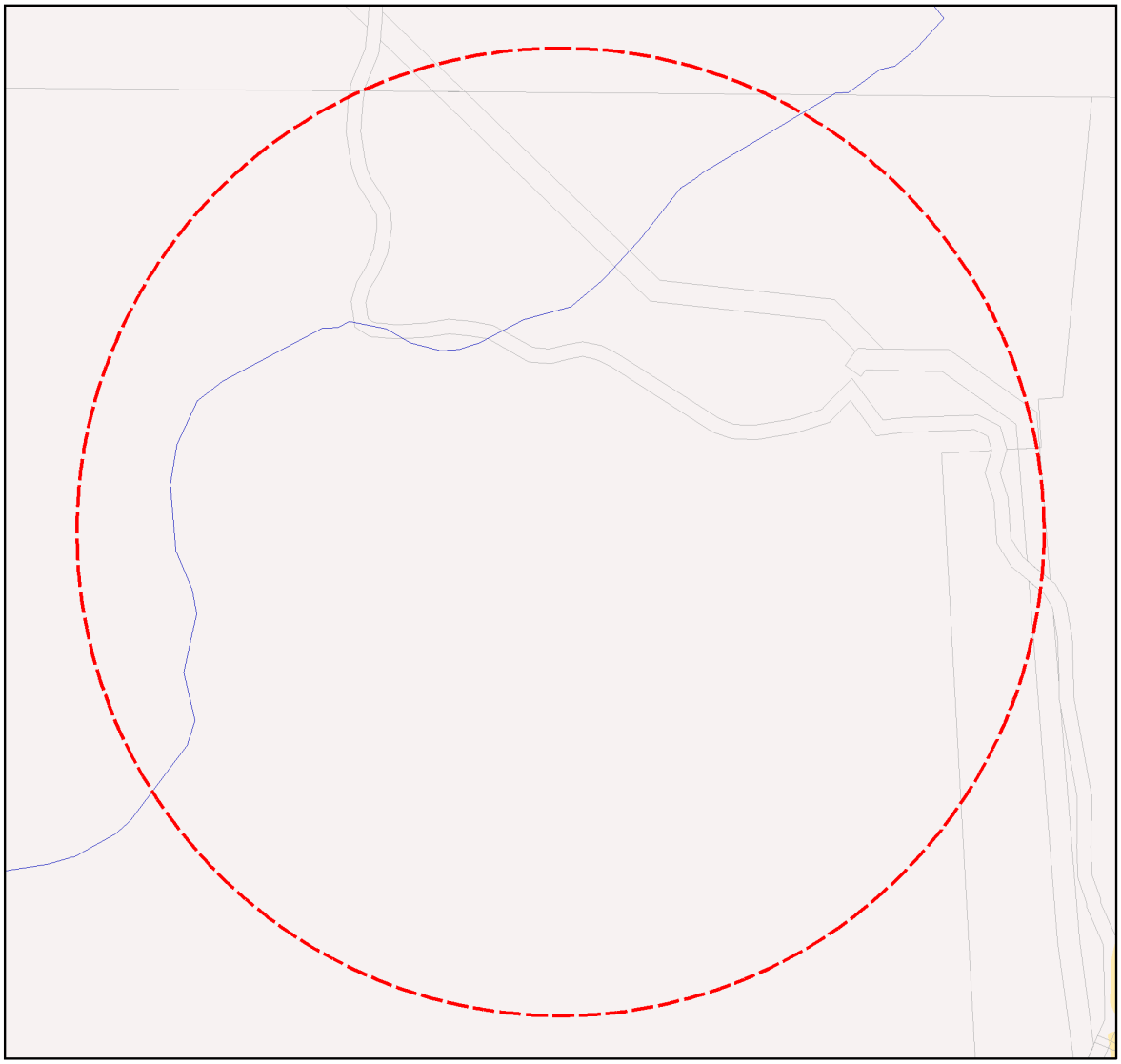
Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals

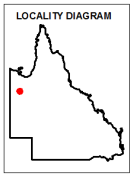


MSES - Species
Threatened (endangered or vulnerable) wildlife and special least concern animals

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)

LOCALITY DIAGRAM



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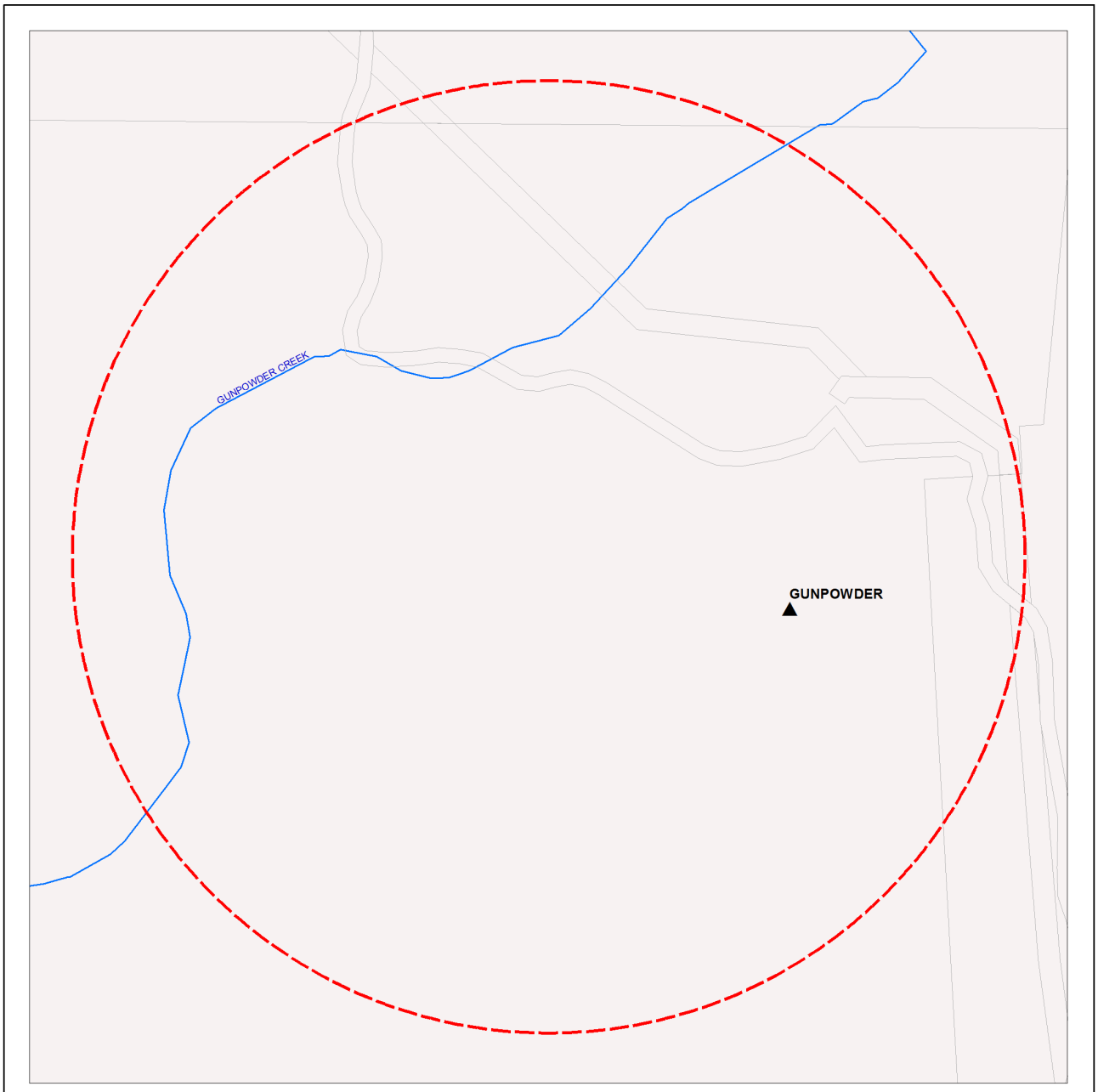
This product is projected into GDA 1994 Queensland Albers

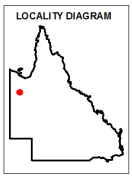
Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species
Koala habitat area (SEQ)

Area of Interest
- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)

LOCALITY DIAGRAM



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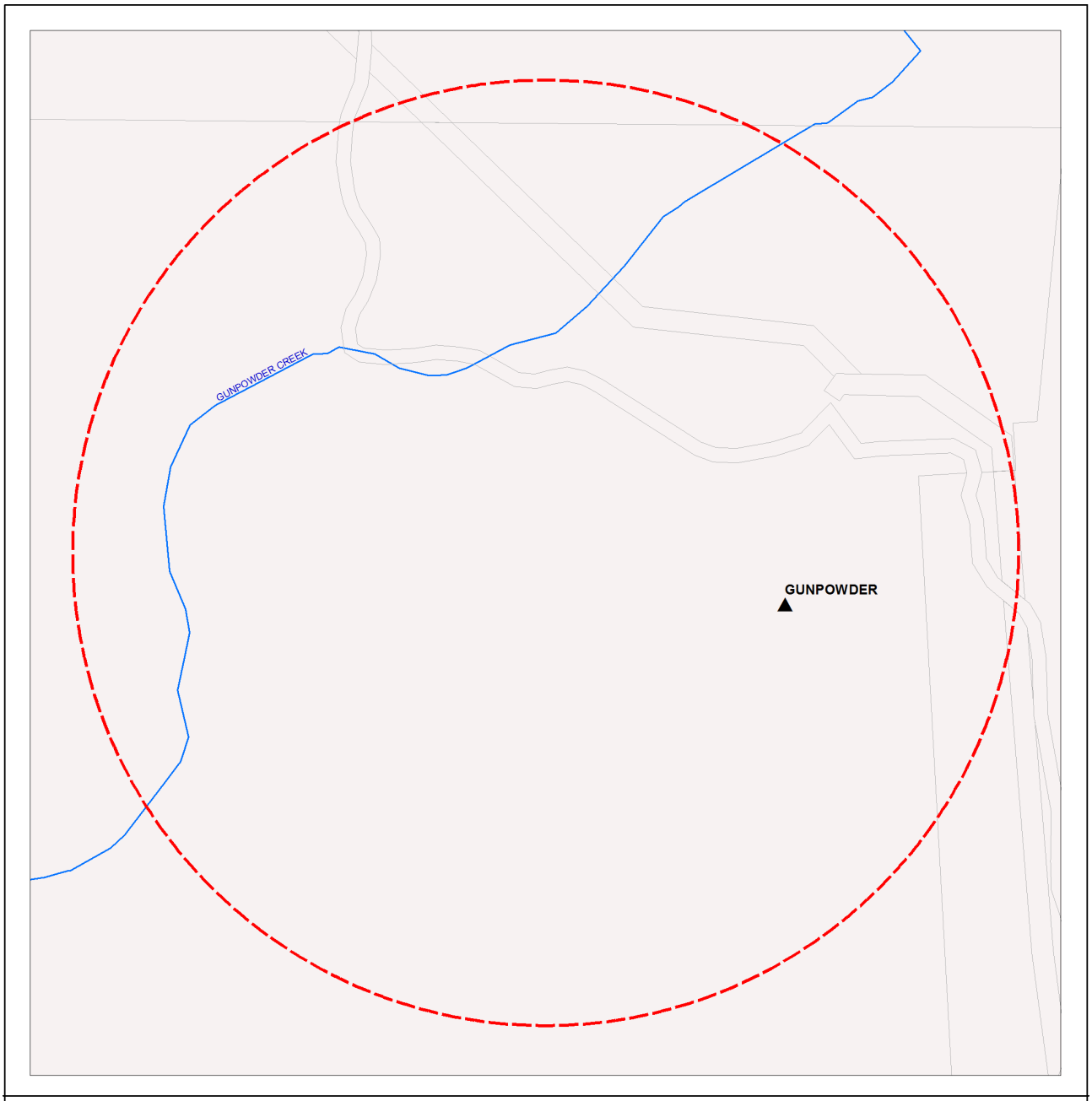
The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area- locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See https://environment.des.qld.gov.au/wildlife/animals/living-with/koalas/mapping

The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.

0 225 450 675 900 1,125 m

This product is projected into GDA 1994 Queensland Albers

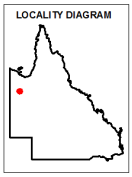
Map 3c - MSES - Wildlife habitat (sea turtle nesting areas)



MSES - Wildlife habitat (sea turtle nesting areas)

Area of Interest
- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (sea turtle nesting areas)

LOCALITY DIAGRAM



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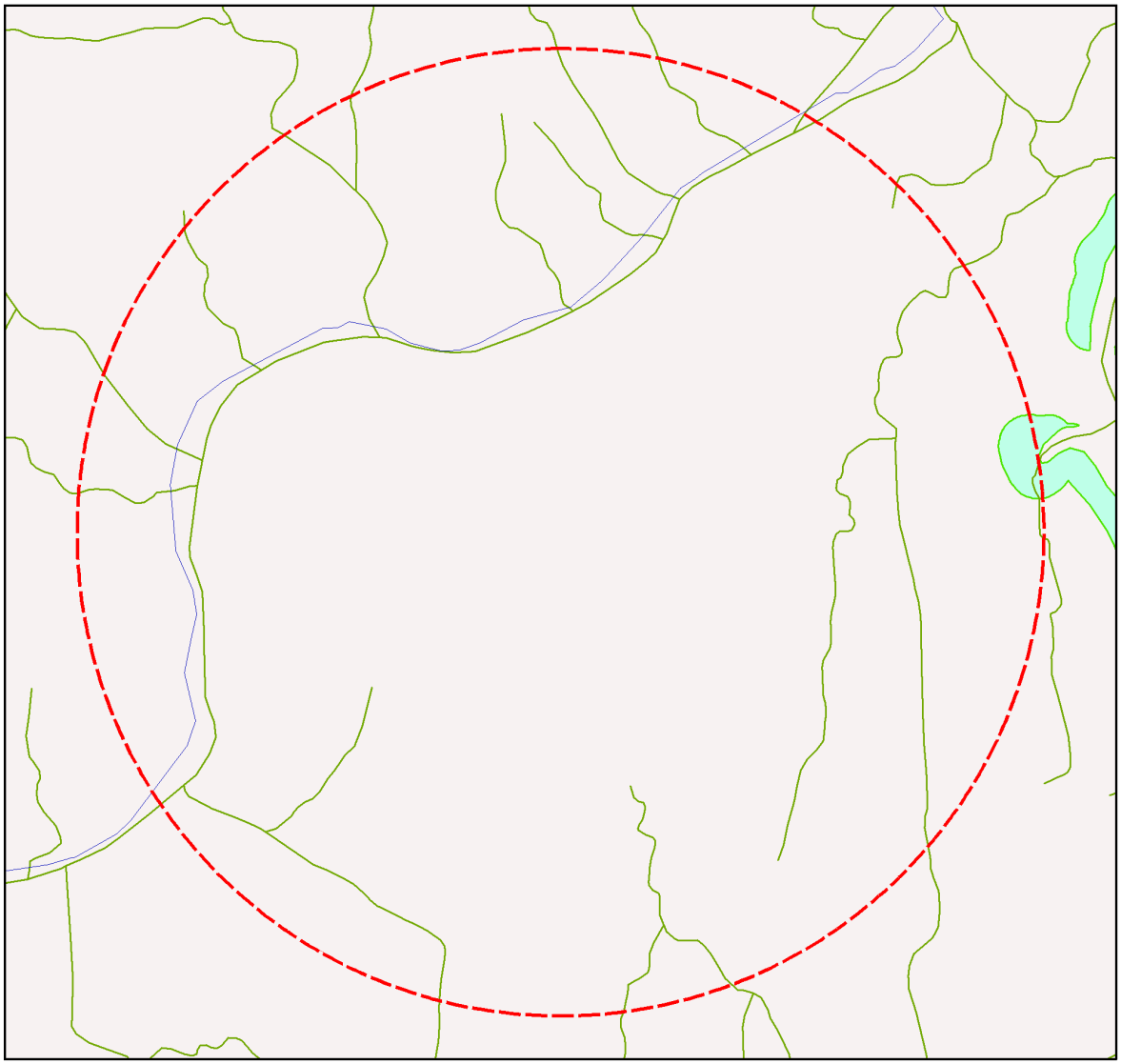
MSES mapping of sea turtle nesting areas identifies beaches where the recorded number of turtle nests are over 1% of the turtle species or genetic stock. The linework is also deliberately extended along nearby rocky coastlines and headlands to recognise that significant numbers of nesting adults and hatchlings can become disoriented by light pollution from development on rocky coastlines and headlands while navigating offshore from nesting beaches.

0 225 450 675 900 1,125 m

This product is projected into GDA 1994 Queensland Albers

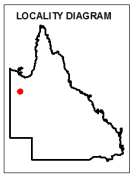
Map 4 - MSES - Regulated Vegetation

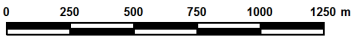


MSES - Regulated Vegetation

Area of Interest

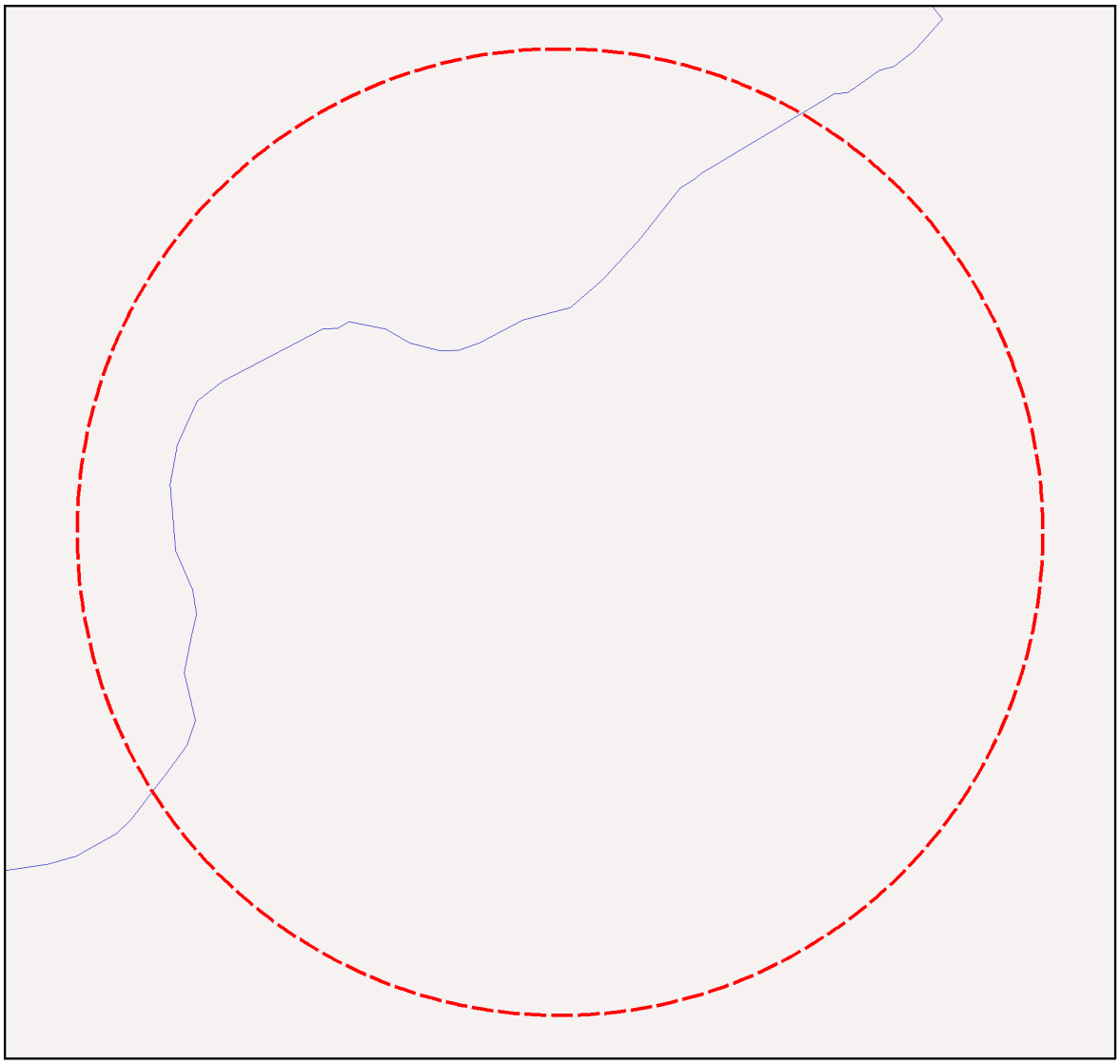
- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (category R - GBR riverine)
- Regulated vegetation (essential habitat)





This product is projected into GDA 1994 Queensland Albers

Map 5 - MSES - Offset Areas

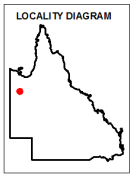


MSES - Offsets

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Legally secured offset area (offset register)
- Legally secured offset area (vegetation offsets)

LOCALITY DIAGRAM



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This product is projected into GDA 1994 Queensland Albers

Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.information.qld.gov.au)**
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	- WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019 - Sea Turtle Nesting Areas records
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- *Environmental Protection Act 1994*
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- *Vegetation Management Act 1999*

APPENDIX 6 RISK ASSESSMENT CRITERIA

1. CONSEQUENCE RATING

When assessing consequence, consider the most credible worst-case impact. Where a risk has multiple impacts, select the category with the highest rating.

CONSEQUENCE RATING

Rating / Category	Group Financial	Site Financial	Health, safety & well-being	Environment	Social/Cultural Heritage	Legal & Compliance	Reputation
5. Catastrophic	>$75M	>$35M	Multiple fatalities or terminal illnesses/ Multiple total permanent disabling injuries	Irreversible impact to ecosystem/ long term harm to highly valued species/ecosystem	Irreparable damage to tangible/intangible heritage of significance	Loss of licence to operate. Imprisonment of directors/officers	Sustained local, state or national condemnation by media, public, government/non government organisations
4. Major	$15M-$75M	$7M-$35M	Fatality/ Total permanent disabling injury / multiple LTI's > 2 weeks	Long term impact to species/ecosystem	Ongoing impact to tangible/ intangible heritage of significance	Material breach of regulation. Civil litigation/prosecution	Wide spread adverse local or state attention from media, public, government/ non government organisations
3. Moderate	$5M-$15M	$2M-$7M	Lost time injury or illness	Short term impact, not affecting ecosystem function	Recoverable impact to tangible/intangible heritage	Breach of regulation with fines and penalties	Adverse attention from media or heightened concern by local community
2. Minor	$750K-$5M	$500K-$2M	Medical treatment injury or illness	Immediately recoverable environmental impact	Immediately recoverable impact to tangible/intangible heritage	Breach of low level commitment that is reportable	Limited adverse local public or media attention and complaints
1. Insignificant	<$750k	<$500K	First aid treatment injury or illness	Inconsequential environmental impact	No tangible/intangible heritage impact	Procedural non reportable breach	Public concern restricted to localised complaints

2. LIKELIHOOD RATING

Determine the likelihood of the risk occurring and resulting in the credible worst-case impact

LIKELIHOOD RATING

Select the rating that best applies to the individual risk. Rows not intended to correlate.

A. Rare	B. Unlikely	C. Possible	D. Likely	E. Almost certain	
The event may occur in exceptional circumstances	The event could occur	The event should occur	The event will probably occur	The event is expected to occur	Description (High level business risk)
>25 years	Once every 10-25 years	Once every 5-10 years	Once every 2-5 years	More than once a year	Frequency (Operations)
<1%	1%-10%	10%-20%	20%-50%	>50%	Probability (Projects)

RISK MATRIX

A. Rare	B. Unlikely	C. Possible	D. Likely	E. Almost certain	
15- High	19- High	22- Extreme	24- Extreme	25- Extreme	5. Catastrophic
10-Medium	14-High	18- High	21- Extreme	23- Extreme	4. Major
6-Low	9- Medium	13- Medium	17- High	20- High	3. Moderate
3-Low	5-Low	8- Medium	12- Medium	16- High	2. Minor
1-Low	2-Low	4-Low	7- Medium	11- Medium	1. Insignificant