BP33 UNDERGROUND MINE

Care and Maintenance Water Management Plan

Lithium Developments (Grants NT) Pty Ltd

15 April 2025

1727-24-D2

DETAILS

Report Title	BP33 Underground Mine, Care and Maintenance Water Management Plan
Client	Lithium Developments (Grants NT) Pty Ltd

THIS REVISION

Report Number	1727-24-D2
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Author	KO
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EXECUTIVE SUMMARY

Overview

The BP33 Resource Project (BP33) forms a part of the greater Finniss Lithium Project (the Project), which currently encompasses both BP33 underground mine operation and the adjacent Grants operation (Figure 1.1). The Project is managed by Lithium Developments (Grants NT) Pty Ltd (LD).

This Care and Maintenance Water Management Plan (C&M WMP) has been developed to detail the activities to be undertaken at BP33 during Care and Maintenance (C&M). This plan applies to BP33 only, with a separate C&M WMP prepared for Grants.

Water Management Objectives

The overarching C&M management objectives are:

- Ensure mine affected water accumulation is appropriately managed to minimise the risk of uncontrolled discharge to the environment; and
- Manage and monitor ground and surface waters to ensure risk of environmental harm is minimised and social and environmental objectives are maintained.

The key surface water management principles include:

- Maintain separation of diverted water, sediment water and mine affected water runoff as best as reasonably practicable.
- Reduce the area of surface disturbance to minimise the volume of sediment or mine affected runoff.
- Collect and contain all potential mine affected water into dedicated mine water storages.
- Divert up-catchment water runoff from upstream catchments around the disturbance areas.
- Limit external catchment runoff draining into the box cut.
- Manage sediment from disturbed catchment areas (e.g. WRD, cleared/pre strip areas) by using erosion and sediment control (ESC) measures prior to release offsite.
- Release on site sediment water in a controlled manner in compliance with the ESCP.
- Reuse onsite water (e.g. mine affected water) where possible to support mine operational water demands (and therefore limit mine affected inventories under normal operating conditions).
- Prioritise the use of poor-quality water over before better quality water, where practicable.
- Manage mine affected water discharges to the receiving environment in accordance with the WDL.

Water Balance

A water balance assessment was undertaken for C&M for a nominal four year period. The key outcomes of the assessment indicates:

- Up to 190 ML is predicted to accumulate in the box cut for very wet climatic (1%ile) for the four year forecast period.
- For all modelled climatic conditions, there would be no spills from the Box Cut or any mine water storages.

Monitoring

The operational monitoring programs for water storages, surface water monitoring locations and groundwater bore locations are to be continued throughout the C&M phase. The collected environmental monitoring data and performance of the Environmental Management System will be analysed and reported to regulatory bodies at the frequency and in the manner required of existing operational approvals and in accordance with the surface water and groundwater monitoring programs.

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1 INTRODUCTION

1.1 BACKGROUND

The BP33 Resource Project (BP33) forms a part of the greater Finniss Lithium Project (the Project), which currently encompasses both BP33 underground mine operation and the adjacent Grants operation (Figure 1.1). The Project is managed by Lithium Developments (Grants NT) Pty Ltd (LD).

This Care and Maintenance Water Management Plan (C&M WMP) has been developed to detail the activities to be undertaken at BP33 during Care and Maintenance (C&M). This plan applies to BP33 only, with a separate C&M WMP prepared for Grants.

1.2 PURPOSE AND SCOPE

The purpose of this C&M WMP is to provide a standalone water management plan for periods of C&M that is used to:

- Maintain the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are protected during C&M;
- Maintain the hydrological regimes of groundwater and surface water during C&M so that environmental values are protected;
- Manage onsite storages to minimise the risk of uncontrolled discharges offsite; and
- Monitor ground and surface water quality and provide appropriate controls to mitigate potential environmental risk.

The scope of the BP33 C&M WMP covers:

- Water inventory management of site infrastructure across the C&M phase, including operational Trigger Action Response Plans (TARPs) for site inventory and water quality; and
- Surface and groundwater systems influenced by mining operations, including those upstream and downstream the mine area and downstream the OHD.

1.3 REPORT STRUCTURE

This report is structured as follows:

- Section 2: A description of the existing environment at BP33.
- Section 3: A description of the potential contaminant sources produced by site during C&M.
- Section 4: A detailed description on the C&M water management system.
- Section 5: A water balance assessment of the BP33 C&M water management system over a nominal four year C&M period.
- Section 6: A description of the C&M water monitoring plan.
- Section 7: A description of the acid rock and saline drainage characteristics.
- Section 8: A description of the contingency actions for environmental triggers during C&M.
- Section 9: A description of the C&M WMP review and roles and responsibilities during C&M.
- Section 10: A description of known gaps in information and knowledge.
- Section 11: A list of references.
- Appendix A: Operational Trigger Action Response Plans (TARPs) for site water management.

1.4 RELATED DOCUMENTS

This C&M WMP has been prepared to support key activities that may be undertaken at BP33 during a period of C&M. This Plan should be read in conjunction with:

- BP33 Care and Maintenance Management Plan (Core, 2024);
- BP33 Mining Management Plan (MMP) (Core, 2024a); and
- BP33 Operational Water Management Plan (WRM, 2024b).

1.5 SITE CONFIGURATION AND SCHEDULE

BP33 forms a part of the greater Finniss Lithium Project, which encompasses both BP33 and the adjacent mining operation, Grants. The locations of the two sub-projects are shown in Figure 1.3.

This C&M WMP covers a nominal four year period from date of approval.

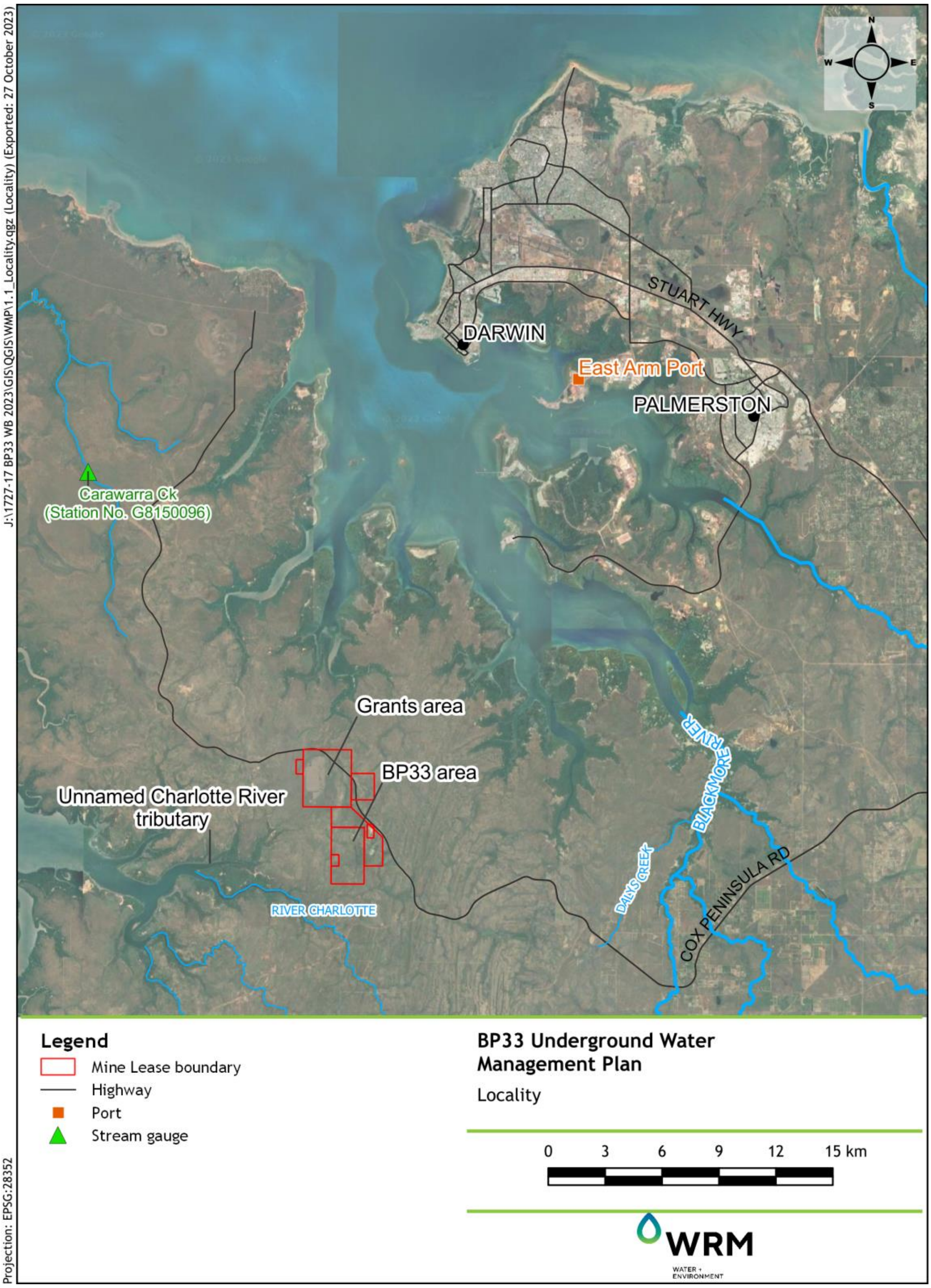

Figure 1.1 Locality plan

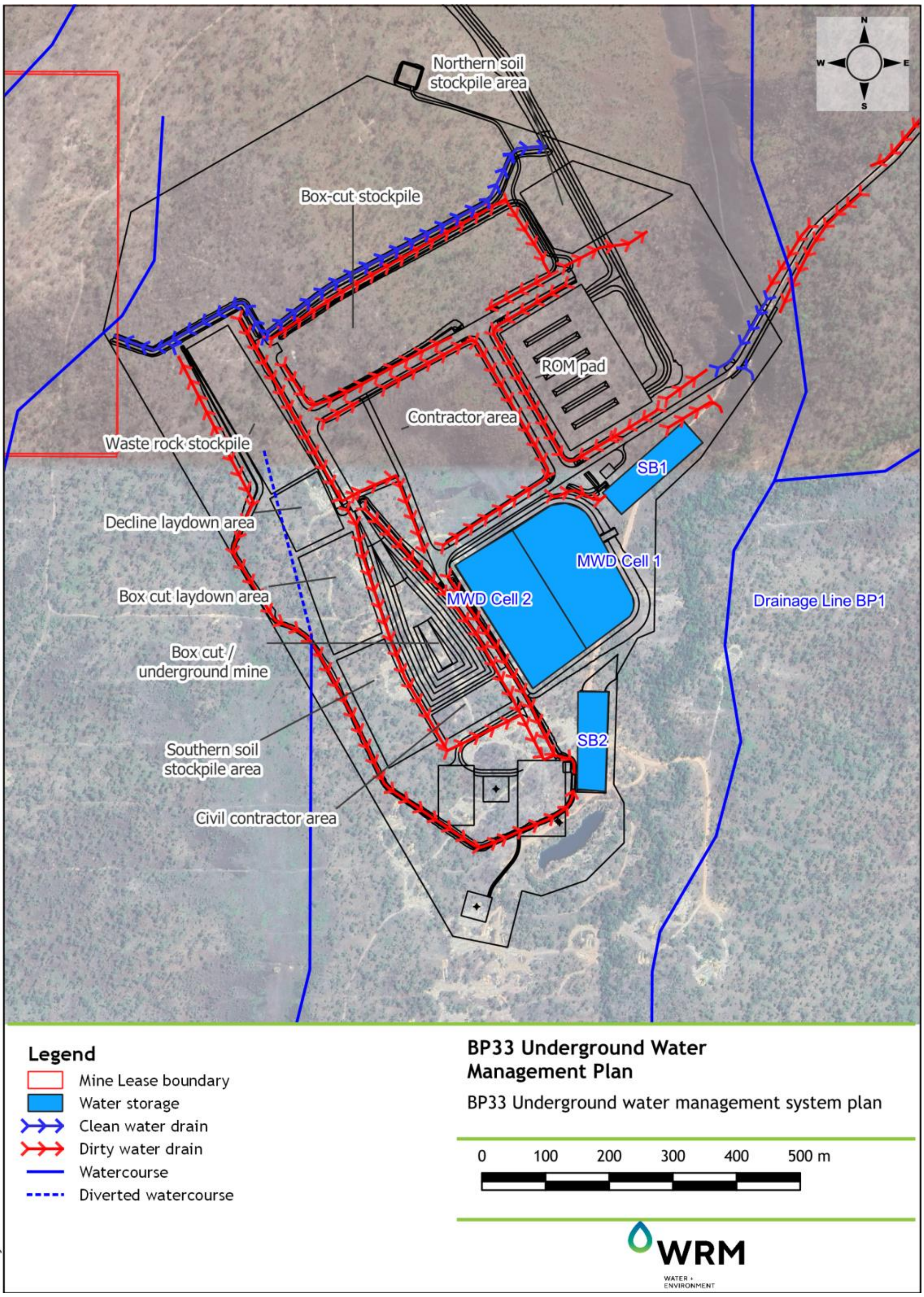

Figure 1.2 BP33 water management system plan

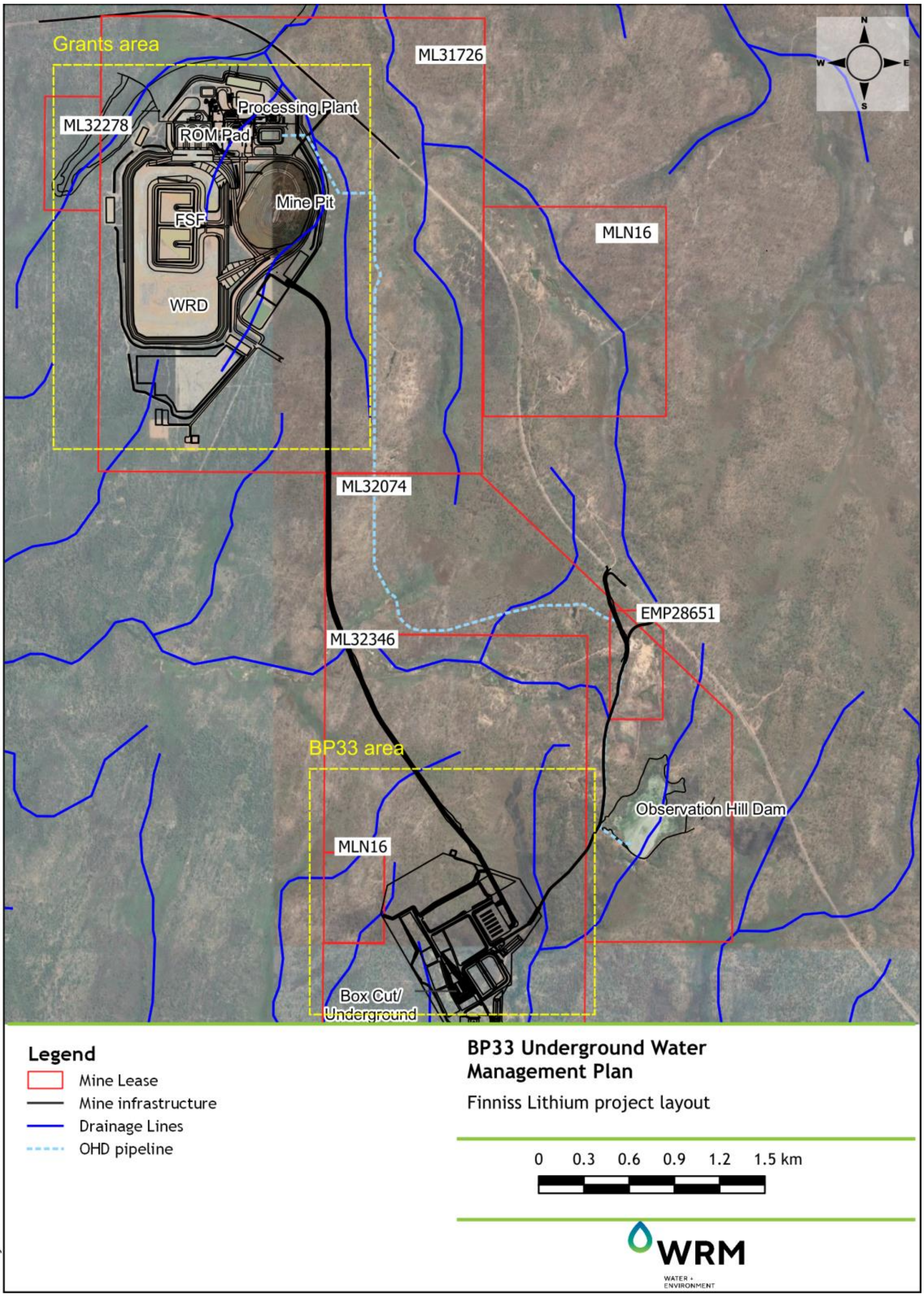

Figure 1.3 Finniss Lithium project layout

2 ENVIRONMENTAL SETTING

2.1 GENERAL

This section of the water management plan describes the regional drainage characteristics in the vicinity of BP33. Environmental values as defined by the ANZECC 2000 guidelines and NT government regulations of these waterways are also described. EcOz (2022) conducted an assessment and description of the relevant environmental values for BP33 which is summarised below.

2.2 ENVIRONMENTAL VALUES

2.2.1 Land use and surface water use

The project area, including both the mine footprint and Observation Hill Dam catchments, are largely undeveloped vacant crown land with only minor disturbances including the sealed Cox Peninsula Road, unsealed access tracks, mineral exploration activities as well as historic mining pits and dams (Frater, 2005).

There are no national parks, conservation areas or any residences, farms or industry within the catchment areas upstream or immediately downstream of the mine or Observation Hill Dam.

No beneficial uses for the water within OHD were identified.

2.2.2 Biodiversity values and Beneficial Uses

Waterways in the project area are largely intact and are considered under ANZECC (2000a) protection level classification as 'slightly disturbed'. They are not considered an example of rare, highly diverse, or significant habitat in the region. Ephemeral drainage lines either side of the mine footprint do not maintain flows into the dry season, and do not have a well-defined channel or riparian vegetation.

The project area also lies within the Bynoe Harbour Region declaration of surface water beneficial uses under the NT Water Act.

An assessment of the riparian vegetation along the waterway downstream of the Observation Hill Dam was undertaken by EcOz (2019). The assessment identified that the vegetation community was in good condition with no major weed populations or fire impacts. The presence of riparian vegetation indicated that the waterway receives a proportion of groundwater inputs to sustain the freshwater-dependant community during the dry season. Although the riparian vegetation communities are not rare, they are considered to be significant vegetation communities as they are spatially restricted and provide habitat to a large number of species.

Riparian vegetation will be monitored in accordance with the Riparian Vegetation Monitoring Plan – Finniss Lithium Project (EcOz, 2022b).

2.2.3 Groundwater environmental and social values

Groundwater environmental and social values been extensively assessed by CloudGMS (2021) and characterised by EcOz (2022). Key aspects are summarised below:

- There is limited use of this aquifer for domestic, stock, or agricultural water supply. The closest registered bore currently in use is located approximately 4.6 km south of BP33 on the Fog Bay Road and is used to provide a domestic water supply.
- The aquifer beneath the BP33 mine site and surrounding areas is a poor groundwater resource. There are medium potential groundwater dependent ecosystems (GDEs) along the waterway to the east of the site.

- Baseline groundwater quality monitoring indicates groundwater is contributing to flows in the drainage line downstream of Observation Hill Dam during the wet season. There is no evidence of spring-fed surface water flows during the dry season.
- Observation Hill Dam is likely a source of recharge to the groundwater aquifer. The well-developed riparian vegetation at this point indicates some level of sub-surface input from groundwater is supporting this vegetation community throughout the dry season.
- Possible GDEs located in proximity to the project will be managed in accordance with the Groundwater Dependant Ecosystem Management Plan – Finniss Lithium Project BP33 Underground Mine (Groundwater Enterprises, 2022).

2.3 REGIONAL DRAINAGE CHARACTERISTICS

BP33 is located within the Finniss River sub-basin of the greater Timor Sea Basin. The Finniss River sub-basin consists of several major streams that discharge into the Timor Sea, as shown in Figure 2.1.

Figure 2.2 also shows the surrounding catchments of the BP33 area. The BP33 area is not located within a named watercourse catchment and would drain into the Bynoe Harbour, via an unnamed tributary of the Charlotte River. Carrawara Creek is located approximately 17 km northwest of BP33 and Charlotte River is located approximately 3 km to the southwest of BP33.

The catchments surrounding BP33 are predominately undisturbed, with some rural residential areas and road infrastructure. Mangroves cover much of the coastal shoreline in the vicinity of BP33.

2.4 LOCAL DRAINAGE NETWORK

Figure 2.2 shows the local drainage features within the vicinity of BP33. Drainage features that cross the BP33 area eventually drain to the Timor Sea. The main tributary that drains through the BP33 area is Drainage Line BP1 (Figure 2.2).

2.4.1 Drainage Line BP1

Drainage Line BP1 has a catchment area of approximately 298 ha and 365 ha to the BPUS SW1 and BPDS SW2 monitoring locations respectively. Of this catchment area, approximately 94 ha is upstream of OHD. The catchment is mostly natural with some grassed areas that were cleared by preliminary exploration activities. The channel is poorly defined, particularly in the upper section of the reach. The channel banks are vegetated with grasses, shrubs and small trees.

The monitoring location at BPDS SW2 records the discharge and water level in Drainage Line BP1. Figure 2.3 and Figure 2.4 shows the recorded flow and water level at BPDS SW2 for the period November 2022 to May 2023. The results shows that the discharge and water level generally correlate with each other.

2.4.2 Unnamed tributary of the Charlotte River

Drainage Line BP1 discharges into an unnamed tributary of the Charlotte River, which has a catchment area of approximately 3,193 ha to the BPDS SW6 monitoring location. The unnamed tributary discharges into the tidally affected section of the Charlotte River.

2.4.3 Drainage Line BP2

Drainage Line BP2 has a catchment area of approximately 53.5 ha to the BPDS SW3 monitoring location and 217 ha to the confluence of the drainage line along BPDS SW3 and Drainage Line BP2. Drainage Line BP2 would discharge into the tidally affected section of the Charlotte River

2.4.4 Overland flow path

The overland flow path to the southwest of the site has a catchment area of approximately 52 ha to the BPDS SW8 monitoring location. The overland flow path would discharge into the Unnamed Tributary of the Charlotte, slightly downstream of the BPDS SW6 monitoring location.

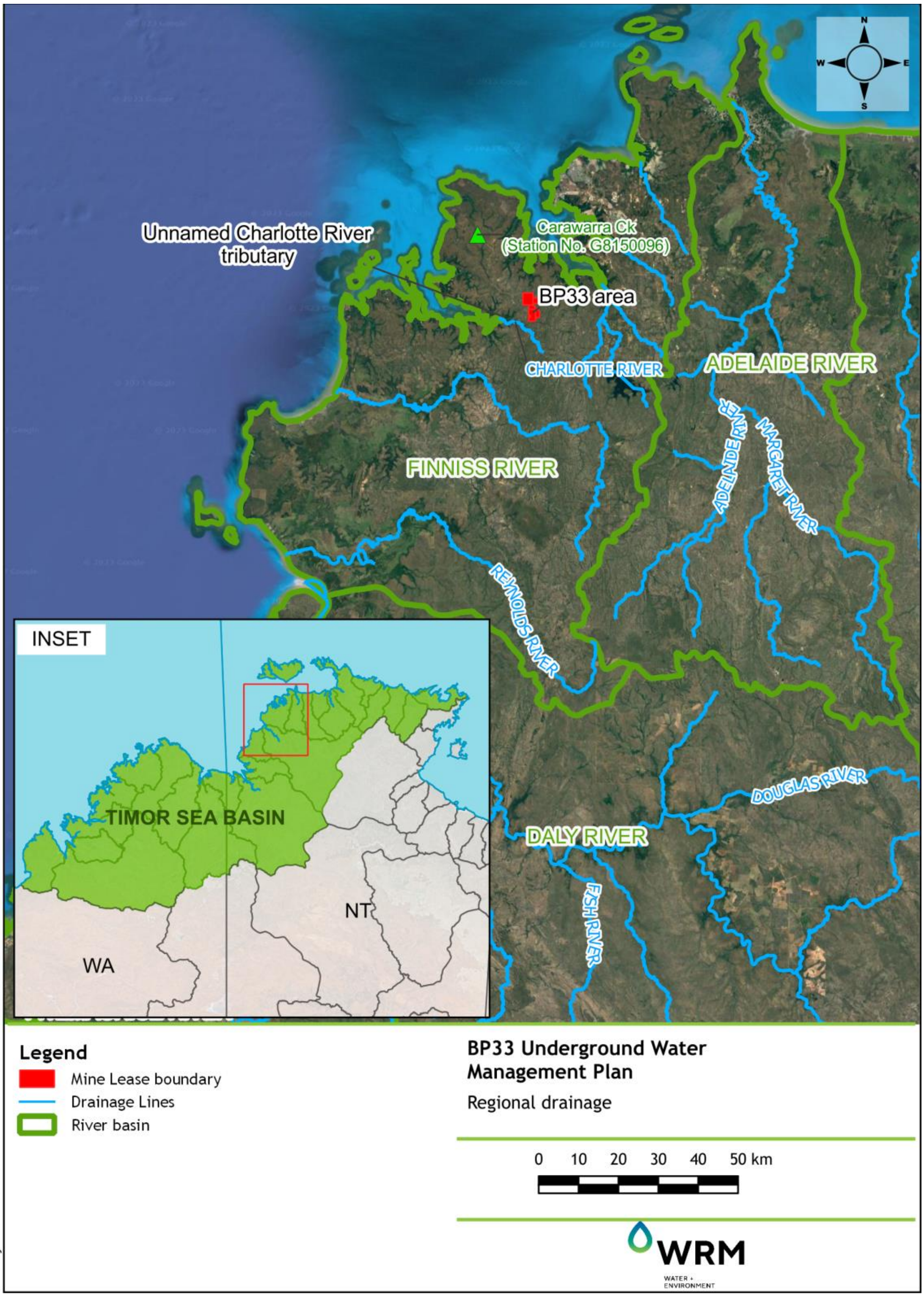

Figure 2.1 Regional drainage

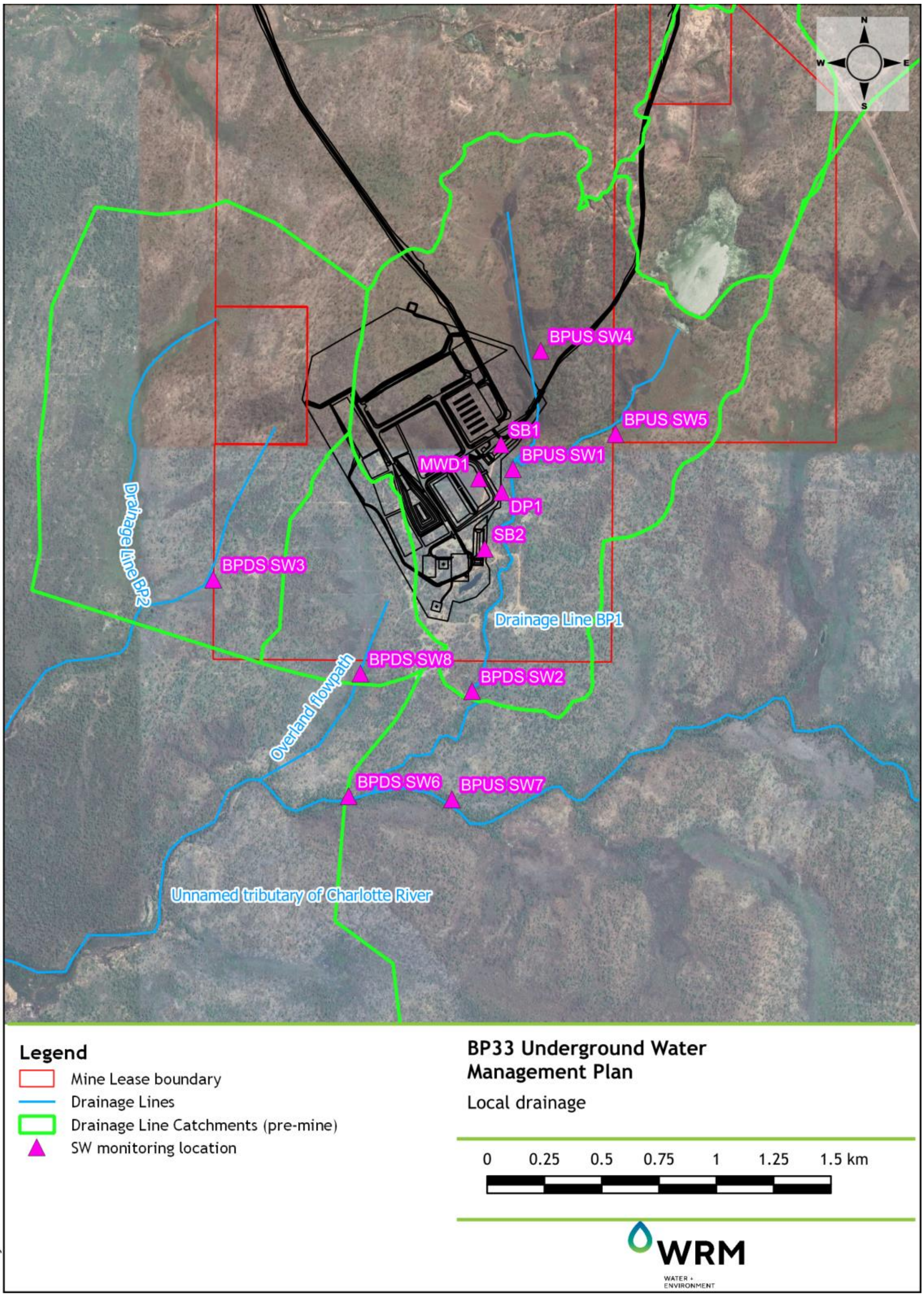

Figure 2.2 Local drainage

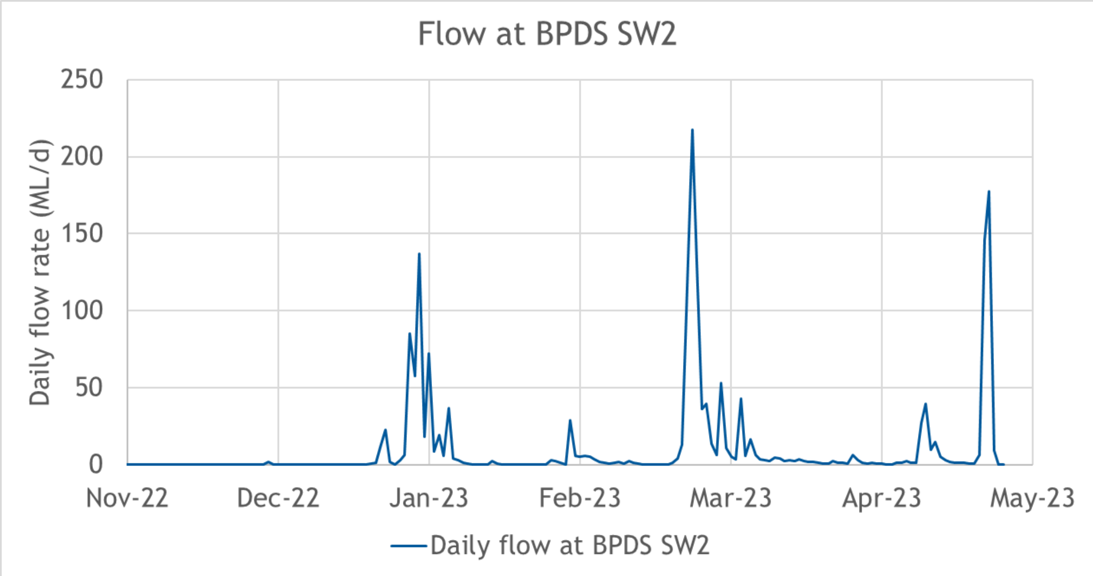

Figure 2.3 BPDS SW2 recorded flow

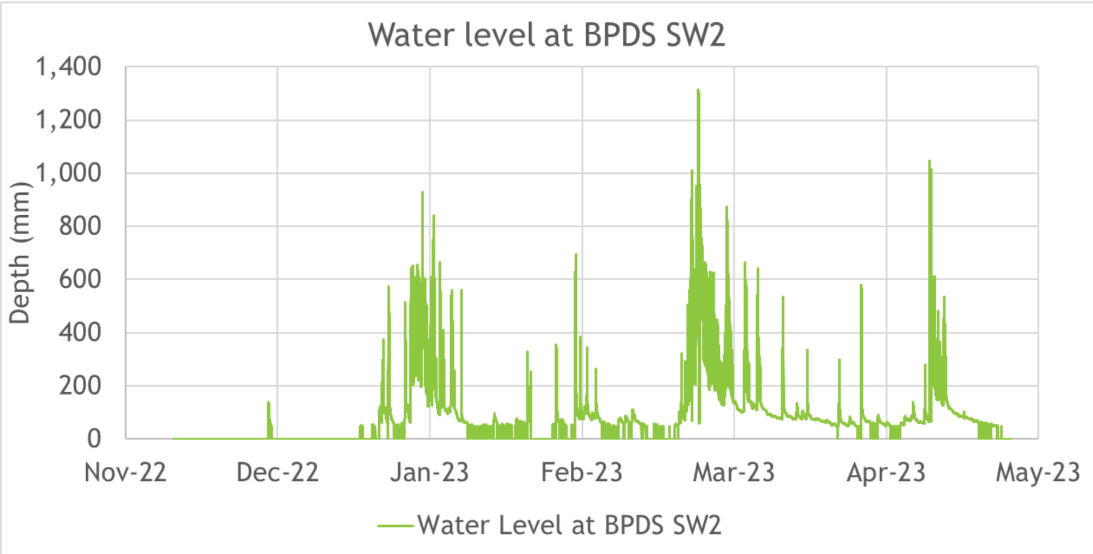

Figure 2.4 BPDS SW2 recorded water level

2.5 CLIMATE

Rainfall and evaporation data was obtained for the Mine site from the Department of Environment and Science (DES) SILO Data Drill Service. The SILO Data Drill data provides a continuous daily data set between 1889 and 2023. Derived daily pan evaporation, lake evaporation and actual evapotranspiration rates were also available for BP33 from the SILO Data Drill Service.

2.5.1 Rainfall

The average monthly rainfalls at BP33 exhibit distinct wet (November to March) and dry (April to October) seasons during the year, with a dry season low of 1.2 mm in July to a wet season high of 389.5 mm in January. The wet season average monthly rainfalls (133 mm to 390 mm) are significantly higher than the equivalent dry season monthly rainfalls (1.2 mm to 57.2 mm). The recorded mean annual rainfall at the Project over the period 1889 to 2023 is approximately 1,528 mm.

Table 2.1 shows the mean monthly and annual SILO Data Drill rainfall, evaporation and Morton's lake evaporation at BP33 based on the available 135 years of data. Figure 2.5 shows the statistical variation of monthly rainfall at BP33.

2.5.2 Evaporation

Table 2.1 shows the mean monthly and annual SILO Data Drill pan evaporation values at BP33 based on the available 135 years of data. Figure 2.6 shows the variation of mean monthly evaporation and evapotranspiration at BP33. The average annual pan evaporation at the Project is estimated to be approximately 2,296 mm, which is approximately 1.5 times the average annual rainfall.

Soil moisture evapotranspiration losses in the AWBM model were estimated using Morton's Wet evapotranspiration, which is on average 98% of Morton's Lake evaporation in the vicinity of the project. Figure 2.6 shows the mean monthly evaporation and evapotranspiration at BP33.

Table 2.1 SILO Data Drill mean monthly rainfall, pan evaporation and lake evaporation at BP33

Month	Mean Monthly Rainfall (mm)	Mean Monthly Pan Evaporation (mm)	Mean Morton's Lake Evaporation (mm)
January	389.5	173.4	165.5
February	319.3	148.5	151.2
March	272.3	163.9	179.2
April	84.1	176.8	179.6
May	9.7	186.1	164.1
June	2.4	178.3	142.6
July	1.2	193.2	153.1
August	1.3	211.3	177.7
September	14.0	223.6	198.2
October	57.2	238.1	218.3
November	133.1	210.4	203.4
December	243.4	192.2	186.3
Annual	**1527.6**	**2295.6**	**2119.2**

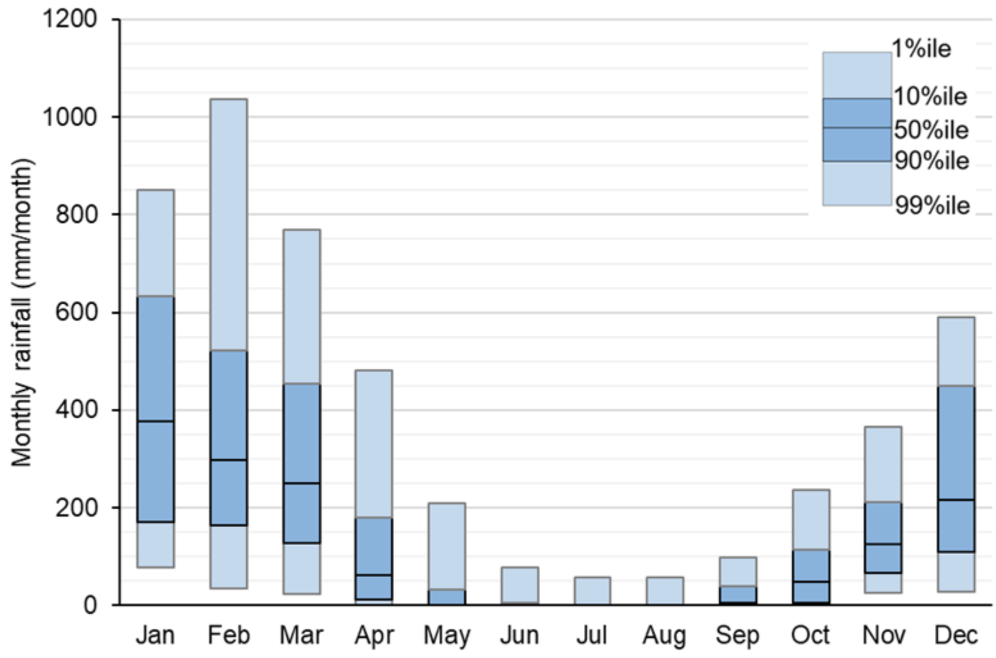

Figure 2.5 Monthly rainfall at BP33 from 135 years of SILO Data Drill rainfall data

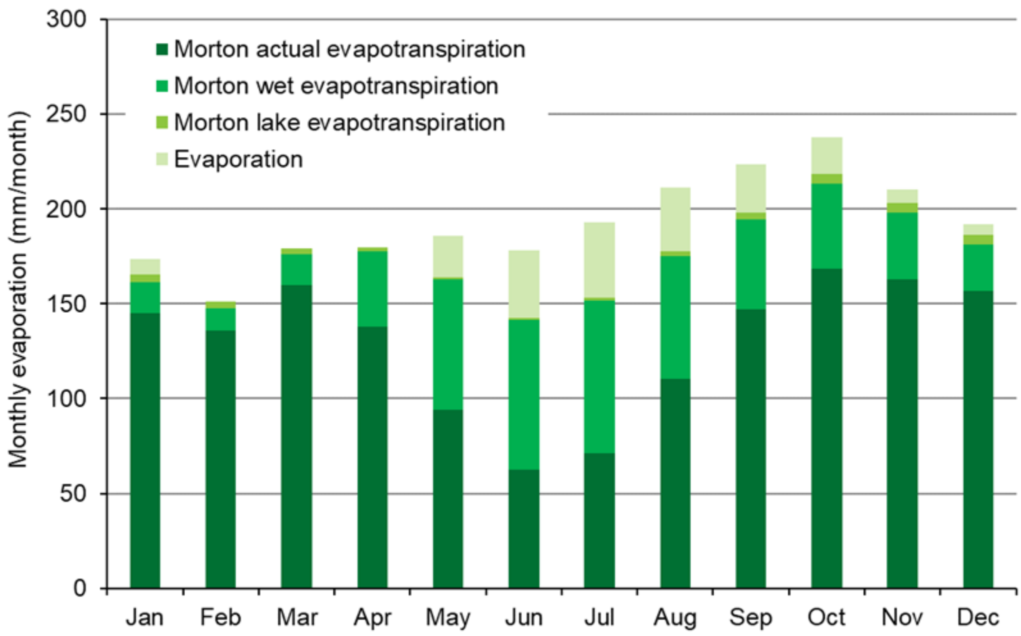

Figure 2.6 Mean monthly evaporation and evapotranspiration at BP33 from 135 years of SILO Data Drill rainfall data

2.6 GEOLOGY AND SOILS

Land units present within the ML boundary were based on mapped land units available on NR Maps (DPEWS, 2022) and described in the Land Resources of the Elizabeth, Darwin and Blackmore Rivers – Greater Darwin Area.

2.6.1 Soil management units

Landform class, land units and associated landform and soil descriptions for the project area, are shown in Table 2.2. The distribution of the land units in the vicinity of the BP33 area is shown in Figure 2.7. Much of the disturbance area comprises rudosol soils associated with land unit 2a1, with small areas of hydrosols associated with land units 6b/5b1 (drainage systems), and 5a (alluvial plains).

Land unit mapping shows the project area has a Nil (Class 1) risk of Acid Sulfate Soils which correlates with the Land Systems of the Northern Part of the Northern Territory which shows there is no potential acid sulfate soils within the project area.

Table 2.2 Land units and soils within the mineral lease boundary (EcOz, 2019)

Landform Class	Land Unit	Landform	Soil Description
Rises	2a1	Low rises and associated upper slopes. Gradient 0.5-4 %. Extensive surface gravels.	Rudosols. Gravelly lithosols, usually shallow with some moderately deep occurrences. Loamy sand or sandy loam surface to sandy clay loam subsoil. 20-40 % gravels in surface, 30-60 % gravels in subsoil. Well drained.
Plains	6b/5b1	Broad drainage floors and creek margins. Gradient < 1.5 %.	Hydrosols Shallow to moderately deep siliceous and earthy sands, minor sandy massive earths. Coarse textured sands to sandy loams. 0-10 % gravel in surface, 5-40 % gravel in subsoil. Well drained.
Alluvial plains	5a	Narrow alluvial plains within upland terrain. Gradient < 1.0 %.	Hydrosols. Hardsetting apedal mottled yellow duplex soils. Fine sandy loam or loam overlaying light clay to medium clay subsoil Minor subsoil ferruginous gravels. Imperfectly drained.

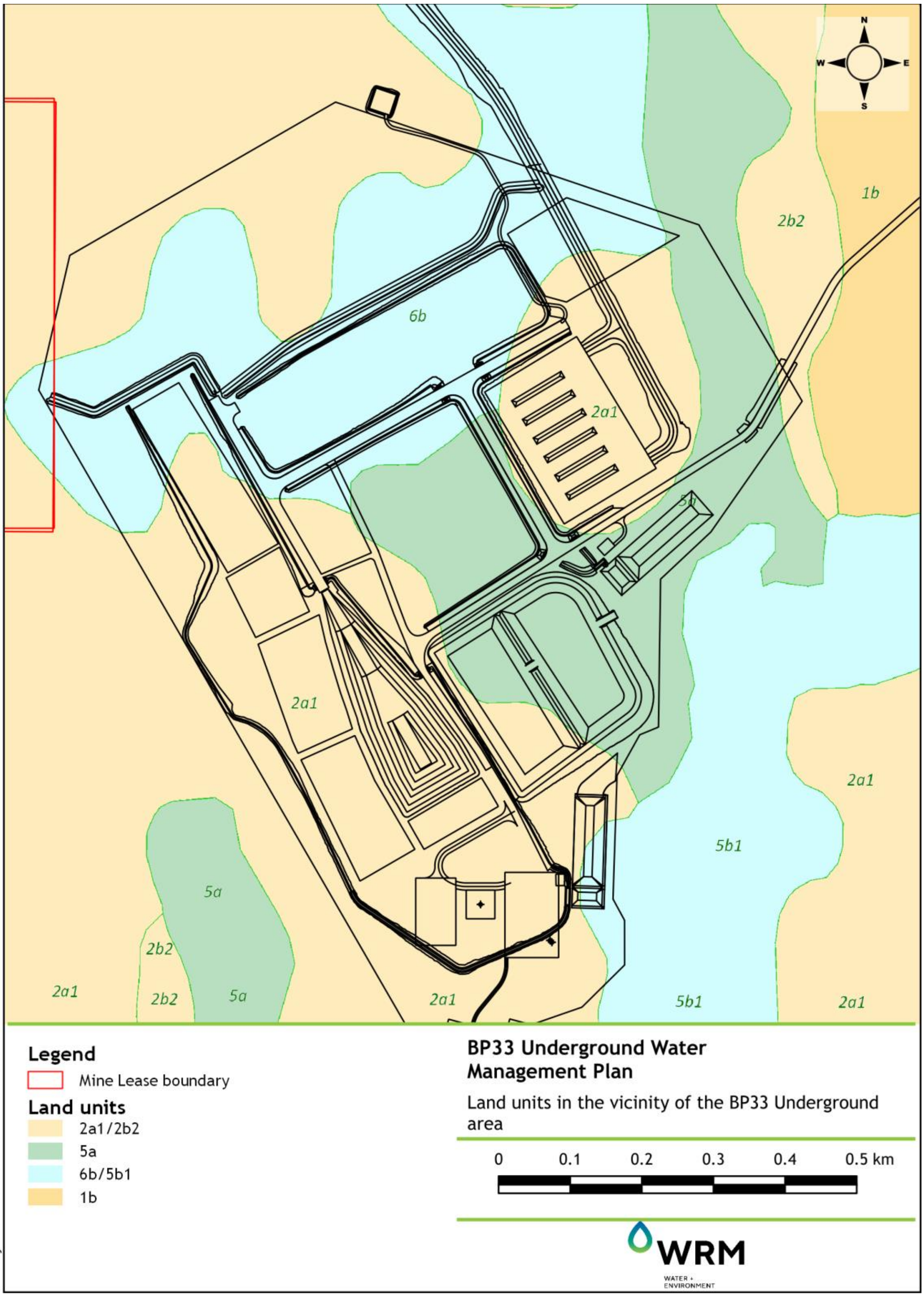

Figure 2.7 Distribution of identified land units

2.6.2 Sodic and dispersive soils

2.6.2.1 Sodicity

Exchangeable sodium percentage (ESP) is a measure of the proportion of sodium ions relative to other cations – referred to as sodicity. Sodicity degrades soil properties by weakening the bonds between soil particles.

Environmental Geochemistry International (EGI) (2020) identified that soils at BP33 have little to no evidence of exchangeable sodium in the soils. The exchangeable sodium was less than 0.1 meq/100g limit of analytical detection. In addition, it was found that calcium and magnesium were the dominant exchange cations in the soil.

2.6.2.2 Emerson Class

The Emerson Class is determined from the Emerson Aggregate Test, an eight-class classification describing the behaviour of air-dried aggregates when placed in distilled water. Specifically, it describes whether the soil aggregates slake or disperse. Soil sampling on the site determined the following:

- Four soil samples exhibited an Emerson Class of 7, indicating that soils were generally non-dispersive, infertile, gravelly sandy loam.
- The low organic matter level and sandy texture of the soil indicates that the spoil has poor structure and limited water-holding capacity and could be suspectable to erosion under wet conditions.

To control erosion from sodic dispersive soils, soils will be selectively handled and managed accordingly.

2.6.3 Soil suitability for irrigation

An irrigation management plan was developed for BP33 in October 2023 (EcOz, 2023) to illustrate the suitability for irrigation at BP33. The outcomes of the assessment indicated that all site tested within the land unit 2a1 are suitable for irrigation at a rate up to 5 mm or 5L/m^2/day throughout the lifespan of the operation.

2.7 GROUNDWATER CHARACTERISTICS

Information below is adapted CloudGMS (2021) along with information gained from the sampling the groundwater monitoring bores located across the mine site.

2.7.1 Aquifer geology

The substrate and underlying geology of the area around the proposed mine footprint comprises a thin surface layer (less than 5 m thick) of laterite gravel, sand and clay, underlain by the Burrell Creek Formation (BCF) comprising shales, siltstones, and strongly foliated phyllite. The weathering profile extends to depths of 30 to 50 m before reaching fresh, un-weathered BCF.

Key aspects of the BCF aquifer are provided below:

- The weathered and fractured BCF aquifer is a poor groundwater resource with a lack of primary porosity and open fracturing, and bore yields typically less than 0.5 L/s.
- Localised higher yields can occur where drilling intersects fracture zones or quartz veining; also at the base of the weathered zone.
- The weathered zone is more permeable than the un-weathered fresh BCF, with the highest permeability's most likely in the overlying Cenozoic sediments and upper-most weathered (laterised) BCF.

- Minor aquifers may occur in the surface Cenozoic sediments in areas with thicker alluvial cover, such as along drainage lines.

2.7.2 Hydraulic conductivity

Slug tests and recovery tests undertaken by GHD (2017b) identified hydraulic conductivity of the following:

- Thin surface laterite aquifer has a moderately high K ranging between 0.068 and 1.7 m/day.
- Weathered zone has a moderate K ranging between 0.022 and 0.16 m/day.
- Fresh BCF has the lowest K ranging between 0.003 and 0.024 m/day.

Slug and recovery tests of the six groundwater monitoring bores installed in September 2020 confirmed that the permeability of the BCF is dependent on secondary porosity i.e., fracture and joint development (Groundwater Enterprises, 2020).

Bores that intersected fractured Burrell Creek Formation (fresh) showed a hydraulic conductivity an order of magnitude higher with a range from 0.15 – 0.28 m/day. No testing was undertaken on the alluvial sediments, which were unsaturated at the time of drilling.

2.7.3 Groundwater levels

Standing water levels (SWLs), measured in metres below ground level (mBGL), have been recorded continuously by loggers. SWL's are also measured manually during water quality sampling rounds. SWL monitoring identified:

- Groundwater levels in the shallow laterite bores are highly responsive to rainfall with water quality reflecting a close connection between surface and groundwater.
- SWLs within the monitoring bores at the end of the dry season range between 4.5 mBGL and 9.8 mBGL for the deeper bores and 4.4 mBGL and 6.6 mBGL for the shallow bores.
- The seasonal change in SWL in the deep BCF bores ranger from 3.7 m to 9.6 m, where the seasonal range is greatest in BPG1 and BPG6.
- The seasonal change in the shallow bores ranges from 3.1 m to 5.5 m.

2.7.4 Groundwater flows and recharge

CloudGMS (2018) identified the following in respect to regional and local groundwater flows:

- Regional groundwater flows were found to be in a north to north-east direction towards Darwin harbour.
- Local groundwater flows are expected to flow from areas of high topography to low topography.
- Diffuse recharge from rainfall is expected to be the dominant recharge mechanism.

3 CONTAMINANT SOURCE STUDY

3.1 OVERVIEW

This section of the C&M WMP describes the activities at BP33 that could potentially generate contaminants that may impact Environmental Values of the receiving waters if not managed. Sources of the potential contaminants have been identified and evaluated based on water quality data that has been collected on site since June 2017.

3.2 SITE FEATURES AND CARE AND MAINTENANCE ACTIVITIES

The site configuration is shown in Figure 1.2 and include:

- The box cut;
- Access and haul roads;
- Mine infrastructure areas including office buildings and workshops;
- Mine and surface water management structures.

During periods of C&M, further development of the box cut and surface water infrastructure would cease with the following key water management activities undertaken:

- Earthworks to ensure disturbance area remain safe, stable and non-polluting;
- Water management including transfer of water between storages and treatment/management of sediment basins;
- Environmental monitoring of ground and surface waters;
- Maintenance of sediment basins, drains and other ESC measures.

3.3 WATER TYPES

BP33 monitors water quality in dams that capture surface runoff. The water quality results are all stored in the sites' water quality database. A summary of water quality in dams with catchments of different water types is provided below.

For water management system purposes, the water generated at BP33 is divided into four types:

- **Raw water:** water sourced external to the mine operations.
- **Diverted water:** surface runoff from areas where water quality is unaffected by mining operations. Diverted water includes runoff from undisturbed areas and any fully rehabilitated areas (i.e. rehabilitated areas with established vegetation and stable landforms). It also includes runoff from the surrounding natural catchment that is diverted around the mine site with no direct impact on the water quality from the mining operations.
- **Sediment water:**
  - Means the following types of water:
    - Water dewatered from the box cut during Stage 1 where chemistry indicates minimal groundwater input and meets surface water trigger values;
    - Rainfall runoff from catchments which can discharge through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an ESCP to manage such runoff, provided that this water has not been mixed with mine affected water.
- **Mine affected water (or mine water):**

- means the following types of water:
  - Water dewatered from the box cut where chemistry suggests significant groundwater input and does not meet surface water trigger values; and
  - A mix of mine affected water and other water.
- Mine affected water does not include surface water runoff which, to the extent that it has been in contact with areas disturbed by mining activities that have not yet been completely rehabilitated, and has only been in contact with:
  - Land that has been rehabilitated to a stable landform and either capped or revegetated but only still awaiting maintenance and monitoring of the rehabilitation over a specified period of time to demonstrate rehabilitation success; or
  - Land that has partially been rehabilitated and monitoring demonstrates the relevant part of the landform with which the water has been in contact does not cause environmental harm to waters or groundwater; or
  - Both.

3.4 WATER TYPE CHARACTERISTICS

3.4.1 Raw water

Raw water is captured and stored in OHD and made available for use at BP33. Raw water is not proposed to be transferred to Grants during C&M.

3.4.2 Diverted water

Diverted runoff areas include the diverted catchments from the site. It is likely that the runoff from the natural catchments would produce runoff with similar characteristics to the baseline water quality conditions (pre-operational monitoring sites).

3.4.3 Sediment water

Sediment water includes runoff from the waste dumps, general mine services areas and the box cut. During the C&M phase, direct rainfall and catchment runoff into the temporary Box Cut will be allowed to accumulate.

Details of the preliminary geochemical testing of waste rock at BP33 is provided in Section 7.2. The study showed:

- Seepage and runoff from the WRD and groundwater that comes into contact with the waste (which is backfilled) would have neutral pH, low salinity and major cation concentrations similar to baseline concentrations in local surface and ground waters.
- Concentrations of a number of metals including cadmium, chromium, iron, manganese and nickel would be very low and be similar to baseline concentrations in local surface and ground waters.
- Acid drainage from the wastes in the WRD is unlikely.
- There is potential for elevated metals levels which includes arsenic, copper, lead, zinc and possibly aluminium.

A total of nine samples (four samples at SB1 and five samples at SB2) were taken from the sediment basins at BP33. The results show:

- The total phosphorus and total nitrogen recorded in each of the sediment dams is elevated in comparison to the baseline water quality conditions.
- There are elevated recordings in aluminium for the 80th percentiles in SB1 and SB2.

- The dissolved metals concentrations for the remaining contaminants are below the Waste Discharge Licence (WDL) trigger values.

The water quality in SB1 and SB2 will continue to be monitored in accordance with the surface water quality monitoring program detailed in Section 6.3.

A Waste Rock Dump Management Plan (Core, 2023) has been developed to provide a general description of the management strategies to be implemented to control acid and metalliferous rock drainage as well as alkaline and saline drainage from the overburden dumps.

The WMP monitoring programs will determine the quality of runoff from the WRDs and provide indications of potential mine drainage impacts. Additional monitoring requirements and TARPs are provided in the waste rock and ore AMD/NMD management plans (LD, 2022b).

3.4.4 Mine affected water

Mine affected water is not expected to be generated during the C&M Phase. Notwithstanding this, where routine sampling indicates a significant groundwater input and water within the box cut does not meet surface water trigger values, water is considered mine affected and dewatered into MWD for release to the environment under a WDL. The conditions in the WDL will be followed prior to any discharge of water and before the start of the wet season.

3.5 SITE BACKGROUND SURFACE WATER QUALITY

The background water quality data collected during the monitoring period indicates:

- TP and TN levels are elevated above the limit of reporting across all sites.
- The pH for catchments that drain to Bynoe Harbour is generally slightly acidic, which correlates to the acidity of fresh rainwater in tropical regions.
- All metal levels, with exception of aluminium are lower the ANZG 95% limit of protection for freshwater species and/or the Limit of Reporting (LOR).
- Aluminium, iron and lithium levels are generally elevated in the environment in comparison to the LOR values.
- OHD has elevated arsenic, iron, and lithium compared to the LOR values.
- OHD baseline water quality indicates a neutral pH when compared to the slightly acidic water in catchments that drain of Bynoe Harbour.
- For Total Nitrogen:
  - The concentrations in OHD are generally higher than the catchments that drain to Bynoe Harbour.
  - The 80th percentiles are generally higher than or equal to the Darwin Harbour SSTVs (0.3 mg/L).
  - The 20th percentile to 80th percentile range for TN concentrations for catchments that drain to Bynoe Harbour and Observation Hill Dam are summarised below:
    - Catchments that drain to Bynoe Harbour: <0.1 mg/L to 0.34 mg/L.
    - OHD: 0.2 mg/L to 0.48 mg/L.
- For Total Phosphorus:
  - The concentrations in OHD are generally similar to catchments that drain to Bynoe Harbour.

- The 20th percentile to 80th percentile range for TP concentrations for catchments that drain to Bynoe Harbour and OHD are summarised below:
  - Catchments that drain to Bynoe Harbour: <0.01 mg/L to 0.02 mg/L.
  - OHD: <0.01 mg/L to 0.02 mg/L.
- For Ammonia:
  - The concentrations in OHD are slightly higher than catchments that drain to Bynoe Harbour.
  - The 20th percentile to 80th percentile range for Ammonia concentrations for catchments that drain to Bynoe Harbour and OHD are summarised below:
    - Catchments that drain to Bynoe Harbour: <0.01 mg/L – 0.07 mg/L.
    - OHD: 0.014 mg/L – 0.09 mg/L.

3.6 SITE BACKGROUND GROUNDWATER QUALITY

EcOz (2022) characterised the baseline groundwater quality which identified:

- Groundwater in the weathered and un-weathered BCF aquifer has moderate alkalinity (comprising 100% bicarbonate alkalinity), with anion and cation levels increasing with depth into the aquifer.
- Total phosphorus, strontium, lithium and zinc levels were found to be significantly higher than the surface water environment.
- Major anion and cation concentrations measured in the shallow laterite aquifer show the groundwater has negligible levels of alkalinity, hardness and dissolved major cations; similar to those measured in the surface water around the mine footprint.

Groundwater quality data collected between 2020 and 2023 for the shallow and deep aquifers indicates:

- For Total Nitrogen:
  - The concentrations in the shallow aquifers are similar to the surface water quality of catchments that drain to Bynoe Harbour.
  - The concentrations in the deep aquifers are lower than catchments that drain to Bynoe Harbour and are at the LOR.
  - The 20th percentile to 80th percentile range for TN concentrations for the shallow aquifers and deep aquifers are summarised below:
- Shallow aquifers: <0.1 mg/L to 0.3 mg/L.
- Deep aquifers: <0.1 mg/L to 0.2 mg/L.
- For Total Phosphorus:
  - The concentrations in the shallow aquifers are more elevated than the surface water quality of catchments that drain to Bynoe Harbour.
  - The concentrations in the deep aquifers are significantly higher than catchments that drain to Bynoe Harbour.
  - The 20th percentile to 80th percentile range for TP concentrations for the shallow aquifers and deep aquifers are summarised below:
- Shallow aquifers: <0.01 mg/L to 0.084 mg/L.

- Deep aquifers: 0.19 mg/L to 1.03 mg/L.

3.7 CHEMICAL AND FUEL STORAGE

Primary chemical storage areas are located within the mine services area. These storage facilities will be constructed and bunded generally in accordance with the relevant specifications of AS1940 – Storage and Handling of Flammable and Combustible Liquids (AS1940).

Incident reporting and the management of spills during C&M are to be undertaken in accordance with the site operational incident reporting forms and procedures. Incidental spills, fuel storage / use and equipment failures will continue to be a potential source of hydrocarbons in surface and groundwater during care and maintenance.

4 CARE AND MAINTENANCE SITE WATER MANAGEMENT

4.1 OVERVIEW

Two management systems have been developed to appropriately manage water at BP33 throughout different project stages which include:

- BP33 operational phase water management system (provided in WRM, 2024); and
- Grants C&M phase water management system (detailed in this Plan).

This section describes objectives of the C&M water management system at BP33, including a description of the infrastructure and systems that may be used to achieve the objectives and principles of this WMS (see below).

4.2 CARE AND MAINTENANCE MANAGEMENT OBJECTIVES

Overarching objectives of the C&M WMS is to:

- Ensure mine affected water is appropriately managed to minimise the risk of uncontrolled discharge to the environment; and
- Manage and monitor ground and surface waters to ensure risk of environmental harm is minimised and social and environmental objectives are maintained.

Specific objectives for each water type are as follows:

- **Raw / external water:** External water not required as site demands would be supplied by the current site inventory. No water is proposed to be extracted from OHD.
- **Diverted water:** Separate from the mine affected and sediment water systems as much as practicable and allow it to pass uninterrupted through the catchment.
- **Sediment water:** Maintain the quality of water discharging from Erosion and Sediment Control (ESC) structures to as close to background levels as reasonably possible.
- **Mine affected water:**
    - Ensure controlled releases of mine affected water prevents environmental harm and undertaken in accordance with the conditions of the WDL.
    - Manage water inventories in wet periods to prevent accidental release of mine affected water offsite and maintain the integrity of mine water storages.
    - Understand, manage and minimise potential impacts of mine affected water on the regional groundwater system.

Changes to the water management system during the period of C&M will continue to be managed in accordance with these objectives.

4.3 CARE AND MAINTENANCE SURFACE WATER MANAGEMENT PRINCIPLES

General principles to manage surface water during care and maintenance include:

- Maintain separation of diverted water, sediment water and mine affected water runoff as best as reasonably practicable.
- Reduce the area of surface disturbance to minimise the volume of sediment or mine affected runoff.
- Collect and contain all potential mine affected water into dedicated mine water storages.

- Divert up-catchment water runoff from upstream catchments around the disturbance areas.
- Limit external catchment runoff draining into the box cut.
- Manage sediment from disturbed catchment areas (e.g. WRD, cleared/pre strip areas) by using erosion and sediment control (ESC) measures prior to release offsite.
- Release on site sediment water in a controlled manner in compliance with the ESCP.
- Reuse onsite water (e.g. mine affected water) where possible to support mine operational water demands (and therefore limit mine affected inventories under normal operating conditions).
- Prioritise the use of poor-quality water over before better quality water, where practicable.
- Manage mine affected water discharges to the receiving environment in accordance with the WDL.

4.4 CARE AND MAINTENANCE WATER MANAGEMENT SYSTEM

4.4.1 BP33 C&M WMS

The BP33 C&M WMS consists of the following storages:

- Box Cut (BC);
- Mine Water Dam (Cell 1 & Cell 2) (MWD);
- Sediment Basin 1 (SB1); and
- Sediment Basin 2 (SB2).

A summary of the mine water storages, their current capacities and surface areas are provided in Table 4.1. The locations of the above storages are presented in Figure 1.2. Table 4.2 shows the proposed C&M operating rules for the BP33 WMS. A schematic of the BP33 C&M WMS is given in Figure 4.1. The BP33 C&M WMS schematic assumes that water from the box cut is treated as sediment water.

The management of each water type within the BP33 WMS is discussed in the following sections.

Table 4.1 BP33 water storages

Dam Name	Existing storage volume at full supply (ML)	Existing maximum operating volume (ML)	Dam surface area (ha)	Maximum catchment area (ha)	Overflows to
MWD Cell 1	73.8	14.8	2.1	2.1	Drainage Line BP1
MWD Cell 2	75.8	15.2	2.1	2.1	Drainage Line BP1
SB1	13.0	Operated as full	0.8	26.4	Drainage Line BP1
SB2	10.6	Operated as full	0.7	16.2	Drainage Line BP1
BC	352[A]	Operated as full	2.7	2.7	SB2

Note[A]: The full supply volume of the BC was based on December 2023 LiDAR.

Table 4.2 Proposed BP33 WMS operating rules

Item	Node Name	Strategy/purpose	Operating rules
1.0	***Operation of construction areas***		
1.1	Box Cut	Groundwater and catchment runoff would fill before spilling into SB2.	• Receives direct rainfall, catchment runoff and groundwater inflows. • Overtops into SB2.
2.0	***Operation of water storages***		
2.1	MWD Cell 1	Constructed as an out of pit storage for UG, as well as the controlled release location for BP33. For the C&M phase, MWD Cell 1 would operated at a low MOL. As MWD Cell 1 only receives direct rainfall, the water quality would be similar to sediment water. MWD Cell 1 would be dewatered to SB2. It is not proposed to release from MWD Cell 1 for the C&M phase.	• Receives direct rainfall. • Potential controlled release to receiving environment. • Dewaters to SB2. • Overflows to receiving environment at emergency spillway.
5.2	MWD Cell 2	Proposed to receive sediment water from SB1 and SB2 to supply makeup demands for mine water demands. For the C&M phase, MWD Cell 2 would be operated at a low MOL. As MWD Cell 2 only receives direct rainfall, the water quality would be similar to sediment water. MWD Cell 2	• Receives direct rainfall. • Dewaters to SB1.

Item	Node Name	Strategy/purpose	Operating rules
		would be dewatered to SB1	
5.3	SB1	Collects sediment runoff	• Receives dewatered inflows from MWD Cell 2. • Overflows to the receiving environment
5.4	SB2	Collects sediment runoff	• Receives dewatered inflows from MWD Cell 1. • Overflows to the receiving environment.

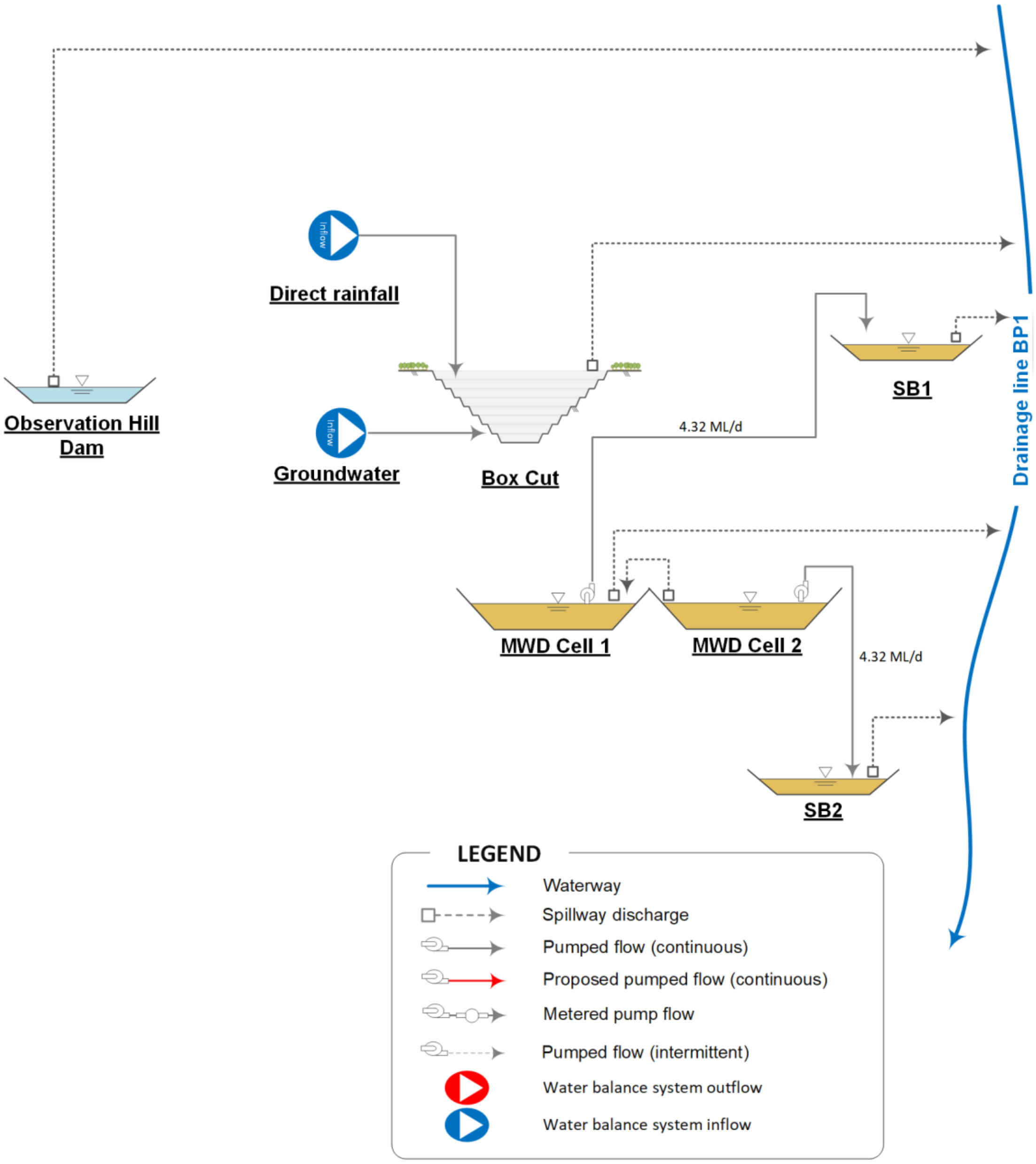

Figure 4.1 BP33 C&M WMS schematic

4.4.2 Stage 1 box cut construction water management

During Stage 1 construction, the temporary 30 m deep box cut is being excavated as part of the underground mine development before being filled in. The temporary box cut is shallower and smaller in surface area when compared to the permanent 60 m deep box cut that was proposed in the BP33 Environmental Impact Statement (EIS). The reduction in box cut size will have ramifications for the management of water as:

- the 30 m deep box cut is expected to receive significantly less surface water and groundwater inflows when compared to the 60 m box cut due to it being temporary, shallower and smaller in surface area;
- the expected groundwater inflows into the box cut may be significantly less than predicted in the EIS based on actual groundwater inflows to the Grants Pit at similar depths; and
- the 30 m deep box cut excavation is not expected to require blasting and it is unlikely that groundwater into the box cut would interact with any ore body in the ground.

Observations during the construction of the box cut indicated that there was minimal ground water ingress into the box cut.

For the C&M phase, water within the box cut will be classed as sediment water. The box cut will be allowed to fill and overtop into the SB2 to reduce the sediment loads before entering the environment. The temporary box cut structure will remain throughout the C&M phase.

4.4.3 Raw water management

For the C&M phase, the pump connecting OHD and BP33 will be offline for the C&M phase. There would be no raw water supplied to BP33.

4.4.4 Mine water management

Mine affected water containment will be provided in MWD Cell 1. MWD Cell 1 had been constructed to receive inflows from the underground mine. Controlled releases into Drainage Line BP1 may also be undertaken from MWD per an approved WDL, when there is excess water stored onsite.

MWD Cell 1 and MWD Cell 2 have not yet been commissioned for the C&M phase. No mine water is dewatered into MWD for the C&M phase and no controlled releases will occur from MWD. Water will be dewatered from MWD to the sediment basins to prevent any uncontrolled spills.

4.4.5 Sediment water management

Sediment water runoff during C&M will be managed in accordance with the ESCP. The primary purpose of the ESCP is to outline strategies to manage clean water and sediment water at BP33 and aims to:

- Examine and address all issues relevant to the generation, management, and mitigation of erosion and sediment transport;
- Provide guidance in erosion and sediment related issues and management techniques applicable;
- Determine the appropriate requirements for sediment and erosion control and management for all land uses; and
- Comply with any relevant regulatory requirements.

Sediment basins detailed in the ESCP have been sized in accordance with the IECA method (IECA, 2008), and have been based on the design standards and methodology for ‘Type B’ sediment basins. A level spreader and flocculant dosing device will be installed at each of the sediment basins to improve efficiency.

Several internal surface water drains are proposed to be constructed to capture surface water from the site and divert runoff to the sediment basins or sediment traps. The sediment basins would then discharge into Drainage Line BP1. Figure 1.2 shows the location of the proposed surface water drains.

The adopted design standard does not provide 100% containment for runoff from disturbed areas. Hence, overflows are expected to occur from sediment basins several times during a wet season.

A summary of the design sediment basin capacities and surface areas are provided in Table 4.1. The locations of the sediment basins are shown in Figure 1.2.

4.4.6 Groundwater management

For C&M, the base case water management strategy is to let the Box cut fill for the duration of the C&M phase. This includes incidental rainfall and groundwater inflow. Water in the Box cut would be treated as sediment water and would spill into SB2 if the capacity of the box cut is exceeded.

4.4.7 Diverted Water Management

The water management system has been designed to divert undisturbed catchments around mining operations wherever practicable. The diverted water drains will divert the up-catchment clean runoff around the site and into Drainage Line BP1 (to the east) or Drainage Line BP2 (to the west). Figure 1.2 shows the location of the proposed diverted water drains.

4.4.8 Water management Trigger Action Response Plan

Trigger Action Response Plans (TARPs) have been developed for the management of water inventory for all onsite water storages including sediment dams during three site stages. The TARPs have been developed in consideration of updated water balance modelling and details the conditions under which water will be managed and transferred within, and release offsite. Appendix A shows recommended operational water management TARPs. The operational TARPs cover:

- Table A.1 - Operational TARP for box cut water quality.
- Table A.2 – Operational TARP for sediment basin water quality which addresses the management of water quality within the sediment basins.

4.5 CONSEQUENCE CATEGORY ASSESSMENT

GHD (2022) had undertaken a preliminary consequence category assessment for OHD and MWD. A summary of the BP33 water storage consequence categories for environmental spills, dam failure and the extreme storm storage (ESS) allowance are provided in Table 4.3. GHD (2022) advise that a design storage allowance (DSA) is not required due to the low consequence of an environmental spill.

Table 4.3 Consequence categories for BP33 water storages (GHD, 2022)

Name	Consequence Category		
	Environmental Spill	*Dam Failure*	*ESS*
OHD	Low	Low	Not required
MWD	Low	Low	Not required

4.6 WASTE DISCHARGE LICENCE

BP33 currently operates under waste discharge licence (WDL) WDL253 for the period February 2024 to February 2029 which allows for the following action to occur:

- Controlled discharge of wastewater from Mine Water Dam (MWD) Cell 1 and into Drainage Line BP1 subject to conditions of the licence.
- Any authorised discharge must:
    a. Not include wastewater generated outside of ML32346 and MLN16;
    b. Not include wastewater treated with polyacrylamide flocculants with more than 0.05% of the neuro-toxin acrylamide monomer;
    c. Occur only when the stream gauge at the compliance point BPDS SW6 shows there is a sufficient amount of water to dilute discharge water to achieve trigger values presented at the compliance point at BPDS SW6;
    d. Occur only when there is flow in Drainage Line BP1;
    e. In the event wastewater is treated, occur only when the treatment process has finished, including allowing sufficient residence time for settlement of flocculants and target contaminants.

In the event wastewater is treated, occurs only when the treatment process has finished, including allowing sufficient residence time for settlement of flocculants and target contaminants.

4.7 SURFACE WATER EXTRACTION LICENCE

LD operate under a Surface Water Extraction Licence (SWEL) 8151018, which allows LD to extract water from OHD for use onsite (i.e. supply for dust suppression and Mill processing demand).

For the C&M, there are no planned transfers between OHD and BP33. It is proposed that all site water demands during the C&M phase will be supplied by site water inventory, if required.

5 CARE AND MAINTENANCE MINE SITE WATER BALANCE

5.1 OVERVIEW

This section of the WMP describes the water balance model that has been used to assess the performance of the mine site water management system in meeting the WMS objectives. The outcomes of the current site water balance model are summarised in this section.

For further details on the water balance model configuration, refer to the Water Balance Model report (WRM, 2024).

5.2 CARE AND MAINTENANCE WATER BALANCE MODEL METHODOLOGY

A computer-based operational simulation model (GoldSim) was used to assess the dynamics of the C&M WMS under conditions of varying rainfall, water quality and production rates for the period between 1 March 2024 and 31 December 2027 for the C&M phase. The GoldSim model dynamically simulates the operation of the water management system (WMS) and keeps complete account of all site water volumes and contaminant loads on a daily time step. For the purpose of this assessment, two key contaminants, which have been identified as limiting the ability to discharge mine affected water, were tracked through the BP33 C&M WMS. These included:

- Total Nitrogen; and
- Total Phosphorus.

Tracking these contaminants informs the maximum allowable controlled release rates under the WDL should it be required.

The model has been configured to simulate the operations of all major components of the C&M WMS. Simulated inflows and outflows included in the model are given in Table 5.1.

Table 5.1 Simulated inflows and outflows of the C&M WMS

Inflows	Outflows
Direct rainfall on water storage surfaces	Evaporation from water surface of storages
Catchment runoff	Offsite spills from storages
Groundwater inflows	

The model incorporates the Australian Water Balance Model (AWBM) rainfall runoff model (Boughton, 2003) to determine the runoff characteristics of the various catchment types on the mine site. The water and solute balance model was used to determine the behaviour of the mine water management system over time.

5.3 ASSESSMENT CRITERIA

The models are used to predict the performance of the following:

- Site wide mine affected water inventory against the combined full supply capacity;
- Compliance with the WDL conditions with respect to the frequency and volumes of controlled releases and the risk of uncontrolled discharge; and
- The risk of requiring external water over and above the external supply limit and SWEL.

The adopted performance criteria for the BP33 water balance are as follows:

- All releases from the mine water dams comply with the WDL conditions; and

The following assumptions were made:

- There are no ongoing site demands for the BP33 WMS during the C&M phase;
- The box cut would be operating to fill and spill into the surface drainage network.
- BP33 MWD has not been commissioned and is not allowed to fill and spill as construction has not yet completed.
- BP33 MWD Cell 1 and Cell 2 are to be operated as low as possible.
- Direct rainfall into BP33 MWD cells are to be pumped out to the sediment basins.
- There are no controlled releases under the WDL anticipated for MWD.

5.4 CARE AND MAINTENANCE SITE WATER BALANCE MODEL CONFIGURATION

The C&M water balance was simulated the period from 1 March 2024 to 31 December 2027 on a daily timestep for BP33 only.

The adopted site storage characteristics are shown in Table 5.2. The adopted catchments and land use reporting to each of the water storages at BP33 is shown in Table 5.3 and Figure 5.1.

Table 5.2 Storage characteristics for BP33 WMS

Dam Name	Storage volume	
	FSV (ML)	MOV (ML)
BC	352	352
MWD Cell 1	73.8	14.8
MWD Cell 2	75.8	15.2
SB1	13.0	-
SB2	10.6	-

Table 5.3 BP33 catchment areas

Dam name	Undisturbed area (ha)	Hardstand area (ha)	Waste Rock area (ha)	Box cut/ Cleared area (ha)	Total area (ha)
BCS	-	-	-	2.7	2.7
MWD Cell 1	-	2.3	-	-	2.3
MWD Cell 2	-	2.3	-	-	2.3
SB1	-	15.1	6.3	5.1	26.5
SB2	-	1.5	-	12.0	13.5
Total	**-**	**21.2**	**6.3**	**19.8**	**47.3**

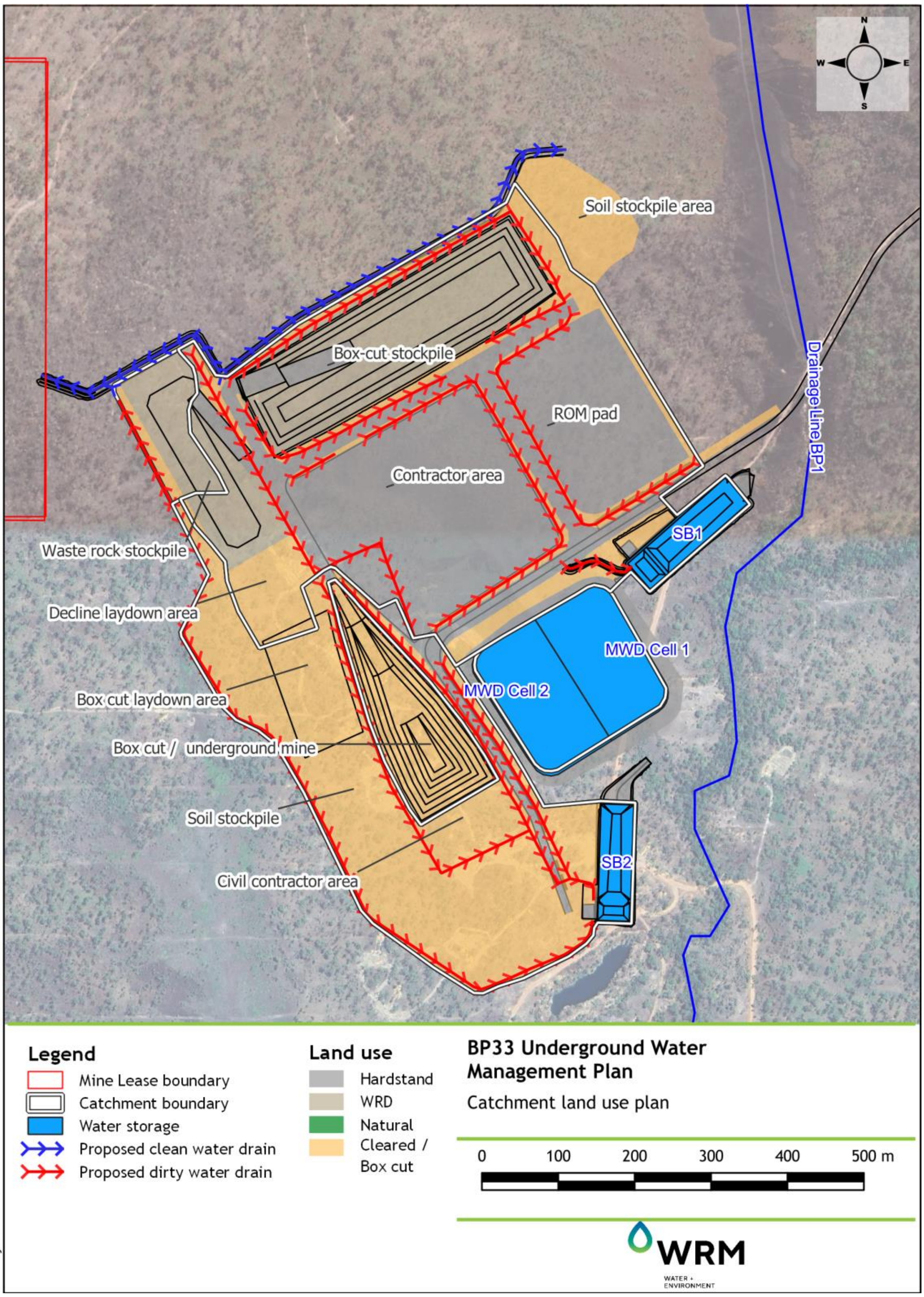

Figure 5.1 Proposed BP33 catchment areas and land use mapping

5.5 MODEL OUTCOMES

Key outcomes from the C&M water balance modelling assessment for the period between 1 March 2024 and 31 December 2027 are as follows:

- Up to 190 ML is predicted to accumulate in the box cut for very wet climatic (1%ile) for the 4-year forecast period.
- For all modelled climatic conditions, there would be no spills from the Box Cut or any mine water storages.
- For median climatic conditions, the site inventory would show a net positive.
- The site inventory would generally follow cyclic trends across the wet and dry periods.

Table 5.4 shows the summary of inflows and outflows of the water management system for the C&M phase for average climatic conditions. Figure 5.2 shows the total storage inventory of the WMS for the C&M phase.

Further information regarding the water balance modelling results and the sensitivity assessment is documented in WRM (2024).

Table 5.4 Site water balance for the base case scenario (median climatic conditions)

	Description	2024 (ML)	2025 (ML)	2026 (ML)	2027 (ML)
Water sources	Surface water inflow	153	377	382	383
	Groundwater inflow	31	36	37	36
	Total inflow	**183**	**414**	**418**	**419**
Water losses and usage	Evaporation (from water storage)	38	83	92	96
	Offsite sediment overflows	84	286	287	287
	Total loss	**122**	**369**	**380**	**383**
Site water balance		**61**	**45**	**38**	**36**

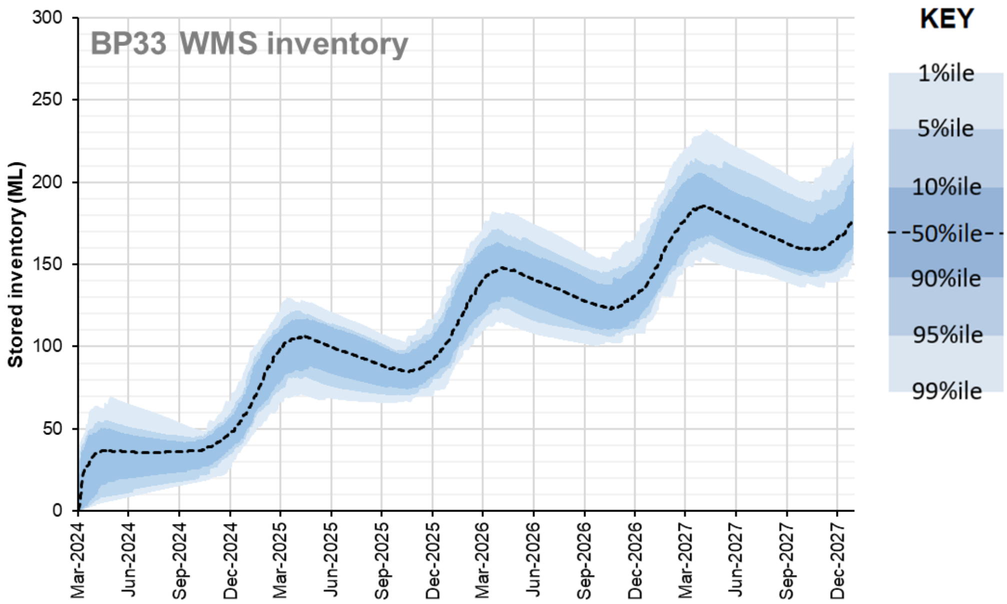

Figure 5.2 Total storage inventory in the WMS (Base case)

6 WATER QUALITY MONITORING PLAN

6.1 OVERVIEW

Operational water quality monitoring programs will be maintained during periods of care and maintenance. The objective is to provide early warning and trigger management actions for preventing impacts to surface waters and/or groundwater aquifers during periods of C&M. Surface water and groundwater monitoring plans are detailed below.

Water monitoring program design, sampling methods, data assessment criteria and reporting follow the guidance recommended in:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy Paper No 4 (ANZECC, 2000a);
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy Paper No 7 (ANZECC, 2000b); and
- AS/NZ Standards 5667:1998 – Water Quality Sampling Parts 1, 4, 6, 10 and 11 (AS/NZS, 1998).

For C&M, it is proposed to continue the operational monitoring program to provide a more accurate representation of receiving waterways.

6.2 PARAMETERS MEASURED

Table 6.1 outlines field and laboratory parameters measured at all surface water and groundwater monitoring locations. An extended metals suited, comprising 30+ metals, is required to be undertaken annually in late wet season recessional flows.

Selected parameters aim to detect all identified surface water and groundwater quality-related impacts detailed in this WMP.

Table 6.1 Surface water and groundwater quality field and laboratory parameters

Type	Parameters (Surface Water)	Parameters (Groundwater)
Field	• pH (pH units) • Electrical Conductivity (uS/cm) • Total Dissolved Solids (mg/L) • Turbidity (NTU) • Temperature (°C) • Oxidation Reduction Potential (mV) • Dissolved Oxygen (%saturation)	• pH (pH units) • Electrical Conductivity (uS/cm) • Total Dissolved Solids (mg/L) • Turbidity (NTU) • Temperature (°C) • Oxidation Reduction Potential (mV) • Dissolved Oxygen (%saturation) • Standing Water Levels

Laboratory	• Nutrients (ammonia, Nitrate, Nitrite, total nitrogen, total phosphorus, reactive phosphorus)
	• Chlorophyll-a
	• Dissolved and total metals:
	  ○ Aluminium
	  ○ Arsenic
	  ○ Cobalt
	  ○ Copper
	  ○ Iron
	  ○ Lithium
	  ○ Lead
	  ○ Nickel
	  ○ Zinc
	• Dissolved and total metals extended suite of 30+ metals in addition to the above (annually)
	• Major anions (sulfate, chloride and alkalinity)
	• Major cations (calcium, magnesium, sodium and potassium)
	• Hydrocarbons TPH/TRH, BTEXN (Sediment basins only)
	• Constituents contained within the flocculants /chemicals used to treat water in sediment basins or MWD.
		• Nutrients (ammonia, Nitrate, Nitrite, total nitrogen, total phosphorus, reactive phosphorus).
		• Dissolved and total metals:
		  ○ Aluminium
		  ○ Arsenic
		  ○ Cobalt
		  ○ Copper
		  ○ Iron
		  ○ Lithium
		  ○ Lead
		  ○ Nickel
		  ○ Zinc
		• Dissolved and total metals extended suite of 30+ metals in addition to the above (annually)
		• Major anions (sulfate, chloride and alkalinity)
		• Major cations (calcium, magnesium, sodium and potassium)
		• Hydrocarbons TPH/TRH, BTEXN
		• Constituents contained within the flocculants /chemicals used to treat water in sediment basins or MWD.

Field Notes	• Weather condition • Flow condition • Any visible items to note i.e. pollutants, algae etc. • Clarity • Odour • Riparian vegetation condition • Photos.	• Weather condition • Bore condition • Any visible pollutants i.e. algae, organisms, hydrocarbons, sheen • Clarity • Odour

6.3 SURFACE WATER MONITORING PROGRAM

The surface water quality monitoring aims to achieve:

- Early detection of contaminants originating from mining operations entering drainage lines and waterways. Potential contaminant sources include:
  - WRD seepage;
  - Water dewatered from the box cut excavation (construction only)
  - Flocculants/chemicals used to treat water across site;
  - Stormwater runoff from the mine site; and
  - Fuel or chemical spills/leaks.
- Monitor box cut water;
- Detect secondary effects on waterways from physical stressors, such as excess nutrient and organic matter inputs from mine run-off/discharge causing eutrophication and algal blooms.
- Monitor contaminant levels in the box cut for guiding water treatment strategies to meet water quality objectives.
- Verify water quality in mine site storages meets discharge criteria prior to release or use in dust suppression.

6.3.1 Surface water quality monitoring sites

Proposed surface water monitoring site locations are shown in Figure 6.1 and detailed in Table 6.2.

Table 6.2 Surface water quality monitoring sites details

Site ID	Purpose	Sampling frequency
BPUS SW1	• **Impact location** • Monitors impacts from BP33 release into drainage line	• **Monthly**: Field and lab parameters during wet season (November to April).
BPDS SW2	• **Impact location** • Monitors impacts from OHD water extraction on downstream waterways and from BP33 mine site operations.	
BPUS SW4	• **Reference location** • Site upstream of any BP33 mine site impacts	
BPUS SW5	• **Reference location** • Monitors impacts from OHD water extraction on downstream watercourses	
BPUS SW7	• **Reference location** • Site upstream of any BP33 mine site impacts	
BPDS SW3	• **Impact location** • Monitors potential impacts from WRDs.	
BPDS SW6	• **Impact location** • Monitors potential impacts from OHD water extraction on downstream waterways and from BP33 mine site operations • Compliance location for WDL253	
BPDS SW8	• **Impact location** • Monitors potential impacts from WRDs.	

OHD	• Monitor ongoing raw water quality whilst not utilised during C&M.	• **Monthly**: Field and lab parameters year round.

Table 6.3 Operational water quality monitoring sites details

<table>
<tr><th>Site ID</th><th>Purpose</th><th>Sampling frequency</th></tr>
<tr><td>SB1 and SB2</td><td>• Monitor water quality in sediment basins to assess treatment options, upstream controls and to ensure compliance with IECA (2008) criteria prior to release.</td><td rowspan="3">• Prior to controlled release: Field parameters
• Weekly: Field parameters during wet season (regardless of discharge)
• Weekly: Lab parameters when discharging (passive and / or controlled)
• Monthly: lab parameters during wet season (November – April) regardless of discharge</td></tr>
<tr><td>MWD Cells 1 and 2</td><td>• Monitor water quality to assess treatment options and ensure compliance with irrigation and / or WDL criteria prior to release</td></tr>
<tr><td>Box-cut[a]</td><td>• Monitor water quality in Box-cut to assess water quality type, treatment options, ensure compliance with IECA (2008) and/or WDL criteria prior to release.</td></tr>
</table>

Note:
a: Sampling of the Box Cut can only be undertaken once survey verification of wall stability has been completed.

6.3.2 Sampling frequency

Sampling frequency will be undertaken as per Table 6.2 and Table 6.3.

6.3.3 Sampling methods

Sampling must adhere to the following:

- All surface water quality monitoring must be undertaken by qualified professionals in accordance with the standards listed in Section 6.1.
- All hand-held field parameter meters must be calibrated immediately prior to commencing sampling or in accordance with frequency recommended in the operating manual.
- All laboratory samples are to be placed into the appropriate laboratory supplied bottles and handled in accordance with the standards listed in Section 6.1.
- Samples must be kept cool in eskies until delivered to a NATA accredited laboratory within required holding times.

6.3.4 Surface water flow gauging

LD monitors surface water flow in the BP33 catchment at a number of gauging stations to provide information for flood assessments, engineering designs and waste discharge calculations.

There are two primary water level loggers in the BP33 catchments in the vicinity of the Project:

- OHD (depth only);
- OHD Spillway located at the Observation Hill Dam; and
- BPDS SW2 located downstream of OHD and the BP33 site.

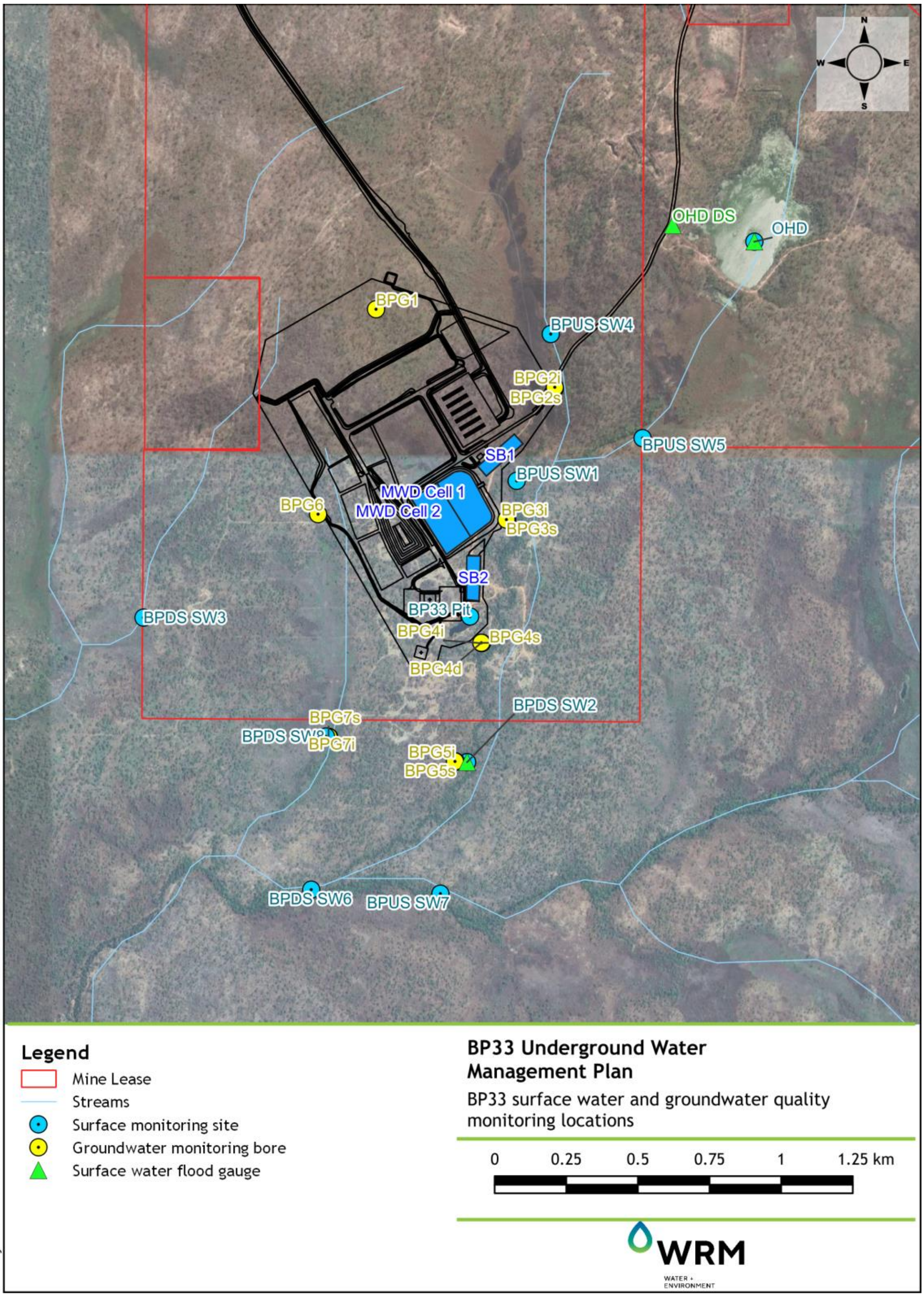

Figure 6.1 Surface water and ground water quality monitoring sites

WRM

6.3.5 Assessment criteria

6.3.5.1 Downstream surface water SSTVs

Table 6.4 lists the SSTVs to apply to surface water sites listed in Table 6.2 per the WDL application. These SSTVs are based on the current WDL and will apply during C&M.

Table 6.4 Downstream Surface Water Trigger Values

Parameter	Units	Analysis	Trigger Value
Environmental Field Data			
pH	pH	In situ	5.4-6.7 [2,3]
Electrical conductivity	µS/cm	In situ	250 [1]
Turbidity	NTU	In situ	14 [3]
Dissolved Oxygen	mg/L	In situ	50 - 100 [1]
Nutrients			
Total Nitrogen	µg/L	Unfiltered	300 [3]
Total Phosphorus	µg/L	Unfiltered	20 [3]
Metals and Metalloids			
Aluminium	µg/L	Filtered (0.45 µm)	70 [3]
Arsenic	µg/L	Filtered (0.45 µm)	13 [1]
Cadmium	µg/L	Filtered (0.45 µm)	0.2 [1]
Chromium (CrVI)	µg/L	Filtered (0.45 µm)	1 [1]
Cobalt	µg/L	Filtered (0.45 µm)	1.4 [1]
Copper	µg/L	Filtered (0.45 µm)	1.4 [1]
Iron	µg/L	Filtered (0.45 µm)	380 [3]
Lead	µg/L	Filtered (0.45 µm)	3.4 [1]
Lithium	µg/L	Filtered (0.45 µm)	430 [4]
Nickel	µg/L	Filtered (0.45 µm)	11 [1]
Zinc	µg/L	Filtered (0.45 µm)	8 [1]

[1] ANZG (2018) 95% species protection, freshwater

[2] 20th percentile of background data for surface water quality

[3] 80th percentile of background data for surface water quality

[4] Ecotoxicology Assessment section 8.3 and 8.4 of the Grants Water Management Plan

6.3.5.2 Sediment basin discharge water criteria

It is anticipated that turbidity in the sediment basins will be reduced during C&M, but will still require monitoring and management to reduce as much as possible. Final discharge from the sediment basins is not always expected to achieve the very low turbidity levels in the receiving drainage lines. As such, the discharge standard recommended for sediment basins in IECA (2008) is adopted:

- *90th percentile NTU reading not exceeding 100, and 50th percentile NTU reading not exceeding 60*

Once discharged, turbidity of water from the sediment basins is expected to reduce rapidly with dilution in the receiving drainage lines, combined with the filtering effect of the vegetation.

6.3.6 Surface water quality Trigger Action Response Plan

An operational TARP for surface water quality has been developed for the BP33 operation and is provided in Table B.3. The TARP will be employed to mitigate and minimise the risk of impacting the environment from a reduction in offsite water quality. The proposed strategy would involve undertaking an investigation to identify the source of contaminants and to develop a more targeted and appropriate management measure depending on the outcomes of the investigation. Surface water quality will be measured at the surface water monitoring locations listed in Table 6.2 which includes the downstream compliance point BPDS SW6.

6.4 GROUNDWATER MONITORING PROGRAM

Table 6.3 outlines field and laboratory parameters measured in all bores during all quarterly sampling rounds undertaken during C&M. An extended metals suite (both total and dissolved) comprising 30+ metals is to be analysed annually.

The parameters aim to allow the detection of all identified groundwater quality-related impacts discussed in the preceding sections of this WMP, such as AMD, or any other contaminants potentially in seepage from the WRD.

Continuous measurement of groundwater levels using Troll Loggers in all bores will allow detection of any groundwater mounding associated with the WRD or any other water storages on site as well as any potential groundwater drawdown around the Box cut.

6.4.1 Groundwater monitoring sites

Proposed groundwater monitoring site locations are shown in Figure 6.1 and detailed in Table 6.5.

Table 6.5 Groundwater monitoring site details

Site ID	Purpose	Sampling frequency
BPG1	• Assess groundwater conditions up-gradient of the site	• **Quarterly**: Field and lab parameters. • **Continuous**: Standing water levels
BPG2s BPG2i	• Assess groundwater conditions up-gradient between box-cut and OHD in the area of mapped GDE potential.	
BPG3s BPG3i	• Assess groundwater conditions and establish a groundwater monitoring point at field-verified GDE and vegetation monitoring site.	
BPG4s BPG4i BPG4d	• Establish a nested monitoring site to investigate the degree of vertical connection between BCF aquifer, the weathered zone in the BCF and the alluvial aquifer in the immediate vicinity of the underground mine	
BPG5s BPG5i	• Assess groundwater conditions and establish monitoring at field-verified GDE and surface water monitoring site BPUS SW2	
BPG6	• Assess conditions down-gradient of box-cut	
BPG7s BPG7i	• Assess groundwater conditions down-gradient of mine site in area of mapped GDE potential	

6.4.2 Sampling frequency

Sampling frequency will be undertaken as per that outlined in Table 6.5.

6.4.3 Sampling methods

Sampling must adhere to the following:

- All surface water quality monitoring must be undertaken by qualified professionals in accordance with the standards listed in Section 6.1.
- All hand-held field parameter meters must be calibrated immediately prior to commencing sampling or in accordance with frequency recommended in the operating manual.
- All laboratory samples are to be placed into the appropriate laboratory supplied bottles and handled in accordance with the standards listed in Section 6.1.
- Samples must be kept cool in eskies until delivered to a NATA accredited laboratory within required holding times.

6.4.4 Assessment criteria

Groundwater quality will be assessed via trend analysis not SSTVs. Management actions as per Table B.4 will be triggered by a greater than 10% variation from baseline conditions.

The range of natural baseline conditions (based on measured 20th and 80th percentile values in accordance with ANZG (2018) guidelines) have been determined for two distinct groundwater units and are defined in Table 6.6 below:

- for the shallow aquifer (bores screened at depths less than 36 mBGL);
  - based on 3 years of data at BPG1, BPG2s, BPG2i, BPG4s, BPG5s and BPG7s.
- and deeper BCF aquifer, given the differing water quality of these systems.
  - based on 3 years of data at BPG3i, BPG4i, BPG4d, BPG5i, BPG6 and BPG7i.

Table 6.6 Groundwater analyte background ranges

Parameter	Units	Analysis	Background Range (shallow)	Background Range (deep)
Environmental Field Data				
pH	pH	In situ	4.9 - 5.56	6.46 – 6.84
Electrical conductivity	µS/cm		53.2 – 80.4	208.8 – 271.9
Nutrients				
Total Nitrogen	µg/L	Unfiltered	100[a] – 300	<100
Total Phosphorus			10[a] – 78	190 – 1,040
Metals and Metalloids				
Aluminium	µg/L	Filtered (0.45 µm)	10[a] – 20	<10
Arsenic			1[a] – 8	124 – 219
Cobalt			<1	<1
Copper			1[a] – 2	<1
Iron			50[a] – 60	160 – 1,600
Lead			<1	<1

Lithium	18 – 97	91 – 708
Nickel	2 – 5	<1
Zinc	7 – 26	5[a] – 10
Hydrocarbons	Below detection limit	Below detection limit

[a] Below limit of reporting

6.4.5 Groundwater quality Trigger Action Response Plan

An operational TARP for groundwater quality has been developed to continually monitor the groundwater quality and determine the impact of operations on the receiving environment. The TARP recommends actions to minimise the risk of impacting the environment. The proposed strategy would involve undertaking an investigation to identify the source of contaminants and to develop a more targeted and appropriate management measure depending on the outcomes of the investigation.

Table B.6 shows the recommended operational TARP for groundwater quality.

6.5 SURFACE WATER AND GROUNDWATER QUALITY AND HYDROLOGIC RECORDING AND REPORTING

All results from surface water and groundwater quality monitoring are automatically uploaded into the LD management program (Esdat). The database contains all baseline and operational field and laboratory data.

The collected environmental monitoring data and performance of the Environmental Management System will be analysed and reported to regulatory bodies at the frequency and in the manner required of existing operational approvals and in accordance with the surface water and groundwater monitoring programs.

Reporting requirements will align with those required for routine compliance monitoring required under the conditions.

6.6 WASTE DISCHARGE LICENCE

WDL monitoring will be undertaken in accordance with requirements of the WDL253.

6.7 SURFACE WATER EXTRACTION LICENCE

SWEL monitoring requirements are documented in the following monitoring plans:

- Surface Water Extraction Licence 8151018 (DEPWS, 2022);
- Surface Water Extraction Licence Monitoring Plan Observation Hill Dam (Ecoz, 2022c); and
- Riparian Vegetation Monitoring Plan (EcOz, 2022b)

7 CARE AND MAINTENANCE ACID ROCK AND SALINE DRAINAGE

7.1 OVERVIEW

A summary of the current understanding of acid rock and saline drainage at BP33 is provided in the following section.

7.2 WASTE ROCK CHARACTERISTICS

Material characterisation studies indicates that the waste rock geochemistry would be considered material with no AMD potential, primarily due to the absence of sulfur which is typical of the sedimentary environment in which it was deposited. The study by EGI (2020, 2021, 2022) had found the waste rock samples:

- Oxidised waste rock samples are devoid of sulphur and classified as non-acid forming (NAF). The oxidised rock which forms majority of the rock excavated, will have a very low risk of acid rock drainage or saline drainage.
- Drainage from the oxidised rock may contain low concentrations of aluminium and zinc.
- Transitional waste rock, which will comprise a small portion of rock removed in the development of box cut and the mine decline, is generally low in sulphur content and can be classified as NAF.
- Fresh waste rock, which will comprise a large portion of the rock removed during development of the underground mine, is generally low in sulphur content but does contain areas which has higher sulphur concentrations. Most fresh waste rock can be classified as NAF however, there is evidence that fresh phyllite may contain PAF material.
- The waste rock extracts from the waste rock samples generally have low salinity concentrations, however the fresh waste rock water extract is generally higher than the other waste rock types.

Considering the results of surface and groundwater monitoring at the BP33 Project, waste characterisation by EGi is corroborated by baseline water quality data:

- pH in groundwater varies between 6.3 and 7.5, indicative of a circumneutral pH environment with sulfate concentrations generally less than 1 mg/L;
- The BP historic Open Cut has a pH of 8.2 and TDS of 14.3 mg/L.

7.3 MONITORING AND MANAGEMENT

Continuation of ground and surface water monitoring programs will assist in the identification of potential acid or saline drainage from the WRD in the unlikely event of occurrence during C&M. The frequence and analytes are considered appropriate to provide early indicators of potential issues so that management actions, as detailed in the BP33 WRD/AMD Management Plan and Care and Maintenance Management Plan, can be applied.

8 EMERGENCY AND CONTINGENCY PLANNING

8.1 OVERVIEW

The BP33 water management strategy has been developed for both normal operation periods and during extreme wet weather events in order to:

- Ensure mine affected water accumulation is appropriately managed to minimise the risk of uncontrolled discharge to the environment; and
- Manage and monitor ground and surface waters to ensure risk of environmental harm is minimised and social and environmental objectives are maintained.

The emergency response plan for site is managed in the sites Health and Safety Management System. A summary of the emergency response, should a failure of the water management system occur, is provided below.

8.2 CONTINGENCY ACTIONS

Contingency actions for several specific WMS-related trigger events are provided in Table 8.1.

Table 8.1 Surface water management contingency actions

Trigger	Action
Mechanical failure of pumping equipment prevents scheduled transfers	• Ensure adequate spares are available. Source temporary equipment if possible.
Damage to water storage infrastructure	• Regular visual inspections of infrastructure, especially following significant rainfall. • Annual geotechnical inspection.
Failure of water storage structures	• Notify downstream residents (if applicable) and NT EPA and DITT of the failed structure. • Investigate the downstream impacts of the failure and complete a detailed report on the impacts of the failure, including an assessment of likely water volume and quality, and required remedial actions. • Investigate the reason for failure of the structure and ensure the stability of other water storages at risk. • Assess the effects of the failure on the WMS and implement mitigation measures
Forecasts of significant rainfall / storm event or water storages nearing capacity.	• Pump water from any storage at risk of unlicensed or uncontrolled discharges. • If groundwater inflows are significant, investigate the implementation of a pipeline between BP33 and Grants to increase the amount of available storage between sites. • Measured groundwater inflows into the BP33 system will guide the decision for the pipeline. • Once the Grants OC has been completed, there would be an opportunity to store mine water from BP33 to reduce the active storage volume on site.
Exceedances in groundwater inflows into the underground works/box cut	• Increase the pumping infrastructure to MWD. • Dewater mine-affected water through controlled releases (under the WDL) or irrigation measures (under the Irrigation management plan). • If the above measures are not possible, there will be flooding of the underground mining works to prevent uncontrolled releases into the environment.

Trigger	Action
Water demands or catchment yield depart from assumed values used in modelling	• Investigate reasons. • Revisit site water balance modelling if required.
Water quality in sediment basin(s) indicates mine-affected water.	• Investigate potential sources of contaminants in the catchment (e.g., WRD, box cut stockpile, contractor area, box cut, etc.) that are contributing to poor water quality. • Inspect the WRD and, if necessary, sample seepage and/or runoff to determine if the WRD is affecting sediment basin water quality. • If WRD is found to be impacting on water quality, investigate geochemistry of the WRD. • Investigate options to divert runoff from the source of poor water quality to a mine water storage if required. • Investigate the option of converting the sediment basin into a mine-affected water storage (and prevent uncontrolled spills into the environment) if the sources cannot be diverted or remediated. • Investigate the option of constructing an additional mine water storage and drains to capture runoff from the contaminated area.
Water quality in Box-cut indicates mine-affected water.	• Manage Box-cut as a mine-affected water storage and prevent any uncontrolled discharges. • Investigate option to transfer to a mine-affected water storage and release under the proposed WDL. • Investigate option of converting an existing storage to a mine-affected water storage (and prevent uncontrolled spills into the environment), if the sources cannot be remediated. • Investigate the option of constructing an additional mine water storage and drains to capture runoff from contaminated areas.
Routine monitoring indicates siltation is causing loss of water storage capacity in water management dams (including Observation Hill Dam, Mine Water Dams and Sediment Dams)	• Undertake desilting operation to reinstate design storage volume.
Water monitoring indicates an exceedance of the Mine Affected Water Release Limits required to ensure mine water is adequately diluted to meet SSTVs at the downstream compliance point (BPDS SW6) per the proposed WDL.	• Cease any discharges which may be causing non-compliance. • Contain any contaminated water where possible to prevent environmental harm. • Continue to monitor water quality in the area of interest. • Undertake an investigation to ascertain the cause of the non-compliance. • Report the non-compliance to the Administrating Agency and other relevant parties.
Receiving water quality monitoring indicates exceedance of Receiving Waters Contaminant Trigger Levels	• Cease any controlled discharges which may be causing the non-compliance until further analysis is undertaken. • Undertake an investigation in accordance with the WDL.
Exceedances in groundwater bore water quality indicating an impact on groundwater bores.	• Undertake an investigation to ascertain the cause of the non-compliance. (from waste rock or underground works) • Report the non-compliance to the Administrating Agency and other relevant parties. • Investigate drainage options to redirect any waste rock contaminants to the MWD. • A risk-based approach consistent with the GARD Guide (INAP, 2014), will use the results of long-term kinetic testing to inform development of prevention and mitigation

Trigger	Action
	measures required in the detailed mine design to prevent metalliferous mine drainage.
Community complaints received of impacts to stock and domestic water supply.	• Undertake an investigation in accordance with the WDL.
Uncontrolled discharge	• Monitor water quality and quantity of the discharge and assess the potential for environmental harm. • Contain any contaminated water where possible to prevent environmental harm. • Investigate the use of the discharge and modify the water management system where necessary to prevent future uncontrolled discharges. • Report the non-compliance to the Administering Agency and other relevant parties.
Riparian vegetation monitoring – Change in covered riparian vegetation exceedances	• Undertake investigation in accordance with Table 4.1 of the Riparian Vegetation Monitoring Plan (EcOz, 2022b). • Implement response to surface water flows monitoring program (WRM, 2022b). • Report on the outcomes of the actions undertaken to the regulator.
GDE Management	• Undertake works in accordance with the GDE Management Plan (EcOz, 2022a).

8.3 OTHER RELEVANT CONTINGENCY ACTIONS

8.3.1 No offsite discharge – mine affected water

It is unlikely that during a significant rainfall event, water will be needed to be discharge from the release dam (MWD) to the receiving waters. MWD is a turkey's nest and is only driven by direct rainfall and the groundwater inflows from underground operations. It is likely that groundwater inflows into MWD will control the frequency and rate at which water will be able to be discharged into the receiving waters in compliance the WDL conditions. In the event where water quality within the release dams exceeds the release criteria for the observed flow event, no releases will be made to the downstream waterways.

For the C&M phase, the BP33 MWD cells have not yet been commissioned and are to be managed at a low operating level to prevent any uncontrolled spills.

9 REPORTING AND REVIEW

9.1 REVIEW OF THE C&M WMP

The water management plan will be updated/revised in accordance with the conditions of the BP33 Environmental Assessment and if there are any material changes to the operation of the BP33 water management system.

9.2 CARE AND MAINTENANCE ROLES AND RESPONSIBILITIES

Table 9.1 shows responsibilities for implementation of various aspects of the C&M WMP. The organisational structure for care and maintenance periods are to be confirmed.

Table 9.1 Roles and responsibilities

Role	Responsibility/Accountability

HSE Manager	• Ensure a site WMP is prepared, implemented and maintained.
	• Ensure water management projects are planned and budgeted for.
	• Ensure adequate storage is available to enable ongoing production through wet and dry climatic conditions.
	• Manage implementation of water management improvement projects.
	• Ensure that water is managed in accordance with the WMP.
	• Design, budget for and arrange the construction of sediment, erosion control and mine water drains/dams.
	• Communicate the WMP to the Project Management team and other relevant stakeholders.
	• Ensure the Plan of Operations addresses water management. Specifically plan to ensure that:
	  o Adequate storage is available to enable ongoing production through wet and dry climatic conditions;
	  o Contingencies are in place for climatic extremes;
	  o Interaction with waste disposal strategies is understood;
	  o Closure planning is incorporated.
	• Ensure that planned infrastructure is in compliance with the WMP.
	• Ensure planned maintenance schedules are implemented to maximise the availability of fixed and mobile pumps in the mining area.
	• Ensure all water pipelines and control structures in the maintenance area are regularly inspected, maintained and promptly repaired.
	• Communicate the WMP to operational teams

Environmental Superintendent	• Ensure that water is managed in compliance with the Water Management Plan.
	• Ensure all water pipelines and control structures are regularly inspected, maintained and promptly repaired. Specifically:
	  o Prevent spills, leaks and unlicensed discharges;
	  o Maintain adequate dewatering capability for high rainfall events;
	  o Ensure systems to protect against sudden inrushes of water are fully operational at all times;
	  o Maintain storage capacity in runoff capture dams;
	  o Ensure efficient recycling and preferential use of mine water.
	  o Ensure water supply meets supply demands.
	• Ensure all storages are maintained and operated in accordance with the WDL.
	• Ensure contingency plans for climatic extremes are adhered to.

Environmental Advisor	• Preparation, implementation & maintenance of the site Water Management Plan. • Advise the Environmental Superintendent on water management control & planning requirements. • Prepare site water balances to define water use, storage & discharges; and to monitor and forecast site water management needs.

Role	Responsibility/Accountability
	• Arrange the inspection & maintenance of clean, sediment, erosion control & mine water drains & dams. • Communicate requirements for incident reporting to Project team. • Advise the Environmental Superintendent on water metering requirements. • Design, implement and maintain the water monitoring program. • Report on and communicate performance against water plans and targets. • Audit record report.
Environmental Officer / Technician	• Water quality sampling and data entry. • Inform the Environmental Advisor on water quality samples. • Communicate water quality outcomes to environmental department.

10 INFORMATION/KNOWLEDGE GAPS

10.1 GAPS IN INFORMATION

This WMP has been prepared based on the mine site design and operational assumptions, consistent with the current stage of mine planning. Throughout the document, information and knowledge gaps have been identified that required further work to inform the development of risk management strategies. Information and knowledge gaps and actions proposed to address these are summarised in Table 10.1.

Table 10.1 Information/knowledge gaps, how and when they will be addressed

Information/knowledge gap	Work required	Timing
Toxicant (metal) concentrations in seepage from temporary WRDs	• Long term kinetic testing results to determine if specific design controls required on WRDs and/or ROM to capture and treat contaminated water. • Provide detailed WRD and ROM designs in MMP. • Incorporate contaminants of concerns and monitoring locations into surface water monitoring program. • Redirect internal capture drains to discharge into MWD instead of SB1 if there are exceedances in contaminants of potential concern.	• Kinetic Column Leach (KCL) test results under free draining, oxidising conditions (designed to simulate conditions during surface storage of waste materials throughout the operational stage) completed. Results of KLC testing under saturated conditions (designed to simulate backfill conditions on closure) is expected to be available June/July 2023.
Water management system	• Detailed feasibility assessment of the water storage, treatment and disposal options identified in site water balance study. • Detailed design of site water management system and update the Water Management Plan.	• Prior to commencement of operations.
Groundwater inflows	• Monitor groundwater dewatering from BCS and underground mine to determine if it's required to increase site storage volumes.	• Prior and during commencement of operations.

11 REFERENCES

ANZECC, 2000a	'*Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy Paper No 4',* Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000
ANZECC, 2000b	'*Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy Paper No 7',* Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000
ANZECC, 2000c	'*Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy Paper No 4, Volume 3, Primary Industries – Rationale and Background Information',* Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000
ANZG, 2018	*'Australian and New Zealand Guidelines for Fresh and Marine Water Quality'*, Australian and New Zealand Governments and Australian state and territory governments, 2018
AS/NZS, 1998	*'AS/NZS 5667.1:1998, Australian/New Zealand Standard, Water quality – Sampling Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples',* AS/NZS, 1998
Boughton, 2003	Cooperative Research Centre for Catchment Hydrology (2003). Technical Report 03/15, Calibrations of the AWBM for the use on ungauged catchments.
CloudGMS, 2018	'*Development of a Groundwater Model for the Grants Lithium Project, Final Version 1.0*', CloudGMS, September 2018
CloudGMS, 2021	'*Finniss Lithium Project BP33 Groundwater Modelling Report*', CloudGMS, June 2021
CloudGMS, 2023	'Technical Memorandum – BP33 Dewatering Assessment 2023 (Draft v0.1)', CloudGMS, September 2023
Core, 2023	'BP33 Waste Rock and AMD Management Plan', Core Lithium, October 2023.
DEPWS, 2022	*'Surface water extraction licence 8151018',* DEPWS, October 2022
DPIR, 2017	*'Mining Management Plan Structure Guide for Mining Operations",* Department of Primary Industry and Resources (DPIR), January 2017
EcOz, 2019	*"Erosion and Sediment Control Plan",* EcOz, March 2019
EcOz, 2022	*"Grants Water Management Plan",* EcOz, April 2022
EcOz, 2022a	*"Surface Water Extraction Licence Monitoring Plan Observation Hill Dam",* EcOz, August 2022
EcOz, 2022b	*"Riparian Vegetation Monitoring Plan Finniss Lithium Project Core Lithium",* EcOz, May 2022
EcOz, 2023	*"Irrigation Management Plan BP33 Underground Mine – Lithium Developments (Grants NT) Pty Ltd",* EcOz, October 2023.
EGI, 2020	*"Geochemical characterisation of waste rock and ore"*, EGI, March 2020
EGI, 2021	*"Static Geochemical Testing of Mine Wastes & Ore"*, EGI, July 2021
EGI, 2022	*"Kinetic Geochemical Testing of Waste Rock – Finniss Lithium Project BP33 UG Mine", EGI, September 2022*

Frater, 2005	*"Tin-tantalum pegmatite mineralisation of the Northern Territory, Northern Territory Geological Survey, Report 16"*, Northern Territory Government, 2005
GHD, 2017a	*"Finniss Lithium Project, Aquatic Ecology Baseline Monitoring",* GHD, October 2017
GHD, 2017b	*'Finniss Lithium Project, Groundwater Investigation Report'*, GHD, December 2021
GHD, 2019	*"Grants Lithium Project, Preliminary Design of TSF and Water Storages - Design Report"*, GHD, March 2019
GHD, 2022	*"Finniss Lithium Project Preliminary Designs for BP33 Water Dams",* August 2022
GE & RDMH, 2022	*"Groundwater Dependent Ecosystem Management Plan BP33 Underground Mine",* Groundwater Enterprises and RDM Hydro, May 2022
IECA, 2008	*International Erosion Control Association (IECA) (2008). Best Practice Erosion and Sediment Control Guideline.*
INAP, 2014	*The International Network for Acid Prevention (INAP) (2014). Global Acid Rock Drainage Guide.*
LD, 2021	*'Finniss Lithium Project BP33 Underground Mine',* LD, November 2021
LD, 2022	*'Finniss Lithium Project BP33 Underground Mine – Water Management Plan',* LD, May 2022
LD, 2022b	*'Finniss Lithium Project BP33 Underground Mine Mining Operations – Mining Management Plan',* October 2022
LD, 2023	*'Finniss Lithium Project BP33 Waste Discharge Licence Application – Supporting Information', October 2023*
NIWAR, 2013	*'Updating nitrate toxicity effects on freshwater aquatic species',* NIWAR, January 2013
Topo, 2023	*'Erosion and Sediment Control Plan',* Topo, 2023
WRM, 2022	*"Finniss Lithium Project Grants Surface Water Infrastructure Assessment",* WRM, 2022
WRM, 2022b	*"Finniss Lithium Project Observation Hill Dam Surface Water Monitoring Program",* WRM, 2022
WRM, 2023	*"Grants Lithium Water Management Plan",* WRM, 2023
WRM, 2023a	*"Grants Lithium – Water Balance Modelling Report",* WRM, 2023
WRM, 2023b	*"BP33 Underground Mine water Balance Modelling Report",* WRM, 2023
WRM, 2024	"Water Balance Modelling Assessment in support of the Grants and BP33 Care & Maintenance Plan WMP update", WRM, 2024

APPENDIX A WATER MANAGEMENT TARPS

Table A.1 Box Cut water quality (Stage 1: Construction Phase) TARP

Level	Triggers	Action/Response
Level 1	Box cut water quality is within than 90% of the SSTVs (Table 6.4 of the WMP).	• No action/response required
Level 2	Box cut water quality is between 90% and 100% of the SSTVs (Table 6.4 of the WMP).	• Review laboratory QA/QC and look for potential quality control issue and request a review if a suspected lab error. • Investigate management measures or treatment procedures to manage any unexpected increases in contaminant concentrations. • Investigate to determine if additional controls or management actions are necessary to achieve compliance. • Increase frequency of monitoring.
Level 3	Box cut water quality exceeds one or more of the SSTVs (Table 6.4 of the WMP).	• Investigate potential cause of elevated trigger values. • Identify the potential source associated with the trigger exceedance. • Increase frequency of monitoring. • Apply relevant mitigation, treatment and contingency measures in level 2 before discharging to SB2.
Level 4	Box cut water quality exceeds one or more of the SSTVs by more than for three consecutive samples or more than 50% for one sample (Table 6.4 of the WMP).	• Cease pumping to SB2. • Apply any treatment additives to achieve compliance with sediment water releases. • Truck box cut water to Grants mine water storages. • Investigate potential cause of elevated trigger values. • Identify the potential source associated with the trigger exceedance by qualified personnel. • Review current management plans and update if necessary. • Notify the regulator in accordance with approval and licence conditions.

Table A.2 Sediment basin water quality TARP

Level	Triggers	Action/Response
Level 1	Sediment basin water quality is within than 90% of the SSTVs (Table 6.4 of the WMP).	• No action/response required
Level 2	Sediment basin water quality is between 90% and 100% of the SSTVs (Table 6.4 of the WMP).	• Review laboratory QA/QC and look for potential quality control issue and request a review if a suspected lab error. • Investigate management measures or treatment procedures to manage any unexpected increases in contaminant concentrations. • Investigate to determine if additional controls or management actions are necessary to achieve compliance. • Increase frequency of monitoring.
Level 3	Sediment basin water quality exceeds one or more of the SSTVs (Table 6.4 of the WMP).	• Investigate potential sources of contaminants in the catchment (e.g., WRD, box-cut stockpile, contractor area, box cut, etc.) that are contributing to poor water quality. • Inspect the WRD and, if necessary, sample seepage and or runoff to determine if WRD is affecting sediment basin water quality. • If WRD is found to be impacting on water quality, investigate geochemistry of the WRD. • Investigate options to divert runoff from the source of poor water quality to a mine water storage if required. • Investigate the option of converting the sediment basin into a mine-affected water storage (and prevent uncontrolled spills into the environment) if the sources cannot be diverted or remediated. • Investigate the option of constructing an additional mine water storage and drains to capture runoff from the contaminated area. • Apply relevant mitigation, treatment and contingency measures in level 2 before discharging from sediment basins.
Level 4	Sediment basin water quality exceeds one or more of the SSTVs by more than for three consecutive samples or more than 50% for one sample (Table 6.4 of the WMP).	• Apply any treatment additives to achieve compliance with sediment water releases. • Cease discharging from the sediment basins. • Apply appropriate controls, measures and diversion/remediation options depending on outcomes of investigations in level 3. • Review current management plans and update if necessary. • Notify the regulator in accordance with approval and licence conditions.

Table A.3 Operational surface water quality TARP

Level	Triggers	Action/Response
Level 1	No exceedances in surface water quality within the adopted trigger values for all parameters at the downstream monitoring point (BPDS SW6).	• No action/response required
Level 2	Exceedance in surface water quality parameter trigger values for one monitoring event	• Review laboratory QA/QC and look for potential quality control issue and request a review if a suspected lab error. • Implement investigation to determine potential cause of elevated trigger value. • Investigate the potential source associated with the trigger exceedance. • Investigate any mitigation strategy and contingency measures to mitigate any contamination sources based on the outcomes of the investigation on the potential contamination source.
Level 3	Exceedance in surface water quality parameter trigger values for two consecutive monitoring events	• Investigate potential cause of elevated trigger values. • Identify the potential source associated with the trigger exceedance. • Increase frequency of monitoring. • Apply mitigation and contingency measures in level 2. • Apply water quality treatment in water storages prior to release.
Level 4	Exceedance in surface water quality parameter trigger values for three consecutive monitoring events; or Exceedance greater than three times the trigger value.	• Validate relevant data to confirm trigger exceedance. • Investigate potential cause of elevated trigger values. • Identify the potential source associated with the trigger exceedance by qualified personnel. • Review current management plans and update if necessary. • Initiate investigation for reasons of increase water quality concentrations. • Notify the regulator in accordance with approval and licence conditions.

Table A.4 Proposed groundwater bore water quality TARP

Level	Triggers	Action	Response
Level 1	No exceedances greater than 10% in any background water quality range.	• No action required.	• No response required.
Level 2	Background WQ variation greater than 10% in two consecutive quarterly samples for any analyte	• Investigate surrounding bores monitoring data. • Investigate any operational events which may affect groundwater quality. • Investigate source of contamination on contaminants of concern and bore location. • Review historical monitoring data to determine any trend.	• Investigate any mitigation strategy and contingency measures to mitigate contamination of groundwater bores based on the outcomes of the investigation on the contamination source.
Level	Background WQ variation greater than: 10% in four consecutive quarterly samples or 20% for two consecutive samples for any analyte.	• Review historical monitoring data to determine historical trends. • Conduct water quality trend analysis with surrounding bores. • Investigate source of contamination on contaminants of concern and bore location.	• Increase frequency of monitoring. • Investigation on potential causes from operation on groundwater quality. • Apply mitigation and contingency measures in level 2.
Level 4	Background WQ variation greater than: 20% in four consecutive quarterly samples or 50% for two consecutive samples for any analyte.	• Investigate surrounding bores monitoring data. • Investigate potential sources of contaminants on the environment and implement mitigation measures at the source if possible. • Implement controls at receptors if modelling indicates potential impact.	• Initiate investigation for reasons of increased water quality concentrations. • Assessment of plume extent and fate by qualified hydrogeologist. • Notify the regulator in accordance with approval and licence conditions.

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