Rio Tinto Aluminium Weipa (RTA Weipa)

Progressive Rehabilitation and Closure Plan (PRCP) Rehabilitation planning part

Weipa (ML7024 and ML6024) & Ely (ML7031) Operations - Version 02

4 April 2023

Ely Operations (EPML00562613): Alcan South Pacific Pty Ltd, 155 Charlotte Street, Brisbane, QLD, 4000, (07) 3625 3000

Weipa Operations (EPML00725113): RTA Weipa Pty Ltd, 155 Charlotte Street, Brisbane, QLD, 4000, (07) 3625 3000

Progressive Rehabilitation and Closure Plan (PRCP) – RTA Weipa and Ely Operations

A transitional PRCP prepared for Queensland Department of Environment and Science (DES) in accordance with DES Guideline – Progressive rehabilitation and closure plans (PRC plans).

Project title	RTA Weipa Operations
Document title	Weipa and Ely Progressive Rehabilitation and Closure Plan (PRCP)
Version	02
Document ID	PLN-HSE-COMP-PRCP-02
Date of submission	3 August 2023

Tenure number	**EA Holder**
EPML00562613	Alcan South Pacific Pty Ltd, 155 Charlotte Street, Brisbane, QLD, 4000, (07) 3625 3000
EPML00725113	RTA Weipa Pty Ltd, 155 Charlotte Street, Brisbane, QLD, 4000, (07) 3625 3000

Table of Contents

List of Tables

List of Figures

Appendices

1.0 Introduction

Rio Tinto Weipa (RTW) is required to submit a Progressive Rehabilitation and Closure Plan (PRCP) for its mining operations in Queensland (Qld) in accordance with the *Environmental Protection Act 1994* (EP Act). RTW hold Environmental Authorities (EAs) for the mining operations; EA EPML00725113 and EA EPML00562613 for ML7024/6024 and ML7031 respectively. The main purpose of the PRCP is for the EA holder to plan how and where activities will be carried out on land in a way that maximises the progressive rehabilitation to a stable condition. It also provides the information on the condition to which the EA holder must rehabilitate the land before the EA is surrendered. The PRCPs are required for both the Weipa Operations (encompassing East Weipa, Andoom and Amrun[1] mine areas on Mining Leases (MLs) (ML7024 and ML6024) and Ely Operations (ML7031).

RTW recognises mining across the Weipa and Ely Operations occurs on Aboriginal land, and acknowledges the unique and special connection Traditional Owners have to their country. Three Land Use Agreements underpin all operations and activities across these leases:

- the Western Cape Communities Co-Existence Agreement (WCCCA, signed 2001) (Indigenous Land Use Agreement);
- the Ely Bauxite Mining Project Agreement (EBMPA, signed 1997) (Aboriginal Agreement); and
- the Weipa Township Agreement (WTA, signed 2001).

These Agreements capture the aspirations of the business and Traditional Owners to work together towards creating mutual value for the long term. They lay the foundation for intergenerational benefits and sustainable economic, cultural, social and environmental outcomes – including obligations for progressive rehabilitation and determining post mining land uses.

It is acknowledged that given RTW hold two EAs, two PRCPs are technically required. It is important to note that, in addition to the obvious shared general environmental conditions, mining is conducted seamlessly between the leases, with ore mined from ML7031 being transported directly to ML7024 for further processing, storage and transport. Thus, the integrated nature of the mining operations across the two leases warrants a holistic, integrated rehabilitation and closure planning approach, i.e. a single PRCP Plan. To satisfy administrative requirements, this PRCP report will be submitted separately for each EA, however two separate PRCP schedules have been prepared for the different lease areas and will each be submitted for the individual EAs.

The DES Guideline: Progressive Rehabilitation and Closure plans (PRC plans) (2021) (referred to herein as the PRCP Guideline) provides the information to assist companies in complying with the amendments to the EP Act and the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (Qld) (MERFP Act). It also contains information for existing EA holders for transitioning their mining activity to the PRCP framework. The PRCP Guideline has been used in the preparation of this PRCP, and a checklist as per Section 6 of the DES application form has been provided in Appendix A.

The two components of the PRCP are:

- PRCP planning component (this plan) which provides the background information to the PRCP Schedule.

[1] The Amrun Project is the first stage of the South of Embley (SoE) Bauxite Mine and Port Project. It was renamed in consultation with the local traditional owners. In this plan, the SoE Project is described as the Amrun Project. Future expansion of the Amrun Project through the Norman Creek mine area has been approved as part of the SoE Project.

- PRCP Schedule which includes the development of management milestones and criteria and the timing for each rehabilitation milestone to be achieved. The PRCP Schedule is prepared separately for each lease in the required spreadsheet template (ESR/2019/5103.xls) and within Appendix B.

1.1 Geographic context

The mining operations permitted under EA EPML00725113 and EA EPML00562613 cover an area of 381,538 ha. The MLs are spread across the western Cape York Peninsula between Aurukun in the south to Vrilya Point in the north (Figure 1). The MLs include:

- ML7024 - covers the Amrun mining operations in the south (previously called the Boyd components of the South of Embley Project), the East Weipa operations in the central area, Andoom operations north of Weipa, and a standalone portion of ML7024 near Vrilya Point. ML7024 covers some areas within the township of Weipa.
- ML6024 - covers a small area south of Weipa across the Embley River.
- ML7031 - in the north covers the Ely operations.

1.2 Mining operation summary

Mining of bauxite commenced at East Weipa in 1963 and is currently planned to continue until 2062. The very simple process has not changed much in that time, comprising a basic load and haul operation, beneficiation and transport to customers via ocean-going vessels out of the Port of Weipa and more recently Amrun port. The three mining operations, and their sub-areas, (Figure 1) covered within this PRCP are:

- East Weipa operation
- Andoom / Ely operation
- Amrun operation

1.2.1 Mine areas

Although the MLs cover a large area in the north (including the stand-alone portion of ML7024 in the far north around Vrilya Point and the northern portions of ML7031 (Figure 1), no mining has occurred in this area to date and the current approved mine plan does not include mining in this area, therefore it is not included in this PRCP.

To maintain consistency within this document the figures will be displayed in the same map index extents as shown on Figure 1, which excludes those areas of the ML's that have not been mined and are not planned for in the future under current approvals.

Some figures, including maps, utilised in this PRCP have been sourced from previous Rio Tinto reports, plans and other documents. Where the legend or any other aspect of the figure indicates a timeframe or date, that information is only relevant to the source document, and not this PRCP (unless otherwise noted). Older figures include mine plans which were relevant at the time of the source document preparation only.

1.2.2 Sensitive Receptors

The Weipa and Napranum Townships located adjacent to, and partially within the ML7024 are regarded as the nearest sensitive receptors to the Weipa mining operations. Weipa and Napranum Aboriginal community are shown in Figure 2 relative to the mining leases, key infrastructure and life of mine disturbance extents.

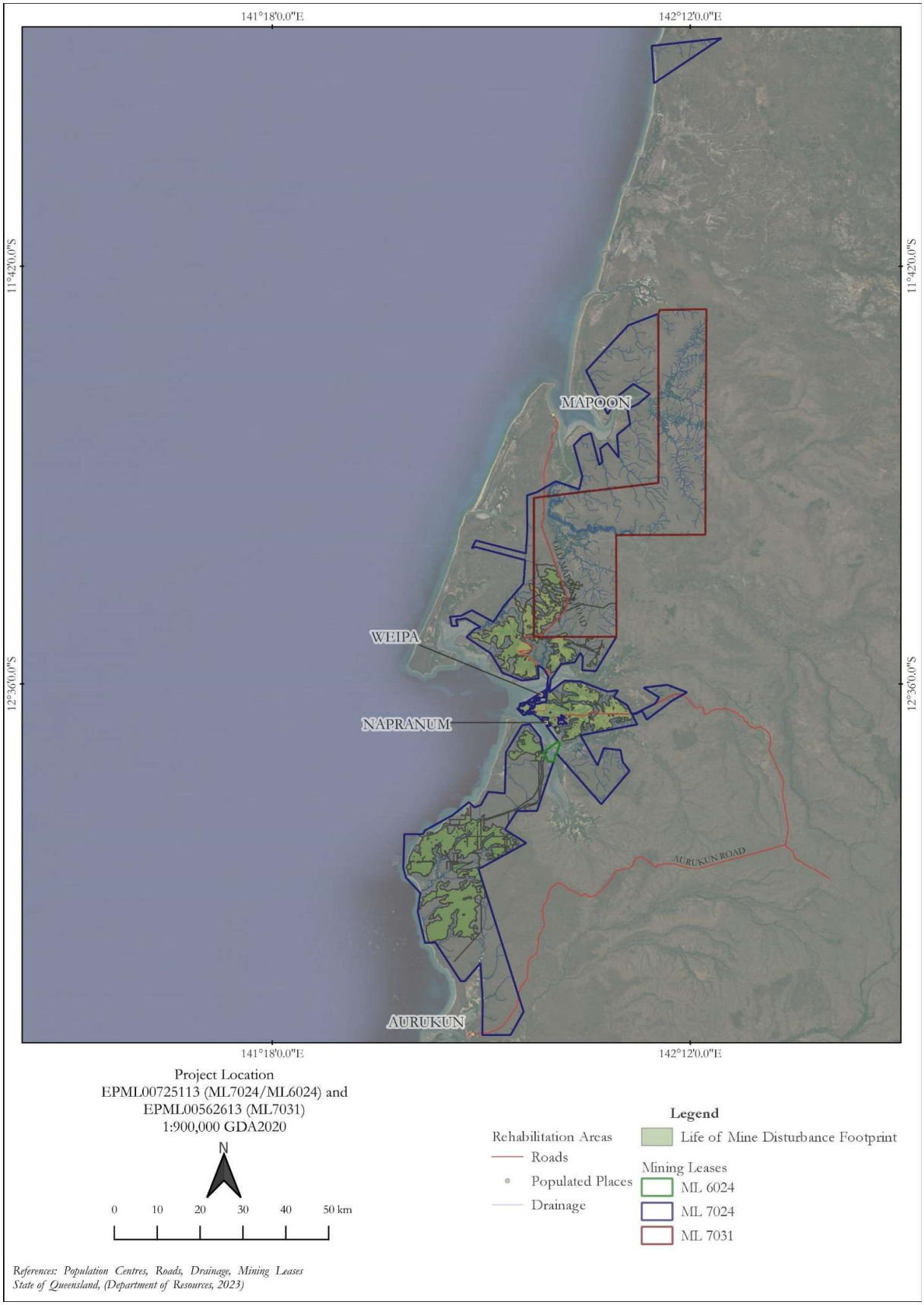


Figure 1: Project location

Figure 2 Weipa and Napranum Town Boundaries

1.2.3 Weipa Township

The township of Weipa was constructed in the 1960s to house a permanent mining workforce and has grown to become the regional hub of the Western Cape York with over 4,100 people (2021 Census data) and many local businesses and government services. Though initially strongly reliant on the existence of the mine, today, the Township and its survival are not intrinsically linked to continued Rio Tinto mining operations.

The town is managed by the WTA. Much of the town is part of the ML7024 lease, however many lots have been excised (e.g. to freehold) to support development of the town, resulting in a mosaic of tenure types across the WTA management area. Some infrastructure that supports the town (e.g. sewage treatment plants, landfill, potable water network, power station, and some airport features within ML) are located on ML7024 and authorised by EA EPML00725113. Whilst not located within the WTA boundary, these facilities are considered 'community' or 'public' infrastructure in relation to mine closure planning, and are identified as potentially suitable for transfer to a third-party who will become responsible for ownership, liability, and ongoing management.

Negotiations have commenced between RT Weipa and the State Government regarding a strategy to transition the Weipa Township from RTW to a local council under the *Local Government Act 2009*. Negotiations include the development of a robust community consultation campaign which will inform the transition strategy.

For State Government, the transition process advantages are threefold. Transition would allow for Weipa to be legislated under the *Local Government Act 2009,* the newly established local government could better serve as a regional hub for other local councils and provide shared services, and, finally, transition would ensure the equal application of rights for Weipa residents as with residents of other local government across Queensland.

The Weipa Town Planning Scheme sets out WTAs intention for the future development in the planning scheme area, over the next 15 to 20 years (Weipa Town Authority, 2019). Part of the planning schemes strategic intent is to guarantee an economic base and sustainable future for Weipa beyond the mine life. The phase out of mining activity surrounding Weipa township is seen as an opportunity for growth beyond the established WTA boundary, subject to resolving tenure constraints, meeting Traditional Owner expectations and aspirations and addressing environmental issues. Strategic and specific outcomes identified within the Weipa Town Planning Scheme which are considered to potentially influence PMLU of ML7024 include:

- The WTA boundary is to be expanded at some point beyond the current boundaries (this would require expansion into parts of ML7024).
    - Strategic framework mapping within the planning scheme identifies potential future areas where this may occur, including identifying Lorim Point infrastructure area as an urban area.
- Future economic opportunities are identified to include establishing alternative primary production businesses beyond the WTA boundary, including seafood processing and agricultural logistics and support businesses in appropriate areas, primarily in industrial areas in proximity to the Port of Weipa.
- The sustainable and reliable supply of electricity responds to population and industry growth and advances in energy efficiency and alternative supply options.
- A safe, secure and efficient water supply is provided through the protection of water sources and water supply infrastructure.

The agreement with relevant stakeholders, including Traditional Owners and the WTA, will be conducted through ongoing consultation plan as described in Section 3.2.

1.2.4 Public and community infrastructure

In addition to the areas within the WTA boundary and associated infrastructure that supports the town within ML7024, additional mining plant and water infrastructure may be left in place for future use by a third party, subject to stakeholder and the administering authority's agreement. RTW have previously commenced

discussions with Traditional Owners regarding these assets and the potential for these assets to remain has been identified within the RTW Rehabilitation Management Plans (RMPs) (Rio Tinto Weipa 2019a, b, c). Consultation regarding these assets will continue through the ongoing community consultation plan (refer to Section 3.2).

In the absence of an agreement with third parties which specifies retention of certain assets, the PMLU for all disturbed areas remains “Native Ecosystems”, scheduled for rehabilitation with the associated milestone criteria applying to these areas.

1.3 Rehabilitation summary

Mine site rehabilitation has been undertaken progressively for over 40 years. During this time, rehabilitation requirements, expectations and techniques have changed. Over the life of the mine, the overall goal of the rehabilitation program has been to return the land to a post-mining land use that will be safe, stable, self-sustaining, requires minimal maintenance and protects downstream water quality.

Returning the mined areas to a native ecosystem became the primary goal of rehabilitation during the 1970s, however, pasture and forestry post mining land uses were also trialled between the 1960s and mid-2000s in collaboration with the government and local stakeholders including traditional owners; under the Western Cape Communities Co-Existence Agreement (WCCCA) and Ely Bauxite Mining Project Agreement (EBMPA). Whilst the WCCCA and EBMPA provide for alternate post-mining land uses, the primary goal of rehabilitation prior to 2008 was “to establish self-sustaining vegetation comprising a variety of native plants, which in turn supports native fauna”. Whereas following 2008, the goal shifted toward establishing a sustainable native ecosystem that is as similar to the pre-existing ecosystem as can be achieved within the limits of recognised good practice rehabilitation methods and the post-mining environment (Rio Tinto Weipa 2019a, b).

Rehabilitation of mined land is currently undertaken progressively after mining activities have ceased, in accordance with the RTW RMPs (Rio Tinto Weipa 2019a, b). Topsoil placed on the mine floor is spread and ripped, prior to seeding with a mix of local native species. Rehabilitated areas are monitored to evaluate progression towards approved completion criteria. Maintenance work, including remediation activities, erosion, weed, and fire control are conducted as required.

Rehabilitation methodology and management is discussed in more detail in Section 6.0.

1.4 Current land outcome documents

The PRCP Guideline recognises that mining companies developing a transitional PRCP often have defined Post-mining Land Uses (PMLUs), rehabilitation objectives, milestones and closure outcomes contained within existing, already approved ‘land outcome documents’ (LODs).

Transitional provisions in Section 3.2 of the PRCP Guideline state that ‘*Where a Post-Mining Land Use (PMLU) has been previously addressed in a land outcome document and is able to be transitioned into the PRCP Schedule, the holder is not required to complete the information requirements under section 126C(1)(j) of the EP Act in this section for those PMLUs’.*

This is relevant for the PRCP schedule, milestones and criteria (Section 6.13) where the hierarchy of LODs (as per Section 750 of the EP Act) has been considered. It is noted that although this is a transitional PRCP the legislative requirements under section 126C(1)(d) of the EP Act still apply. LODs used to develop this PRCP include:

- The EAs
    - EPML00562613
    - EPML00725113
- RMPs

- Rehabilitation Management Plan ML7024 (developed under condition C23 of EA EPML00725113)
- Rehabilitation Management Plan ML7031 (developed under condition C15 of EA EPML00562613)
- Interim Rehabilitation Management Plan (IRMP) SoE ML60247024 (developed under condition C24 of EA EPML00725113)

- Land Use Management Plans (LUMP)
  - Land Use Management Plan North of Embley River (developed under condition C6 of EA EPML00725113)
  - Land Use Management Plan South of Embley River (developed under condition C6 of EA EPML00725113)

2.0 Project planning

2.1 Baseline information

This baseline information section comprises the relevant characteristics that existed prior to mining, which may influence the rehabilitation and closure planning process. Where the full requirement of baseline information is not available, for example due to the extensive history of the site, what is available is provided along with an explanation of the relevance of any (particularly environmental) other available regional information from the region. Where insufficient information is available, it is generally in relation to low-risk aspects and is presented as either a commitment to undertake further work to redress the gap or a justification as to why it is not relevant.

2.1.1 Topography

The MLs are situated in the Weipa Plateau province of the Cape York Peninsula bioregion (Sattler and Williams 1999). They contain diverse landscapes dominated by the tertiary laterite of the undulating Weipa plateau and extensive coastal plains adjoining the Gulf of Carpentaria. Vrilya Point near the Jardine River and Pera Head to the south of Weipa both feature tall red bauxite cliffs along the coastline. Figure 3 provides the topography overview of the region, with Figure 4, Figure 5 and Figure 6 showing the topography of Weipa, Andoom/Ely and Amrun areas respectively.

Several large rivers pass through the MLs including the Ward River near Aurukun and the Embley, Hey, Mission and Pine rivers around Weipa. In the north are the Dulhunty, Ducie and Wenlock rivers. The Watson and Archer Rivers flow south of ML7024. There are also numerous smaller creeks and drainage lines.

2.1.2 Climate

Weipa lies within the Australian Monsoon Zone and has a distinctive wet (summer) and dry (winter) season. The main Bureau of Meteorology (BOM) station used for the operations is located at Weipa's Aerodrome (Weipa Aero, BOM station #027045). Table 1 outlines climate averages from that station. The recorded long-term average annual rainfall for the area is 1,911 mm. The monthly mean rainfall ranges from 1.4 mm in July to 502 mm in February. Mean daily potential evaporation ranges from 5.0 to 8.9 mm, and the recorded average annual pan evaporations is upward of 2,400 mm (BOM 2017).

The area typically experiences warm summers and winters with a comparatively narrow temperature range. Maximum temperature ranges from 31˚C on average in July, to 35.8˚C on average in November. Average minimum temperatures range between 18.7°C and 24.3°C. Mean 9 am relative humidity varies from 83 to 86% in January, February and March to 61 to 69% in August, September, and October (BOM 2017).

The onset of the wet season can vary, with approximately 97% of rain falling between November and April. High variability in monthly rainfall is evident from year to year, within years, and over a range of sites in the local area. Up to 80% of average annual rainfall occurs as a result of tropical cyclonic events during the wet season months of December to April, together with convective storms that often develop in the late afternoon. One cyclone, on average, is expected to be formed in the Gulf each year, with two to three occurring in the Coral Sea (Dames and Moore 1996).

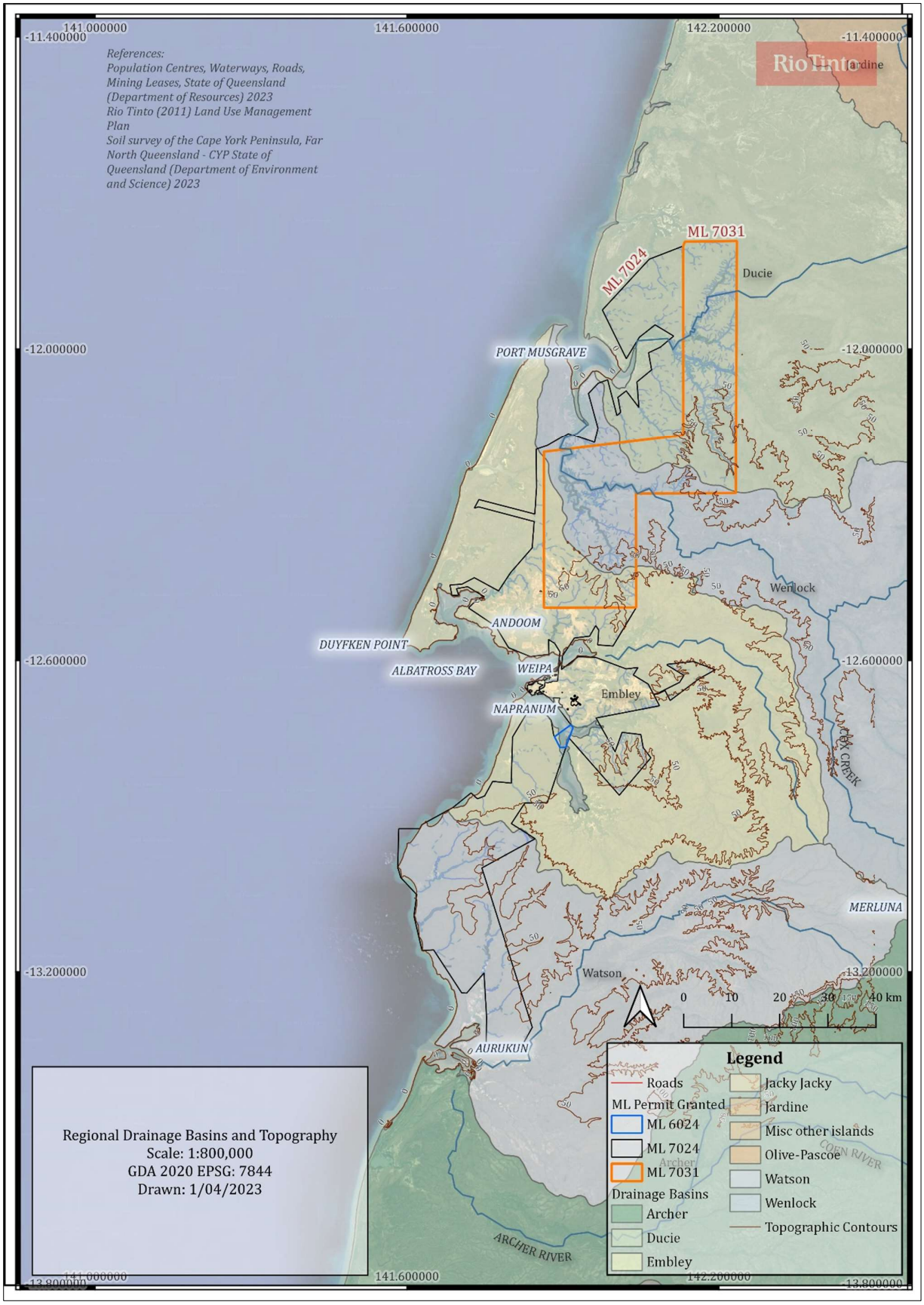


Figure 3: Regional topography and drainage basins

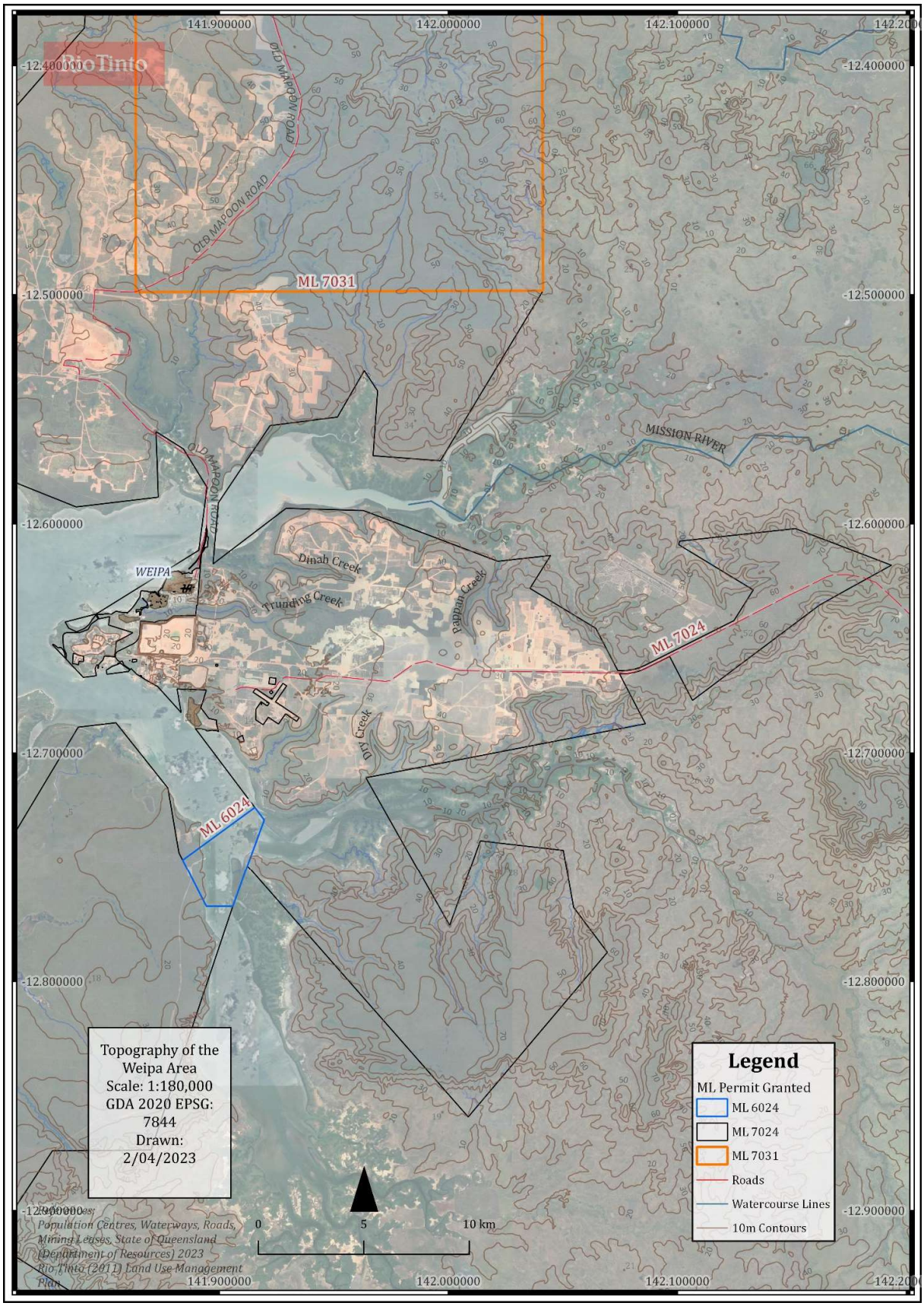


Figure 4: Topography of the Weipa Area

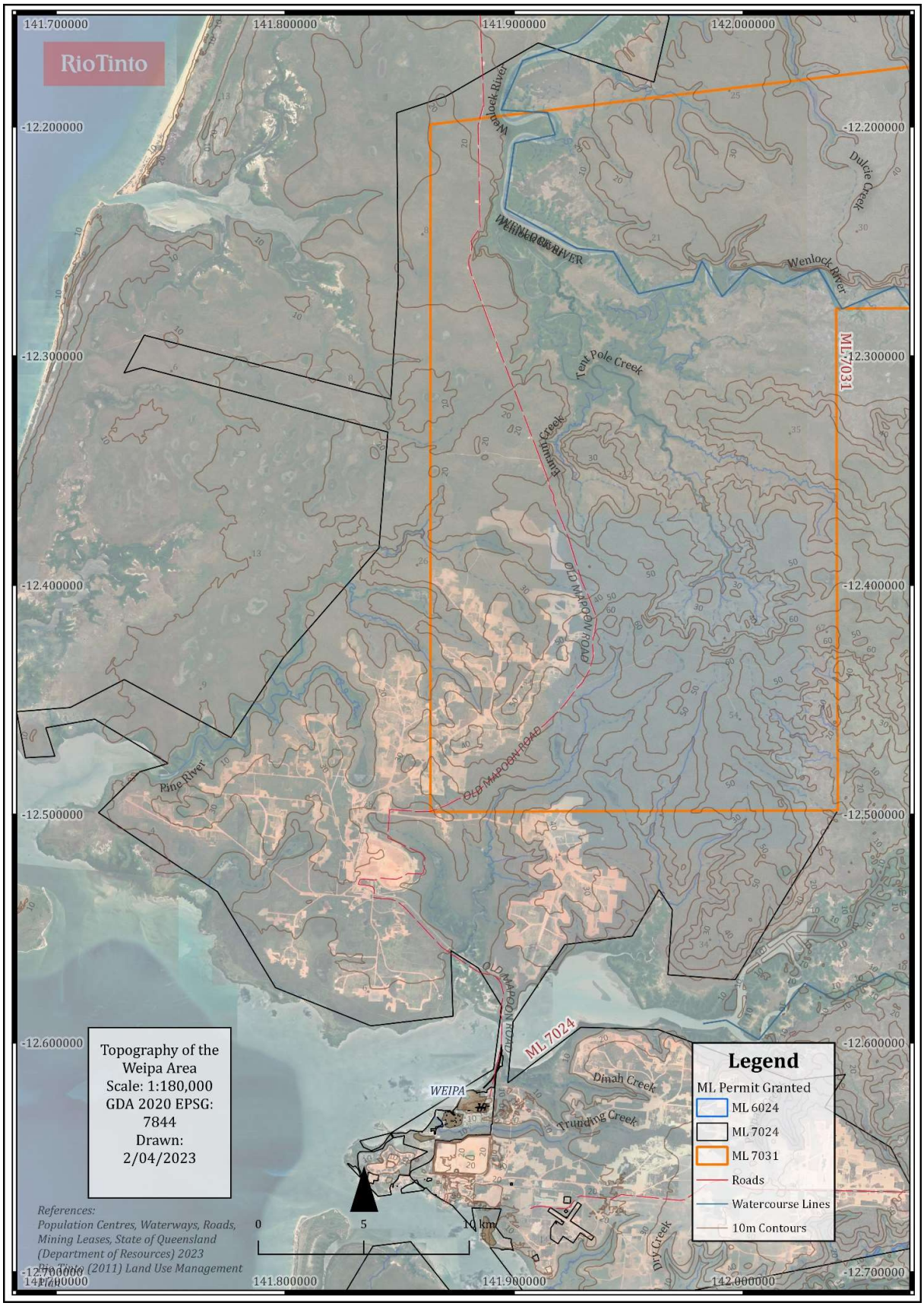


Figure 5: Topography of the Andoom and Ely Area

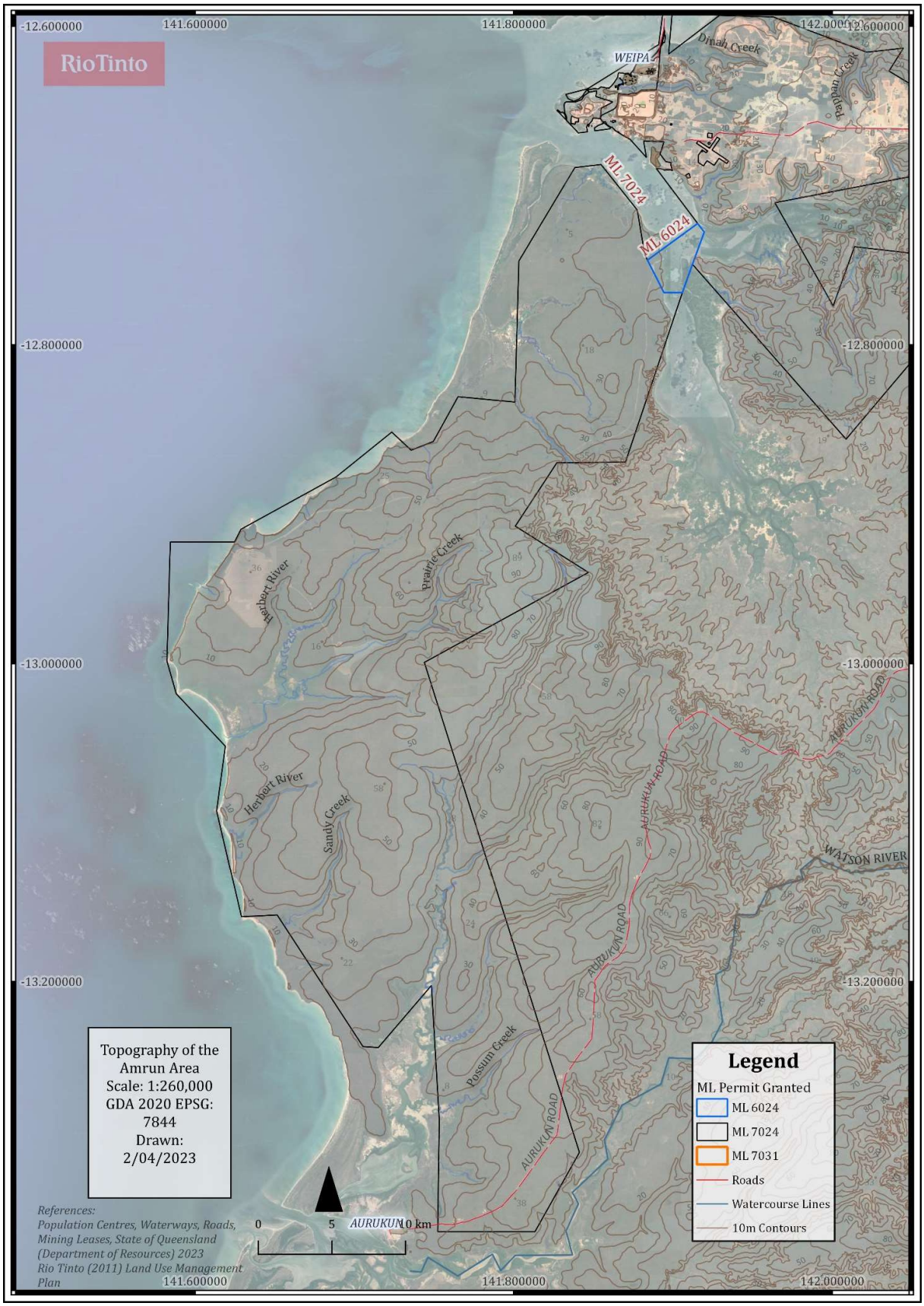


Figure 6: Topography of the Amrun Area

Table 1: Climate averages – Weipa Aerodrome (BOM)

Month	Temperature (°C) (1992-2021)		Relative humidity (%) (1992-2011)		Evaporation (mm) (2009-2021)	Wind Speed (km/h) (1992-2011)		Rainfall (mm) (1990-2021)		
	Mean max	Mean min	9am	3pm	Mean Daily	9am	3pm	Mean Monthly	Highest Daily	Highest Monthly
Jan	32.0	24.3	83	73	5.6	11.4	15.8	482	356	910
Feb	31.5	24.2	86	76	5.0	9.7	13.9	502	201	502
Mar	31.8	23.9	83	70	5.1	11.4	13.7	405	245	405
Apr	32.3	22.9	77	59	5.9	15.6	16.2	97.9	144	97.9
May	31.9	21.4	75	52	5.9	15.9	16.9	20.3	67.6	20.3
Jun	31.0	20.0	74	49	5.8	15.5	18.5	3.4	18.6	3.4
Jul	31.0	18.9	72	44	6.3	15.6	18.8	1.4	5.8	1.4
Aug	32.1	18.7	69	41	7.1	17.0	18.8	5.1	24.4	5.1
Sept	34.4	19.8	65	37	8.3	18.7	19.2	1.5	8.2	1.5
Oct	35.7	21.8	61	39	8.9	19.2	19.2	19.6	46.0	19.6
Nov	35.8	23.5	64	46	8.5	16.5	18.1	95.8	110	95.8
Dec	34.1	24.2	75	60	6.8	12.7	15.4	271.2	136	271
Annual average	**32.8**	**22.0**	**74**	**54**	**6.6**	**14.9**	**17.0**	**1,911**	**-**	**-**

2.1.2.1 Long-term climate projections

The long-term climate projections are important to understand when planning for mine closure. The Qld Government (DES 2019) has published projections regarding climate change in the Cape York region, which are summarised in this section.

For the near future (2030) of Cape York, the annual average warming is projected to be between 0.5 and 1.2°C above the climate of the 1986-2005. The region's current summer average temperature is 28°C, however with these projections could rise to 29°C by 2030 and over 31°C by 2070. By 2070, the projected range of warming is 1.8 to 3.3°C, depending on future emissions.

As for temperature, high climate variability is to remain a major factor influencing rainfall changes over the next few decades. Rainfall changes for 2070 continue to show a large amount of variability, with the intensity of heavy rainfall events likely to increase. Tropical cyclones, although going to be less frequent, are expected to be more intense.

Change in fire frequency depends on the spatial variability of future rainfall. However, when and where fire does occur, its behaviour is likely to be more extreme.

The Fifth Intergovernmental Panel on Climate Change (IPCC) assessment report on climate change predicts a sea level rise of 0.28 to 0.61 m by 2100 (Church *et al*. 2013). RTA's modelling of the Weipa area indicates that sea levels could rise between 0.08 m and 0.12 m by 2049. Based on these predictions, sea level rise would not impact the operations (Rio Tinto Alcan 2011).

2.1.3 Geological setting

The project area is situated in the Carpentaria Basin in the Western Cape region, which consists of marine and fluvial sediments. The geology of the Western Cape region is represented by the following geological units which are listed in descending stratigraphic order (Rio Tinto Alcan 2011):

- Coastal dunes
- Estuarine and delta deposits
- Ferruginous duricrust, including bauxite (the Aurukun Surface which is derived from laterised Bulimba Formation). This formation is part of the Wyaaba beds.
- Trunding Clay

- Napranaum Sand
- Bulimba Formation
- Rolling Downs Group
- Gilbert River Formation
- Garraway Beds
- Permian Basement Rock.

The MLs occur within the Batavia Landscape and are situated on the Weipa plateau (Rio Tinto Weipa 2019a, b). The Batavia Landscape is associated with the laterised Bulimba Formation and Rolling Downs Group (siltstone, labile glauconitic sandstone and mudstone). Figure 7, Figure 8 and Figure 9 shows the mapped geological units of the ML areas, and these are described in Table 2.

Table 2: Geological units of the project area

Geological unit	Dominant Rock	Age	Description
TQd\a	Duricrust	Late Tertiary - Quaternary	Aluminous laterite, including bauxite; with sandy 'A' horizon; deep weathered Aurukun surface (younger events). This unit is the source of the commercial bauxite deposit.
Qc	Alluvium	Quaternary	Mud, silt and sand; coastal flats.
Qhcb	Sand	Holocene	Moderately well-sorted, fine to coarse-grained quartzose to shelly sand and some gravel; beach ridges and cheniers.
Bulimba Formation	Sedimentary	Paleocene - Eocene	White to pale grey or reddish brown, poorly indurated, clayey quartzose to feldspathic sandstone, poorly sorted granule to (locally) pebble conglomerate and sandy claystone; commonly ferruginised
Rolling Downs Group	Mudrock	Early Cretaceous – Late Cretaceous	Siltstone and mudstone; minor glauconitic sandstone

The dominant geological unit of the project area is the Duricrust (TQd\a), which consists of aluminous laterite including bauxite. It is underlain by the Bulimba Formation, which was deposited as an extensive alluvial fan system within the region and is considered the parent material from which the aluminous laterite was derived (Dames and Moore 1996). In the Amrun area, there is a transitional zone of kaolinite clay between the bauxite and sandstone layers, as shown in Figure 7 (Rio Tinto Alcan 2011). In the other ML areas, the bauxite has more direct contact with the ironstone gravel in a mottled clay matrix.

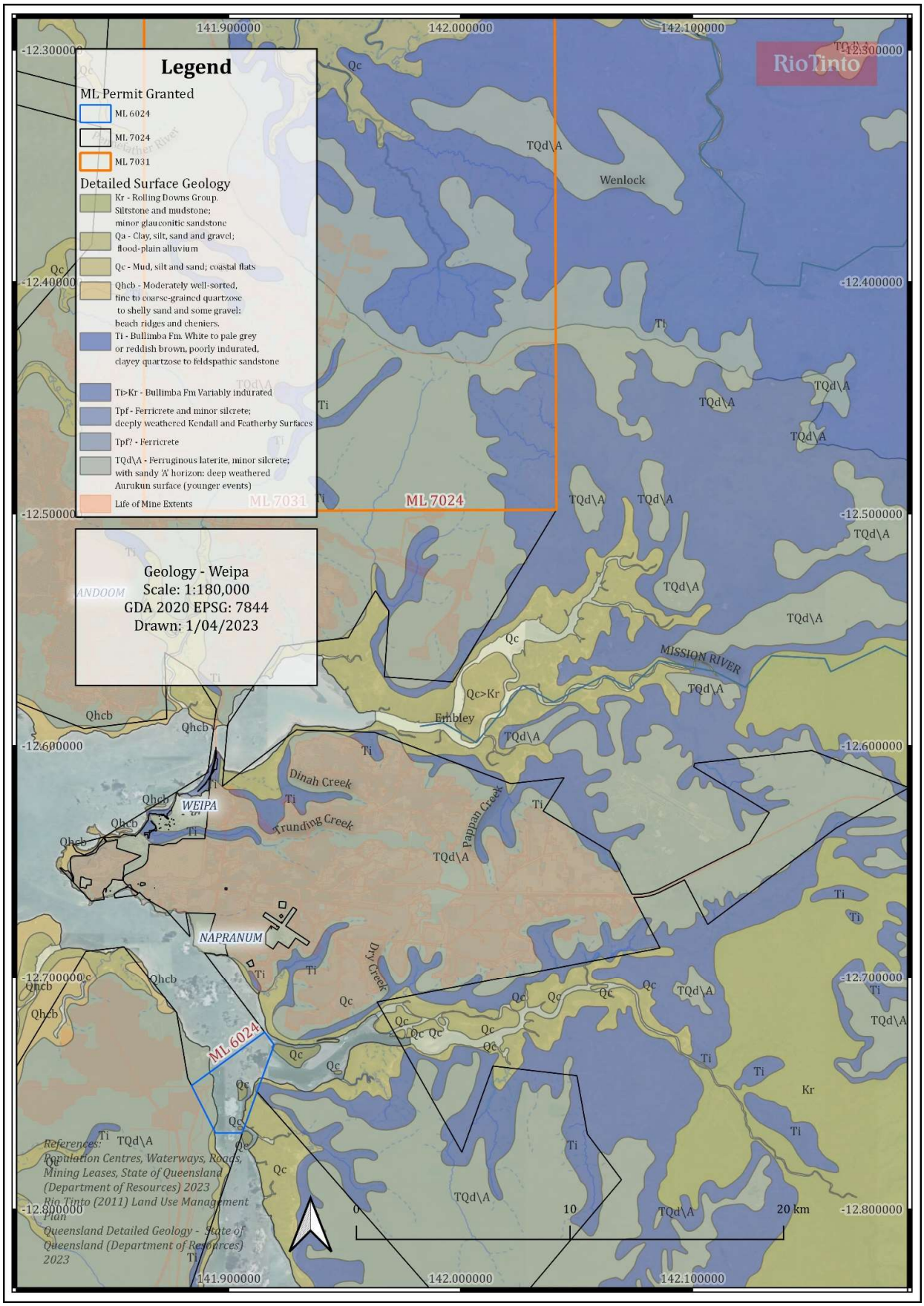


Figure 7: Geological mapping units of the Weipa area

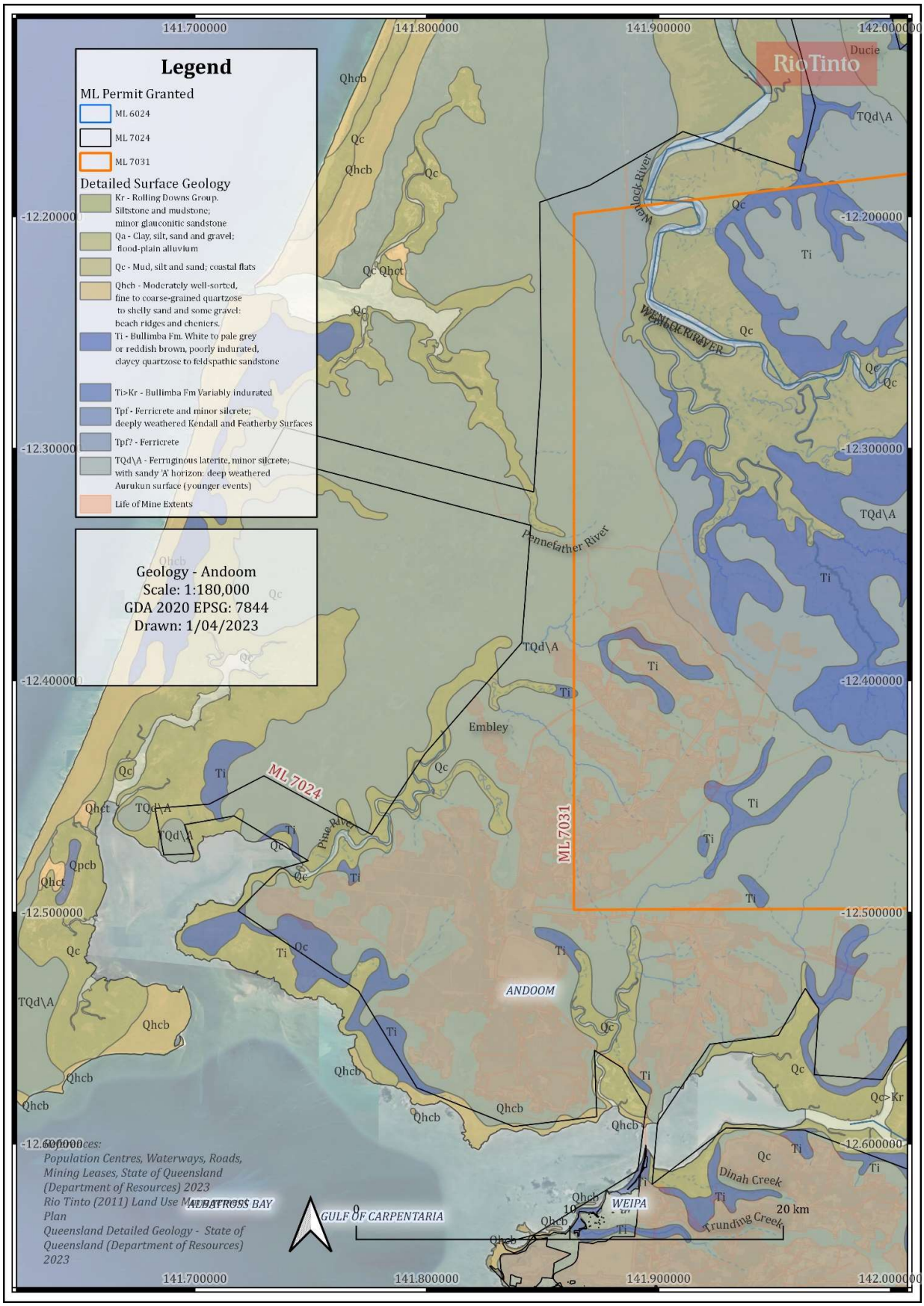


Figure 8: Geological mapping units of Andoom and Ely area

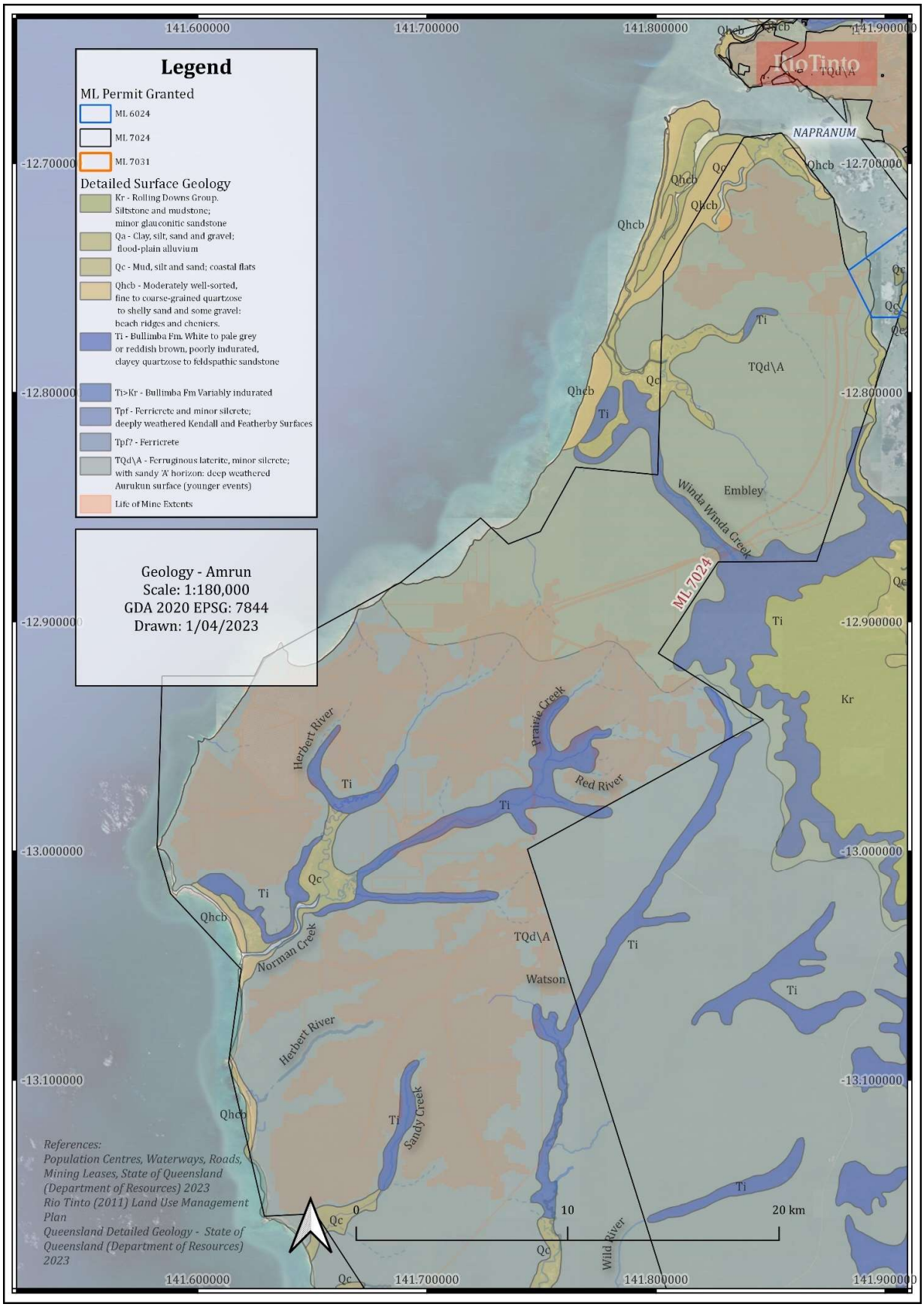


Figure 9: Geological mapping units of the Amrun area

2.1.4 Hydrology

2.1.4.1 Regional context

Weipa's mining operations are located along the western coast of Cape York Peninsula on gently undulating bauxite plateaux incised by a network of rivers and smaller creeks. Numerous semi-perennial watercourses plus smaller ephemeral creeks flow in a (generally) westerly direction eventually discharging into the Gulf of Carpentaria.

The Weipa peninsula is bounded by the Mission River to the north and the Embley River to the south, and forms part of the Embley drainage basin (Figure 3). The Andoom and Ely mining areas lie to the north of the Mission River, with most mining activity (thus far) falling within the Embley drainage basin, and areas of undisturbed mining lease extending north into the Wenlock River and Ducie River catchments. The Amrun mine area lies to the south of the Embley River, extending almost to the Watson River near Aurukun, and is co-located within the Watson and Embley drainage basins.

While the large rivers are considered perennial, due to dry season discharges from the shallow aquifer systems, most creeks flow only in the wet season. These river systems and portions of their associated tributaries are tidally influenced and are typically marked by mangrove swamps at the estuarine margins.

The tidal channels of the various river and creek systems in the area of the mining leases all have variable depths, ranging from <1 m to over 6 m, maintained by the natural scouring action of ebb tidal flows and wet season freshwater discharges (Dames and Moore 1996). In terms of stream geomorphology and channel stability, streams and creeks in the area are stable, with very little active bed incision or deposition, nor major bank scour or failure occurring. In some locations there is localised movement of particularly erodible material, however all entire streams and creeks are generally stable.

2.1.4.2 General hydrology

A key characteristic of surface waters in the bauxite plateaus is that most are intermittent *sensu stricto*, in that they hold water during the wet season and for a period afterwards, but that most water bodies dry out before the end of the dry season. Wet season rainfall typically commences in November, but it is usually not until January, after soil moisture stores are filled, that streams show appreciable flow. Thereafter, flows rise until March or April in response to wet season rainfall and then decline once rainfall ceases. The middle and lower reaches of most creeks tend to exhibit continuous (but receding) flow into the dry season becoming tidally influenced at the lower reaches in the dry season.

There are perennial to semi-perennial refugia within most catchments, but some may not have refugia in all years. There is typically strong connectivity between ground and surface waters, and stream flow and linear extent are groundwater driven for most of the dry season where present, with only minor contributions from fluvial sediments and aquifers. Perennial lakes are apparently functionally ground water lenses and/or spring fed with few sufficiently deep to persist through the dry season without recharge.

The proportion of surface runoff across the four drainage basins is remarkably small (<1%) and reflects the flat topography and the very high infiltration rates of the soils and lateritic strata (Rio Tinto Alcan 2011). This results in streamflow that does not respond quickly to runoff until after the catchment is appropriately saturated and there is no "first flush" response to rainfall at the start of the wet season. The intermittent waters are predictably inundated each year, with the initial stream flow in the wet season, followed by water pooling and then drying.

Water quality in creeks and streams varies considerably during this seasonal cycle, with decreasing water quality as pools develop and begin to dry up, although organisms residing within these ecosystems generally have a lifecycle strategy adapted to these dynamics and are resilient to naturally occurring variations in physicochemical stressors.

The water quality characteristics of the freshwater creeks and streams of the area reflect the nature of water flowing through and within bauxite terraces, with the laterite layers acting as a physical and chemical filter resulting in very clear, almost salt-free surface waters. The systems are characterised by low conductivity, , solute concentrations and hardness, although they have naturally elevated dissolved aluminium concentrations (Rio Tinto Alcan 2011). Fauna activity such as wild pigs can cause elevated turbidity at times, particularly in the late dry season when water levels and streamflow are low.

Baseline water quality of a number of freshwater creeks and the major rivers in the Weipa/Andoom (Northern Operations), Ely and Amrun mining areas is collected as part of their respective Receiving Environment Monitoring Programs (REMPs). In summary, the water quality of freshwater creeks (in the region can be characterised as:

- pH: 4.0-7.8
- Field EC: 11-91 µS/cm
- Turbidity: 0.1 – 56 NTU (note: A single measurement of 930 NTU from an Amrun creek has been omitted from the range as an outlier)
- TSS: <5 – 120 mg/L
- Dissolved Al (filtered): <5 – 668 µg/L

At the end of the wet season (June/July), freshwater streams in and around the mining leases achieve their lowest levels of conductivity, pH and turbidity due to the combined effects of groundwater recharge and freshwater concentration from direct rainfall. Creeks located close to estuarine water are subject to higher pH and conductivity levels resulting in higher pH increases within the intertidal zones.

2.1.4.3 Watercourses and stream orders of the mining leases

As detailed in the RTW Land Use Management Plan, watercourse data provided by DNRM has been used to map watercourses within the mining leases and the Strahler stream order system has been applied to assign stream order to each stream reach.

The DNRM mapping has been undertaken at a scale of 1:100,000 and therefore represents a preliminary representation of the extent and location of watercourses, particularly with respect to headwater streams. Watercourses are shown in Figure 10 for East Weipa and Andoom, and Figure 11 for Amrun.

The following definitions of a watercourse are used to identify watercourse location and extent during ground-truthing.

The “Regional Vegetation Management Code for Western Bioregions – version 2” defines a water course as the area of land between the high banks of a natural channel (whether artificially improved or not) in which water flows permanently or intermittently, and that is represented as:

- A creek, stream, river or watercourse at a scale of 1:100 000 on the Vegetation Management Watercourse Map; or
- A creek, stream, river or watercourse at a scale of 1:250 000 on the Vegetation Management Watercourse Map where there is no 1:100 000 map available.

The Regional Vegetation Management Code doesn’t define the terms “channel” or “banks” but the *Vegetation Management Act* defines “bed and banks” as follows:

- Bed and banks, of a watercourse or lake, means land over which the water of the watercourse or lake normally flows or that is normally covered by the water, whether permanently or intermittently.
- Bed and banks, does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater.

Based on these definitions a channel must have a bed over which water normally flows, whether permanently or intermittently but that a channel does not include adjacent land that is from time to time covered by floodwater.

There are only two stream order 4 watercourses on the mining leases, which are defined as relevant watercourses for the under Section 41C of the EP Regulation. These include:

- Marmoss Creek which only briefly intersects the mining lease to the south-east of the East Weipa mining area;
- Lower reaches of the Ward River towards the south of the Amrun mining area.

2.1.4.4 Mine area hydrological characteristics

Localised surface water catchments and sub-catchments have been delineated from digital elevation data for the Weipa, Andoom, Ely and Amrun mine areas as shown in Figure 12 to Figure 14 respectively. Given the homogenous nature of the landscape, the key differentiator between local catchments is catchment size and connectivity of streams to the shallow groundwater aquifer. The smaller the catchment, the more highly ephemeral stream flow becomes.

Area specific hydrological characteristics and features of the Weipa, Andoom, Ely and Amrun mining areas are presented in Table 3.

Table 3: Hydrological features of the Weipa, Andoom, Ely and Amrun mining areas

Mining area	Hydrological features specific to the area
Weipa	Three types of swamps are prominent within the area: swamps along margins of drainage lines, spring fed swamps and basins of seasonally flooded swamps. These are summarised as follows: • Willum Swamp – basins of seasonally flooded swamps, contains standing water continuously. • Beening Creek, Strong Creek and Trunding Creek also contain swamps located along the margins of these drainage lines.
Andoom	Several swamps of environmental interest occur within the Andoom area. These are summarised as follows: • Blue Water Swamp – outer margins of internal drainage depressions • Top Luang - outer margins of sink holes and internal drainage depressions • Pine River Swamp – basins of seasonally flooded swamps • Tea Tree Swamp – outer margins of sink holes and internal drainage depressions • Botchet Swamp – basins of seasonally flooded swamps. Andoom Creek also contains basins of seasonally flooded swamps along its extent, while Luthing Creek contains swamp areas in the outer margins of sink holes and internal drainage depressions.
Ely	There is one constructed dam (Ely Dam) located on the Ely Lease (ML7031), which has a maximum storage capacity of 4.38 gigalitres (GL) and a catchment area of 18.25 km^2. Ely Dam receives water from direct rainfall, catchment runoff, catchment baseflow and direct groundwater seepage. The dam is managed to release an 'environmental flow' (Dec to July) to sustain downstream aquatic and riparian ecosystems.
Amrun	There is a constructed freshwater dam at Amrun (Arraw Dam) which can store up to 11 GL[2] and has a dam catchment area of 77km^2 (Rio Tinto Alcan 2011). Arraw Dam receives inputs from direct rainfall, catchment runoff, catchment baseflow and direct groundwater seepage. The dam is managed with the ability to release an 'environmental flow' to sustain downstream aquatic and riparian ecosystems.

[2] Arraw Dam is licensed for expansion to 29GL

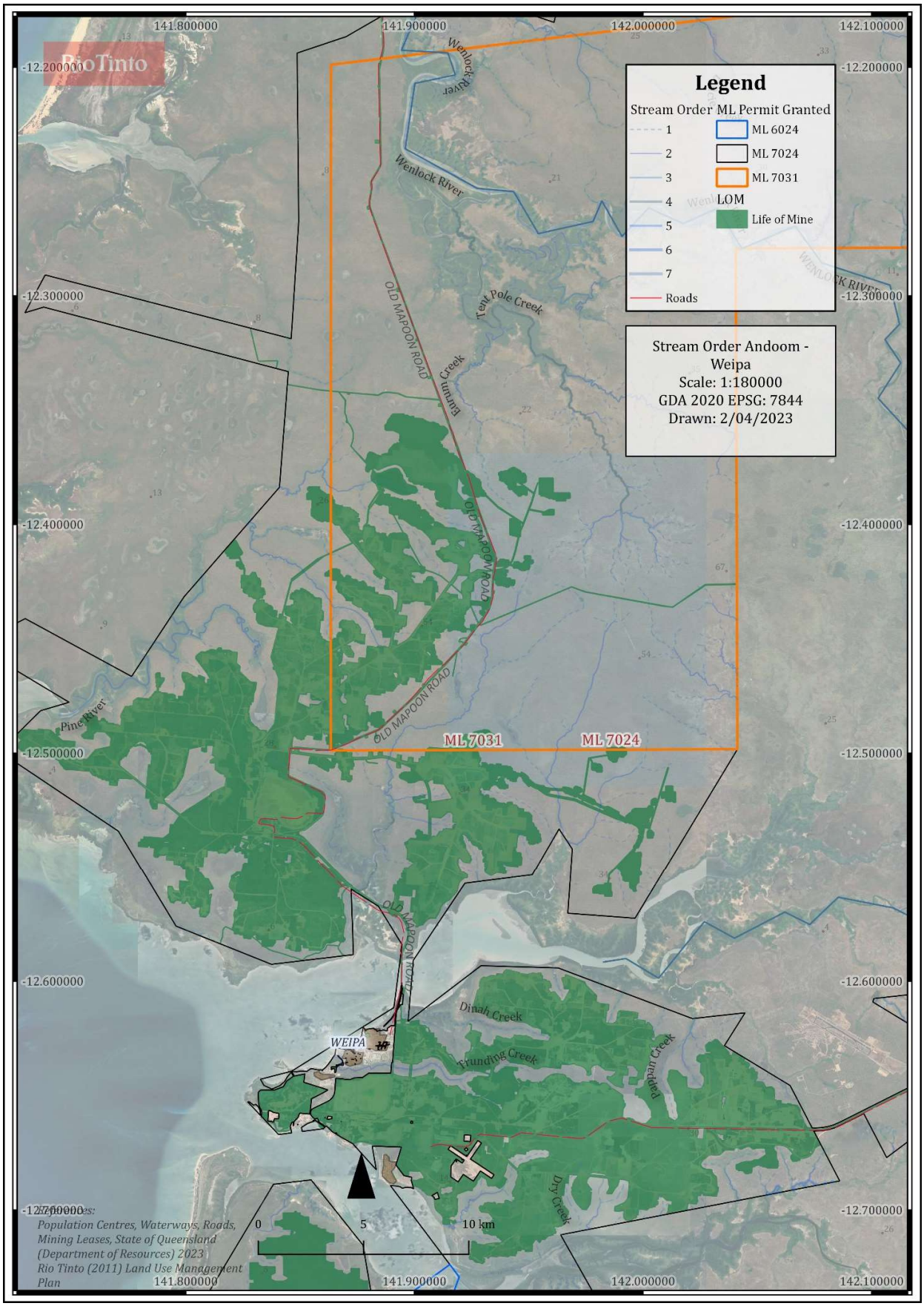


Figure 10: Watercourse and stream order for East Weipa and Andoom

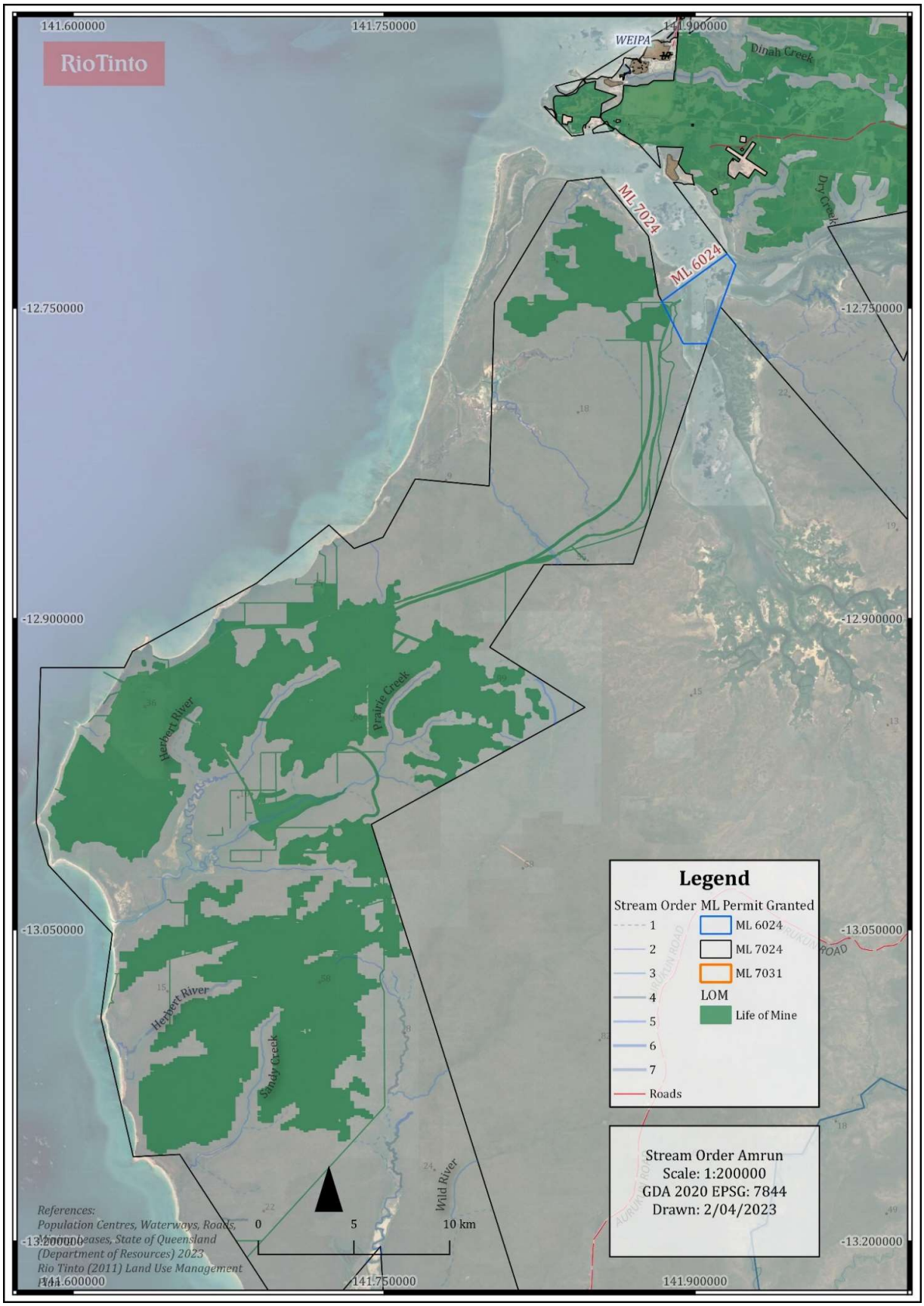


Figure 11: Watercourse and stream order for Amrun

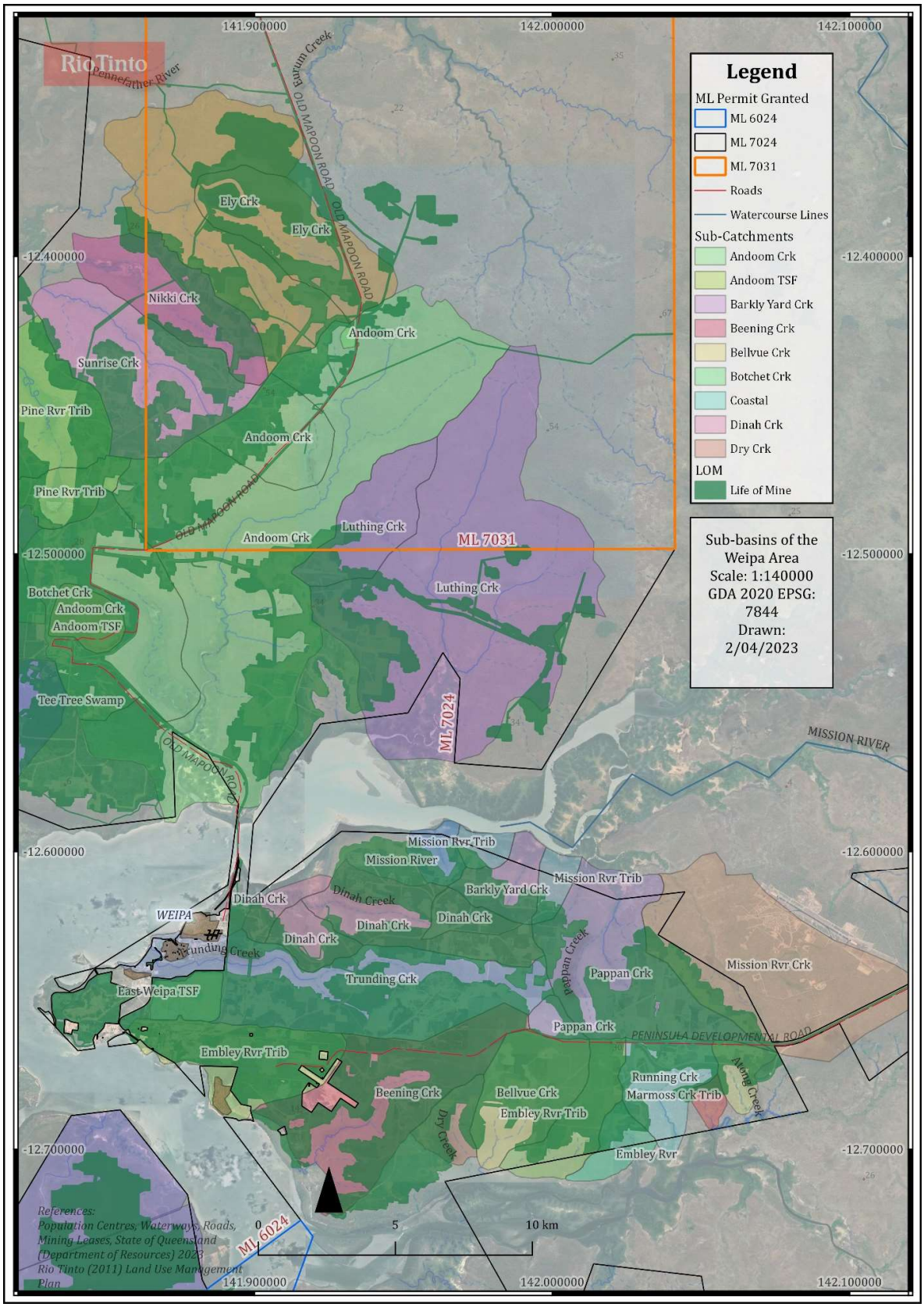


Figure 12: Surface water catchment and sub-catchment boundaries – Weipa

Progressive Rehabilitation and Closure Plan (PRCP) Rehabilitation planning part

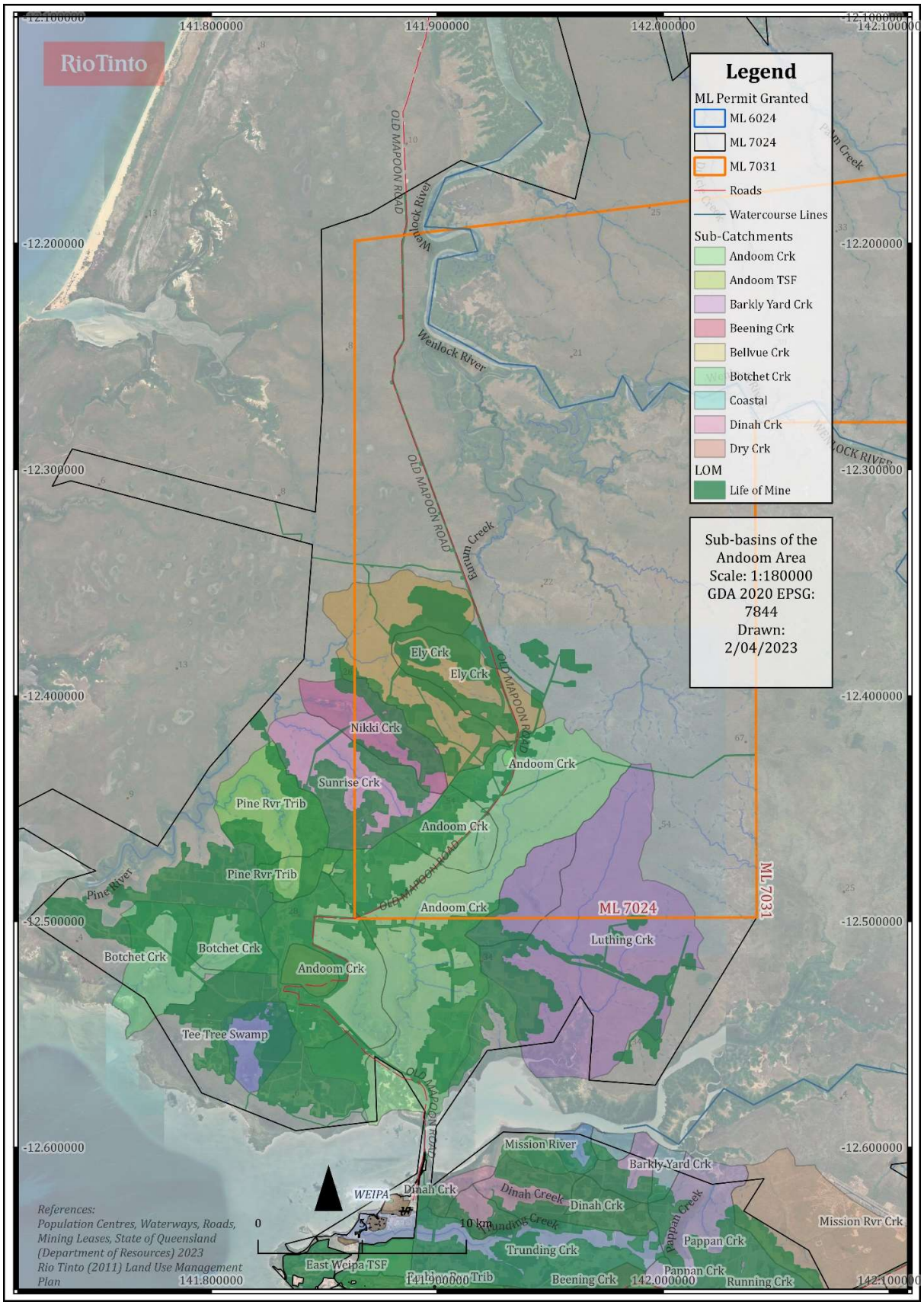


Figure 13: Surface water catchment and sub-catchment boundaries – Andoom

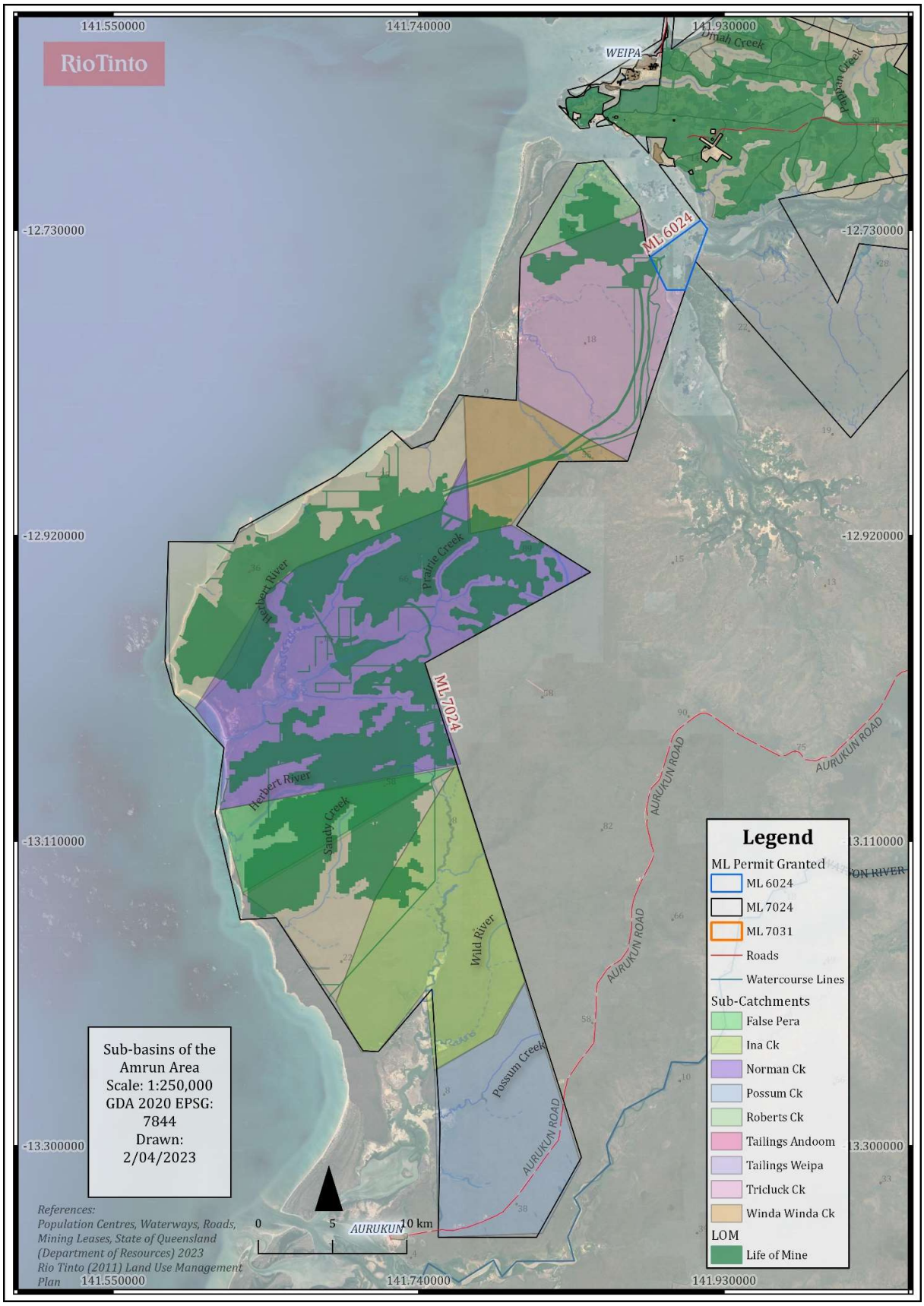


Figure 14: Surface water catchment boundaries – Amrun

2.1.5 Hydrogeology

Groundwater occurrence on the west coast of Cape York can be considered as two entities; the shallow aquifer and artesian aquifer resources. The shallow aquifer resources are generally found between 0-20m below the surface and occur within the formations above the Rolling Downs group, while the artesian water body commences about 700m below ground, hosted within the Gilbert River formation and Garraway Beds (Figure 15).

This section shall discuss the groundwater properties and levels for these aquifers within the three distinct mining areas of Weipa, Andoom/Ely and Amrun. Hydrogeological Conceptual Models (HCMs) for the shallow aquifers have been developed, including consideration of operational and post-operational impacts, and are provided in Section 6.3.

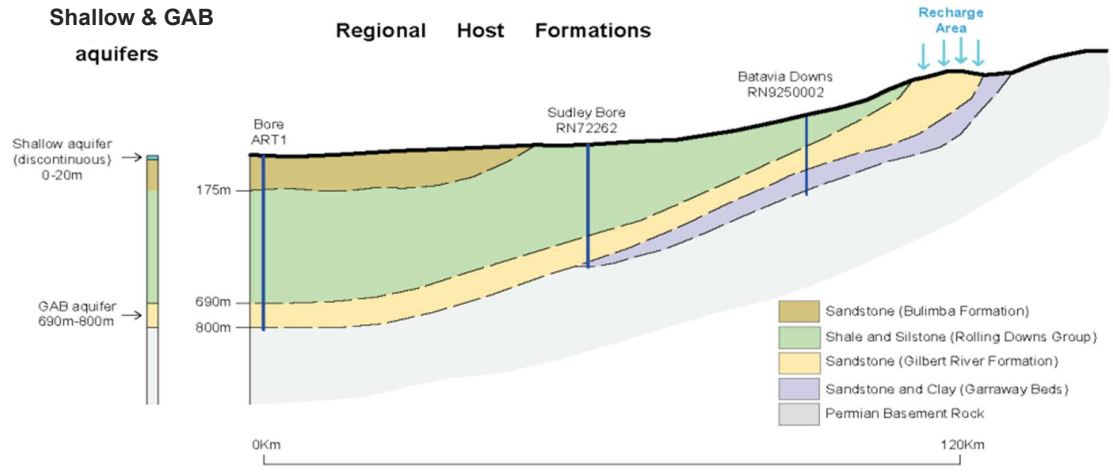


Figure 15: Typical groundwater aquifer profile in the area

2.1.5.1 Shallow Aquifers

The shallow aquifers typically occur above the Rolling Downs Group within coastal dunes, estuarine and deltaic deposits, bauxite units and Wyaaba beds, and the Bulimba Formation (Figure 15). They are primarily driven by rainfall recharge in the local area, rising during the wet season, and dropping during the dry season, typically occurring at depths varying from 6 m to 10 m above sea level, and varying in thickness from 3 m to 30 m, thinning towards the west.

The shallow aquifers have localised recharge mechanisms associated with groundwater-surface water interactions and rainfall infiltration and runoff. In the shallow aquifers, the groundwater flow direction is a subdued reflection of topography. The shallow aquifers discharge via rivers and creeks, and directly into the ocean causing localised drawdown of the water table. The shallow aquifer system of the Weipa peninsula is a significant resource, while those in and around the Andoom/Ely and Amrun mining areas are considered intermittent at best.

The Weipa peninsula shallow aquifer is unique to the mining leases due to the presence of the Napranum sand layer which sit above the relatively impermeable Bulimba Formation and form an unconfined aquifer where it is overlain by bauxite, and a confined or semi-confined aquifer where overlain by silt/clay. The formation is typically constrained to old stream channels, which trend easterly, with the sediments not continuous and not always hydraulically connected (Rio Tinto Alcan 2011). In general, in the Weipa peninsula aquifer lies less than 20m below the surface and broadly flows west and then radially outwards to the coast (as depicted in Figure 16).

Recharge to the Weipa peninsula shallow aquifer is primarily though vertical seepage, with water temporarily held within the bauxite and ironstone layer. A silt/clay layer beneath the bauxite is sufficiently permeable to

allow these high recharge rates of the underlying shallow aquifer in response to rainfall. Overland run-off is minimal until the infiltration capacity of the bauxite has been reached.

The Weipa peninsula shallow aquifer is a high yielding source of good quality water and is used to supply potable water to Weipa township as well as the Lorim Point, East Weipa and Andoom mine centres. It also serves as supplementary process water for the East Weipa operations.

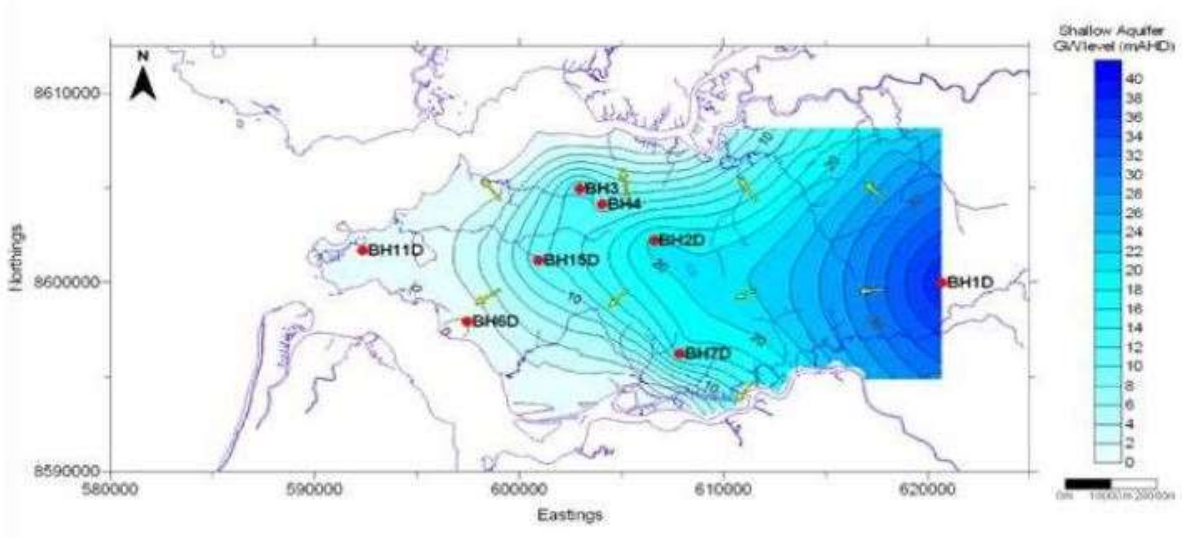


Figure 16: Shallow aquifer groundwater contour flows at Weipa

In the Andoom and Ely area, a similar Napranum sand shallow aquifer is largely absent, with isolated occurrences only. The Trunding clay and silt layer generally forms an effective base in this area, which is negligibly permeable. Within these areas, the bauxite is the single water bearing unit with the underlying ironstone/clay acting as a barrier to vertical permeation. There is a general east to west flow direction or flow following the local topography.

At Andoom, only a small volume of shallow aquifer water is extracted to provide potable water to the mine centre. Freshwater inputs as supplementary process water are obtained from Ely Dam (after tailings decant, water management slots and other sources are exhausted). A hydrograph for the Andoom and Ely shallow aquifer bores and the response to rainfall is provided in Figure 17 and the water level contours for 2011/2012 and 2012/2013 wet seasons in Figure 18.

In the Amrun area, like Andoom, the shallow aquifer formation only appears in limited parts. Similarly, the Bulimba Formation is less developed in this area and is not a viable water source south of the Embley River. The bauxite layer is present typically as a laminate overlying the clay layer within which poorly developed and discrete aquifers are present. Therefore, the shallow aquifers are not uniform and have poor connectivity (the shallow aquifer groundwater flows are not mapped for the Amrun region due to the discontinuous nature of the shallow aquifer in this area).

Groundwater levels during the dry season are typically 4 m to 8 m below the base of the bauxite. A representative hydrograph of the groundwater response to rainfall at an Amrun monitoring bore (MB01) is provided in Figure 19. Localised semi-permanent baseflow into streams and tree swamps has been observed, even at the end of the dry season. This indicates that although the extent of the shallow aquifers might be limited in places, the aquifer parameters such as storativity and transmissivity are highly variable and are capable of supporting high baseflows at specific locations (Figure 20).

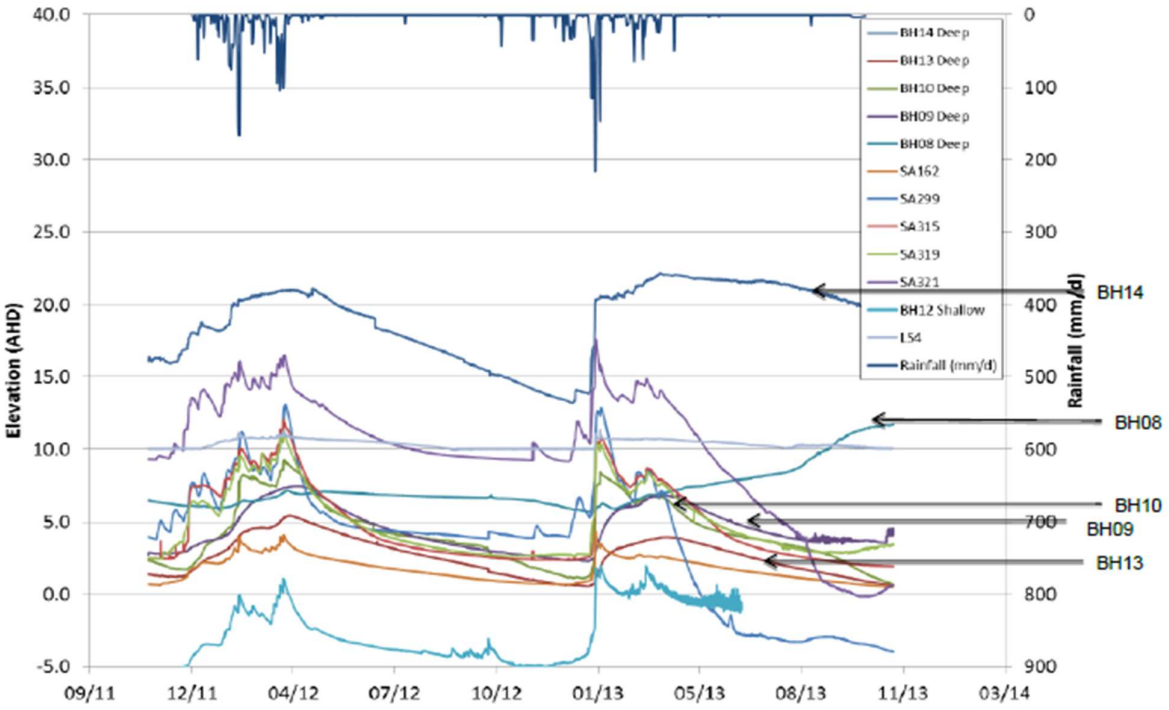


Figure 17: Andoom and Ely shallow aquifer hydrographs (2011-2013)

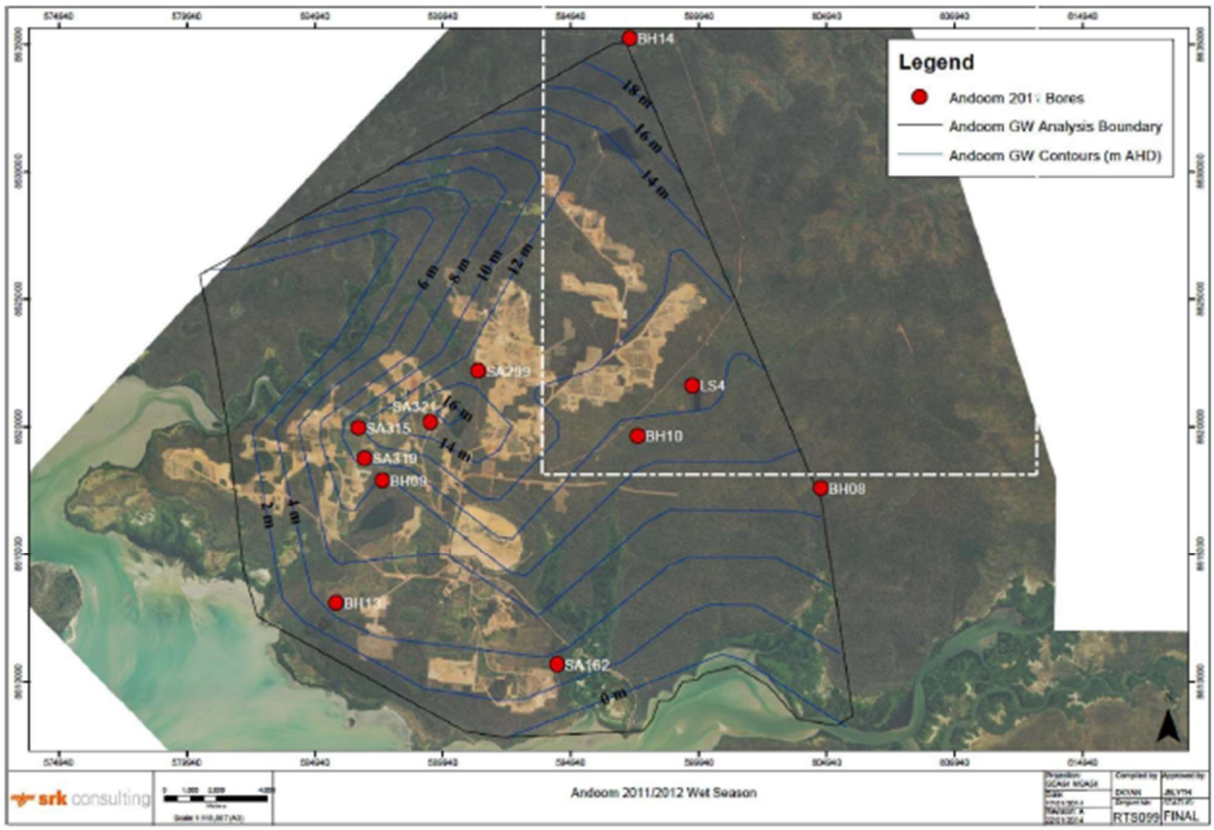


Figure 18: Andoom and Ely water level contours for 2011/2012 wet season

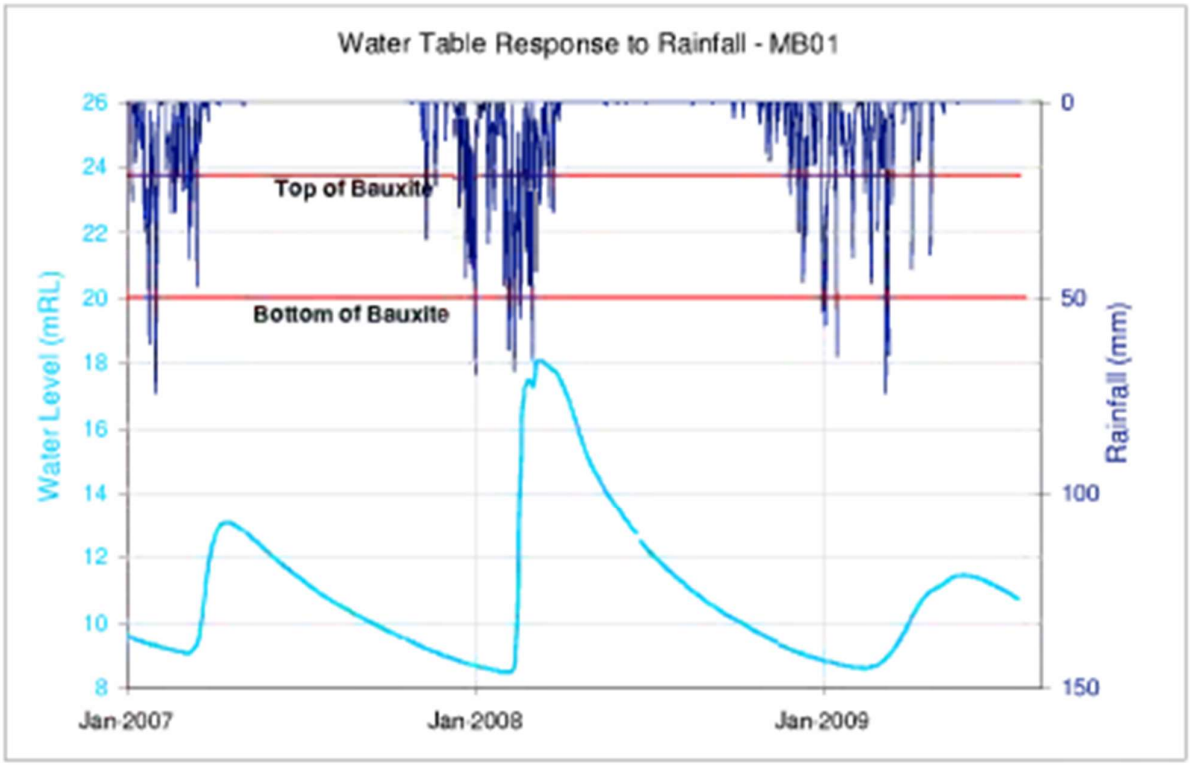


Figure 19: Groundwater level in response to rainfall at Amrun monitoring bore MB01

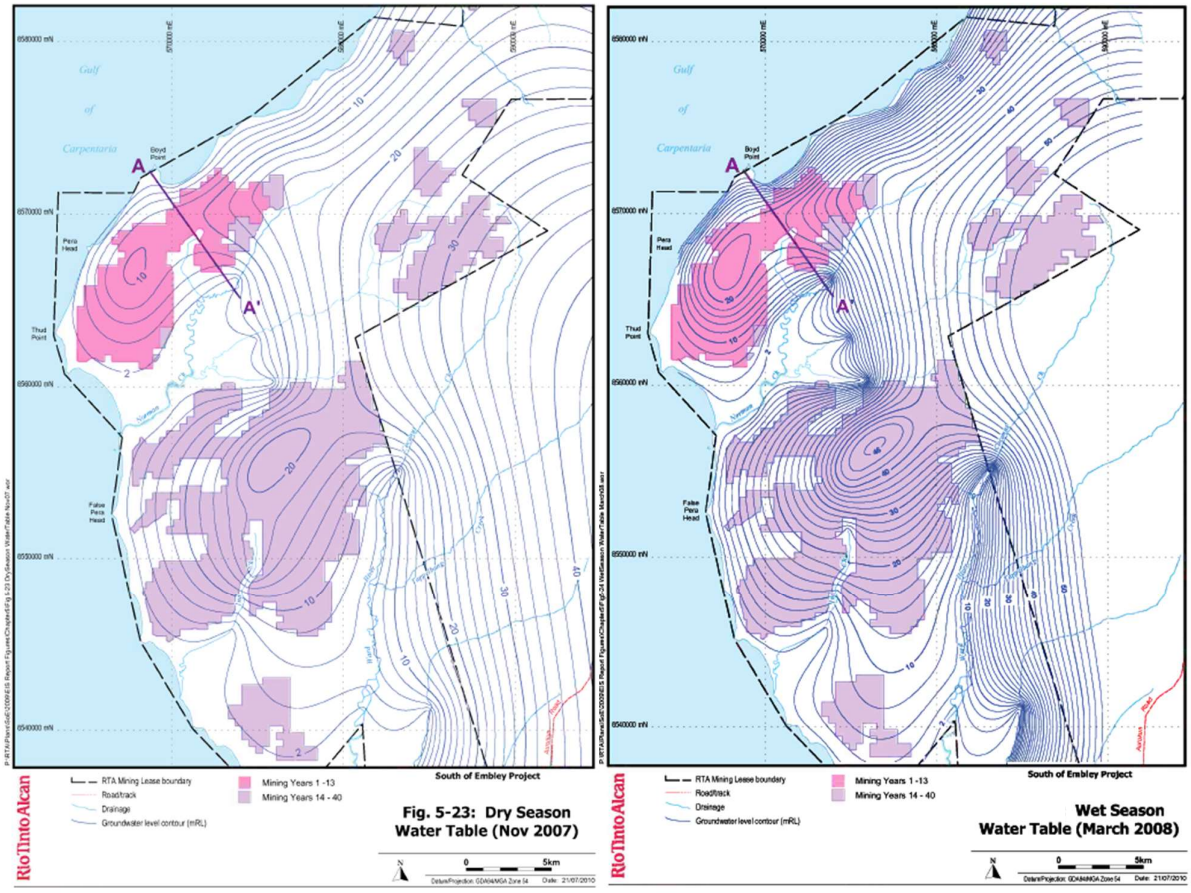


Figure 20: Amrun groundwater levels during the dry and wet seasons

In general, water quality of the shallow aquifer is similar to surface water quality, hence its suitability (with basic treatment) as potable water. For example, an early study at Ely found the baseline shallow aquifer water quality to be within the applicable receiving environment guidelines except for iron which was marginally elevated (Dames & Moore 1996).

More recent water quality results for the Amrun shallow aquifer indicate that the pH is acidic to slightly acidic, ranging from pH 3.9 to 6.5 (Rio Tinto Alcan 2011). Most of the groundwater is fresh; however, depending on the location, and the subsequent influence of the tidal regime, some groundwater is saline, ranging from 635 µS/cm to 21 600 µS/cm (at SOE01). Hardness ranged from <1.0 to 6 mg/L $CaCO_3$, which is reflected in the surface waters suggesting a linkage of surface water features to groundwater. The values of parameters measured in the groundwater generally tend to reflect those recorded for the surface waters with the exception of higher concentrations of copper, nickel and zinc in the groundwater. (However, it should be noted that the samples were collected mostly at the end of the dry season when the residence time of groundwater would be at its longest, and certain elemental concentrations at their maximum.)

2.1.5.2 Artesian aquifers

The regional artesian resource is confined below the Rolling Downs Group, within the Gilbert River Formation and Garraway Beds (Figure 15), and forms part of the Great Artesian Basin (GAB). The lithology of these units is a fine to coarse grained quartzose sandstone with pebble conglomerate and siltstone. Artesian conditions occur from the coastal margin inland to areas where topography lies up to 30-40 m above sea level, and the resource typically occurs about 700 m to 1000 m below ground level (Rio Tinto Alcan 2011; Dames and Moore 1996).

Recharge of this artesian resource is believed to primarily occur in the Great Dividing Range, 120 km east of the Weipa area, via fractured sandstone of the Gilbert River Formation during annual rainfall events, particularly along watercourses. Transmissivity in the artesian aquifer varies between 1 and 5 m per year. A typical hydrogeological cross-section of the artesian resource, from east to west across the area, is shown in Figure 15.

Artesian bores provide supplementary process water to operations only when needed, after the preferred sources such as tailings water harvesting, slots, and shallow aquifer (at Weipa) or freshwater dams (at Andoom/Ely and Amrun). Artesian water is viewed as a last resort water source due to the importance of the resource as well as unfavourable water properties for process requirements. The artesian bore field is (including a few non-operational bores) shown on Figure 21.

Earlier studies of the Andoom/Ely region (Dames and Moore 1996) found:

- East to west flow rates in the artesian aquifer Gilbert River Formation and Garroway Beds, as estimated using radiometric dating, are between 1 to 5 m/year, with residence times of 20 000 to 100 000 years. Based on a hydraulic gradient of 8×10^{-4}, and transmissivities of 700 m^2/day, the estimated through flow under the Andoom/Ely area would be about 10 000 m^3/day.
- The Gilbert River and Garroway Beds are under artesian pressures (24 to 35 m above ground level (aGl)). Water levels at Batavia Downs show little seasonal variations. The nearest monitoring bore in the Gilbert River Formation is at Andoom (RN35613).

Monitoring results from five existing artesian bores at the Weipa operations indicate that artesian water quality is variable (Rio Tinto Alcan 2011):

- pH ranged from 4.7 to 8.3;
- Artesian water is generally brackish with EC ranging from 1,800 µS/cm to 16,000 µS/cm, with variable cation, anion and metals concentrations
- Elevated hardness corresponds with chloride, sodium and total dissolved solids concentration in water.
- Dissolved iron ranged from <100 µg/L to 2,000 µg/L, while dissolved manganese ranged from 40 µg/L to 1,500 µg/L.
- Water temperatures vary from 30°C in the shallower areas to over 100°C in the deeper areas.

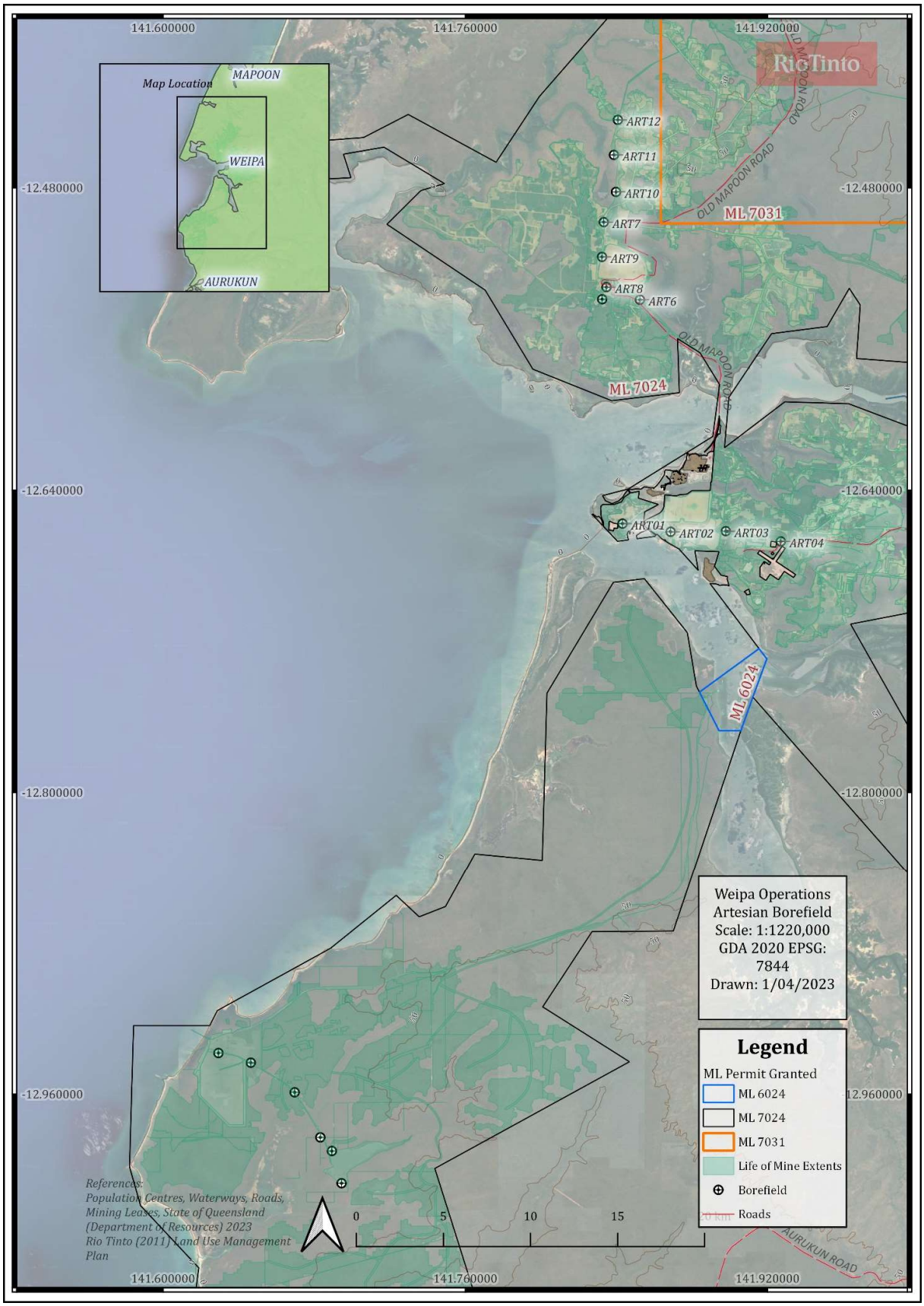


Figure 21: Weipa operations' artesian aquifer borefields

2.1.6 Soil

A general overview and description of the soil types, soil properties and productivity for the area surrounding the project is provided in this section.

2.1.6.1 Soil types

The soil types in the region have been mapped as part of the Cape York Peninsula Land Use Study (CYPLUS) to a scale of 1:250,000k (Biggs and Philip 1995). The study described seven soil landscapes on the Cape York Peninsula, which are based on distinctions in physiography and geology as well as elements of vegetation and current land use. RTW leases are located entirely within the Batavia Landscape and situated on the Weipa plateau.

Figure 22 - Figure 24 shows the soil types mapped within the project area, and Table 4 provides a summary of these soil types.

Table 4: Soil type summary

Soil type name	Soil type map unit	Relevant geological unit	Australian Soil Classification	Typical landform
Weipa	Wp (1-3)	T&Qa – Tertiary and Quaternary Bauxite	Red Kandosol	Gently undulating plains to undulating rises on plateaus
Andoom	Ad	T&Qa – Tertiary and Quaternary Bauxite	Yellow Kandosol	Gently undulating plains to undulating rises on plateaus
Bertie	Bt	KTi – Bulimba Formation	Red Kandosol	Undulating rises
Scorpion	Sp	KTi – Bulimba Formation	Yellow Kandosol	Undulating rises
Mapoon	Mp	Ql – Quaternary swamp deposits	Hydrosol	Lakes and swamps
Skardon	Sd	Quaternary coastal deposits – marine sediments	Hydrosol	Tidal flats, playas, plains
Caravan	Cv	Quaternary coastal deposits – older sand deposits	Orthic Tenosols	Dunes, beach ridges
Batavia	Bv	Rolling Downs Group	Yellow or Brown Dermosol	Gently undulating plains to undulating rises
Marina	Mn	Quaternary coastal deposits – marine sediments	Aquic or Grey Vertosol	Tidal flats, playas, plains
Somerset	Ss	Quaternary coastal deposits – recent sand deposits	Orthic Tenosol	Foredunes, beach ridges
George	Go	Quaternary coastal deposits – marine sediments	Hydrosol	Tidal flats, playas, plains
Vrilya	Vy	Quaternary coastal deposits – recent sand deposits	Rudosol	Foredunes, beach ridges

Source: Biggs and Philip (1995).

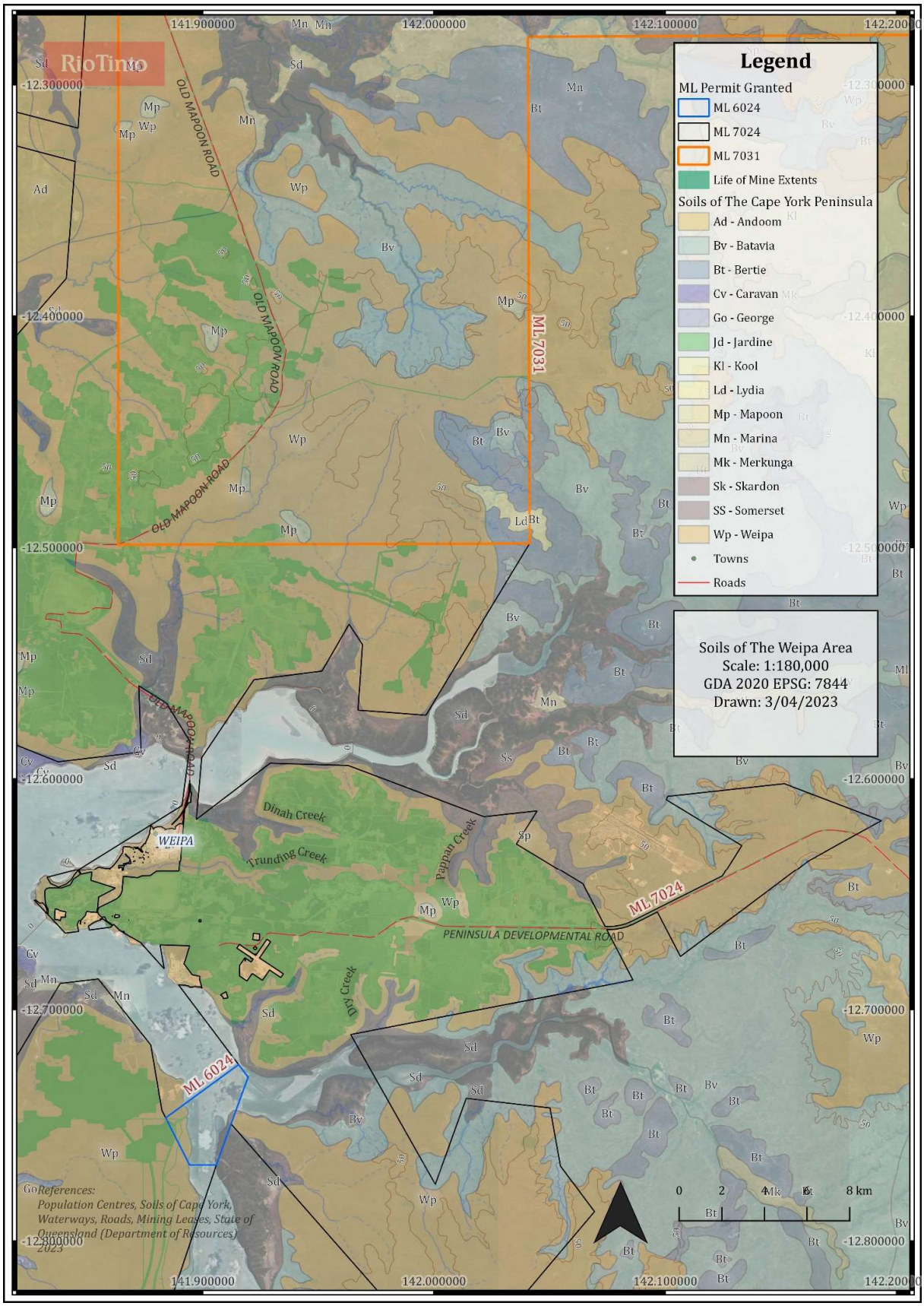


Figure 22 Soil Types Weipa Area

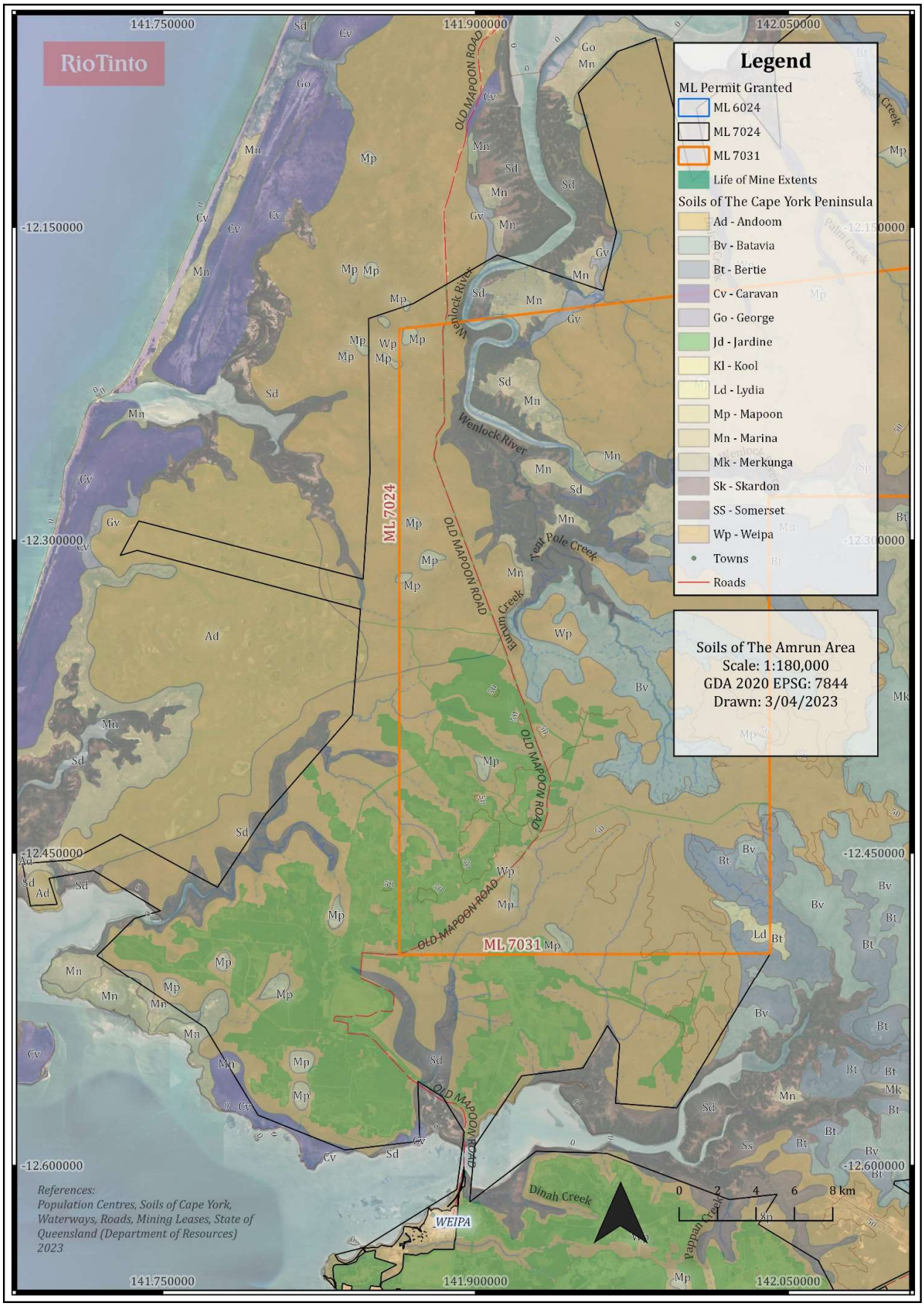


Figure 23: Soil types within the Andoom and Ely area

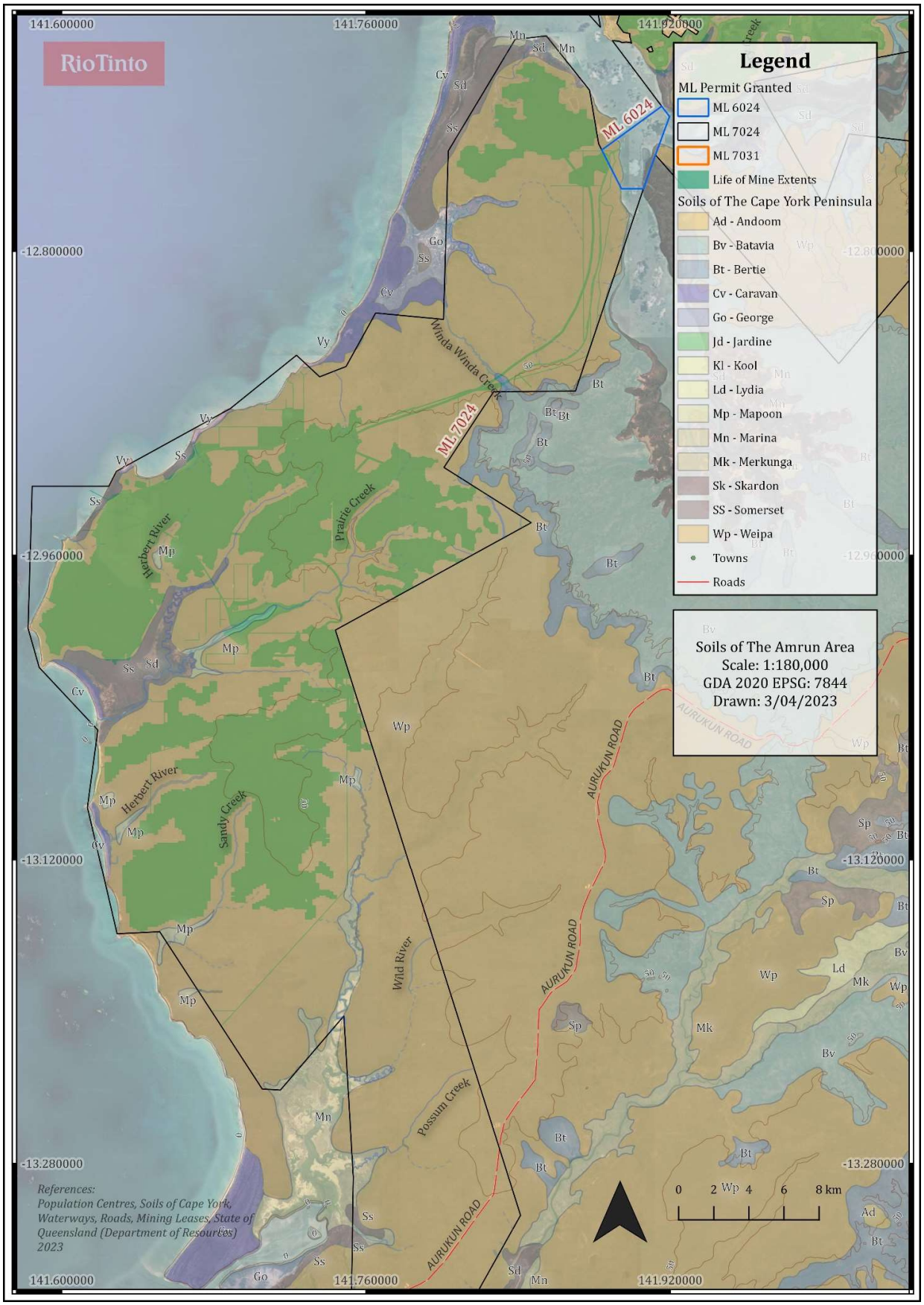


Figure 24: Soil types within the Amrun area

2.1.6.2 Soil properties and productivity

Soil surveys undertaken in the project area confirmed that Red Kandosols dominate the landscape with characteristics including:

- Red in colour
- Massive structure (structureless)
- Textures are typically sandy clay loam to light clay
- Depth varies from moderately deep (0.5 – 1.0 m) to very deep (>1.5 m) (to the bauxitic horizon)
- Coarse fragments are typically abundant on the surface of and throughout the soil profile
- Soils are generally highly permeable and well drained (to the bauxitic horizon)
- Slightly to moderately acidic with a pH range generally of 5.7 to 6.5
- Low salinity and chloride levels
- Often sodic, particularly in the sub-soils (exchangeable sodium percentage >6%)
- Low levels of calcium, magnesium and potassium
- Extremely infertile and nutritionally deficient soils with low levels of Colwell extractable phosphorous and very low exchangeable potassium
- Nutrients such as nitrogen, calcium and potassium present in the surface of soil, due to nutrient recycling in the litter layer. This layer represents the main nutrient storage capacity for tropical soils.

Various trials have been undertaken on the site over the years, aimed at testing the productivity of the soils. When rehabilitation began in 1966, initial rehabilitation research aimed to create a commercially viable industry for the local population, and considered a range of options, including pasture for grazing and commercial forest and horticultural crops. These trials were found to be unsuccessful for a range of reasons including low soil productivity to sustain commercial agriculture and were discontinued. Subsequently while the WCCCA and EBMPA provide for these alternate post-mining land uses, it is generally agreed that the rehabilitation approach most likely to succeed is to establish self-sustaining native vegetation suited to the natural environmental conditions.

Chemical data obtained for the soils sampled within the operational areas showed generally low to moderate fertility. Total phosphorous and available phosphorous show very low to low levels, and total nitrogen levels are low to moderate.

2.1.7 Land stability

The project area has been mined since 1963, therefore it is difficult to know the pre-existing land degradation status of the area. The dominant soil type in the project area is the Red Kandosol associated with the Weipa soil type, which occurs on slightly elevated plains with a level to gently undulating surface (Rio Tinto Alcan 2011). This weathered, well-drained soil is moderately permeable with minimal surface run-off. Areas with hard-setting surfaces may result in some localised surface ponding. Most of the rehabilitated areas on site are associated with this soil type and are at relatively low gradient, therefore erosion is not a major factor in rehabilitation success or failure. There are scattered, relatively small areas of high gradient areas where erosion can be more significant, however these tend to be distal to the bauxite plateaus (subject mining areas)

The results of erosion monitoring of rehabilitated mined areas at RTW indicate that once soil profiles are revegetated and have settled (usually 3-5 years after topsoil has been respread), little active erosion is observed (Rio Tinto Weipa 2019a).

2.1.8 Terrestrial ecology

Cape York Peninsula is its own Biogeographic Region (Dames and Moore 2006; Rio Tinto Alcan 2011), which is characterised by forest communities, the boundaries of which largely correspond with the southern distributional limits of Darwin Stringybark (*Eucalyptus tetrodonta*) forest in Qld. This large bioregion is further subdivided into subregions, with the MLs located within the Western Plains province subregion (Sattler and Williams 1999). This subregion is further subdivided into three physiographic units as described in Section 2.1:

- The Mapoon Plain – coastal and near-coastal landforms on sand plains and alluvial deposits in the westernmost parts of the Weipa area (including extensive dunefields and swampland areas).
- The Weipa Plateau – a gently sloping, elevated plateau dissected by sparsely distributed broad shallow stream beds, typically consisting of a layer of aluminous laterite over an older ironstone or sandstone base (including extensive areas of Darwin Stringybark open forest with isolated vine thickets and paperbark sinkholes and narrow riparian corridors of gallery forest).
- The Merluna Plain – a less fertile area of low woodland in the easternmost parts of the Weipa area on shallow clay soils over an ironstone or sandstone base.

Detailed vegetation studies of these areas have been completed over past 30 years, with particular focus on the broader Weipa area, including the areas of the MLs (see Godwin 1985; Gunness *et al*., 1987, Neldner & Clarkson 1995; Dames & Moore 1996; Rio Tinto 2011; Queensland Herbarium 2019).

2.1.8.1 Regional ecosystems and land units

Regional ecosystems (REs) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform, and soil (Sattler and Williams 1999). A summary of those REs and the corresponding land units (version 11.1 dated April 2019) is presented in Table 5 and Figure 25 - Figure 27 (Queensland Herbarium, 2019).

Table 5: Regional ecosystems and corresponding land unit (2019)

RE	Description	Land unit	Description
3.5.36b (previously 3.5.2)	Darwin Stringybark (*Eucalyptus tetrodonta*) and Melville Island Bloodwood (*Corymbia nesophila*) tall woodland on deeply weathered plateaus and remnants	2a	Woodland with Molloy Red Box (*Eucalyptus leptophleba*) on sandy loams
		2b	Darwin Stringybark woodland on lateritic bauxite
		5k	Darwin Stringybark woodland on outcropping ironstone
		5j	Long-fruited Bloodwood woodland of drainage basins
		2b	Darwin Stringybark Woodland on lateritic bauxite
3.5.11/3.3.20 (previously 3.5.22c)	Darwin Stringybark and Melville Island Bloodwood woodland on lower slopes of plains and rises/Clarkson's Bloodwood (*Corymbia clarksoniana*) +/- Cooktown Ironwood (*Erythrophleum chlorostachys*) +/- Bloodwood species (*Corymbia* spp.) woodland on undulating plains	2c	Darwin Stringybark Woodland on yellow eroding slopes
		4a	Gallery forest along watercourses
		5k	Darwin Stringybark Woodland on outcropping ironstone
		5j	Long-fruited Bloodwood Woodland of drainage basins
		7b	Broad-leaved Tea-tree – Swamp Box Woodland
3.1.1a/3.1.3/3.1.6		6b	Orange Mangrove (*Bruguiera*) Zone

RE	Description	Land unit	Description
	Closed forest to low closed forest of Stilted Mangrove (*Rhizophora stylosa*) +/- Orange Mangrove (*Bruguiera gymnorhiza*) +/- Reflexed Orange Mangrove (B. cylindrica) +/- Grey Mangrove (*Avicennia marina*)/Yellow Mangrove (*Ceriops tagal*) and/or Smooth-fruted Yellow Mangrove (*C. australis*) +/- Grey Mangrove low open forest/Sparse herb-land or bare saltpans on salt plains and saline flats	6c	Spurred Mangrove (Ceriops) Zone
		3d	Red Mangrove (*Rhizophora*) Zone
3.2.6a	Beach She-oak (*Casuarina equistefolia*) woodland to open forest on foredunes	5c	Beach She-oak woodland
3.3.5a	Evergreen to semi-deciduous notophyll vine forest on alluvia on major watercourses	3c	Notophyll vine forest on lateritic or bauxitic red earths
3.3.9	Swamp Mahogany (*Lophostemon suaveolens*) woodlands on creek lines and swamps	7b	Paperbark/Mahogany woodland of the outer margin of drainage depressions
3.3.20 (previously 3.3.21 and 3.3.22c)	Clarkson's Bloodwood (*Corymbia clarksoniana*) +/- Native Apple (*Syzygium eucalyptoides*) woodland on lower slopes of sand ridges and in drainage depressions	-	-
3.3.50a	Broad-leaved Paperbark (*Melaleuca viridiflora*) low open woodland on floodplains	3b	Paperbark (*Melaleuca* spp.) swamp of sinkholes and drainage depressions
3.7.3	Cullen's Ironbark (*Eucalyptus cullenii*) +/- Darwin Stringybark woodland on erosional escarpments and plains	5b/5f	Cullen's Ironbark Broad-leaved Carbeen (*Corymbia confertiflora*) Woodland
		4a	Gallery forest along permanent or semi-permanent watercourses

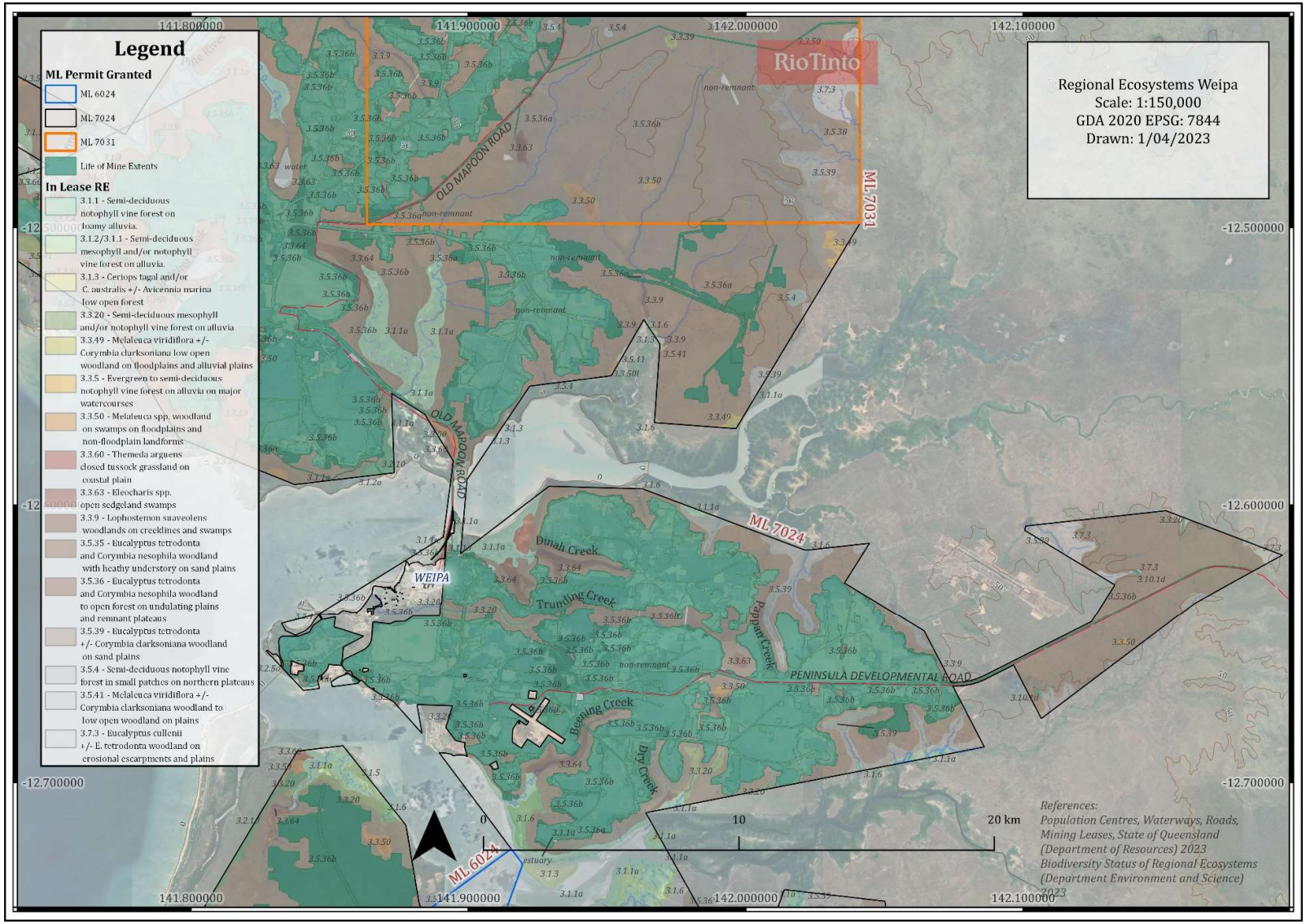


Figure 25 Regional Ecosystems - Weipa Area

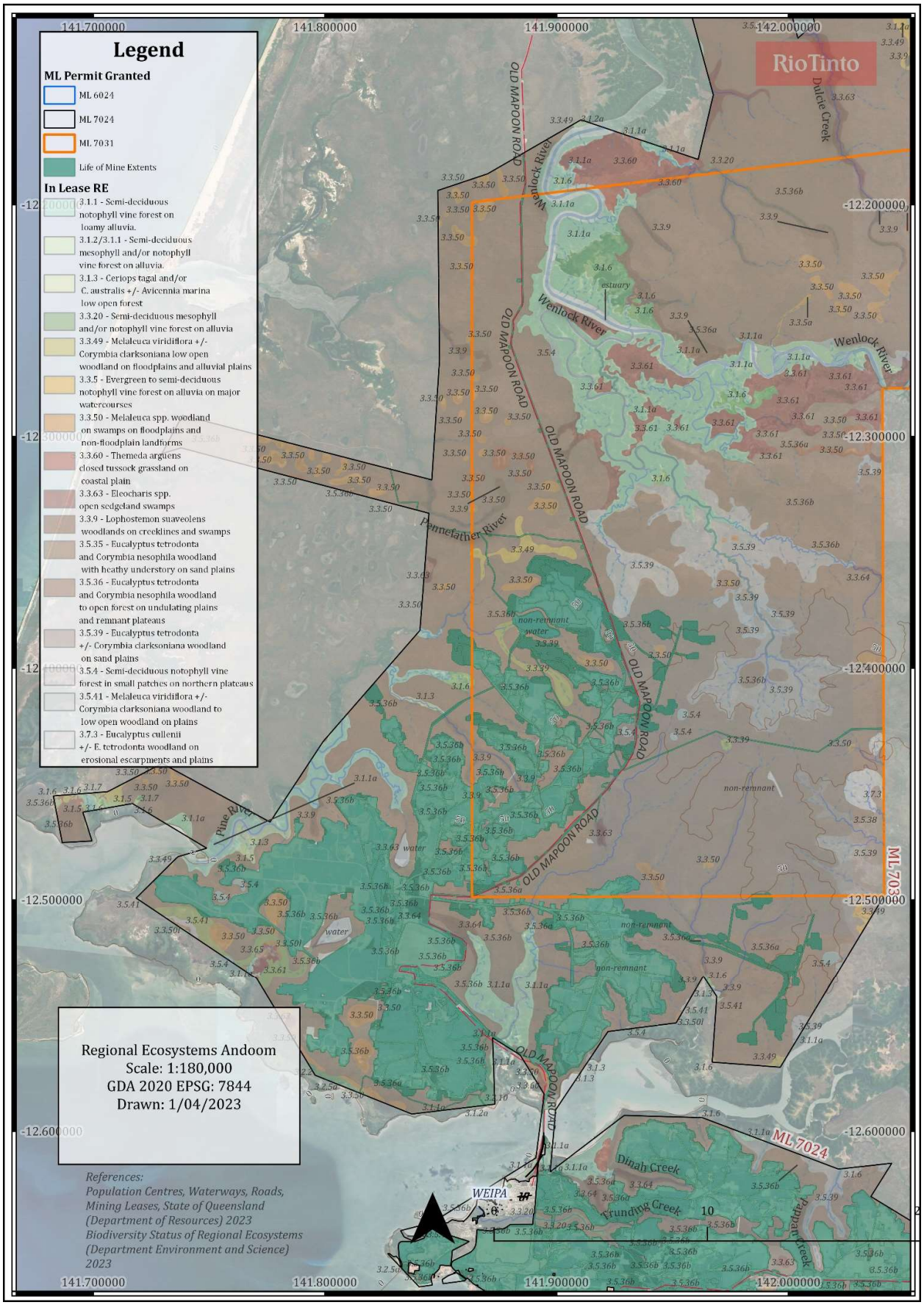


Figure 26: Regional Ecosystems – Andoom area

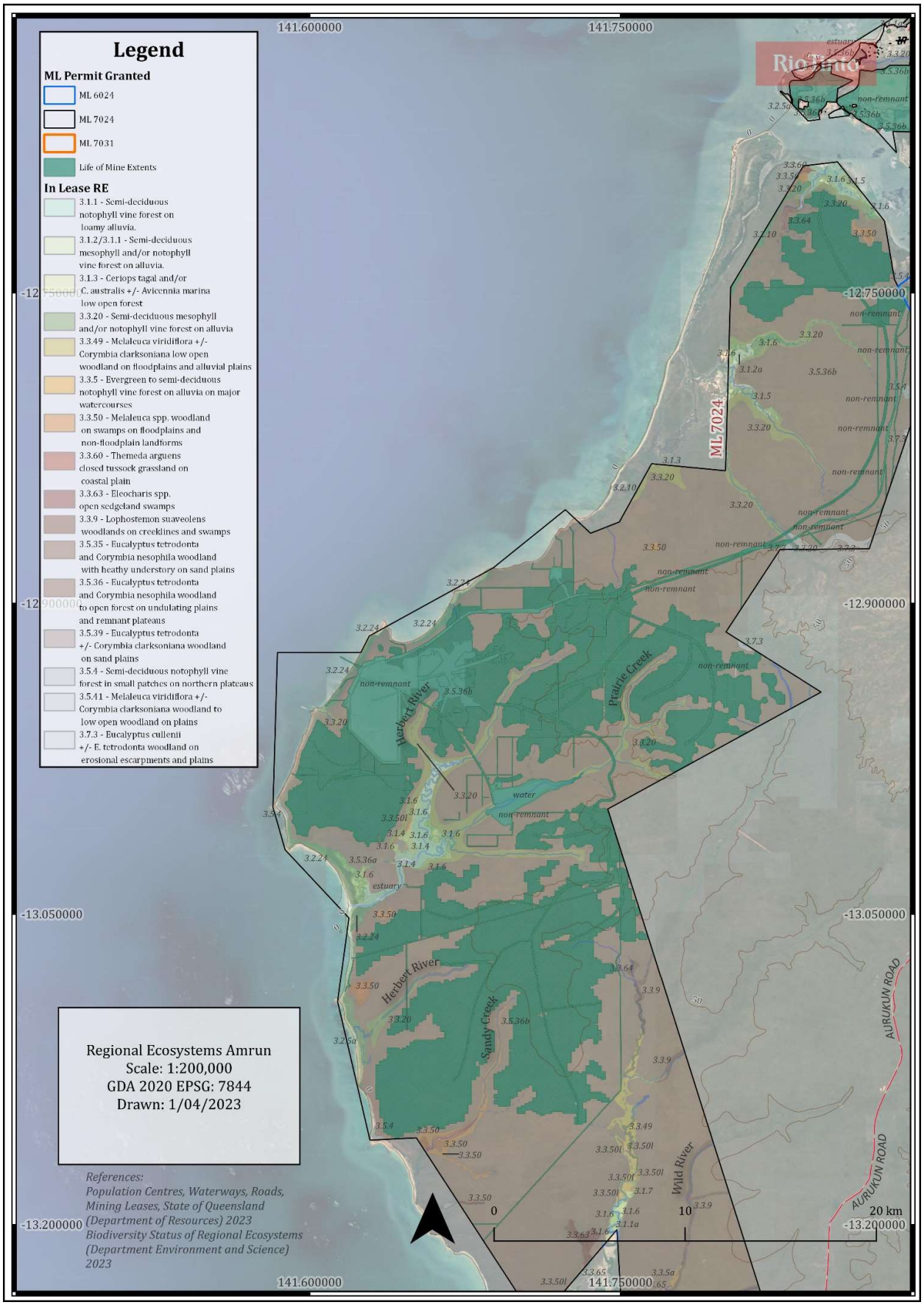


Figure 27 Amrun Regional Ecosystems

The RE mapping identifies 43 REs, within seven different land zones, across all the MLs. Those communities largely reflect the communities delineated in the historical, finer scale studies. The REs mapped across the MLs comprise several 'of concern' and 39 'least concern' REs listed under the *Vegetation Management Act 1999* (Qld) (VMA).

Several 'of concern' REs occur within the MLs. These communities are either restricted to coastal dunes (RE 3.2.2; RE 3.2.2a; RE 3.2.3; 3.2.26a), or are associated with sinkholes, springs, or water seepages (RE 3.3.39; RE 3.10.1d; RE 3.10.20). None of these communities are within the footprint of the mining activities, with all communities disturbed by the mining activities having a 'not of concern' status. The biodiversity status of all REs proximal to the Life of Mine Extent are shown in Figure 28 - Figure 29.

Most of the remnant vegetation within the MLs is characterised by Darwin Stringybark (*Eucalyptus tetrodonta*) open forests and woodlands, with smaller areas of riparian vegetation, vine thicket patches, and paperbark swamps (Rio Tinto Alcan 2011; Queensland Herbarium 2019). This community is mapped as RE 3.5.36b (woodland to open forest of Darwin Stringybark and Melville Island Bloodwood (*Corymbia nesophila*) occurring on sands on tertiary plateaus) (Queensland Herbarium 2019). This community is referred to as RE 3.5.2 in historical documents (e.g. Rio Tinto Alcan 2011) or land unit 2b, which has been updated in the RE mapping version 11.1 dated April 2019.

The vegetation communities of the wider Weipa area and the MLs are typical of those occurring elsewhere in the Western Cape York region on the bauxite plateau landform. The communities dominated by Darwin Stringybark and Melville Island Bloodwood (i.e. RE 3.5.36b) are the most widespread vegetation type. They occur almost exclusively on the bauxite plateau areas where mining occurs. The remaining vegetation communities are of much smaller spatial extent within the MLs and are associated predominantly with drainage systems and coastal complexes that are peripheral to the bauxite plateau. Other vegetation communities, dominated by gums (*Eucalyptus* spp.), Paperbarks (*Melaleuca* spp.), and vine forest species, occur adjacent to mining areas in association with alluvial, riparian and wetland habitats.

Other sensitive vegetation communities occur within the MLs are associated with 'not of concern' REs and include riparian zones, wetlands, estuarine environments, vine forests, coastal vegetation on sand, and vegetation on escarpments. These communities largely occur outside of the direct mining footprint because they are not associated with the bauxite plateau.

To protect these sensitive communities, the current operation of the MLs provides for a network of environmental buffers surrounding each community (Rio Tinto Weipa 2014; Rio Tinto Weipa 2015). These buffers provide a framework for the protection of sensitive vegetation and environmental features on each of the MLs. Prior to conducting mining activities that involve significant disturbance to land, these provisional buffers are adjusted to create operational buffers. That adjustment is based on the latest mapping information and ground-truthed data. Through this process, disturbance to these sensitive vegetation communities, and other environmentally sensitive areas by mining is avoided.

Numerous studies covering the floral species of the MLs were completed from 1977 to 2011. Currently, 887 vascular plant taxa are known from the MLs. This high diversity and richness is likely a reflection of the diversity of vegetation communities and habitats present, which include closed forest, woodland, and a range of stream and wetland habitats.

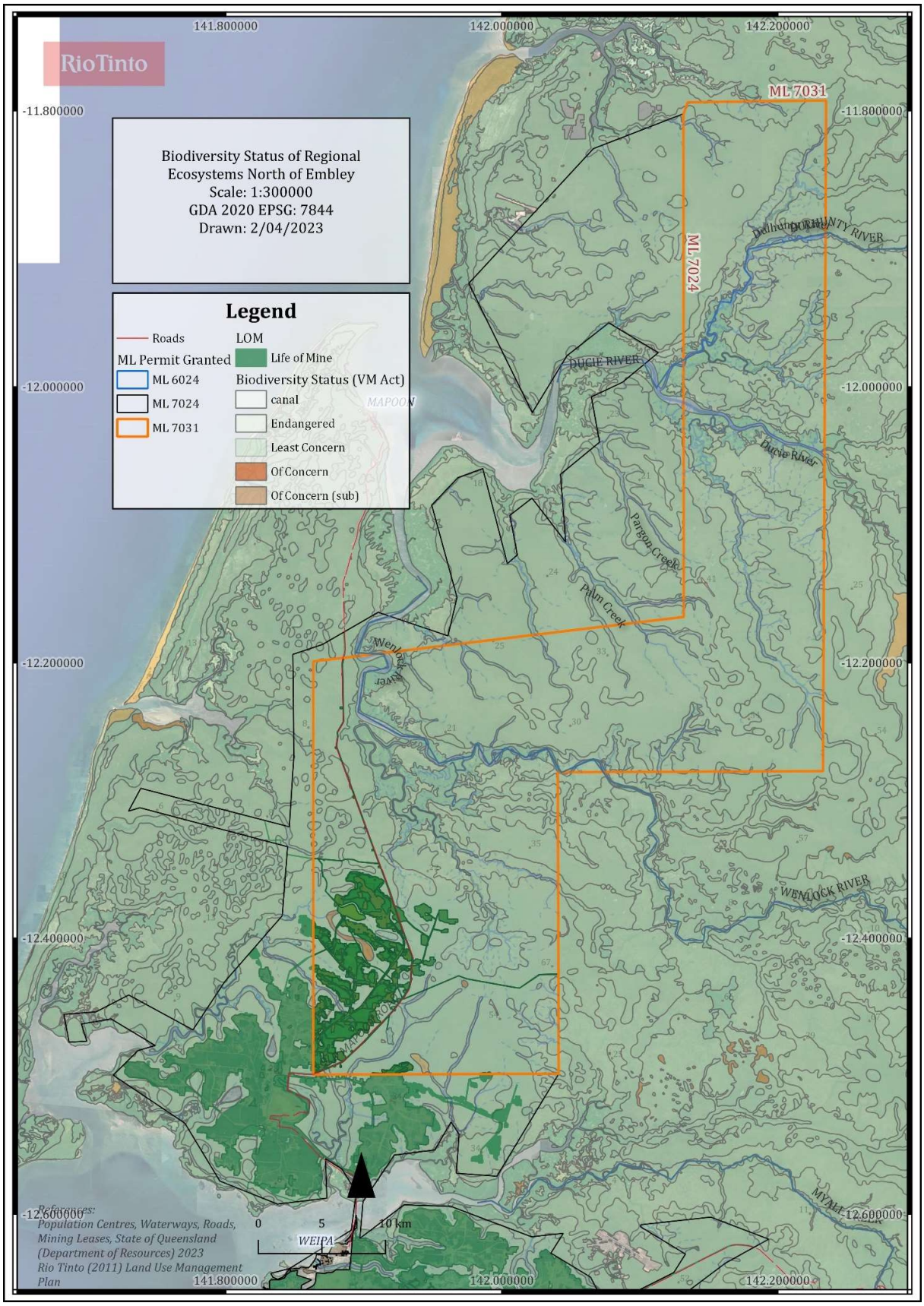


Figure 28 Biodiversity Status Regional Ecosystems Weipa - Andoom

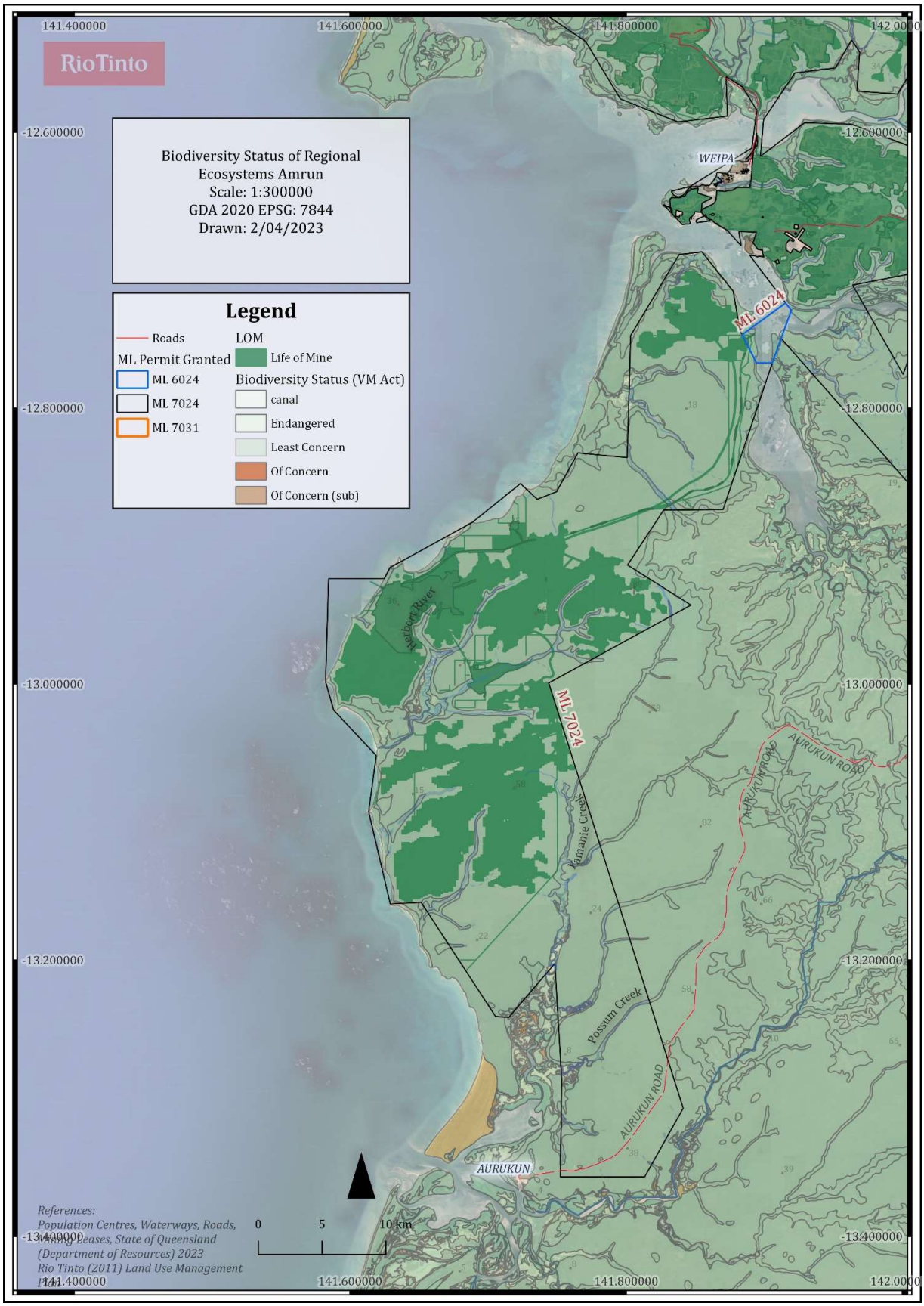


Figure 29 Biodiversity Status Regional Ecosystems Amrun

2.1.8.2 Fauna

Over the last 40 years, numerous studies have been completed with the aim of describing the fauna species and communities within the MLs, and wider area.

Currently, there is a reasonable understanding of the fauna communities within MLs. These communities are strongly tied to the major habitat types of the MLs, and their corresponding REs and physiographic units (refer to Section 2.1.8.1).

The MLs support a relatively high diversity of vertebrate fauna, including 31 species of frog, 113 species of reptile, 389 species of bird and 53 species of native mammal (ALA 2020; DES 2020). Darwin Stringybark open forest has the highest vertebrate species diversity, followed by dune-field woodland, riverine gallery forest, and semi-evergreen coastal vine forest. Of these species, eight are listed as 'endangered', eight as 'vulnerable', two as 'near threatened', and 37 as 'special least concern' under the NC Act. Three are listed as 'critically endangered', four are 'endangered', and eight are 'vulnerable' under the EPBC Act.

Currently, management plans are in place for those species at high or critical risk of being adversely impacted by mining or other activities. Like the flora, this includes predictive habitat mapping for these threatened species, which incorporates known habitats, known records, and RE types. High suitability and moderate suitability habitats were mapped for fauna reflecting the mobility of species, and their ability to use different habitat types.

The riverine gallery forest associated with the lower Wenlock River is known habitat for the threatened Red Goshawk (*Erythrotriorchis radiatus*), Palm Cockatoo (*Probosciger aterrimus*), and Rufous Owl (*Ninox rufa meesi*). Similarly, the estuaries and river mouths of many of these rivers, and the wetlands south of the Pennefather River, are important habitat areas for migratory birds, such as the threatened Eastern Curlew (*Numenius madagascariensis*), and Little Tern (*Sternula albifrons*), with the foreshore habitats important for local populations of the threatened Beach Thick-knee (*Esacus magnirostris*).

2.1.9 Aquatic ecology

A key characteristic of freshwater ecosystems on the bauxite plateau is that most show marked seasonality, holding water during the wet season and for a period afterwards, but most waterbodies dry out before the end of the dry season. There are perennial to semi-perennial refugia within most catchments, but some may not have refugia in all years. There is a strong connectivity between ground and surface waters, the volume of stream flow during the dry-season is heavily dependent on relative position to aquifers and the amount of discharge occurring. Dry season persistence of tree swamps may be more driven by volume/evaporation relationships as these systems tend to have more impervious clay/silt sediments lining the depressions they occur in. Perennial lakes are apparently functionally groundwater lenses, and/or spring fed, with few sufficiently deep to persist through the dry season without recharge (Rio Tinto Weipa 2019a).

The typically very clear fresh waters support diverse aquatic plant communities. Inland wetland habitats tend to be dominated by species that are both aquatic and terrestrial forms, or tubers/seeds that can aestivate during the dry season (or in sediments that become saline in upper estuarine settings) (Rio Tinto Weipa 2019a). However, the low nutrient status of the waters and sediments, despite supporting a diverse assemblage of aquatic plants, tends to limit the growth of some forms, resulting in a generally low abundance of epiphytic algae.

2.1.10 Weed and pest species

Weed surveys have been undertaken since 2013 for most of the MLs. These surveys confirmed 29 weed and/or introduced species. Two species are 'restricted' invasive plants (Category 3) under the *Biosecurity Act 2014* (Qld). One of the species, Gamba Grass (*Andropogon gayanus*) is also a weed of national significance (WoNS). Weed and pest management has been implemented across the MLs, with ongoing monitoring and control programs in place.

Gamba Grass is a major pest species in vast areas of northern Australia. It is a large tussock forming grass (up to 70 cm in diameter and 4 m tall) that forms a dense monoculture. Gamba grass forms tall, dense stands up to 4 metres tall, which cure later in the dry season and result in hotter burns that native ecosystems are not adapted to. These hotter burns lead to significant damage and an inability of the native systems to recover resulting in an altered ecosystem.

Gamba grass occurs extensively throughout the western and south-western areas of the Andoom mine, particularly within pasture trial areas and native rehabilitation areas. Smaller, isolated areas of Gamba grass are found in other areas in Andoom and also the Weipa peninsula.

2.1.11 Pre-mining land use

This section outlines the historical Indigenous and European land uses for the area.

2.1.11.1 Historical Indigenous land uses

Archaeological evidence indicates that Indigenous people have occupied Cape York Peninsula for at least 37,000 years before present (BP) and remnants of their continued presence can be found in many forms around the Weipa region. A number of archaeological site types have been recorded over the Western Cape, which provide evidence of past land use by indigenous people including shell mounds, stone artefacts and scarred trees.

Archaeological research has established the high cultural and scientific significance of the Weipa shell mounds, some of which have been dated at up to 2,500 years old. There are over 500 recorded shell mounds in the Weipa area. Cultural heritage surveys have also identified scarred trees from Aboriginal tool making or honey collection, stone artefact scatters, earthen mounds and also historical heritage from the early cattle industry and mining. The number of archaeological features generally increases with proximity to water and settlements. Natural features and plants and animals also have cultural heritage values for Traditional Owners. The maintenance of cultural traditions through these beliefs and access to country are significant to Traditional Owners.

RTW is committed to working with Traditional Owners to manage and protect cultural heritage sites across its MLs. Indigenous cultural heritage on the RTW leases is managed under the WCCCA, the EBMPA, the Rio Tinto Cultural Heritage Management Standard and the RTW Cultural Heritage Management System.

2.1.11.2 Historical European land uses

Historic European archaeological sites have been recorded on the ML. These date from the late 19th century onwards and are often associated with both Non-Indigenous and Indigenous activities. These sites include cattle yards and fences constructed as part of the broader cattle industry across Cape York Peninsula. Substantial cattle yards have been recorded on the ML at Running Creek and a number of small yards are known within from the Ely and Willum Swamp areas. These sites are particularly significant to some Indigenous people, especially those who worked on cattle stations.

The Western Cape also has a rich history of interaction between Indigenous people and Christian Missionaries. Several missions were established in the late 1800s within the immediate vicinity of what later became RTW's MLs.

The most visible changes to the Weipa region occurred when mineral exploration and mining commenced in the late 1950's and early 1960's. Postdating this, several temporary logging camps were also set up around the area. These activities are represented by the remains of mining camps, the Weipa telegraph line and various roads that pre-date mining.

2.1.12 Current land use

Mining activities began at Weipa in the late 1950s, following discovery of the bauxite resource in 1955 by a geologist working for Consolidated Zinc Pty Ltd named Harry Evans. Mining is the current dominant

commercial land use at Weipa. The MLs are surrounded by a mixed tenure of Aboriginal land (Napranum and Mapoon Deed of Grant in Trust (DOGIT), Aurukun Shire and Apudthama Land Trust) on which Napranum, Mapoon and Aurukun communities and related outstations are located. Pastoral leases to the east are Billy's Lagoon & Batavia Downs; to the south-east are York Downs, Merluna and Watson River. The Steve Irwin Wildlife Reserve and Bertiehaugh Station to the north east of the Wenlock River is leased by Australia Zoo and is actively managed for nature conservation and cattle grazing.

Mining activities for bauxite and heavy mineral sands are also adjacent land uses with exploration and/or MLs having been let by the State government for bauxite mining on the 'Aurukun' lease to the east of the Amrun mining area (Glencore), a small area of land on the south of the Embley landscape (Greencoast Resources) and areas to the east of Mapoon (Rio Tinto Exploration and Metro Mining, among others). Coastal areas on the north-west of the South of Embley landscape are currently being used for mineral sands mining (Metallica minerals), and other areas to the west and northwest of Andoom mine are being explored.

The town of Weipa is demarcated by the WTA boundary and is approximately 1,200 ha in size. Weipa was constructed in the 1960s to house a permanent mining workforce and has grown to become the regional hub of the Western Cape York with over 4,100 people (2021 Census data) and many local businesses and government services.

The local indigenous people have a historic connection with the land and travel widely throughout the leases for a range of traditional activities including:

- Fishing, hunting and gathering
- Ceremonies
- Maintaining their Cultural Heritage
- Maintaining connection to Country

A number of outstations have been established on the leases to enable members of the various Traditional Owner groups to access more remote locations to undertake these activities.

Tourists, visitors and members of the local communities frequently utilise areas of the lease holdings for various recreational pursuits.

2.1.12.1 Land use zones

Five separate land use zones (with fourteen subzones) that cover land owned, leased or managed by RTW (within and surrounding the MLs) are summarised in Table 6 (Rio Tinto Weipa 2015, Rio Tinto Weipa 2014). Land use zones have been established through the integration of regulatory requirements and tenure status with the physical, operational, environmental and social characteristics of the land.

The specific permitted activities and restrictions for each Land Zone, land management objectives and target as well as the Land Use Conservation process, are documented in detail in the Land Use Management Plans, developed pursuant to Condition C6 of both environmental authorities (Rio Tinto Weipa 2015, Rio Tinto Weipa 2014).

Table 6: RTW Land use zones, sub-zones and acceptable uses

Zone	Sub-zone	Inclusions / Acceptable Uses
Weipa Township (not relevant to land South of Embley River)	Residential	Single/multiple dwellings
	Industry	Evans Landing Industrial Estate
	Retail and Commercial	Shops and services
	Tourist Commercial and Entertainment	Caravan park, hotels, cultural centre

Zone	Sub-zone	Inclusions / Acceptable Uses
	Community and Special Use	Hospital, schools, cemetery, water reserves
	Open Space	Parks, gardens, sporting grounds, green belts
Mining Operations	Operational Mining	Active mining areas in the process of being mined, i.e. cleared, stripped, mine floor, dumped, spread, ripped
	Mine access and Run of Mine (ROM)	Includes haul roads, topsoil stockpiles, borrow pits, mine face setbacks
Mining Infrastructure	Administration & support infrastructure	Includes offices, training and laboratory buildings, stores & salvage yard, Evan's Landing Landfill (North of Embley River), stores (South of Embley River)
	Operational infrastructure	• Ore dumping stations • Beneficiation plants • Rail (North of Embley River) • Conveyor lines • Product (ore) stockpiles • Port (South of Embley River) • Ship-loader facilities • Workshops • Power Stations • Active/inactive tailings dams • Water recovery slots and water dams
Special Use	Subleases	Land subleased to and from RTW, e.g. Humbug terminal area (South of Embley River), shiploader on Qld Strategic Ports Corp land (North of Embley River)
	Informal agreements	This includes non-RTW uses but on ML tenure, e.g. Horse Club, Bow Hunters Club, Rifle Range, Napranum Sewage Farm
	Contaminated sites	Sites currently on the South of Embley Project Contaminated Sites Register (South of Embley River) and the RTAW Contaminated Sites Register (North of Embley River)
Restricted Use	Protected	Areas specifically protected from disturbance by legal or other agreements, for example: • Waterways, riparian areas, gallery forests, wetlands, swamps, coastal communities, vine thickets and culturally sensitive areas required by EPBC Act Approval. • EW Frigate bird roost zone committed to Federal Govt. (2009) (North of Embley River)
	Conservation	Areas managed for additional restricted uses, for example: • Areas managed for additional restricted uses. • Other areas set aside for additional efforts to avoid, minimise, mitigate, and/or offset impacts from mining and associated activities • Lorim Point frigate bird roost zone • Voluntary buffer areas for 'prohibited areas'
	Rehabilitation	Includes rehabilitated areas from all other land zones
	Provisional Mining Use	This includes the remainder of all land holdings that is available for mining pending appropriate approval permits. Over the life of the mine, land in this is likely to proceed to other land zones either by being mined or being looked at for other conservation opportunities.

2.1.13 Underlying landowners/landholders

RTW operations cover three separate mining leases over crown land. Traditional Owner groups represented for MLs ML6024, ML7024 and ML7031 largely reside in five main communities or towns; Weipa, Aurukun, Napranum, Mapoon and New Mapoon (Northern Peninsula Area). Of these, only Weipa is located within the MLs.

Rio Tinto has entered into three land use agreements with indigenous peoples of the land and sea, the WCCCA (a registered ILUA under Native Title legislation), the EBMPA and the Weipa Township Agreement. These Agreements record the terms on which Aboriginal people and communities provide their consent for mining on ML7024/6024 and ML7031. The Agreements provide for formal consultation processes between Rio Tinto and the Traditional Owners and Aboriginal communities who are signatory parties to the Agreements. Consultation under these Agreements is further discussed in Section 3.

Aboriginal rights have been established in legislation through the *Native Title Act (Commonwealth) 1992* and the *Aboriginal Cultural Heritage Act (Queensland) 2003*. Native Title applications and determinations have been completed for areas of both ML7024 and ML7031, with the exception being most of the Weipa Peninsula. Native Title determination provides certainty for State Government transition of land post mining lease relinquishment; to Traditional Owners and Native Title holders. The WCCCA and the EBMPA have the intent that post-mining relinquishment of land will be on petition to the State Government by Traditional Owners (as may be represented through the Cape York Land Council) and/or Native Title holders as Aboriginal Land tenure under the *Aboriginal Land Act (Queensland) 1991*.

Areas to the South of Embley River relevant to ML7024/ML6024 and north of the Mission River for MLs 7024 and 7031 have all progressed to Native Title determinations. The only area not currently under Native Title application or determination is the Weipa Peninsula, a part of ML7024. This area remains unclaimed and not included in a Native Title application at present. Cape York Land Council, in response to various requests is currently researching the basis for a claim for this remaining unclaimed area. In the absence of this, there exists a risk to the closure consultation and relinquishment process for this area due to the absence of a clear and agreed native title holder with which RTW and the State can engage.

2.2 Project description

In accordance with the PRCP Guideline and Sections 126C(1)(b) and c(ii) of the *Environment Protection Act 1994* (EP Act), this project description section of the PRCP provides an overview of the mining operations, including:

- Mining tenements, including the area of each tenure
- Primary mine features and infrastructure on site
- Type of mining operation
- Proposed duration of operations as a whole

It also provides details on how and where the activities have been and will be carried out, including maps.

The RTW bauxite mining operations comprise three mining leases (ML7024, ML6024 and ML7031) located on the west coast of the Cape York Peninsula (latitude 12°39'S and longitude 141°53'E), adjacent to the town of Weipa. ML7024 and ML6024 total 246,829 ha and encompass Andoom, East Weipa and Amrun operations, and ML7031 covers 138,906 ha encompassing the Ely mine area.

RTA Weipa Pty Ltd (RTAW) is the owner and operator of the Weipa Operation and is wholly owned by Rio Tinto Aluminium Limited, the ultimate shareholder of which is Rio Tinto Limited. Alcan South Pacific Pty Ltd (Alspac) is the tenement holder of ML 7031. RTAW, Alspac and Rio Tinto Aluminium Limited are parties to an Agreement under which Ely mining is undertaken by RTAW on behalf of Alspac.

The ML7024/6024 operations operate under the Environmental Authority (EA) EPML00725113 (Mining Activities) and ML7031 operates under the EA EMPL00562613 (Mining Activities).

For mine planning purposes, the life of Weipa mine operations is determined based on current ore reserves. The expected year of cessation of mining is 2062 for Weipa (including Amrun) and approximately 2027 for Ely. Bauxite resource availability indicates that mining could continue beyond these dates, however for the

purposes of this plan, mine and rehabilitation scheduling reflects the period to 2062 and approximately 2027 for Ely.

The mining is of a continuous duration throughout the years with mining moving to new areas within the MLs in alignment with mine planning and as market demands. The area of mining which occurs per year is approximately 500 ha to 1,300 ha, and the total proposed area for disturbance is shown in Table 7. This has been taken into account in the PRCP Schedule when describing the scheduling of when areas are available for rehabilitation.

Table 7: Approximate area proposed for future disturbance

Mine	Mining Disturbance (Ha)	Infrastructure[1] Disturbance (Ha)
East Weipa	46	
Andoom	544	78
Ely	600	47
Amrun	23,093	1652

[1] includes haul roads.

Figure 30 - Figure 32 indicate conceptually where mining may occur for the Weipa, Andoom/Ely and Amrun operations respectively. However, depending on market conditions, the total area of disturbance and location of disturbance may increase within the current approvals, in which case a PRCP update shall be undertaken if required.

Areas of existing rehabilitation (as at 2022) are provided in Figure 30 - Figure 32. Infrastructure which supports mining operations will continue to be utilised throughout the operating life of the mine. Section 2.2.3 outlines the mine features.

2.2.1 Mining tenements

ML7024 and ML6024 were granted under the *Commonwealth Aluminium Corporation Pty. Limited Agreement Act 1957* for the purposes of exploration and mining of bauxite and associated activities and ML6024 was granted for the purpose of a transport corridor. The leases have an effective date of 1/1/1958 and the expiry date is 31/12/2041 with an option to extend to 31/12/2062. Lease extensions past 2062 can be obtained, beyond the initial renewal period, subject to both parties' right to terminate on two years notice.

ML7031 was granted under the *Alcan Queensland Pty Ltd Agreement Act 1965* for the purposes of mining of bauxite and encompasses the Ely mining area and exploration for bauxite in the land north of the Wenlock River. Exploration is planned for the areas north of Weipa on ML7031 to delineate additional ore bodies and to support future mining in the area. The Mining Lease has an effective date of 1/1/1964 and the expiry date is 31/12/2047 with an option to extend to 31/12/2068. Lease extensions past 2068 can be obtained, beyond the initial renewal period, subject to both parties' right to terminate on two years notice.

The bauxite reserve model indicates that mining could continue beyond these stated end dates.

2.2.2 Environmentally relevant activities

The environmentally relevant activities (ERA), as designated by ML7031, ML6024 and ML7024, are included in Table 8.

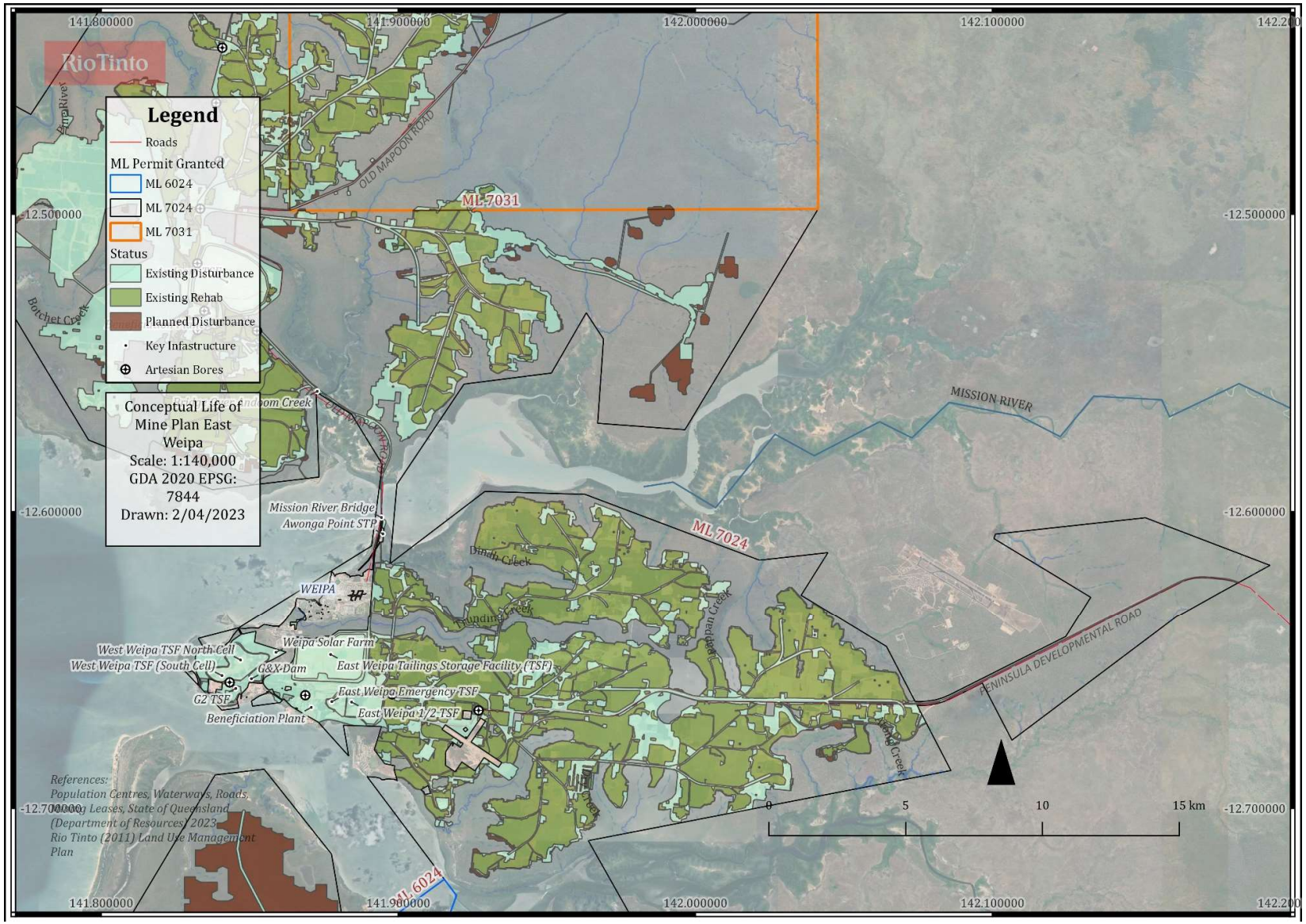


Figure 30: Weipa conceptual life of mine extent

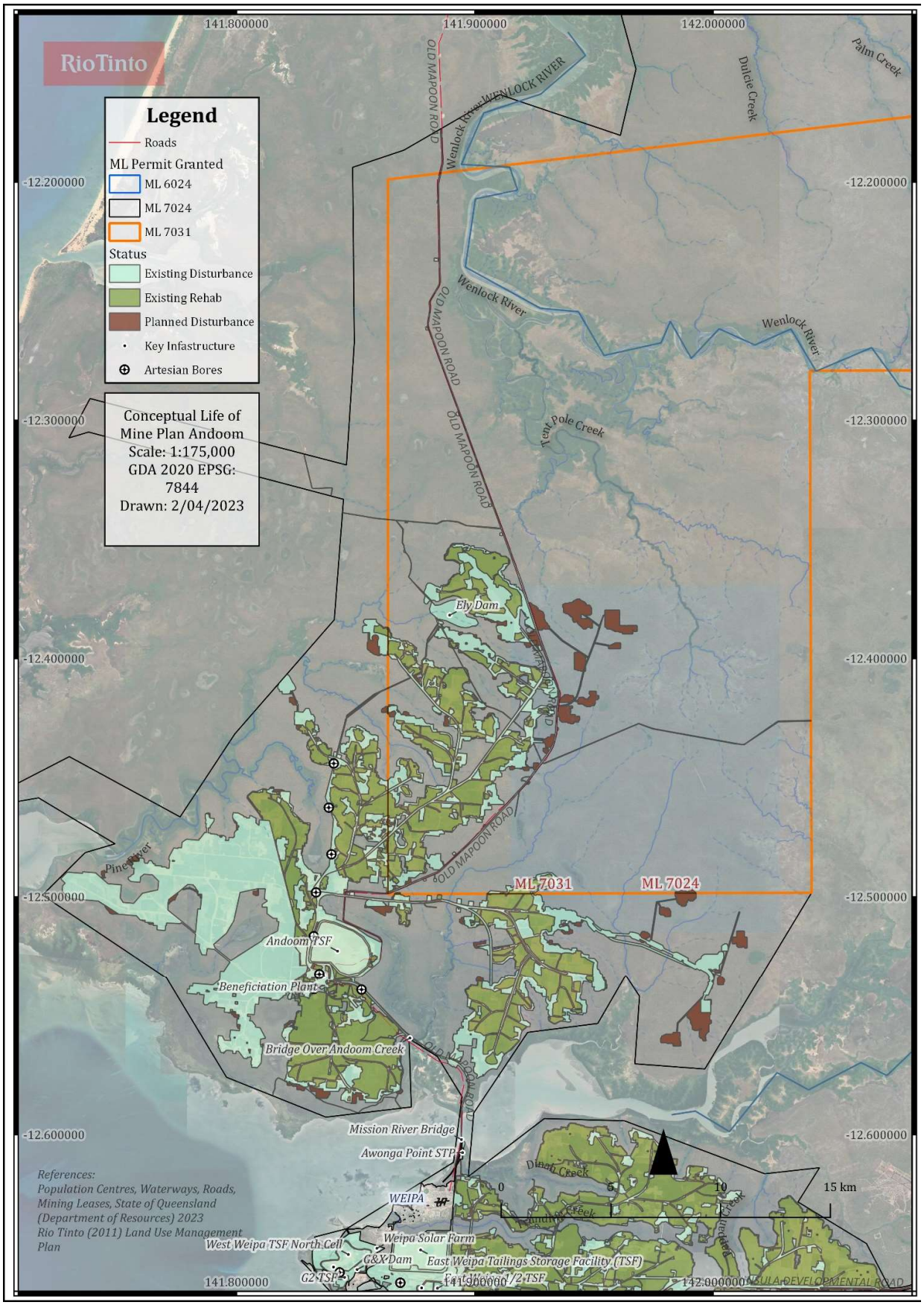


Figure 31: Andoom/Ely conceptual life of mine extent

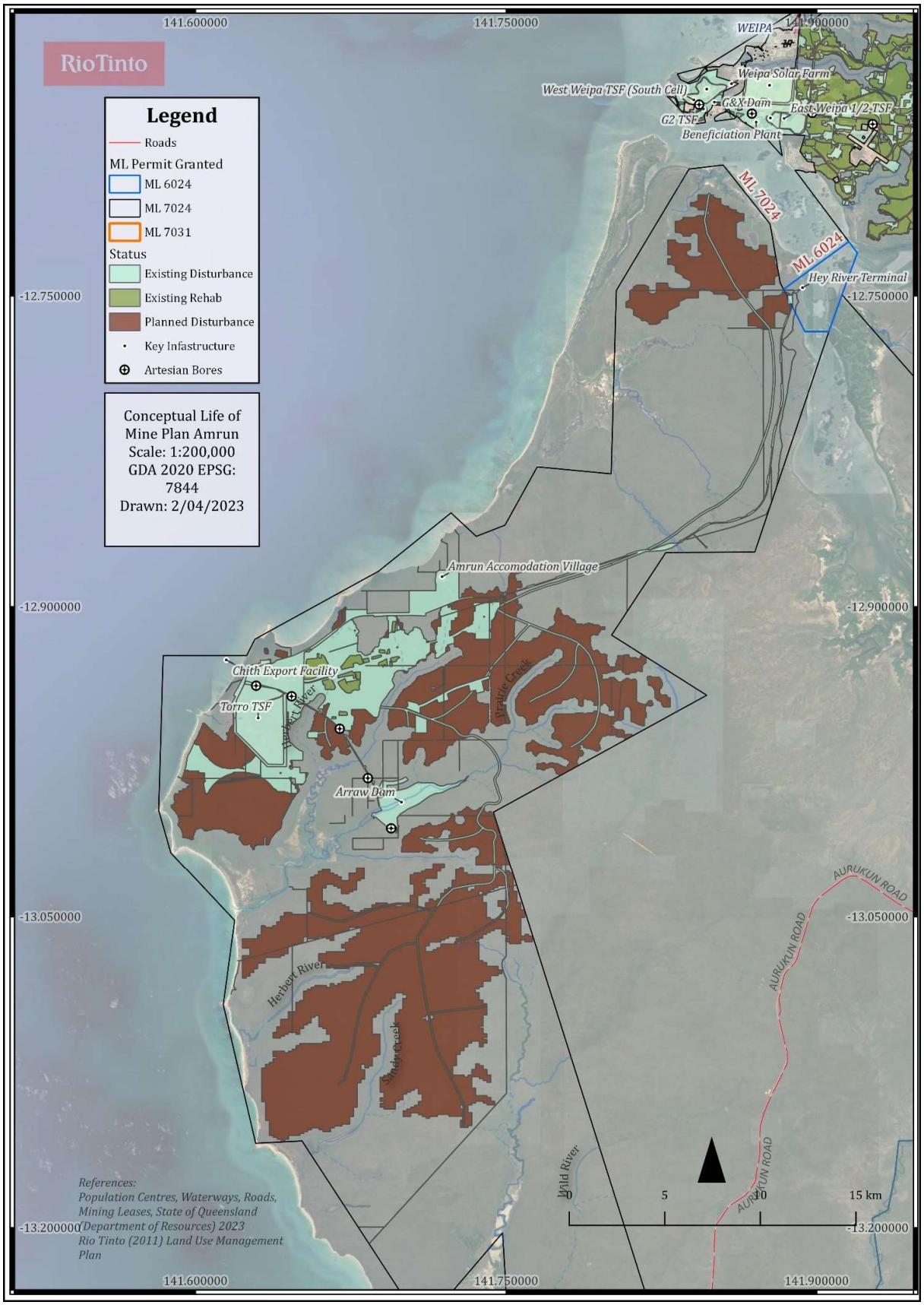


Figure 32: Amrun conceptual life of mine extent

Table 8: Environmentally Relevant Activities

ML	Environmentally Relevant Activities (ERA)
ML7031	Mining Activities - Bauxite
ML6024 and ML7024	**Prescribed activities**
	ERA 8(3) Chemical storage – storing more than 500m3 of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3.
	ERA 14(2a) Electricity generation – Generating electricity by using fuel, other than gas, at a rated capacity of 10MW electrical to 150MW electrical.
	ERA 16(1d) Extractive and screening activities – dredging, in a year, more than 1,000,000t of material from the bed of naturally occurring surface waters.
	ERA 16(2a) Extractive and screening activities – Extracting, other than by dredging, in a year, 5,000t to 100,000t.
	ERA 16(3a) Extractive and screening activities – Screening, in a year, 5,000t to 100,000t.
	ERA 31(2b) Mineral processing – processing, in a year, other than coke, more than 100,000t/year.
	ERA 50(1a) Bulk material handling – loading or unloading 100t or more of minerals in a day or stockpiling 50,000t or more of minerals within 5km of the highest astronomical tide or 1km of a Watercourse.
	ERA 50(2) Bulk material handling – loading or unloading 100t or more of bulk materials in a day or stockpiling bulk materials.
	ERA 58 Regulated waste treatment – Operating a facility for receiving and treating regulated waste or contaminated soil to render the waste or soil non-hazardous or less hazardous.

	ERA 60(2c) Waste disposal – Operating a facility for disposing of in a year more than 5,000t to 10,000t of waste consisting of –
	• Only general waste; or,
	• General waste and either, or in combination, of the following
	  ○ A quantity of limited regulated waste that is no more than 10% of the total amount of waste received at the facility in a year:
	  ○ If the facility is in a scheduled area – no more than 5t of untreated clinical waste. 5,000t but under 10,000t year (1)(b).

	ERA 63(1d) Sewage treatment – operating sewage treatment works, other than no-release works, with a total daily peak design capacity of more than 4,000 but not more than 10,000EP.
	ERA 64(3) Water treatment – Treating 10ML or more of raw water in a day.
	Resource activities (Schedule 2A ERA's)
	ERA 11 – Mining bauxite

2.2.3 Mine features

The main mine features and infrastructure located within each ML are outlined in Table 9. These mine features are listed in the EAs and displayed in Figure 33 - Figure 35. It should be noted that Ely operations utilises infrastructure located within the Weipa Operations mining areas. Also, the Norman Creek infrastructure of the Amrun project area are approved under the EA however they are not proposed to be constructed at this stage and are therefore excluded from this PRCP. A PRCP amendment shall be undertaken if this Norman Creek infrastructure is to be constructed.

Table 9: Mine features / infrastructure

Mining activity	ML7024 and ML6024 – Weipa Operations	ML7031 – Ely Operations
Extraction Areas	Mining areas Sand Quarry - Nanum Tawap Sand extraction areas Dredge extraction areas Boyd Port, Hey River Terminal	Mining areas
Processing Activities	Beneficiation Plants • Weipa, Andoom, Boyd and Norman Creek	
Tailings Storage Facilities	East Weipa (EW), East Weipa 1 & 2 (EW1/2), West Weipa (WW2), Andoom, Emergency Dam, G & X Dam, G2 Dam Amrun (Boyd – Torro Dam), Amrun (Norman Creek)*	
Water Supply Dam	Arraw Dam (previously called Dam C)	Ely Dam
Waste Disposal / Treatment	Landfill • Evans Landing Sewage Treatment Plants • Awonga Point, temporary camps (south of Embley River), Boyd Infrastructure Area, Boyd Accommodation Village, Norman Creek Infrastructure Area.	
Electricity Generation	Power Stations • Andoom, Lorim Point, Boyd Infrastructure Area, Norman Creek Infrastructure Area Electrical Generators	
Chemical Storage Areas	Andoom Power Station Fuel Storage Weipa Airport Fuel Farms • Andoom (Service Bay), East Weipa (above ground and underground), Weipa Waste Oil Mobile/temporary chemical storage areas Heavy Equipment in Mining Areas Weipa Main Store Weipa Environmental Compound	
Motor Vehicle Workshops	Various – heavy and light vehicle workshops, contractor workshops	
Accommodation	Accommodation • Boyd Accommodation Village Temporary camps • South of Embley River*, Boyd Bay Fly-camp*	
Port / Ship loading facilities	Boyd Port	

Mining activity	ML7024 and ML6024 – Weipa Operations	ML7031 – Ely Operations
Barge / Ferry Terminal	Hey River Terminal Pera Head Temporary Seaborne Access (Barge Landing) Boyd Point Temporary Seaborne Access (passenger jetty)	
Water Treatment	Water Treatment Plants • Weipa, Lorim Point, temporary camp (south of Embley River)*, Boyd Infrastructure Area, Norman Creek Infrastructure Area*	
Transport Corridors	Transport corridor Haul roads / access tracks	Haul roads / access tracks
Town Activities	Weipa Township	

Note: * denotes approved by EA but not currently included in this PRCP.

2.2.4 Type of operation

The RT Weipa Operation currently produces metal grade bauxite used to produce aluminium. The mining and rehabilitation process at RTW is briefly described below.

2.2.4.1 Exploration

Exploration drilling is periodically undertaken throughout ML7024 and ML7031 to determine the extent of bauxite resources and delineate ore bodies. The access tracks, which form the majority of the exploration disturbance, revegetate rapidly without active intervention. The remaining disturbance caused by exploration activities is progressively rehabilitated.

2.2.4.2 Bauxite mining

Mining of bauxite involves front-end loaders using a shallow, open cut technique to load the bauxite into haul trucks which take the ore to a dump station for transportation to a beneficiation plant by rail and/or belt conveyor. Native vegetation clearing is prioritised when the ground is sufficiently saturated to allow tree roots to pull clear rather than snapping off. Cleared timber is pushed into windrows, the cleared vegetation is then root-raked and burnt. The annual area cleared for mining is likely to vary between approximately 500 ha to 1,300 ha, depending on production levels.

Topsoil removal is conducted ahead of mining, and wherever practical, stripped topsoil is returned directly to the mine floor in preference to stockpiling. The details of the progressive rehabilitation process undertaken after mining is complete is provided in Section 2.3.

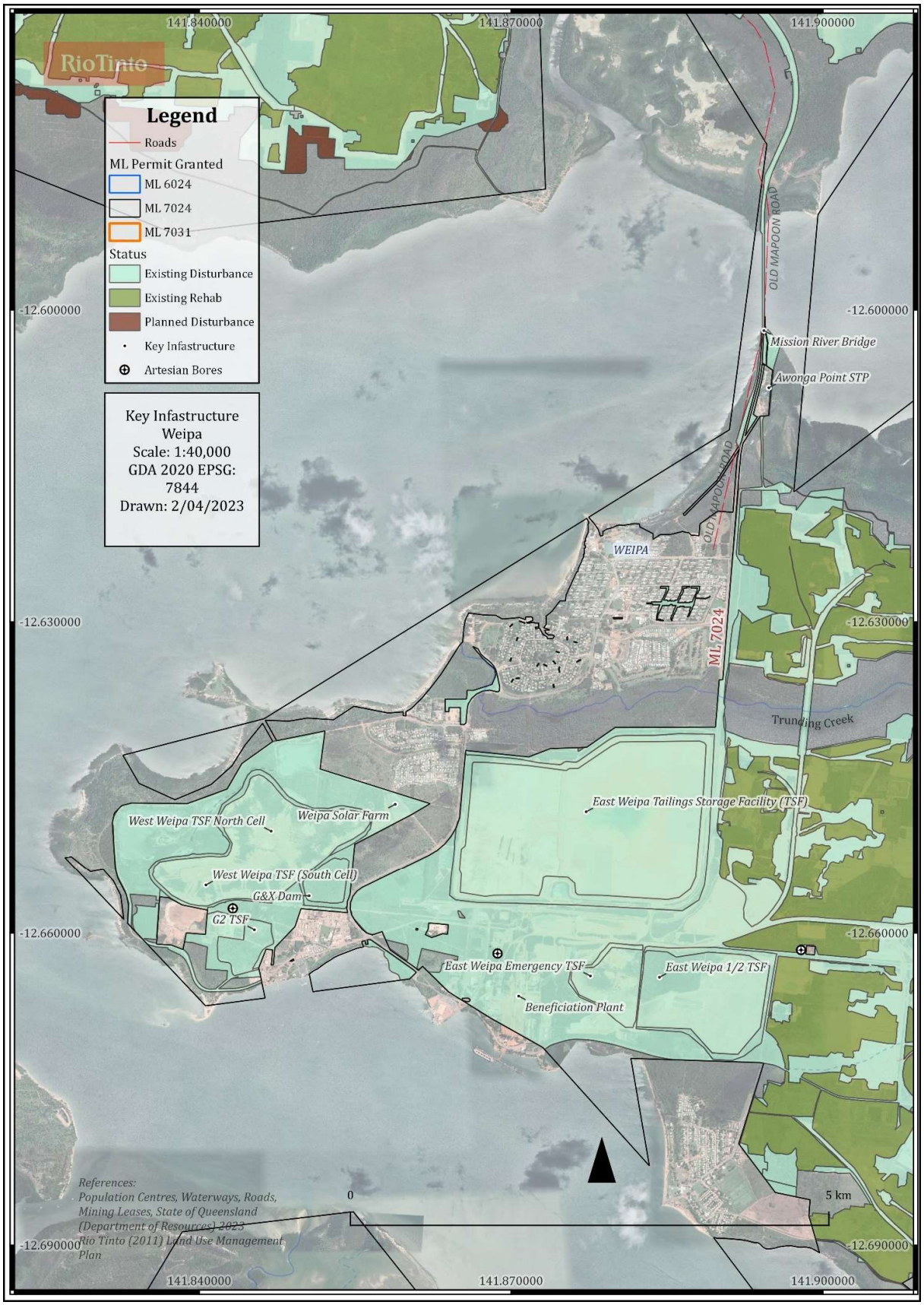


Figure 33: Key mine features and infrastructure of Weipa mining area

Figure 34: Key mine features and infrastructure of Andoom and Ely mining area

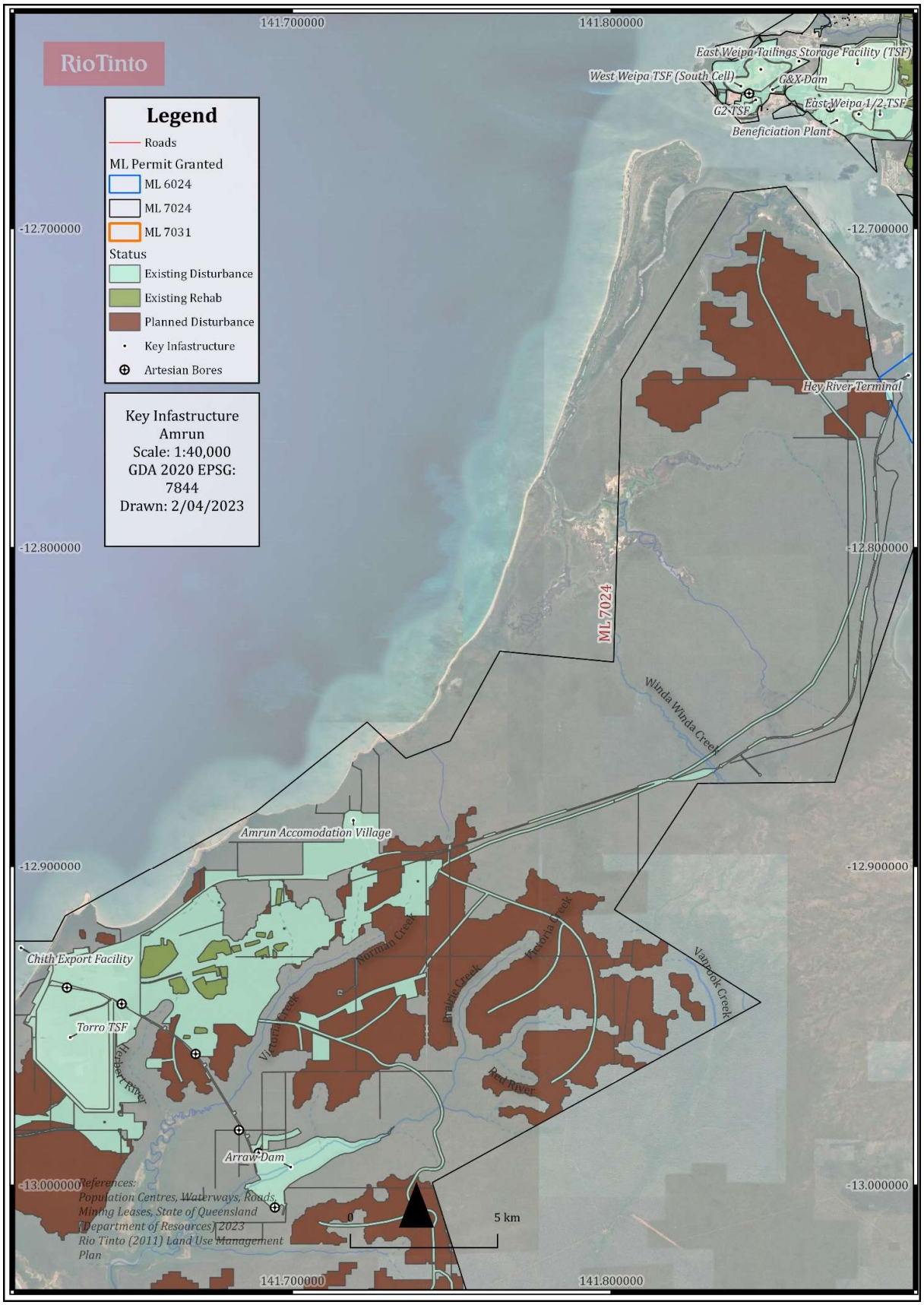


Figure 35: Key mine features and infrastructure of Amrun mining area

In the commercial bauxite market, customers specify particular grades of product in their orders (especially with respect to Al, Fe and Si). So that varied customer specifications for each ship load are met, it is necessary to move mining activities from pit to pit at short notice, or to mine several pits at the same time, and blend the product before loading the ship. This operational practice results in multiple pits being retained as 'open' for extended periods of time. These areas only become 'available for rehabilitation' once the local ore body hosting these pits is exhausted, which could be many years for certain product types or grades. As sales and customer specifications are not necessarily well known in advance, there is little ability to confidently predict when these areas will be exhausted (and hence become available for rehabilitation).

2.2.4.3 Bauxite processing

Bauxite ore is processed by beneficiation, a process where oversized particles are removed by screening and fine particles are removed by rinsing with water. After beneficiation, metal grade bauxite (product) is stockpiled prior to shipping. Beneficiation plants are located at Weipa, Andoom and Amrun.

2.2.4.4 Mineral waste disposal

Fine particles washed from the bauxite product are pumped as slurry for deposition and storage in above-ground dams called Tailings Storage Facilities (TSFs). No chemicals are added to the process. Once deposited in the TSFs, the solid materials settle, surplus water is decanted, and recycled back through the beneficiation process. More information on the TSFs is provided in Section 6.9.

2.2.4.5 Railway transportation and ship loading

Washed bauxite product and some crude bauxite are transported from Andoom to Weipa and conveyed from product stockpiles and blended to meet customer specifications while loading on to ships at Lorim Point. Ship loading facilities at Lorim Point are located outside the lease area of ML7024 on land sub-let from North Queensland Bulk Ports and therefore sit outside the scope of this PRCP.

2.2.4.6 Water supply

Process water is used for beneficiation, haul road watering, and haul road construction and comes from various sources including artesian and shallow aquifer ground water and surface water.

Artesian water is mostly used as process water in the beneficiation of bauxite. Priority is placed on recycled and shallow aquifer water supplies however artesian water is routinely required, particularly at Andoom and Amrun where shallow aquifer water has limited availability. East Weipa utilises four artesian bores to supply process water to the beneficiation plant. The Andoom borefield includes eight artesian groundwater bores and two shallow aquifer bores. An additional six bores are utilised for the Amrun operation.

There are two main shallow aquifer bore networks on the Weipa Peninsula:

- One network comprising 24 bores supplying process and potable water to East Weipa mining operation, Lorim Point and Evan's Landing Industrial Area.
- Another network comprising ten bores supplies the majority of potable water to WTA.

A pipeline from the Ely Dam, located on Ely (Kwambakachini) Creek provides process water to the Andoom plant. The Arraw Dam, located on the central tributary of Norman creek, supplies process water to the Amrun operations.

2.2.5 Duration

The life of Weipa mine operations is determined based on current ore reserves. The expected year of cessation of mining is 2062 for Weipa and currently expected cessation of mining for Ely is approximately 2027.

Bauxite resource available indicates that mining could continue beyond these dates, however for the purposes of this plan, mine and rehabilitation scheduling reflects the period to 2062 and approximately 2027 for Weipa

and Ely respectively. Mining at the East Weipa and Andoom mine areas is expected to cease prior to these dates, approximately 2024 for East Weipa and 2027 for Andoom, subject to market demand for bauxite. The mining is of a continuous duration throughout the years with mining moving to new areas within the MLs in alignment with mine planning and as market demands. The area of mining which occurs per year is approximately 500 ha to 1,300 ha, and this has been taken into account in the PRCP Schedule when describing the scheduling of when areas are available for rehabilitation (refer to Section 2.3).

Infrastructure which supports mining operations will continue to be utilised throughout the operating life of the mine, and post cessation of mining to support rehabilitation activities. Rehabilitation of mining infrastructure and other prescribed environmentally relevant activities on the leases has also been scheduled as land is available for rehabilitation (refer to Section 2.3). Design of mine features for closure

The mining operations were approved under EAs prior to the release of the PRCP Guideline on 1 November 2019. The Section 3.1 of the PRCP Guideline state that transitional PRCPs are not required to demonstrate how aspects of the mine site have been designed for closure for existing or approved disturbance. Therefore, the design of mine features for closure is not a requirement for this transitional PRCP.

2.3 Rehabilitation planning

The Weipa operations have been progressively rehabilitating mined areas for over 40 years, with more than 16,500 ha revegetated (~14,500 ha at ML7024 and ~2,000 ha ML7031) to a native ecosystem to date. The routine scheduling of rehabilitation is primarily determined by the mine plan which sets the areas to be cleared, stripped, mined and rehabilitated. The aim of the mine plan is to minimise land disturbance and maximise rehabilitation while maintaining bauxite ore availability.

Recent performance has proven upward of 700 ha of new rehabilitation can be reliably established on an annual basis with the right planning, resourcing and execution strategies in place. This extensive experience has shown that consistently delivering these large quantities of good quality rehabilitation also requires effective management of the many extraneous factors that can impact which ‘areas are available’ and when might be ‘as soon as practicable’ for them to be rehabilitated. Examples of these factors include:

- Market drivers impacting areas available for rehabilitation (see Section 2.2.4.2).
- Seasonal variations (see Section 2.1.2).
- Limited seed availability (see Section 6.2.2).

A key strategy behind Weipa’s successful rehabilitation program is that rehabilitation planning and execution is agile, and able to adjust to match the land available (location and quantity) at the start of each annual rehabilitation season. This means that rehabilitation planning at Weipa normally uses a relatively short-term planning cycle (e.g. up to five years). Given that the PRCP aims to maximise progressive rehabilitation throughout the life of an operation, at Weipa this means developing a long-term rehabilitation plan for over 40 years into the future. To develop this long-term plan, a number of considerations (routine and extraneous) have been adapted to produce a set of assumptions or allowances based on evidence and/or experience, to ensure a reasonably sound, achievable plan is put together.

2.3.1 Progressive rehabilitation

This section presents a summary of operational and biophysical constraints that effectively set the ‘logic’ by which the timing for long-term progressive rehabilitation plan has been derived. Many of these constraints are associated with risks identified and assessed in the Risk Assessment in Section 7.0. Note, the different risk factors should not be considered individually, but as potentially applying all at once, and therefore their cumulative impact on the long-term progressive rehabilitation plan can be appreciated. 7.0

The progressive rehabilitation methodology is thoroughly presented in Section 6.0, and definitions and explanations of the Rehabilitation Areas (RAs) and Rehabilitation Milestones (RMs) can be found in Section 6.13.4.

2.3.1.1 5-year planning periods

As explained above, rehabilitation planning at Weipa is normally a relatively short-term process, reliant on agile planning and execution practices. For the purposes of preparing a long-term plan it is considered most useful to represent planning in five-year periods as is utilised in the PRCP schedule for a number of reasons:

- The Weipa Operation has a long remaining life of mine of over 40 years.
- Annual variability (due to a range of factors) should be manageable within a 5-year period to achieve derived milestones.
- Traditionally, mine planning at Weipa is based on a five-year planning cycle which supports the integration of rehabilitation planning with mine planning.
- The monsoon tropics of northern Australia are notoriously subject to high variability in monthly rainfall from year to year, within years, and over a range of sites in the local area (Section 2.1.2). Seasonal issues (such as early or long or bigger than average wet seasons) can restrict the time available for rehabilitation operations to achieve target quantities of areas for topsoil spreading, ripping and revegetation seeding and fertiliser. This reinforces the conservative approach to setting long-term rehabilitation targets in 5-year periods to allow for the inter-seasonal variation to be accommodated.

2.3.1.2 Areas available for rehabilitation

Progressive rehabilitation will continue within the “mined areas” Rehabilitation Area (RA1) throughout the life of the mine as soon as practicable after land becomes available. The term ‘mined’ in this case refers to the meaning under section 6A of the *Mineral Resources Act 1989,* which refers to mining of a probable or proved ore reserve. Disturbed land is available for rehabilitation (as per Section 126D(5) of the EP Act) if the land is not being mined, unless:

- The land is being used for operating infrastructure or machinery for mining.
- The land contains a proved or probable ore reserve that is to be mined within 10 years after the land would otherwise have become available for rehabilitation.
- The land is being used to access active mining areas or proved or probable ore reserves, i.e. haul and pit roads, active mine face access.
- The land contains infrastructure to be handed over to a third-party post mining.

At Weipa, there are site specific factors that influence when land is available for rehabilitation, including:

- Bauxite market drivers have major implications for areas of the mine becoming available for rehabilitation due to the need to keep multiple pits ‘open’ for extended periods of time to provide variable grades of ore to blend to meet customer specifications (see Section 2.2.4.2). For this purpose, and with consideration to the EP Act definition provided above, evidence and experience shows that mine areas typically become available for rehabilitation within 5 years of clearing and this has been applied in the PRCP schedule.
- As recognised in the EP Act definition above, there is a standing requirement to maintain roads accessing mining areas and active mine face offsets in mining areas. An allowance of 20% of cleared areas are assumed to be unavailable for rehabilitation until the end of end of mine life to accommodate such operational requirements.

Weipa has been mining bauxite for over 40 years and is currently shipping in excess of 35 million tonnes of product grade bauxite annually from its three operations. Reflective of this, there are areas of historical disturbance that have not yet been rehabilitated but are, or could be, available for rehabilitation. With due consideration of the cumulative nature of the constraints to rehabilitation planning (see Section 2.3.1.4 below), and a priority on achieving the best quality new rehabilitation, these starting inventories of disturbed mine areas are fully scheduled for completion within the long-term progressive rehabilitation plan.

2.3.1.3 Existing rehabilitation

Weipa has more than 15,000 ha of established native ecosystem rehabilitation. Due to the long history of the Weipa operation, the changing objectives over time and improvement in revegetation techniques, this established rehabilitation can be variable in age, type and quality. The following dot points describe how the existing rehabilitation has been incorporated into the PRCP Schedule:

- Depending on the age of rehabilitation (and therefore its expected maturity relevant to final milestone criteria, areas of existing rehabilitation are included in the PRCP schedule at different milestones (RM4, RM5 or RM6) to allow for the time required for rehabilitation of different ages to develop through the rehabilitation milestones (Section 6.13.4).
- Large areas of existing rehabilitation are likely to reflect the historic objectives of the era in which they were established. These areas may not be progressing toward the required milestone criteria associated with more contemporary rehabilitation. Thus, an allowance of 15 years (in RM6) is applied for potential trajectory rectification / remediation works to be developed, applied and become effective (Section 0).
- Rehabilitation identified as not achieving particular targets is flagged for management through the remediation program (Described in Section 9 of the Rehabilitation Management Plan (RTAW, 2021). For some sites, this may simply mean waiting for several years until the failing rehabilitation corrects itself or active remediation activities take effect, and the target is met (Section 6.13.4).
- Some areas of historical rehabilitation, in particular West Andoom, are impacted by the ecosystem altering weed Gamba grass (Section 2.1.10). It is a significant challenge to manage this weed and establish good quality native ecosystem rehabilitation that can meet the expected rehabilitation milestone criteria. In acknowledgement of this, the PRCP schedule includes an allowance of 20 years for the West Andoom area (RA3) to enable research and development, integrated weed control and monitoring activities to be undertaken.

2.3.1.4 Operational constraints

As with any complex activity such as large scale mine site rehabilitation, there are a number of factors which have an impact on success which are not 100% predictable nor controllable. For these factors, experience must be relied upon to develop appropriate allowances (or contingencies) for use in (especially long-term) rehabilitation planning to ensure targets are reasonable and do not drive unrealistic or unhelpful execution practices. Considerations factored into the PRCP Schedule timeframes include:

- In some areas, mining and/or rehabilitation operations can be impeded by localised inundation during the wet season. Where ground or surface water conditions become inundated, mining may not be able to continue and rehabilitation operations either cannot be undertaken or, if already executed, the rehabilitation may fail to establish. This \reinforces the conservative approach to setting long-term rehabilitation targets in 5-year periods to allow for the inter-seasonal variation to be accommodated.
- Weipa savannah woodland species. To maintain local provenance of these species within rehabilitation, RTAW has a well-developed local seed procurement program. A significant source of the seed procurement program relies on supply through the Aboriginal communities seed collection program which is supplemented where required by commercial seed collectors, to achieve the annual seed collection targets required to support rehabilitation operations (Section 6.2.2). Experience from

this program has highlighted the inter- and intra-seasonal seed phenological variability of the target local native species and resulted in a planning assumption that no more than 1,200 ha of rehabilitation will be able to be seeded in any given year.

- Topsoil that has been stockpiled for more than one wet season is known to have reduced value in terms soil biological and nutrient characteristics. In addition, stockpiled soil is more susceptible to weed impacts. Unfortunately, due to the nature of the mining process at Weipa, stockpiling of topsoil is sometimes unavoidable. When this stockpiled topsoil has been utilised for rehabilitation, an allowance of 10 years delay has been built into the PRCP schedule at RM4 to provide for a period of weed treatment and reintroduction of organic matter.

2.3.2 Closure rehabilitation

An array of additional infrastructure is required to support mining operations, including processing infrastructure such as the beneficiation plants and tailings storage facilities (TSFs), communication networks, water, sewage and electrical services, fuel storage, mechanical workshops and more. Following cessation of mining, the schedule for decommissioning, demolition and/or removal of these facilities is unlikely to commence immediately and is dependent on a range of factors:

- The desire for third party land use partners to retain or reuse some assets.
- It is likely that beneficiation will continue for 6-12 months following cessation of mining to exhaust any ROM or other ore stockpiles.
- Many facilities will be required to support closure operations while the mining areas are subject to rehabilitation activities (e.g. requiring fleet) which may take upward of 5-10 years to complete rehabilitation execution works for whole mine areas such as Andoom and East Weipa.

For PRCP scheduling purposes, a general allowance of 10 years is provided for most infrastructure and TSFs to be available for rehabilitation. Naturally, given the opportunity, areas no longer required to support closure activities will be rehabilitated.

As described in Section 6.9.1, the TSFs have a 2-stage decommissioning and closure strategy including a 20 year ‘control and monitor’ phase before final closure and rehabilitation. This strategy is scheduled in the PRCP as occurring over approximately 20 years.

In addition to this, there is a subset of buildings and other infrastructure which will not be decommissioned or rehabilitated (therefore not made available for ‘rehabilitation’), but rather have potential to be utilised for:

- Post-closure maintenance and monitoring activities and/or
- Post-closure community benefit and are thus assumed to be made safe and transitioned in a condition agreed with relevant third party/s (Section 1.2).

3.0 Community consultation

This section outlines the consultation undertaken during the development of this PRCP and the consultation plan, that outlines the ongoing engagement with key stakeholders in relation to the rehabilitation and closure activities described within this PRCP.

Community consultation is focused on the Traditional Owners of the land, firstly as when the mining leases are relinquished the land is to be returned to them, therefore they need and have a right to be consulted on the rehabilitation and closure activities. Secondly it is a legal obligation under the WCCCA and EBMPA (Agreements). Consultation on mining operations, progressive rehabilitation, environmental and cultural heritage protection, post mining land use, and tenure are key aspects of these Agreements. Both Agreements require the establishment of a Coordinating Committee, to meet quarterly each year to review and make decisions in relation to these aspects. There are two separate Coordinating Committees and beneath them sub-committees can be established to provide a forum for specific information to be presented to inform and enable the sub-committee to make recommendations to the Coordinating Committee.

Currently both Coordinating Committees have an Environment and Heritage sub-committees where most of the rehabilitation discussion are held, these also meet quarterly prior to Coordinating Committee, to support their role in decision making. The WCCCA Coordinating Committee has established specific sub-committees, including Land Relinquishment and Transfer, East Weipa Closure. Attendance at the committees is governed by the signatories to the agreements, noting the State of Queensland is a signatory to the WCCCA and attends the quarterly Coordinating Committee meetings.

It should be noted that prior to the commencement of the PRCP process, these forums have supported constructive and collaborative engagement including but not limited to:

- Establishment of rehabilitation goals and objectives to reflect the agreed Post Mining Land Use (PMLU)
- The development of completion criteria as required under the Rehabilitation Management Plan (per Environmental Authority) and land use agreements.
- Deriving cultural values workshops; an exercise consulting with traditional owners on the species they wish to be returned to country as part of the rehabilitation process. Species include those utilised in traditional practices such as tool making and bush tucker.
- Annual rehabilitation reporting and tours to share success and learnings. These represent opportunities to see how the rehabilitation process is undertaken, experience rehabilitation at various ages and development towards meeting criteria.
- Annual update to Environment & Heritage sub-committee on changes to rehabilitation establishment, remediation and monitoring, as well as annual targets/totals for completed rehabilitation.
- Endorsement of Land Outcome Documents including the Rehabilitation Management Plan and the Amrun Rehabilitation Strategy (RTAW, 2022)

Through the Agreements and consultation mechanisms, Traditional Owners maintain a strong cultural connection to their country and have an expectation that they will be kept informed about developments proposed on their land, including post-mining land use and relinquishment.

This transitional PRCP does not change or amend any previously agreed PMLU with primary stakeholders. However, under both Agreements contain mechanisms for an alternative PMLU to be nominated or recommended by the Traditional Owners (WCCCA Section 8.2 and EBMPA Section 7.8). Should an alternative PMLU be identified and agreed with the Traditional Owners, it is expected that an amendment to the PRCP will be submitted by RTW.

For the purposes of the transitional PRCP development, other stakeholders, including the WTA (non-voting member of the WCCCA sub-committee), Napranum Aboriginal Shire Council (signatory to both agreements) and Department of Environment and Science (DES) (signatory to WCCCA) have also been consulted (see Community Consultation Register, Section 3.1).

As this is a transitional PRCP, it should be noted that regular formal consultation processes as per Agreement obligations will continue regarding progressive rehabilitation and be the appropriate forum for PRCP consultation. The ongoing consultation process is summarised in Section 3.2.

3.1 Community consultation register

A site-based Communities team supports RTW, this includes maintaining a register of all community interactions, also they undertake the secretariat duties for the Traditional Owner Coordinating Committees and sub-committees, capturing the formal record of matters discussed, recommendations and agreed actions. Proceedings of formal consultation meetings under the WCCCA and EBMPA are confidential between the parties and only relevant information from stakeholder consultation shall be reflected in the register.

Traditional Owners have been the focus of the consultation for this transitional PRCP which has included discussions on preserving the existing rehabilitation and closure engagement, agreements, and management, which will be integrated under the new legislative framework. The consultation has focussed on the transition of existing progressive rehabilitation and land outcomes as outlined in the Agreements, including rehabilitation establishment, monitoring and maintenance, completion criteria, and post mining land use (PMLU).

The community consultation register is provided at Appendix C, presenting the relevant consultation activities related to progressive rehabilitation and closure matters prior to and during the development of the PRCP. All ongoing engagement and consultation in relation to the PRCP will be recorded in this register.

3.2 Ongoing community consultation plan

RTW have established processes and protocols for consultation with its key stakeholder groups. The ongoing consultation plan for the rehabilitation under the PRCP, expands on the principles established by the business' approach to Communities and Social Performance (CSP), and is summarised in the Community Consultation Plan (Appendix D).

Ongoing progressive rehabilitation consultation will continue to remain consistent with existing processes determined in the Agreements (described in Section3.3), principally through the Environment and Heritage sub-committees.

Closure consultation is also conducted within the existing CSP framework and is reflected in the CSP annual plan for the operation.

To ensure that rehabilitation and closure meets the expectations of stakeholders, closure studies are undertaken prior to the end of mine life for each of the mining areas within Weipa Operations; East Weipa, Andoom and Amrum. Key components of these studies include the engagement with stakeholders and completing technical investigations on final landform, progressive rehabilitation, engineering, decontamination, demolition, retention of assets, and social and economic impacts of closure.

Although relinquishment of the Mining Lease is still sometime away, closure studies have commenced or are planned to commence as the end of mine life for East Weipa and Andoom approaches.

The principal engagement method on closure study matters is via the Coordinating Committee, and an East Weipa Closure sub-committee has been established.

Consultation with State and Local Government stakeholders will occur as part of regular meetings held with individual agencies, and the community as part of regular engagement forums. Consultation on specific issues is also undertaken outside of these regular meetings as the need arises. Consultation with other stakeholders

is conducted in a manner that is appropriate to the stakeholder and the specific issues requiring discussion (for example, engagement with Traditional Owners can be conducted on country as requested).

The timing of discussions and their focus will change as closure studies for each of the operational mine areas mature and progresses towards closure objectives, or new deposits are discovered and developed. The focus areas for discussion are listed in Table 10.

Table 10: Closure planning focus areas

Stage	Focus
During operations	• Undertake stakeholder identification and stakeholder mapping. • Work to understand key environmental, cultural and social values relating to life of mine, including operations and long-term closure (e.g. final landforms). Monitor progressive rehabilitation. • Ongoing consultation with stakeholders as part of operational processes to identify additional stakeholders and / or concerns that may impact closure.
Closure planning (studies)	• Commence closure-specific discussions with key stakeholders. • Discuss and agree (where relevant) key environmental, cultural and social values and closure objectives with key stakeholders, and alternative Post Mining Land Uses • Ensure closure objectives and indicative closure criteria remain relevant and appropriate. • Include closure in Traditional Owners engagement forums, established under the terms of Agreements with relevant groups. • Identify key social risks and opportunities for consideration in preliminary closure strategies. • Prepare Closure Stakeholder engagement and communication plan
In the lead up to closure (studies)	• Communicate outcomes of studies undertaken to improve the closure knowledge base, reduce closure risks or improve closure strategies. • Finalise end point criteria through key stakeholder engagement and consensus. • Discussion future uses for infrastructure with other parties, i.e. retention of assets. • Commence workforce communication strategy. • Finalise Closure Stakeholder engagement and communication plan
Closure (execution and cessation of mining)	• Implement Closure Stakeholder and communication plan • Work within Agreements consultation structure to update on monitoring requirements (e.g. land rehabilitation)
Post-closure (relinquishment)	• Continue to engage and consult within Agreements structures to feedback on post-closure monitoring and maintenance programmes. • Supporting Government to take a leading role in handing back land to Traditional Owners

3.3 Integration of rehabilitation consultation into existing engagement

The ongoing rehabilitation and closure planning consultation will be integrated into the existing stakeholder engagement framework systems and meetings. As outlined in Section 0, the primary stakeholders for rehabilitation activities are the Traditional Owners where engagement frameworks already exist within the Agreements. Annual Land and Rehabilitation Reporting and quarterly Environment & Heritage Subcommittee meetings provide review and endorsement of actions and outcomes through the agreements Coordinating Committees. Rehabilitation is a key theme for these meetings and discussions include planning, execution, establishment and monitoring methodologies, site visits, completion criteria and success rates.

3.4 Additional stakeholders

As the mining operation continues and the rehabilitation and closure planning progresses, additional stakeholders will be consulted where relevant. This is likely to include the WTA (as the representative local

Government body); signatory Aboriginal Councils; Community Groups; RTW Employees; State Government Departments; Commonwealth Government Departments; adjacent Landowners / Landholders.

4.0 Post mining land use

Section 1.3 describes how mine site rehabilitation has been undertaken progressively for over 40 years of operations at the Weipa bauxite operations and the historical and current rehabilitation goals.

The approved Post Mining Land Use (PMLU) is described as 'native, self-sustaining woodland vegetation comprising a variety of species, which in turn supports native fauna'. This is described within the RMPs, which are approved LODs, and agreed to with the TO Groups under section 8.1.1 of the WCCCA and section 7.8 of the EBMPA.

As outlined in the WCCCA (clause 8.2), and EBMPA (clause 7.8) a land use other than rehabilitated native vegetation can be proposed by Traditional Owners. However, for an alternative land use to be accepted at relinquishment, the option needs to be evaluated, confirmed to be a viable option, and accepted as end point criteria through the Agreements consultation process. The post-mining land use must then receive final review and endorsement through the Agreements Coordination Committees and then the State Government by way of a Major PRCP Amendment.

As described within the RMPs, all mining equipment, infrastructure and plant will be removed and rehabilitated unless agreement is reached with relevant stakeholders and the administering authority for the relevant items to remain (as allowed for in Condition (C26) of the EA). The RMPs specifically identified that water and plant infrastructure may be left in place. Town infrastructure is likely to be required for the ongoing operation and development of the town. Subject to stakeholder engagement and the administering authority's agreement under Condition (C26), elements of town infrastructure will likely be transferred to a third party owner who will become responsible for ownership, liability and ongoing operations (refer to Section 1.2.4).

The Weipa Town Planning Scheme identifies opportunities for expansion of the town boundaries (refer Section 1.2.3). The 'community' or 'public' infrastructure which are proposed to be left for community use are aligned with the strategic intent and outcomes of the Weipa Town Planning Scheme. RTW will continue consultation with the WTA, and other stakeholders and Traditional Owners, regarding other assets and areas of the ML7024 lease which may be transitioned to third party uses. Future changes to the PMLU as a result of these consultations will be incorporated into this PRCP by way of amendment.

5.0 Non-use Management Areas

There are no proposed non-use management areas (NUMA) associated with the ML areas.

6.0 Rehabilitation management methodology

This section outlines the rehabilitation methods based on the existing knowledge of the baseline environment (Section 2.1), understanding of how the environment is affected by mining (Section 2.2), and the subsequent proposed rehabilitation to meet the relevant Rehabilitation Milestone within the PRCP Schedule.

The described rehabilitation methods aim to achieve the proposed PMLU (native, self-sustaining woodland vegetation comprising a variety of species, which in turn supports native fauna) and have been developed from the results of many years of rehabilitation activities and stakeholder consultation. The rehabilitation techniques have been trialled, monitored and refined over time. As the project does not propose any NUMAs there are no methodologies proposed for the management of a NUMA.

Progressive rehabilitation is undertaken as mined out areas become available during the operational phase of mining. Progressive rehabilitation maximises the benefits of reduced environmental impacts on disturbed land, reduces liabilities on the company and aims for a geotechnically stable, revegetated, landscape which has minimal impact on the surrounding environment.

There has been a number of different studies that support the reasoning behind particular rehabilitation strategies and relate to soils, hydrogeology, hydrology, revegetation, waste characterisation, landform and cover design and water management.

The information summarised within this section has supported the development of the PMLU milestones, milestone criteria, planned timeframes within the PRCP Schedules.

6.1 Soils and cover material assessment

As areas become available, rehabilitation earthworks are initiated. Soil assessment, characterisation and mapping has been carried out across the mining tenures to gain a thorough understanding of the type of soils being disturbed by mining.

Soils in the Weipa region, particularly those potentially subject to disturbance by mining, are understood to be relatively homogenous. This area covers the bauxite resource which generally co-occurs with Darwin Stringybark (*Eucalyptus tetrodonta*) open forest to tall woodland on lateritic earths (Regional Ecosystem Type 3.5.2), which has been mapped at 1:100,000 for the entire Cape York Peninsula (Rio Tinto Weipa 2014, 2015).

Topsoils contain practically all of the nutrients, seeds, and beneficial organisms found in the soil and at Weipa are very shallow. Topsoil nutrition, including organic matter, at Weipa is also very low due to the frequent fires and ancient nature of the soils.

6.1.1 Topsoil, soil stripping, placement and re-profiling

Rehabilitation methodologies ensure quality topsoil is replaced after mining, in turn returning the soil seed bank and providing a suitable growing media for revegetation. Topsoil is generally defined as the original surface layer of mineral soil containing material that is usually darker, more fertile, and better structured than the underlying layers. Topsoils contain practically all of the nutrients, seeds, and beneficial organisms found in the soil and tend to be shallow in the Weipa area. Topsoil nutrition, including organic matter, at Weipa is also very low due to the frequent fires and ancient nature of the soils.

To ensure soil preservation, topsoil is stripped at a maximum depth of 600 mm. If there are areas just over 600 mm (e.g. 700 mm), a minimum of 300 mm is benched as topsoil and the remainder managed as subsoil. Generally, the suitable growth medium includes a combination of topsoil and subsoil. It is believed that topsoil returned at anything over 5 to 10 cm thickness (over a suitable growth medium) should provide the rehabilitated site with sufficient biological components (i.e. seed and microbes/mycorrhizae) to support good rehabilitation outcomes (Rio Tinto Weipa 2019a).

To assist in rehabilitation establishment in mined areas topsoil is routinely ameliorated with Phosphate based fertilisers. In TSF areas or areas requiring erosion protection grass establishment is encouraged through the

application of N based fertilisers. (e.g. fertiliser application to increase soil fertility and seed application to replace the diluted seed store) (refer to Section 6.1.5). It is important that soil handling is undertaken using appropriate and practical methods to ensure that rehabilitation benefits from the following:

- A suitable growing media with physical properties which optimise plant growth e.g. porosity and water holding capacity. This is managed by pit floor ripping and pre-seeding scarification.
- Optimal nutrition supplied by a combination of topsoil and fertiliser amendments.
- The soil seed bank of native plant species which supplement the applied rehabilitation seed mix.
- Symbiotic micro-organisms which form important associations with many native plant species used in rehabilitation. Soil microbes are primarily contained in fresh topsoil.

Topsoil removal is conducted three to twelve months ahead of mining during the dry season when soil moisture is sufficiently low to minimise negative impacts on soil compaction. Wherever practical, topsoil and subsoil are stripped separately and returned directly to nearby areas of the mine floor. With the exception at Amrun, where due to specific requirements for rehabilitation performance, topsoil is strictly separated from red waste before being returned sequentially to the mine floor.

Topsoil and subsoil is replaced sequentially on mined areas available for rehabilitation and spread to depths similar to those that were stripped. A conceptual view of the soil profile before and after mining is shown in Figure 36, including a conceptual >600 mm overburden scenario and <600 mm scenario.

Generally, the overburden, subsoil and topsoil stripped from a new mining area are taken directly to an existing mined out area that is awaiting rehabilitation. Ideally, this material is respread, ripped, and seeded within the same dry season. In circumstances when operational requirements prevent stripped material being directly re-located it is temporarily stockpiled.

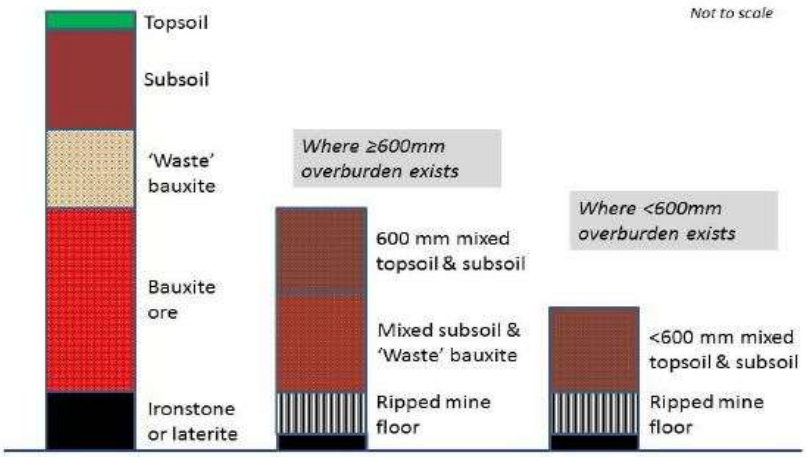


Figure 36: Conceptual pre-mining soil profile (left) and post-mining soil profiles (centre and right)

6.1.2 Stockpiling

Only when stripped topsoil cannot be directly returned to the mine floor it is placed in a temporary stockpile. The mine planning process endeavours to use stockpiles as soon as possible. Wherever possible, stockpiles are located above areas subject to wet season inundation and are constructed to optimised footprints and heights. This optimisation means:

- That stockpile footprints are minimised, to reduce the need for additional clearing of native bushland or a reduction in the area of land rehabilitated.

- Stockpile heights are maintained below 5 m (to minimise compaction and maximise the soil surface area to volume ratio and maintain as many valuable chemical, physical and biological properties as possible).

Experience shows that topsoil stockpiles generally contain sufficient native seed (especially grass seed) that they naturally revegetate during the first wet season providing good erosion control and initiating recovery of some of the biological and chemical values in the outer layer of the topsoil. Any topsoil required to be stockpiled across a wet season (1 November to 1 May) is inspected for vegetation establishment and, if required, is sown with a seed mix dominated by grasses to control weeds and erosion.

A qualitative assessment has been undertaken across the MLs to identify where a topsoil deficit exists and why subsoils or alternate growth mediums need to be used (Section 6.1.4). Stockpile records are maintained which include the origin of the topsoil, stockpiles volumes and location, erosion controls, and ongoing management information such as the status of revegetation, weed and erosion.

Stockpiles can be a source of weeds for new rehabilitation which presents a significant risk of not achieving PMLU. To prevent this, weed infested stockpiles are inspected and treated where possible. However, treatment of weeds is often more effectively achieved once the stockpiled soil has been returned to the rehabilitation area, before the target seed mix is applied. Similarly, non-weed infested stockpiled topsoil becomes nutrient deficient over time decreasing its viability for rehabilitation.

To address the risk presented by using stockpiled soil operational priority is given to returning fresh topsoil and minimising stockpiling practices.

An operational trial is also underway to determine appropriate pre-seeding treatment solutions to revive significantly depleted soils, and to enable target vegetation to establish. The PRCP schedule allows for ongoing pre-seeding treatment over consecutive years, i.e. continual weed treatment and reintroduction of organic matter through delayed achievement of RM4 milestone criteria by 10 years.

The delayed target seed mix application also ensures that native seed is not wasted. Thereby mitigating risks associated with having limited native seed availability (see Section 6.2.2)

6.1.3 Ripping

Ripping is the process of breaking up the mine floor, which is comprised of ironstone or compacted pisolitic material using a bulldozer with a tine attachment. The mine floor can be quite compacted after the bauxite has been mined from the traffic of haul trucks and other heavy earthmoving equipment. The purpose of ripping is to increase water infiltration rates thereby reducing the severity of erosion and maintaining water and air space. Ripping also encourages deep root penetration allowing greater anchorage and access to water, crucial for the growth and survival of larger trees and shrubs. The soil at Weipa can form a thin surface crust even after light rainfall, creating an impenetrable layer for seedling establishment. Therefore, in those areas that have not been recently ripped, the soil surface is scarified prior to seeding to improve porosity and water holding capacity.

Ripping normally occurs immediately following the soil being respread on the mine floor. However, sometimes ripping is undertaken prior to the placement of soil for rehabilitation. In either case, the minimum ripping depth into the mine floor is approximately 500 mm. On slopes ripping is carried out along the contour (across the slope) to reduce sheet erosion. Ripped lines are spaced at approximately three to four metres apart.

6.1.4 Materials balance

The materials inventory for the site shows a slight deficit of topsoil available for the current disturbance footprint at Andoom and a more significant deficit at East Weipa (Table 11). These calculations are based on a review of spatial data, including some historical data.

The topsoil deficit is likely due to historical practices including filling borrow pits and other mined areas with topsoil, respreading topsoil at depths thicker than stripped to elevate post-mining landscape, and the Pre-2008 sequencing method of dumping and spreading (which left topsoil sitting on the mine floor).

Strategies to address the topsoil deficit are being trialled, as detailed in Table 21, and include:

- Returning stripped overburden and stockpiled soil at reduced thicknesses, possibly supplementing material with a lower waste layer to ensure sufficient water holding capacity remains.
- Utilisiing ameliorated tailings to form a growth medium. The proposed amelioration methods are subject to further analysis

As indicated in Table 11:

- 72,565,731m^3 of tailings material is available to be borrowed from the EW TSF which is more than sufficient to offset the 10,826,000 deficit m^3 in East Weipa.
- 56,455,381 m^3 of tailings material is available to be borrowed from the Andoom TSF which is more than sufficient to offset the 1,964,000 deficit m^3 in Andoom.

The positive kaolin balance will be addressed through closure activities including relocation of the remaining kaolin into a nearby pit. Relatively small volumes will be reserved for future utilisation including relining the Evans Landing landfill first flush ponds and various contaminated sites' management.

Table 11: Inventory of material types across the MLs (m^3)

Material	Description	East Weipa	Andoom	Amrun	Ely	Total
Topsoil	Stockpiled topsoil	544,000	21,522,000	85,929,000	6,127,000	114,123,000
	Volume required to cover disturbed area (at average stripping depths – i.e. 600 mm at Weipa, 300/450 mm at Andoom	11,370,000	23,486,000	62,978,000	6,074,400	103,909,000
	Variance	-10,826,000	-1,964,000	22,951,000	52,000	10,214,000
Available tailings	Sourced from EW TSF	72,565,731	56,455,381			
Kaolin	Stockpiled kaolin	174	N/A			174
	Volume required to reline EVL landfill first flush ponds and misc. contaminated sites management	0.175	N/A			0.175
	Variance	174	N/A			174

Note: rounded to nearest thousand, where appropriate.

6.1.5 Soil amelioration

The red Kandosol soils used in rehabilitation at Weipa are extremely infertile and nutritionally deficient. However, target native species are adapted to the geochemical conditions characteristic of these soils.. Most physical and chemical parameters are not significantly altered by the mining soil handling processes unless they are stockpiled (see Section 6.1.2).

There is some reduction in macro- and micro-nutrients due mostly to dilution of the topsoil through the handling process. This is largely addressed through provision of fertiliser at the time of seeding, with an aim to provide sufficient nutrients to maximise initial establishment and plant growth during the first wet season. The type and rate of fertiliser application is determined by the nature of the rehabilitated soils and plant species being re-established. Generally, superphosphate is applied at a rate of 200 kilograms per hectare (kg/ha) using a tractor-towed belt spreader or via aerial seeding.

Once the post-mining soil surface is prepared (respread and ripped), an assessment of soil heath and suitability is carried out to confirm soil is suitable for target vegetation (RM4). Soil is determined suitable if RM4 criteria are met, and the growing medium is:

- Soil sourced directly from stripped area in the same season (fresh return).
- Soil of degraded quality (e.g. weed infested, sourced from long term stockpile or other medium) and it has had sufficient pre-treatment, i.e. weed treatment, organic matter inoculation to receive target seed mix.

Soil suitability for target vegetation is crucial to avoid 'wastage' of limited native seed resources; further explained in Section 6.2.2.

6.2 Revegetation process

Section 1.3 describes how mine site rehabilitation has been undertaken progressively for over 40 years of operations at the Weipa bauxite operations and the historical and current rehabilitation goals. Presented in the following sections and in Figure 37 is a summary of the progressive revegetation process.

Figure 37: Overview of the progressive revegetation process

6.2.1 Surface preparation

The soil surface is scarified immediately prior to seeding. Pre-seeding scarification assists in providing suitable growing media properties to optimise plant growth (e.g. porosity and water holding capacity).

The soil can form a thin surface crust even after light rainfall, creating an impenetrable layer for seedling establishment. Scarification breaks through any soil surface crust and creates small furrows of soft soil which allow seed to settle and germinate. Scarification maximises the chances of seed survival, germination, and establishment.

Similar to ripping, scarification on sloping ground typically occurs along the contour in order to minimise sheet or gully erosion. Scarification is carried out using various means, such as a tractor-towed disc plough, a tractor-towed multi-tine scarified, a grader with a scarifier or a dozer with a ripper beam attachment.

6.2.2 Plant species selection

Local, native species are selected for inclusion in the rehabilitation program primarily due to their likely suitability to the anticipated post-mining conditions of the area to be rehabilitated. Framework species are selected based on the target end land uses. The proximity of the site to be rehabilitated to the wet season water table is the key factor determining which native plant community is most appropriate for the post-mining landscape. Generally, Eucalypt-dominated 'dry' woodlands, with grassy understories (land units 2b and 2c, see Section 2.1.8.1) are established on the free-draining areas. In those areas that are seasonally inundated, or less free draining, Melaleuca swamp and Melaleuca/Swamp Mahogany vegetation communities (land units 3b and 7b among others, see Section 2.1.8.1) are established.

A schematic representation of these land units in relation to the wet season water table is shown in Figure 38.

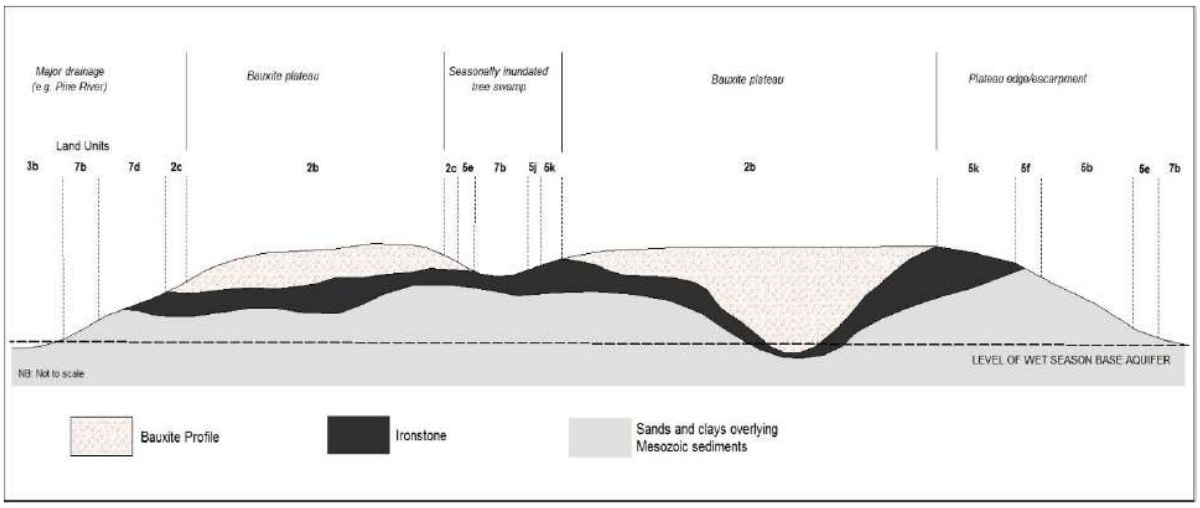


Figure 38: Schematic representation of pre-mining land units in relation to depth of wet season water table

Based on these target land units, a suite of 'framework' species has been developed representing the key species which need to be re-established to ensure that the rehabilitation develops into a mature ecosystem which is resilient to the local disturbance regimes and meets the goals and objectives of the rehabilitation.

The key resource for effectively conducting revegetation operations is viable, locally sourced framework species see of the target land units. For the projected areas requiring rehabilitation, approximately 90% is likely to require a "dry" seed mix; which includes high proportion of *Eucalyptus tetrodonta* (Darwin Stringybark), *Corymbia nesophila* (Melville Island Bloodwood), and *Erythrophleum chlorostachys* (Cooktown Ironwood).

A significant consultative program was undertaken in 2010 and again in 2012 (Fell, 2012) to work with Traditional Owners to identify species which were considered 'culturally important' and which might be appropriate to incorporate into the rehabilitation program. Thirty-seven plant species were identified by Traditional Owners as a priority for re-establishment within the rehabilitation. Twenty-eight of these occur naturally within Eucalyptus Tetrodonta woodlands and are considered suitable for drier areas. An additional

15 plant species, from other, non-woodland vegetation communities, were recognised as priority plants for incorporation in low lying, seasonally inundated, areas that occur within the post-mined landscape.

The current seed mix already includes 27 of these species (when available). In addition, analysis of older rehabilitation shows that 32 of the 37 species have established in rehabilitated areas. This compares favourably with undisturbed sites of the target land units where 31 of the 37 species have been recorded.

Culturally important species which have not been seen in the rehabilitation to date are included in the 'target' list for ongoing development of our species diversity under the RTW Research Program as outlined in the RMPs (Rio Tinto Weipa 2019a, b, c).In summary, priority is placed on local, native species from the target land unit vegetation communities, including those which are:\:

- Framework species
- Able to reliably colonise from freshly replaced topsoil
- Suited to establishment from broadcast seed
- Able to be collected within the Indigenous Community Seed Collection Program or commercial seed collections contracts
- Of cultural significance to Traditional Owners.

Accordingly, a comprehensive set of seed mixes is currently used specifically tailored to establish rehabilitation with a high likelihood of achieving the rehabilitation goals and objectives for each disturbed area. These seed mixes are used routinely each year as part of the progressive rehabilitation program. Additional seed mixes are developed to meet other requirements, such as to establish vegetation to control dust on the TSFs, or to reduce erosion on steep slopes through use of a 'high grass' seed mix.

The current typical RTW seed mixes and rates used for revegetation of the 'dry' woodland communities, 'wet' seasonally-inundated vegetation communities, and stockpile stabilisation are outlined below in Table 12. Seed rates for specific species can vary based on environmental factors (e.g. soil properties) of the target rehabilitation area and on annual seed availability.

Table 12: Typical seed mixes and rates for revegetation

Species	Dry (g/ha)	Wet (g/ha)	Stockpiles/ (g/ha)	Identified as Culturall Significant in Fell (2012)
Framework				
Corymbia clarksoniana	50	10	0	Yes
Corymbia nesophila	200	0	0	Yes
Corymbia stockeri	50	10	0	
Erythrophleum chlorostachys	300	20	0	
Eucalyptus alba	50	20	0	
Eucalyptus brassiana	40	40	0	Yes
Eucalyptus cullenii	50	10	0	
Eucalyptus leptophleba	50	10	0	
Eucalyptus tetrodonta	400	50	0	Yes
Lophostemon suaveolens	5	10	0	

Species	Dry (g/ha)	Wet (g/ha)	Stockpiles/ (g/ha)	Identified as Culturall Significant in Fell (2012)
Melaleuca leucadendra	5	5	0	Yes
Melaleuca stenostachya	0	5	0	
Melaleuca symphyocarpa	0	5	0	
Melaleuca viridiflora	5	5	5	Yes
Midstorey/Understorey				
Abrus precatorius	5	0	5	Yes
Acacia aulacocarpa	5	2	0	
Acacia auriculiformis	5	2	0	
Acacia crassicarpa	10	5	0	Yes
Acacia leptocarpa	5	5	5	
Acacia platycarpa	5	5	5	
Acacia rothii	10	10	10	Yes
Adenanthera pavonina	10	5	0	
Alphitonia excelsa	20	10	0	Yes
Alstonia actinophylla	0.5	0.2	0	Yes
Alstonia spectabilis	0.5	0.2	0	Yes
Antidesma parviflorum	5	2	5	Yes
Atalaya varifolia	4	0	2	
Brachychiton garrawayae	5	2	0	
Breynia cernua	5	2	5	
Cassytha filiformis	4	0	4	
Cayratia trifolia	4	0	4	
Clerodendron floribundum	20	2	2	
Cochlospermum gillivraei	10	2	2	
Elaeocarpus spp	5	2	0	
Ficus opposita	20	0	10	Yes
Grevillea glauca	10	2	2	
Grevillea parallela	10	2	2	
Grevillea striata	10	2	2	
Livistona muelleri	50	10	0	Yes
Petalostigma pubescens	10	5	0	
Planchonia careya	10	5	0	
Sterculia quadrifida	10	5	0	

Species	Dry (g/ha)	Wet (g/ha)	Stockpiles/ (g/ha)	Identified as Culturall Significant in Fell (2012)
Xylomelum scottianum	5	2	0	
Dioscorea transversa	4	0	0	
Erythrina vespertillio	5	0	0	
Grewia retusifolia	10	0	0	Yes
Morinda reticulata	10	0	0	Yes
Siphonodon pendulus	10	0	0	
Ampelocissus acetosa	4	0	0	
Canarium australianum	5	0	0	
Large seed				
Pandanus spiralis	500	500	0	Yes
Parinari nonda	75	75	0	Yes
Grass seed				
Aristida holathera	10	0	120	
Ectrosia leporina	20	10	150	
Eriachne armittii	5	0	75	
Eriachne burkittii	5	0	75	
Heteropogon contortus	20	10	150	Yes
Heteropogon triticeus	20	0	150	Yes
Imperata cylindrica	20	10	120	
Sorghum plumosum	20	0	150	

6.2.3 Direct seeding and seedlings

Direct seeding of the seed mix has been found to be the best method for establishing desired plant species, especially considering the scale of the progressive rehabilitation program. Direct seeding is generally undertaken using either a belt spreader towed behind a tractor, or via aerial seeding.

Seeding typically occurs between November and January of each year to help ensure the soil moisture and follow-up rainfall is favourable to seedling establishment. Large seed, such as that of *Pandanus spiralis* and *Parinari nonda*, are too large to be spread using the aeroplane or tractor spreaders. As a result, these seeds are hand sown. Due to the extensive area of rehabilitation, modified 4WD vehicles are used to deliver these large seeds. This operation typically occurs early in the wet-season immediately following tractor seeding operations (i.e. January).

At Weipa, planting of seedlings can be used as a remediation technique to correct substandard rehabilitation, rather than an initial rehabilitation establishment method. Seedling planting can be advantageous in that there is a higher likelihood of the individual plants surviving the first dry season (than germinants from broadcast seed), the planted seedlings will be more resilient to fire earlier, and as a mode of reintroducing particular species not suited to establishment from broadcast seed. Areas intended for seedling planting may include:

- Recently rehabilitated areas which have failed to establish only a few key species.
- Areas which are targeted for 'accelerated' rehabilitation, e.g. wildlife corridors.
- Areas where species struggle to establish (e.g. inundated areas).
- Areas at risk of fire or competition from weeds where accelerated establishment and growth of framework species is desirable.

Seedling planting may also be used to establish priority species where there is in sufficient seed volumes for direct broadcast over the subject area.

6.3 Hydrogeology

The baseline hydrogeology of the shallow and artesian aquifer resources is described in Section 2.1.5 including the groundwater occurrence, regional recharge and discharge locations, and groundwater quality. This type of information forms the foundation of the series of shallow aquifer hydrogeological conceptual models HCMs that have been developed for mining operations at Weipa. The HCMs inform understanding of the expected changes to the baseline hydrogeology from mining, as well as from the rehabilitation of mined areas and cessation of groundwater extraction for water supply.

6.3.1 Hydrogeological Conceptual Models

Due to the intermittent or insignificant shallow aquifer systems found to occur at the Andoom/Ely and Amrun mining areas, most interest in mining and post-mining impacts relate to the Weipa Peninsula shallow aquifer. RTW has developed two (HCMs) for the Weipa Peninsula, which considered the influence of mining as outlined above, as well as the baseline conditions of the shallow aquifer only, and the following geological units:

- Ironstone, mottled clay, and bauxite layer (Wyaaba Beds)
- Silt/clay layer (semi-confining Trunding Clay)
- Napranum sand layer (shallow aquifer)
- Bulimba Formation siltstone/sandstone (low permeability base)

The surficial bauxite aquifer at Weipa is conceptualised to form a single, partially connected aquifer with the underlying Napranum Sand which is separated in some areas by a semi-permeable ironstone and clay 'aquitards' (Wyaaba Beds and Trunding Clay). The two conceptual models (indicating the operating mine scenario) are summarised as:

- Weipa Conceptual model case #1 considered the creeks or swamps terminating within the shallow aquifer (Figure 39).
- Weipa Conceptual model case #2 considered the creeks or swamps terminating within the bauxite/ironstone unit (Figure 40).

The Weipa HCM indicates that groundwater inputs which originates as meteroric water from the extraction areas within the bauxite, permeates through the bauxite to the Napranum Sand or semi-permeable Trunding Clay. During the wet season when areas are inundated, groundwater flow occurs from the surficial aquifer to the underlying shallow aquifer, recharging it. During the dry season, the water level in the surficial aquifer declines, and discharge from the shallow aquifer to the surficial aquifer can occur. Many local creeks and swamps may extend into the underlying shallow aquifer forming a direct hydraulic continuity within the aquifer. These pathways could also enable recharge to the shallow aquifer during the wet season when the area is inundated, and similarly, discharge during the dry season.

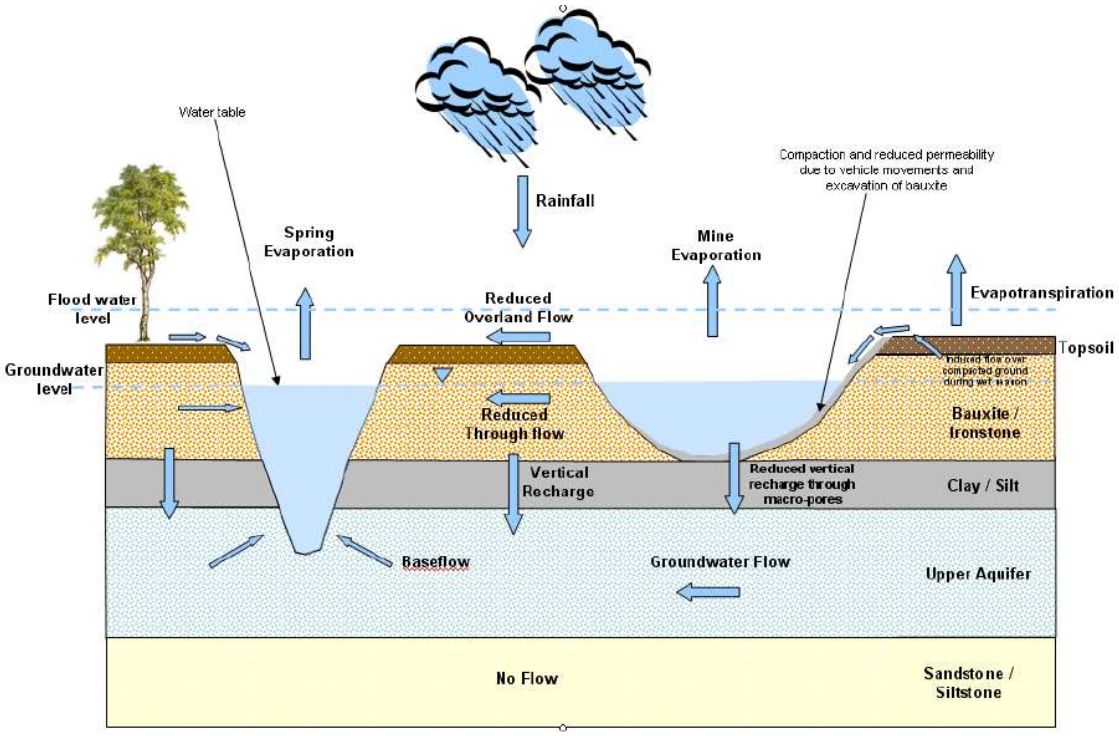


Figure 39: Weipa Hydrogeological Conceptual Model – Case 1

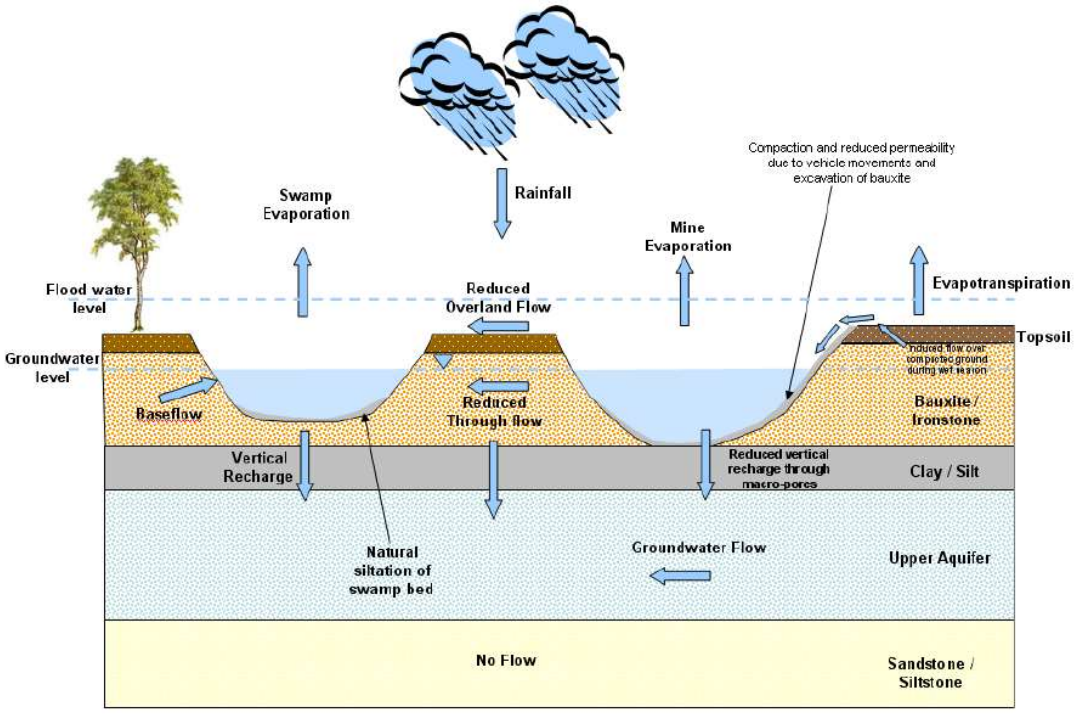


Figure 40: Weipa Hydrogeological Conceptual Model – Case 2

At Andoom, the bauxite is the single water bearing unit (Figure 41) with the underlying ironstone/clay acting as an aquitard. The Andoom/Ely HCM indicates that groundwater which originates from extraction areas within the bauxite predominantly moves within the bauxite unit or connected units of the Wyaaba Beds, above the Trunding Clays.

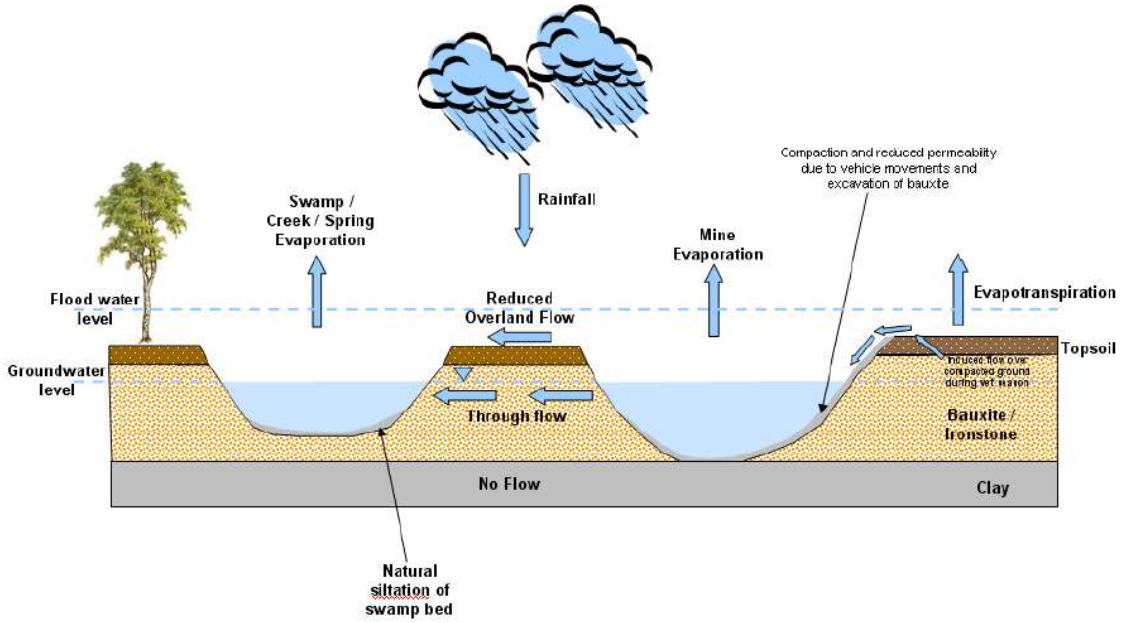


Figure 41: Andoom Hydrogeological Conceptual Model

Within the Amrun area, the groundwater is only within the bauxite horizon (and mined areas) during the wet season. Amrun shallow aquifer levels during the dry season are typically 4 m to 8 m below the base of the bauxite. Therefore, Rio Tinto Alcan (2011) concluded that there would be a very small impact from the effects of mining at Amrun on the groundwater during and post rehabilitation activities.

The groundwater cross section for the Amrun area provided in Figure 42 displays the bauxite horizon and the wet and dry season water table. The wet season water table is below the base of the bauxite for the majority of the area and that the dry season water table is always below the base of the bauxite. During mining, the wet season water table is predicted to rise above the base of the bauxite infrequently.

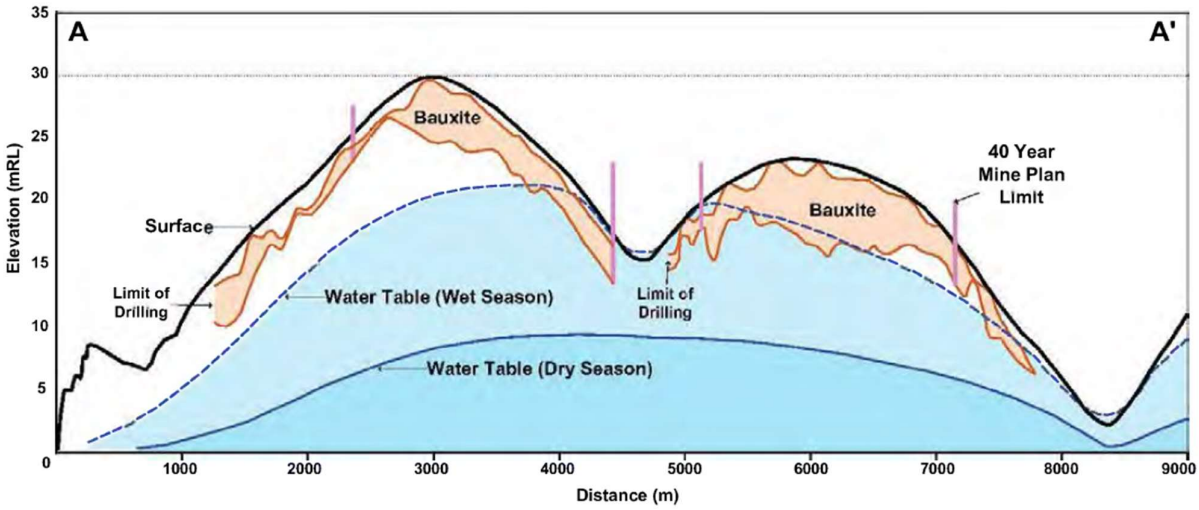


Figure 42: Amrun groundwater cross section

An example of the useful outputs provided by HCMs is provided in Figure 43, of the inferred hydrograph for undisturbed, mining and rehabilitated areas for Andoom. The graph clearly shows the return of the surface and shallow groundwater regime, after rehabilitation matures, to reflect ‘undisturbed’ conditions.

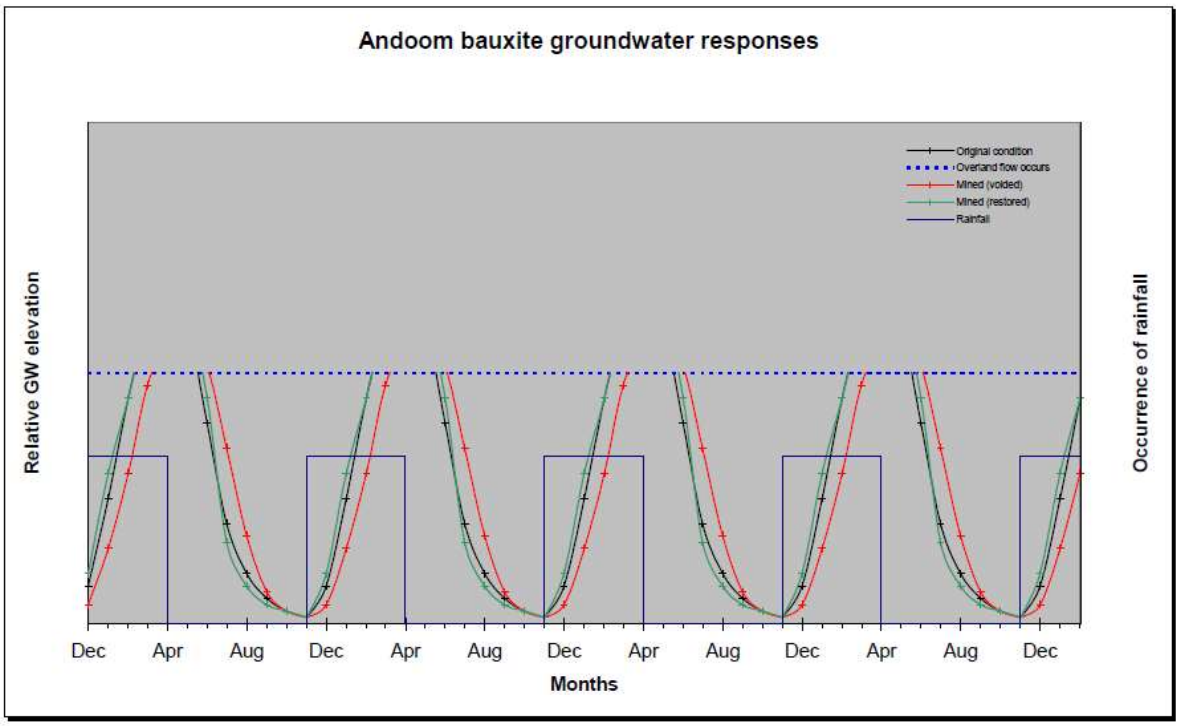


Figure 43: Andoom inferred hydrograph for mining and rehabilitated (restored) areas

6.3.2 Impacts of mining and rehabilitation on hydrogeological systems

In general, the impacts of the mining process on the shallow aquifer are predominantly temporary and able to be reinstated or mitigated by rehabilitation and closure activities. The methods for rehabilitation of the mined area are described in Section 6.1 and Section 6.2 (e.g. soil and topsoil placement, re-profiling, ripping and revegetation). The impacts considered in the HCMs are listed below, along with commentary as to the mitigating effect of the rehabilitation method:

- Reduced overland flow due to open mine pits

  Mostly temporary – rehabilitation will reinstate a vegetated, stable land surface that will support natural overland flows. In general, there will be a minimal net change to the overland flow conditions relative to the unmined areas. Some areas will experience extended periods of seasonal inundation, particularly where the shallow aquifer sits at or just below ground level such as some areas of the Weipa mine – see Section 6.4 for a discussion of surface hydrology during and after mining.

- Reduced through flow due to removal of the bauxite layer (mostly Weipa)

  Temporary – rehabilitation will return subsoils and topsoils to the mine floor prior to revegetation, providing a layer of material with comparable hydraulic characteristics to the bauxite, allowing for vertical flows.

- Reduced vertical recharge through macro-pores on the mine floor (mostly Weipa)

  Temporary – the rehabilitation method includes subsurface ripping of the topsoiled mine floor.

- Compaction and reduced permeability of mine floors and pit access roads due to vehicle movements and excavation of bauxite, causing induced flows over or around compacted ground during the wet season.

  Temporary – the rehabilitation method includes subsurface ripping of the topsoiled mine floor.

An additional impact on the shallow and artesian aquifer resources is extraction of water for mining and residential purposes. At closure the artesian and shallow aquifer bore networks supplying the mining operations will be decommissioned and rehabilitated (as described in Section 6.12.2). Some shallow aquifer bores will be required to continue to provide potable water to the Weipa township. As part of the water management plan numerical groundwater modelling is carried out as required to simulate the aquifer state and estimate groundwater storage and predicting potential impacts of management changes to the shallow aquifer at Weipa. Although no shallow groundwater recharge modelling has been undertaken for post closure conditions, given the high degree of rainfall infiltration, it is likely that when the bore network ceases to extract water from the aquifers for processing, they will recover to pre-mining conditions relatively quickly.

6.4 Hydrology – including flooding, seasonal inundation, drainage and erosion control

Section 3.4 of the PRCP Guideline requires that flood plain modelling is required for all sites with voids proposed as a NUMA. Areas which have been disturbed for mining and associated activities are proposed to be rehabilitated to a stable condition (except those proposed 'community' or 'public' infrastructure to be left for community use, see Section 1.2.4) and no residual voids are proposed to be left as a NUMA. Therefore, flood plain modelling has not been conducted and is considered not relevant to this PRCP.

As described in Section 6.3.1 above, the physical process of bauxite mining has a range of (mostly) temporary impacts which, due to their strong inter-connectivity, effect both the shallow aquifers and the surface water systems of the mining areas.

The mine areas are dissected by areas of undisturbed land, including that buffered for protection of creeks and drainage lines, swamps and coastal margins, and sites of cultural significance. These features form 'terminal boundaries' around the mine pits, which are lowered by comparison (with depths reflecting the amount of bauxite removed). Other above-ground features such as haul roads and stockpiles can also form surface water 'boundaries' for the mine areas.

With local surface water volumes effectively increased due to surface compaction and reduced infiltration, these boundaries prevent surface water overland flows from draining away and can, in some areas, cause long term seasonal ponding issues. This is exacerbated in areas, such as on the Weipa Peninsula, where the shallow aquifer is substantial and frequently comes near or above the ground surface during wet season flows.

However, once rehabilitated, in most areas surface water ponding and surface runoff return to near-natural levels (very low), due to the mine floor being ripped to increase infiltration and evapotranspiration increasing with developing vegetation biomass (Rio Tinto Alcan 2011) (Table 13).

Table 13: Rainfall-runoff characteristics of undisturbed, open and rehabiltiation mining areas

Water Balance Component		Undisturbed	Open Mining Area	Immature Rehabilitation	Mature Rehabilitation
Evapotranspiration	mm	735	615	724	747
	%	42.6%	35.3%	41.6%	42.9%
Surface Runoff	mm	10	23	5	3
	%	0.6%	1.3%	0.3%	0.2%
Baseflow	mm	843	905	820	801
	%	48.0%	52.0%	47.1%	46.0%
Deep baseflow/recharge	mm	153	198	192	190
	%	8.8%	11.4%	11.0%	10.9%

Landscape scale planning shall identify where key post-mining drainage features will be required, including removal and/or landforming of above-ground features within the mine area domain, such as haul roads, stockpiles, to ensure that the overall drainage of the area is not compromised. These drainage features may be able to be established as part of the progressive rehabilitation operations or, more likely, as part of the final closure activities. These drainage designs will consider the post-mining sub-catchments and endeavour to reinstate surface flows in a way that interact with the shallow aquifer in a natural way, drain the rehabilitated landscape as well as ensuring landform stability and downstream water quality is maintained.

Even with a proven, effective rehabilitation program and expertly designed post-mine drainage system and landform implemented, there will likely be some rehabilitated areas of the Weipa Peninsula where ongoing, seasonal inundation is significant following mine closure. For these areas, the experience gained from progressive rehabilitation activities during mining has provided a proven method to establish a native ecosystem PMLU of a ‘seasonally inundated wetland’ comprised of species selected from naturally occurring, similar systems near the mine.

6.4.1 Erosion Control

The progressive rehabilitation method includes soil handling, species selection and seeding rates aimed to ensure (among other things) that vegetation development is sufficient to reduce erosion from rehabilitated areas. Erosion monitoring of rehabilitated mined areas indicate that once soil profiles have settled (usually after 3-5 years of topsoil replacement) there is little active erosion observed. There is a very low likelihood of the rehabilitated landscape having a negative impact on the downstream water quality of the surrounding ecosystems.

The features of mining and slopes that are likely to require specific erosion control include the battered terminal mine boundaries and the road drains and contours. The terminal mine boundaries will have a maximum slope angle of 25% or 1:4 (Section 3.1 of the Rehabilitation Management Plan). These will be stabilised by increasing the surface roughness, tailored seed mixes with greater grass seed and breaking up the slope length. There may be instances where haul roads may need to be removed to reinstate any surface water flow paths.

Long term erosion controls that would be utilised for rehabilitation and closure include:

- Land forming to reduce slopes, maximise infiltration and reduce risk of erosion
- Revegetation
- Using revetment and reno mattresses in lined channels
- Rock mulching on slopes to reduce raindrop impact and overland flow.

The planning of the location, number and size of the drainage channels to be constructed will be determined prior to closure in a detailed hydrology study.

Post closure water management and runoff from the TSFs is described in Section 6.9.6.

6.5 Landform design

After overburden and soil are returned to mine floor following mining, the final rehabilitated land surface is at a lower elevation than the original land surface due to the removal of the bauxite, but the overall slope of the landform is generally similar. Where mined areas abut non-mined areas, batters are formed and these are contoured to a maximum slope of 25% or 1:4 (Section 3.1 of the Rehabilitation Management Plan). . Vegetation will be retained within environmental buffers and other non-mined areas (excluding infrastructure). Through the retention of vegetation buffers and proposed progressive rehabilitation with native species, no significant changes to broad scale vegetation character of the mining areas at the landscape scale are expected. The final landform will not contain waste rock dumps, however some historic overburden stockpiles may remain which will be battered down to a safe and stable slope and rehabilitated. Based on stakeholder consultation to date, TSFs will appear as elevated features in the post-mining landscape (in some cases reaching 40 m above ground level). These comprise a relatively minor proportion of the disturbance footprint, however some of the East Weipa TSFs are located within the immediate vicinity of the Weipa Township. The top of these facilities will be contoured to form gentle free draining slopes. Some self-draining ponds may be retained. Suitable water management features will be installed to minimise erosion. The tailings storage facility embankments and surface will be revegetated. Further details of how the TSF final landform designs are provided in Section 6.9.4.

Given the very broad extent over which mining areas extend producing a 3D design of the entire final landform would not provide a beneficial visualisation of the post-mining landscape. Schematic representations of the post mining landform to assist with rehabilitation planning have been prepared previously as documented within the RMPs, and as a basis for hydrological studies (refer to Section 6.5.1).

Consultation will continue with key stakeholder groups on the final landform which will be developed n accordance with the endorsed completion criteria.

6.5.1 Schematic representation

A high-level landscape hydrology study for the East Weipa area final landform has been conducted which aims to provide a basis for further hydrological work (such as the flood risk profiles and flood models) during closure studies. The estimated final landform for East Weipa with the major streams indicated are provided in Figure 44. A conceptual final landform design has been commenced in preparation for the final landform and hydrology studies to be completed during formal closure studies. An example of the conceptual Andoom final landform is provided in Figure 45.

Conceptual final landform planning and modelling predicts visually what the landform will be like at closure. Mining-related features that stand out include the TSFs. The change in topographic relief of the majority of mining areas is barely perceptible from surrounding areas when mapped on a regional scale. This is reflective of the minor changes to topography due to the extraction of bauxite and subsequent rehabilitation activities. The assessments to date provide an initial schematic representation of the landform, which will be updated where relevant as the closure planning process progresses to further refine aspects relating to drainage lines and the likely indication of the water flow and capture sites.

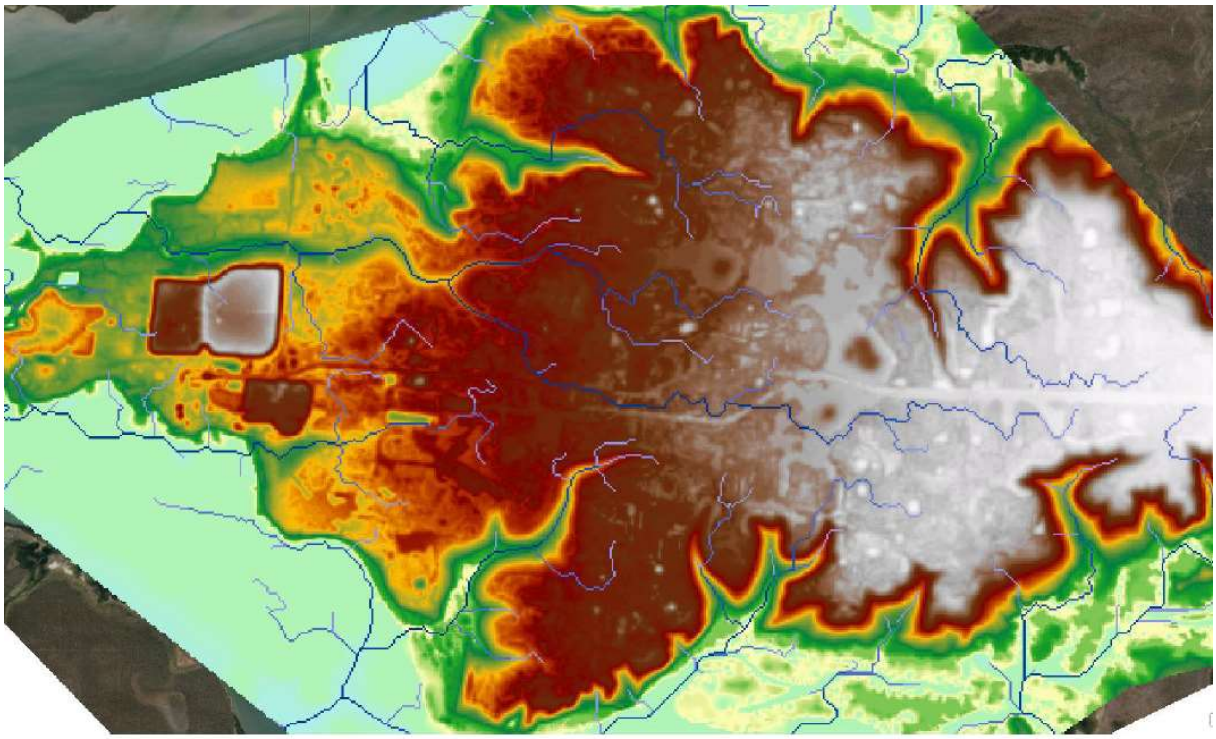


Figure 44: Conceptual East Weipa final landform

6.6 Water management

Surface and groundwater management is a key aspect of achieving successful rehabilitation and mine closure. The assessment of potential contaminants posing a risk to environmental values of the receiving environment highlighted that, for the mining activities, no contamination to local surface or groundwater systems is expected post-closure. This is further supported by downstream water quality monitoring results with the water quality characteristics of the area reflecting the nature of water flowing through and within bauxite terraces.

Tailings is the main mineral waste generated at the mining operations and tailings geochemical characterisation is described in Section 6.9.2.

Potential sources of water contamination during operations include hydrocarbons and chemicals from industrial areas (such as workshops, fuel storage tanks), commercial chemicals used in mining associated activities (e.g. fire fighting chemicals) and leachates from the operational landfill (to be handed over to a third party to support the post-mining Weipa township, as per Section 1.2.4).

For these sources, individual source-pathway-receptor (SPR) models are developed as part of the Site Contaminated Site Register and Program (Section 6.12.3), and as part of closure studies, further investigations shall be undertaken and any specific remediation activities required to achieve post-closure objectives identified.

There are currently no known requirements for long-term or post-closure management relating to:

- infiltration and seepage intervention and collection controls
- surface water diversions and long-term management requirements
- dewatering requirements
- on-going water management and reduction requirements (i.e. treatment)

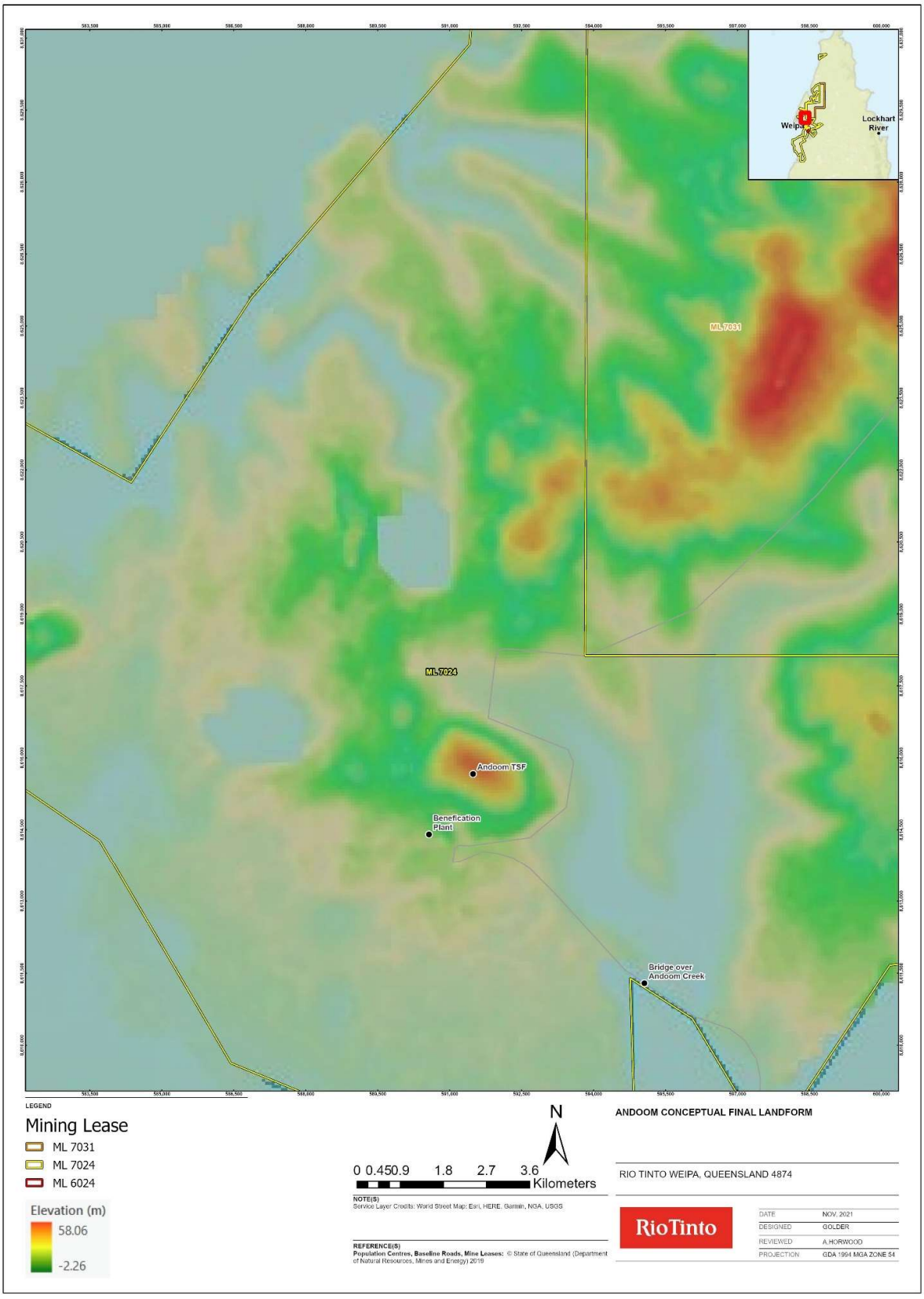


Figure 45: Conceptual Andoom final landform

6.7 Acid Sulfate Soils Management

The bauxite deposit at East Weipa sits on Paleogene sands and clays of the Bulimba Formation whilst the deposit at Andoom, north of Weipa, overlies Rolling Down Group smectitic/vermiculitic sandstones. These units are separated from quaternary sediments which occur primarily in low lying drainage basins, swaps and fringing drainage lines and having been derived from the Holocene marine transgression, include the potential to contain sulfidic material. While estuarine margins may have PASS present, testing at the Hey River barge/ferry terminal location did not find PASS (RTA 2011). Figure 46 and Figure 47 show acid sulfate soils mapping derived from Fitzpatrick et al (2011) for Weipa, Andoom and Amrun respectively. The mapping shows that the Life of Mine Extent (which targets economic bauxite reserves) are outside of areas interpreted to have a “high risk” of acid sulfate soils presence. During the Risk Assessment consideration was given to the likelihood of encountering Acid Sulfate Soils (ASS) during mining operations and, based on available data, the likelihood and consequence of encountering ASS considered low-risk.’

In addition to baseline mapping undertaken prior to the development of the project, in accordance with State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils (Qld Govt, 2002), the location of potential acid sulphate soils (PASS) where new disturbance is to occur will will be determined by the following criteria:

- Elevation less than 5 metres Australian Height Datum based on the sites lidar data;
- Holocene sediments exist based on the Australian GeoScience maps of the Weipa Region; and
- Association with drainage lines (Gunness land units 0 4a. 4b. 4c, 5g, 8b and 12a), basins (land units 7b, 3b and 12b), sandplains and dunefields (5a,3a, 7a, 5d, 7c, 6a, 5c and 12c), marine terraces (land units 5i, 12d, and 12f) and saline flats (land units 8c and 12e) (Gunness 1987).

The State Planning Policy 2/02 together with the administering authority’s Queensland Acid Sulphate Soil Technical Manual (Version 2.2 September 2004) (or otherwise latest edition of the administrating authority instructions for the treatment and management of ASS) provide the framework for RTAW’s plans and procedures for managing PASS.

The following protocol will to be used by RTAW for managing PASS:

- Disturbance of PASS shall be avoided wherever possible.
- A Community Heritage Environment (CHE) permit must be obtained prior to disturbing land for new development (RTAW Internal process as detailed in the Land Use Management Plan (RTAW, 2015) . The CHE permit application will assess the likelihood of the project encountering ASS by overlaying the proposed disturbance footprint on the PASS spatial mapping layer Figure 46- Figure 47. If PASS is to be encountered, a CHE permit will not be issued until an ASS Environmental Management Plan is approved by CHE and plans and procedures for its implementation are in place.
- Undertake sampling to confirm that the PASS contains any ASS.
- Develop an ASS Environmental Management Plan (EMP) for the activity/project. The ASS EMP must be written by a suitably qualified person and adhere to the requirements specified in the latest version of the administering authority’s - Queensland Acid Sulphate Soil Technical Manual.
- If ASS is to be disturbed, all aspect of the Rio Tinto’s HSE performance standard Chemically reactive mineral waste control, needs to addressed and implemented including the requirement for an ARD predication program. This will be included in the ASS EMP.

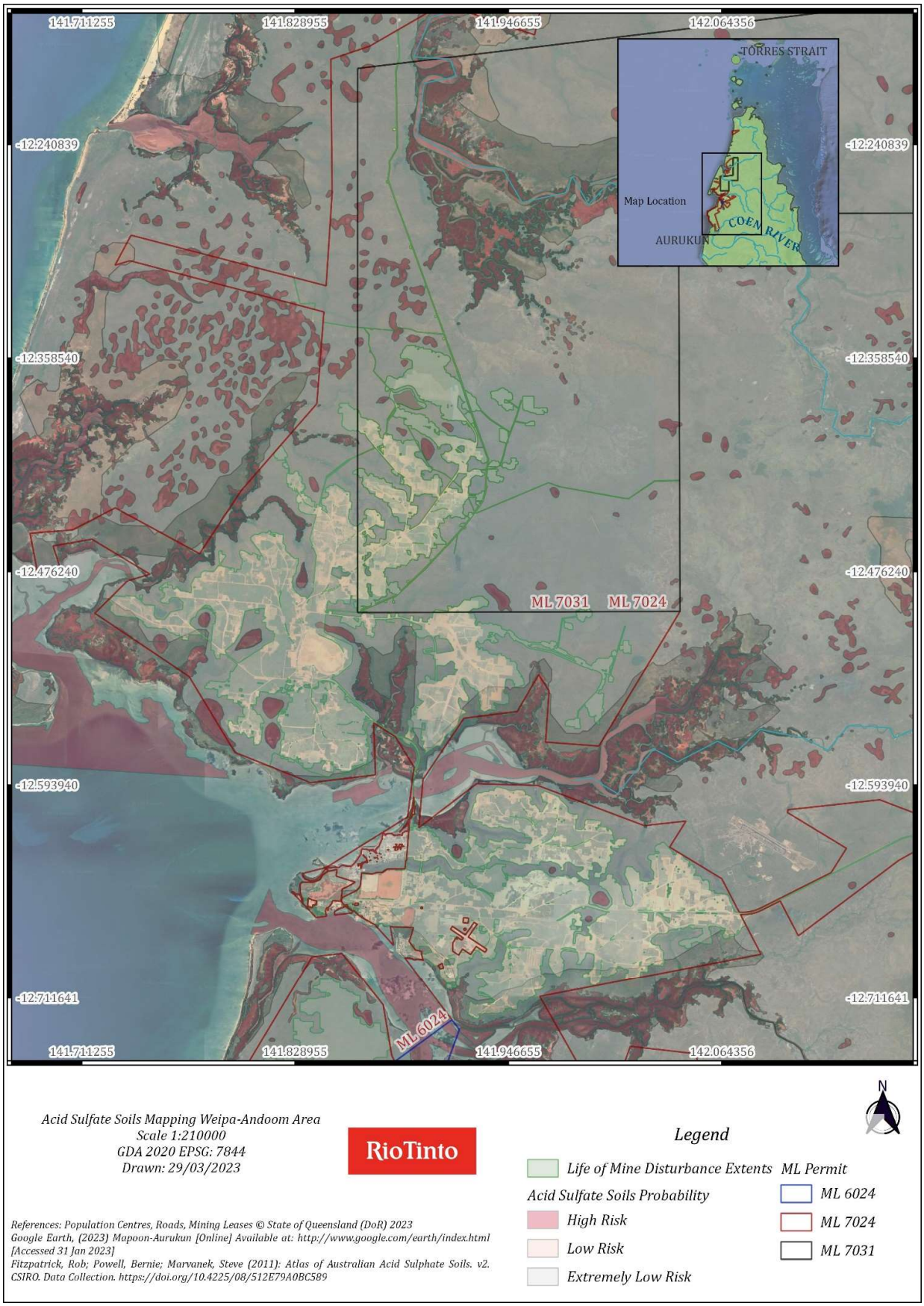


Figure 46 Acid Sulfate Soils Mapping Weipa – Andoom Area

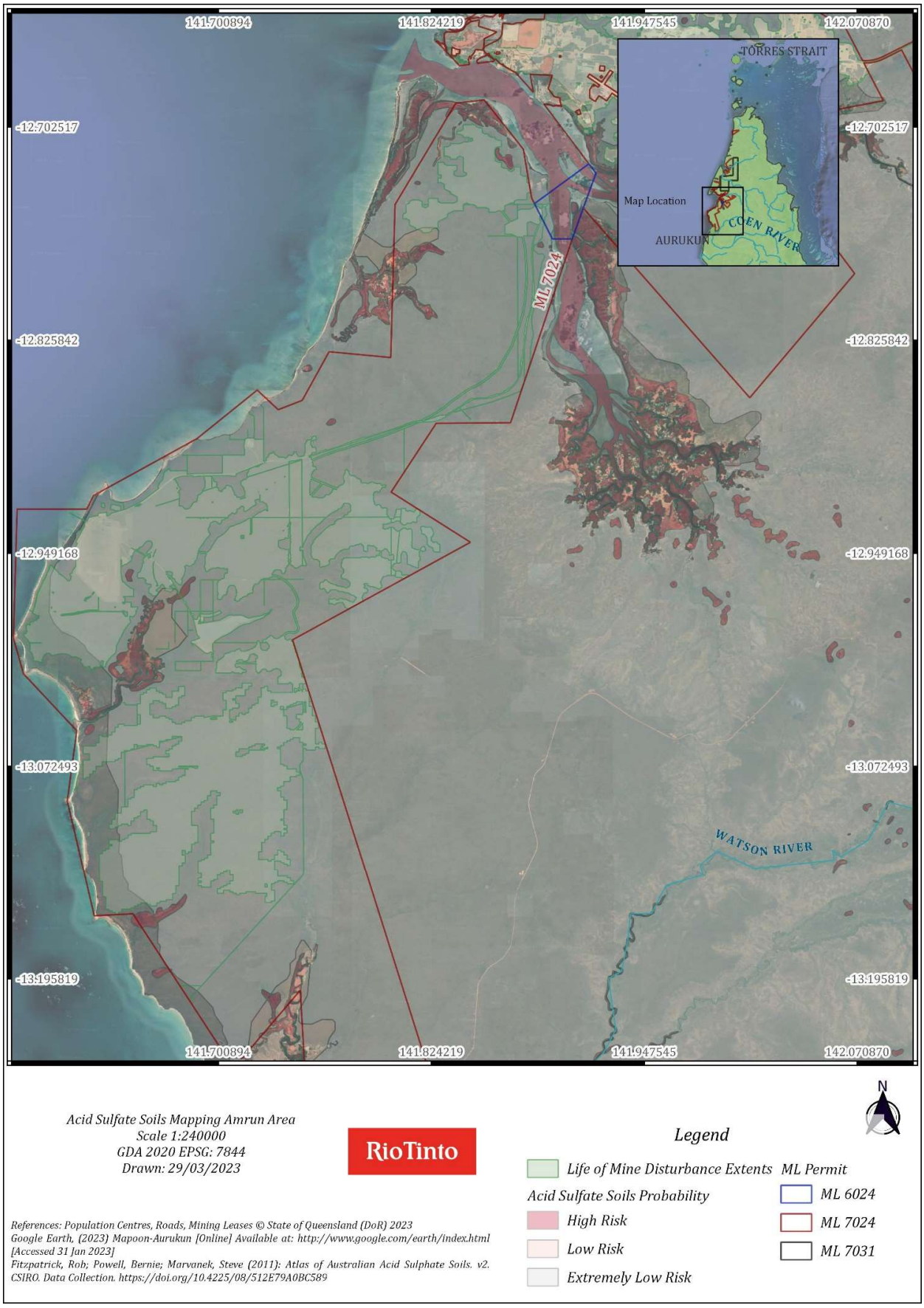


Figure 47 Acid Sulfate Soils Map Amrun Area

6.8 Mine waste characterisation

The mining operations does not create waste rock landforms (see Section 2.2) as the lateritic overburden material is used to backfill the mined areas progressively. The 'cover design' for the mined areas is described in Section 6.1 where the mined areas are progressively backfilled with overburden/soil and topsoil.

Tailings is the main mineral waste generated at the mining operations. The waste characterisation and cover design for the TSFs are provided in Section 6.9.

6.9 Tailings Storage Facilities

The TSFs onsite include the operational East Weipa 4 (EA name: East Weipa Tailings Storage Facility), Andoom TSF and Amrun Torro TSF. The West Weipa 2, G2 and G&X Dams, Emergency Dam and East Weipa 1&2 TSFs are inactive or decommissioned. Although these facilities have had some rehabilitation occur to date, they are not yet rehabilitated to a long-term closure standard. The Emergency Dam is not listed as non-operational in the EA however deposition of tailing ceased many years ago and this TSF has undergone recent progressive rehabilitation works.

The current status of the TSFs as taken from the EA, the rehabilitation performed to date and other pertinent information is described in Table 14. The measured surface area of the tailings top surface and the proposed batter area (indicative for now subject to the final batter angle to be determined during subsequent design phases) is also provided in Table 14.

The locations are shown on Figure 33 for Weipa, Figure 34 for Andoom and Figure 35 for Amrun.

During operations tailings are managed to ensure passive consolidation which increases the strength and density. Tailings are deposited from either the perimeter of the embankment ring main or via single point spigots that extend into the TSF. The general strategy relies on depositing tailing in thin layers typically less than 300-500 mm that passively evaporate and bleed water towards a decant. Through evaporation and beaching of thin layers the tailings passively consolidate, and the stack increases in strength and density.

TSF wall raises are conducted through upstream lifts which steps each successive embankment into the storage area. Mud farming provides a controllable and reliable method for foundation strength gain on deposited tailings and is undertaken prior to upstream wall raises at Andoom since 2014 and Amrun since 2020. Mud farming was also carried out for East Weipa 4 prior to wall raises between 2016 and 2018. This technique uses low ground pressure equipment such as amphibious excavators and swamp dozers, and deposition bays to bleed and consolidate the deposited tailings.

TSFs will remain in-situ at closure as safe, stable and self-sustaining landforms. The TSF landforms will be rehabilitated such that the vegetation will be established on the surface and outer slopes. Closure activities to establish finalised landforms and rehabilitate the TSFs will typically be carried out following cessation of mining operations within the respective mining areas.

Table 14: Tailings Storage Facilities

Facility	Rehabilitation Area	Measured Surface area (ha)	Proposed batter area (ha)	Maximum RL1 (m)	Category	Phase	Description and existing rehabilitation	Aerial Images
East Weipa 4	RA4	361	81	40	High	Active	This is the main operating facility at Lorim Point. The TSF receives bauxite tailings from the East Weipa Beneficiation Plant. The facility now comprises three cells: • Cell 1 and Cell 3 operate as one cell - the east side • Cell 2 – the west side The elevation of the perimeter embankments reaches RL27.7 m for cell 2 (constructed in 2017) and RL34.4 m for cells 1 and 3 (constructed in 2018). The cell 2 and some of the cell 1 and 3 perimeter embankments are vegetated and stabilised. An external spillway is in place allowing for the discharge of water to the North via Cell 2 should it ever be required.	

Facility	Rehabilitation Area	Measured Surface area (ha)	Proposed batter area (ha)	Maximum RL1 (m)	Category	Phase	Description and existing rehabilitation	Aerial Images
East Weipa 1&2	RA5	116	20	Non-operational	Low	Undergoing decommissioning	Constructed in 1975 and ceased operations in 1990. The TSF is inactive and undergoing decommissioning. The facility is split into two cells: • East Weipa 1 • East Weipa 2 The site has undergone rehabilitation on the outer slopes of the perimeter embankments and of parts of the tailings surface with topsoil respreading, mulching and seeding. Vegetation has been established on the outer embankment slopes, which varies from moderately dense grass, shrub and tree establishment to sparse ground cover (grass) with moderate tree establishment. The maximum height of the wall is approximately 15 m. A closure landform and spillway was previously constructed on the TSF however the eastern side did not effectively drain and further decommissioning works have been commenced as described in Section 6.9.4. A series of trial slopes have been installed as a component of the current decommissioning works to inform the long-term batter slope requirements of this and other facilities.	

Facility	Rehabilitation Area	Measured Surface area (ha)	Proposed batter area (ha)	Maximum RL1 (m)	Category	Phase	Description and existing rehabilitation	Aerial Images
Emergency Dam	RA6	40	5	Non-operational	Significant	Undergoing decommissioning	The TSF has been used as an emergency storage due to its proximity to the Lorim Point Plant. The TSF comprises two cells: • Northern Cell: water storage only; currently operational • Southern cell: tailings and water storage facility which is in inactive and undergoing decommissioning. Comprised of a Western Cell and Eastern Cell which was also operated as a former Kaolin cell. Natural regrowth has occurred parts of the Emergency Dam TSF. An additional spillway has been installed as a component of the current decommissioning works.	

Facility	Rehabilitation Area	Measured Surface area (ha)	Proposed batter area (ha)	Maximum RL1 (m)	Category	Phase	Description and existing rehabilitation	Aerial Images
West Weipa 2	RA7	151	19	Non-operational	Very Low	Non-operational	The TSF was constructed between 1978 and 1983. Minimal tailings have been deposited here since 2016 and it is currently inactive. The facility is split into two cells: • North Cell • South Cell Currently, the elevation of the tailings varies between about RL 14 m and RL 8 m in the southern segment, and between about RL 12.5 m and RL 8 m in the northern segment. Revegetation works have been largely confined to the embankments of the facility, where hydro mulching and seeding has intermittently been undertaken. An external spillway is in place allowing for the discharge of water to the north should it ever be required.	

Facility	Rehabilitation Area	Measured Surface area (ha)	Proposed batter area (ha)	Maximum RL1 (m)	Category	Phase	Description and existing rehabilitation	Aerial Images
G2 Dam	RA8	19	2	Non-operational	Very Low	Decommissioned and rehabilitation in progress	The G2 Dam and G & X Dam are located south and east of the West Weipa 2 TSF respectively. The TSFs have been decommissioned and rehabilitated, however they are not yet at the final closure stage. Further review and earthworks/rehabilitation may be required to meet final rehabilitation milestones and criteria. The elevation of the G & X Dam peaks at RL 16m in the south-eastern corner, down to RL 12m in the north-east. The elevation of the G2 Dam varies, with a peak reaching RL 16 m in the eastern portion. The Evans Landing Landfill has been partially constructed within the original footprint of the G2 dam. Future expansions of the landfill are likely to continue to expand into this foootprint.	
G & X Dam	RA9	18	9	Non-operational	Very Low	Decommissioned and rehabilitation in progress	The G2 Dam and G & X Dam are located south and east of the West Weipa 2 TSF respectively. The TSFs have been decommissioned and rehabilitated, however they are not yet at the final closure stage. Further review and earthworks/rehabilitation may be required to meet final rehabilitation milestones and criteria. The elevation of the G & X Dam peaks at RL 16m in the south-eastern corner, down to RL 12m in the north-east. The elevation of the G2 Dam varies, with a peak reaching RL 16 m in the eastern portion. The Evans Landing Landfill has been partially constructed within the original footprint of the G2 dam. Future expansions of the landfill are likely to continue to expand into this foootprint.	

Facility	Rehabilitation Area	Measured Surface area (ha)	Proposed batter area (ha)	Maximum RL1 (m)	Category	Phase	Description and existing rehabilitation	Aerial Images
Andoom	RA10	456	63	40	High	Active	The Andoom TSF is an active TSF which was constructed in 2004 to service the Andoom beneficiation plant. The TSF originally included four cells (cells 1 to 4) and now comprises of two cells: • Cell A – eastern side of the TSF (previously Cell 2 and Cell 3) • Cell B – western side of the TSF (previously Cell 1 and Cell 4) The elevation of the perimeter embankments varies between RL26.58 m and RL29.55 m. A program of foundation stabilisation using mud farming is underway to improve foundation strength around the perimeter in order to support ongoing upstream wall raises. The farming has covered the area 150M from perimeter and now extends to the centre of the facility, close to the decant ponds	

Facility	Rehabilitation Area	Measured Surface area (ha)	Proposed batter area (ha)	Maximum RL1 (m)	Category	Phase	Description and existing rehabilitation	Aerial Images
Torro TSF	RA11	858	NA	55	High	Active	Construction of the Torro TSF starter embankment was completed in 2018 with a capacity of 3 years. The Amrun TSF is divided into two cells: • North Cell • South Cell The ultimate TSF embankment level is RL55 m (approximately 40 m high).	

6.9.1 TSF rehabilitation and closure methodology

The TSF landforms will be rehabilitated with vegetation on the surface and outer slopes to achieve a PMLU of native vegetation. TSF infrastructure such as pumps and pipelines which pump tailings from the beneficiation plant to the TSFs will be removed for decommissioning and closure.

Closure activities are broken into two distinct phases: decommissioning and then final closure. This is similar to the approach already followed for East Weipa 1&2 TSF.

- Stage 1: Decommissioning at the end of mining activities to make safe, stable and revegetate. This work may include some re-shaping of the surface and developing a well vegetated, long term sustainable landform that drains runoff to a suitable spillway (although it may not be the final closure spillway). Ensure minimum stability (including seismic stability) requirements are satisfied, allowances for long term settlement of the final tailings surface whilst ensuring positive drainage off the rehabilitated surface. It also includes upgrade of batter drainage structures and installation of monitoring instrumentation to monitor performance of the decommissioned landform with regards to tailings settlement and dewatering. To facilitate that civil equipment can safely operate on the TSF surface and batters, it is imperative that monitoring be undertaken to verify the subsurface conditions. Monitoring of Stage 1 is expected to be conducted for approximately 20 years.
- Stage 2: Final closure to meet PRCP Schedule requirements. This will likely involve a final spillway and a final long term sustainable external batter to be implemented to reduce ongoing maintenance requirements. Any learnings from the performance monitoring conducted through the Stage 1 (decommissioning) would be implemented. This monitoring may also provide benefits for the final closure solution as more data will enable further optimisation of the Stage 2 design.

The proposed two stage rehabilitation and closure strategies for the TSFs aim to minimise risks such as failure to achieve a stable landform or achieving the PMLU. Existing management controls include the use of accepted industry standards for TSF operations and design and that the TSF design, construction and closure are certified by suitably qualified and experienced person.

Water management and erosion protection for closure is provided in Section 6.9.6.

6.9.2 Tailings Geochemical Characterisation

Bauxite tailings contain no added chemicals and are not classed as hazardous under the DES (previously DERM) Criteria for Determining Dams Containing Hazardous Wastes. Crude ore samples from Weipa and Andoom were analysed for metals and evaluated in terms of enrichment (Rio Tinto Alcan 2011 and Rio Tinto Alcan 2013). The results of the analysis concluded that bauxite is formed in an environment of extreme weathering and does not have any potential to release acid mine drainage or saline leachate. Overall the results show:

- bauxite ore does not trigger the environmental investigation limit for contaminated land in Queensland (EPA 1998)
- bauxite ore is not significantly enriched in any metal when compared to average crustal abundance using the Geochemical Abundance Index (Bowen 1979).
- tailings are not hazardous waste according to DES guidelines (Determining dams containing hazardous waste DEHP 2012);
- metals are not significantly enriched compared to average crustal abundance:
    - arsenic, boron, chromium, cobalt, copper, lead, nickel, selenium, zinc and mercury concentrations are very low and are not considered potential constituents of concern;
    - the concentration of aluminium in tailings leachate and ore leachate was lower than the median of receiving freshwater streams; and
- sea water elutriate analysis shows that bauxite is not hazardous within the marine environment.

Based on these results, it was concluded that leaching from bauxite ore is not anticipated to have an adverse effect on surface or ground waters.

6.9.3 Tailings Geotechnical Characterisation

TSF characterisation has been undertaken for the geochemistry, rheology and geotechnical aspects. This section outlines the current knowledge of the TSFs and how it relates to the rehabilitation and closure methodology.

The following documents have been used to provide guidance to the design criteria and parameters of the TSFs:

- Environmental Authority (EPML00725113) conditions (D28, D29, D30 and D31)
- Department of Environment and Heritage Protection, Manual for Assessing the Consequence Categories and Hydraulic Performance of Structures, March 2016 (Version 5.02).
- Department of Environment and Heritage Protection, Guideline: Structures which are dams or levees constructed as part of environmentally relevant activities, April 2019 (Version 9.01)
- Australian National Committee on Large Dams (ANCOLD) Guidelines on Tailings Dams: planning, design, construction, operation and closure, July 2019.
- ANCOLD Guidelines for Design of Dams and Appurtenant Structures for Earthquakes, 2019
- Global Industry Standard for Tailings Management (GISTM), August 2020

A summary of the geotechnical characterisation for tailings materials from the operational TSFs (East Weipa 4, Andoom, Torro) is provided below. Given that this is a transitional PRCP it is acknowledged that some information for tailings characterisation is unavailable for the older TSFs. Landform design and geotechnical stability is however assessed for the East Weipa 1&2 and Emergency Dam which are currently undergoing decommissioning as described in Section 6.9.4.

Tailings are deposited into the TSFs from the perimeter embankments and beach towards the centre of the facility in thin layers with coarser particles typically beaching closer to the embankments, while the finer particles deposit within the centre of the TSFs. Each layer is are allowed to settle, consolidate and dry out to achieve targeted densities and strength prior to new layers being deposited. The geotechnical characterisation below presents general data from various depths and locations throughout the TSF profile or beach, The data must therefore be further analysed and interpreted to be used in its correct context for TSF construction and closure planning.

The typically sandy nature of the tailings enable relatively quick draining, however consolidation of the tailings is further aided at Torro and Andoom TSFs through mud farming to mechanically densify and evaporate water from the tailings. Mud farming produces a dilative, dense tailings on the beach to provide a stable foundation to supporting earthworks machinery and embankment raises.

Given the tailings characterisation below and the ongoing mechanical compaction from mud farming for wall raises, it is anticipated that closure of the final tailings landform can be undertaken using conventional earthworks equipment and methods.

6.9.3.1 Tailings Material Testing

Tailings materials are sampled and tested during TSF operations for a range of parameters including particle size distribution, Atterberg Limit, specific gravity, moisture content and shear strength. These parameters are used to characterise the tailings settling and consolidation, suitability for both operational wall raises, and ultimately that closure of the final tailings landform can be undertaken using conventional earthworks equipment and methods.

Particle size distribution

The tailings from the East Weipa ore body possess marginally different behavioural characteristics to the Andoom ore body. While samples from the East Weipa 4 and Andoom TSFs indicate tailings in both facilities range from Silty SANDS to Clayey SANDS and Silty CLAYS, the Andoom tailings are predominantly finer. The difference can be attributed to a different beneficiation process which targets high alumina content in the fines range. Samples from the Torro TSF indicate tailings are a Clayey/Silty SAND (SC/SM), but also present as a Silt and Clay.

Specific Gravity

Testing of Weipa TSFs indicate that the tailings specific gravity of ranges at East Weipa 4 from 2.6 to 2.8, Andoom from 2.6 to 2.9 and Torro from 2.5 to 2.7.

Atterberg Limit

Atterberg Limit tests from Weipa TSFs have been conducted to determine the plasticity of the tailings and susceptibility to liquefaction. Tailings samples from the East Weipa 4 and Andoom TSFs recorded a wide range of plasticity from low to high, while Torro tailings is typically low to intermediate.

Moisture Content

Testing of Weipa TSFs indicate that the tailings typically have a moisture content range at East Weipa 4 from approximately 10% to 50%, at Andoom from approximately 20% to 40% and Torro from approximately 15% to 40%.

Shear Strength

Shear strength parameters were assessed to determine the bearing capacity of the tailings. East Weipa 4 TSF clayey tailings peak strength range from 9 to 64 kPa with a broad trend of increasing strength with depth, Andoom TSF tailings peak strength of the range from 10 to 54 kPa with no trend of increasing strength with depth. Torro TSF tailings peak strength range from 2 to 35 kPa. The shear strengths reported here will not be applicable to closure as the in-situ stress conditions would have changed due to desaturation and consolidation of the tailings stack.

6.9.3.2 Tailings Liquefaction Susceptibility

Tailings liquefaction susceptibility is assessed in accordance with the ANCOLD Guidelines for Design of Dams and Appurtenant Structures for Earthquakes (2019). The liquefaction susceptibility considers the tailings only. The liquefaction assessment does not assess the susceptibility of the non-tailings materials used within TSFs embankments which are dense hard materials.

Weipa tailings materials across all TSFs are susceptible to liquefaction. Given this susceptibility mud farming is used to control saturation levels and tailings density prior to embankment raises and ultimately prepare a stable landform for rehabilitation and closure.

6.9.3.3 Tailings Density

Tailings density is sampled from the TSFs during operations to determine that the tailings are reaching the target density for TSF stability.

At East Weipa 4 both the active cells 1/3, and the inactive cell 2 have typically recorded densities above the historical target of 1.1 t/m^3 with an increasing trend. The target density was increased in 2021 to 1.3 t/m^3 with the active cell 1/3 meeting the target density and the inactive cell 2 trending towards meeting this higher target density in the upper levels prior to closure of the facility.

At Andoom and Torro TSFs mud farming is conducted to improve tailings density for future wall raises. Tailings density is primarily assessed from the mud farmed areas which provide foundations for the embankment

raises. Density sampling from the Andoom and Torro TSFs mud farmed areas have recorded average tailings density of 1.65 t/m^3, above the target tailings density of 1.5 t/m^3.

The density sampling and analysis confirms that the mud farming is significantly improving the tailings strength and promoting a dense tailings surface that should be maintained through to closure.

6.9.3.4 Hydraulic Conductivity and Consolidation

Hydraulic conductivity of the tailings is sampled to provide an indication of the time to desaturate the tailings stack at closure and beyond. The tailings at East Weipa 4 range from low (10^{-8} m/s or lower) to high hydraulic conductivity representative of the sandy tailings. The farmed tailings have typically low hydraulic conductivity in the order of 10^{-8} m/s at Andoom and ranging from 10^{-7} m/s to 10^{-8} m/s at Torro.

At Torro, although the permeabilities are relatively low, the TSF has been observed to have a strong downward gradient draining through the foundation, as such the measured and modelled phreatic levels and pore pressures in the tailings are low. Low phreatic levels improve the stability of the dam, particularly near and within the perimeter embankment and is favourable for final closure of the facility.

Mud farming at Andoom and Torro assists with initial drying and desiccation of newly placed tailings and will be key to the tailings dam strategy to achieve raises up to an including closure.

6.9.4 Final Landform Design

The final landforms for the TSFs are described below. The final landforms are further progressed for the East Weipa 1 & 2, and Emergency Dam TSFs which are currently undergoing rehabilitation. The remaining TSFs which are operational have only high level conceptual final landforms which are described below. Further details of the final landforms for operational TSFs will be prepared during respective closure studies and can be added to the PRCP following completion of the studies.

The overarching intent of the TSF final landform design is to create a free draining (“water-shedding”) landform. Given leaching from bauxite ore is not anticipated to have an adverse effect on surface or ground waters (refer to Section 6.9.2) the closure designs do not include an engineered capping system with a liner to prevent infiltration.

The final landform design process includes analysis of the long-term stability of the landform. Analysis included in the design process is likely to include the following, or similar methods as suitable at the time of design preparation.

- Stability analysis and modelling using Slope/W software, to confirm factors of safety for stability.
- Hydrogeological modelling was undertaken using MODFLOW UGS to investigate the groundwater response to the closure design.
- Landscape evolution modelling was undertaken using SIBERIA software to investigate potential long-term erosion rates, and the erosion response to varying embankment reshaping construction materials and vegetation covers.
- Settlement and consolidation analysis.
- Two-dimensional surface water modelling has been conducted using HEC-RAS to analyse the performance of each designed hydraulic structure, design flow conditions downstream.

Decommissioning works will be managed through a proven Quality Assurance / Quality Control (QA/QC) program consistent with the existing wall raise projects.

The two stage decommissioning and rehabilitation process (refer Section 6.9.1) includes monitoring of the performance of the final landform design, including planned trials, with potential for maintenance and management in the interim period or final rectification within Stage 2 earthworks. TSF monitoring and maintenance is further described in Section 8.8.

6.9.4.1 East Weipa 1&2 and Emergency Dam TSF

East Weipa 1&2

The closure design of East Weipa 1&2 and East Weipa Emergency TSFs has been completed. The two stage decommissioning and closure approach described in Section 6.9.1 has been commenced. The Stage 1 works are expected to be completed by the end of 2021. Ultimately these two adjacent TSFs will produce one final rehabilitated landform. Stage 1 closure works are highlighted in Figure 48.

The Stage 1 closure design for EW1&2 TSF includes the following construction work:

- Reshaping of the EW1&2 TSF tailings surface;
- Extension and modification of the EW1&2 TSF spillway;
- Excavation of the EW1&2 TSF outlet channel;
- Construction of the embankment reshaping trial pads;
- Dressing the tailings surfaces with topsoil, and/or mulch or compost and establishing vegetation.

The tailings surface has been designed into a reshaped free draining landform by excavating high areas and filling lower areas on the eastern side. The landform will drain rainfall runoff into the centre of the facility towards the inlet of the closure spillway which extends from the centre of the facility to tie into the existing spillway at the western embankment. Two inlet drains have been designed to allow runoff from the western side into the spillway approximately halfway along. Inclinometers are to be installed on the crest of the spillway slope to monitor any further movements during the interim monitoring period. An outlet channel has been designed downstream of the existing EW1&2 TSF spillway to convey flow into a low area south of the facility which acts as a natural retarding basin.

In preparation for the Stage 2 works, embankment reshaping trial pads have been designed to be constructed during Stage 1. The embankment reshaping trial pads have been located on the north-western side of EW 1&2 TSF, within the northern EWED decant cell. The purpose of the embankment reshaping trial pads is assess the performance and resistance to erosion of different configurations and surface treatments (Ironstone and 50/50 blend of Ironstone and tailings) for the embankment reshaping. Regular inspections of the embankment reshaping trial pads will be conducted to visually assess the erosion and conduct flora surveys identifying species diversity and density.

A preliminary Stage 2 closure design has been commenced, and will be finalised following performance monitoring of the Stage 1 works over the interim monitoring period. The Stage 2 closure design includes construction of the following works if determined to be required following Stage 1 monitoring:

- Reshaping of the EW1&2 TSF confining embankments;
- Excavation of the downstream toe drain network;
- Excavation of the attenuation pond; and,
- Potential modifications to the EW 1&2 TSF spillway.

Embankment reshaping has been preliminarily designed as a concave slope from the crest to toe, designed as a cut to fill operation to strategically place extra fill in areas where the tailings are found to be weaker. Perimeter toe drains are designed to safely convey the runoff from the reshaped slopes to designated outlet locations; comprising of existing drainage lines, low retarding areas and an excavated attenuation pond.

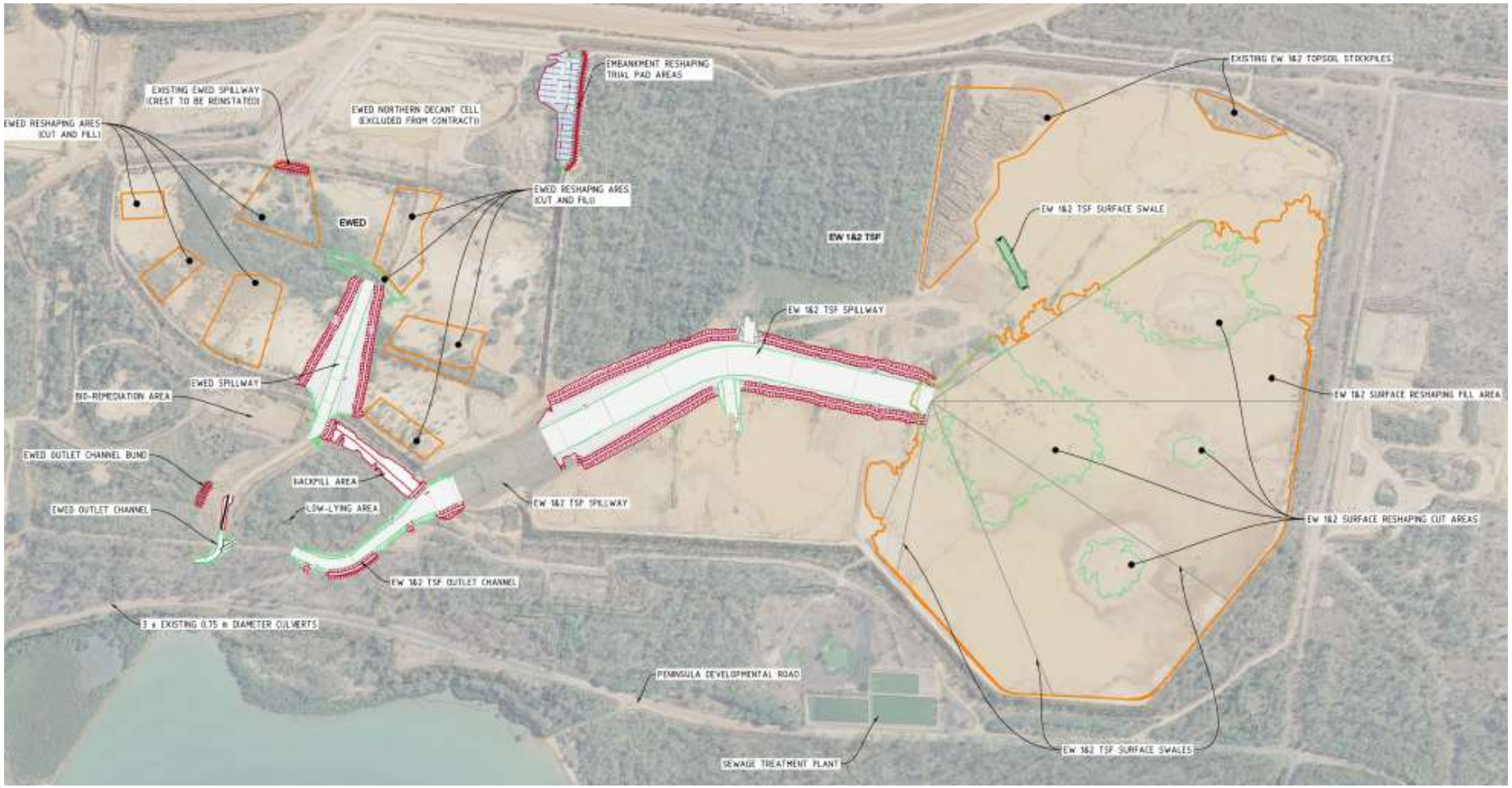


Figure 48: EW1&2 and Emergency Dam TSFs – Stage 1 closure design

Emergency Dam TSF

The decommissioning and closure of Emergency Dam TSF cells is planned to be undertaken at varying times with the closure strategy currently being refined. The Northern Cell, which is operated as a water dam, will continue to be active until final closure of the East Weipa Operation and Andoom Operations.

The Eastern and Western Cells will be decommissioned and rehabilitated in alignment with the two stage decommissioning and closure approach described in Section 5.8.1. The Stage 1 closure design includes construction of the following works (Figure 48):

- Reshaping of the Emergency Dam tailings surface;
- Excavation of the Emergency Dam spillway;
- Construction and formalisation of the Emergency Dam outlet channel;
- Backfilling of the area between EW 1&2 TSF Spillway and Emergency Dam Spillway; and,
- Dressing the tailings surfaces with topsoil, mulch and/or compost and establishing vegetation.

The reshaping design consists of removing the remnant dividing embankments between the tailings and Kaolin cells and excavating several high areas whilst filling adjacent low areas. The reshaping has been designed as a cut to fill operation which directs rainfall runoff towards the centre of the facility. A closure spillway has been designed to safely and effectively convey the design flow from the centre of the facility in a southerly direction. Downstream of the spillway, the existing outlet channel has been formalised and has been designed to connect with the low area from which the EW 1&2 TSF outlet channel discharges into, to allow surface waters from both facilities to flow away from the area.

Preliminary embankment reshaping is to be conducted as part of the Stage 1 works. Monitoring data relating to the performance of reshaped embankment slopes of varying grades, construction materials and surface treatments will be used within planning for Stage 2 works.

A preliminary Stage 2 closure design has been commenced, and will be finalised following performance monitoring of the Stage 1 works. The Stage 2 design includes construction of the following if determined to be required following Stage 1 monitoring:

- Reshaping of the EWE TSF confining embankments; and,
- Excavation of the downstream toe drain network;

Embankment reshaping has been preliminarily designed as a concave slope from the crest to toe, designed as a cut to fill operation to strategically place extra fill in areas where the tailings are found to be weaker. Perimeter toe drains are designed to safely convey the runoff from the reshaped slopes to existing drainage lines.

Final landform analyses

Several further analyses have been conducted for the closure design of EW 1&2 TSF and EWED as summarised below.

Stability analyses have been conducted using Slope/W software for the designed spillways and reshaped embankment slopes. The determined factor of safety was >1.5 for all static cases.

Hydrogeological modelling was undertaken using MODFLOW UGS to investigate the groundwater response to the closure design. It was found that the phreatic levels within EW 1&2 TSF and EWED will continue to lower with time after closure until both facilities become drained with no phreatic surface existing.

Landscape evolution modelling was undertaken using SIBERIA software to investigate potential long-term erosion rates, and the erosion response to varying embankment reshaping construction materials (Ironstone and 50/50 blend of Ironstone and tailings) and vegetation covers. It was determined that if vegetation reaches 100% coverage, erosion rates remain low at 0.54 t/ha/year, and do not increase between 100 and 500 years.

Erosion rates for the Ironstone facing are the same as for the 50:50 blend of Ironstone and tailings. Once vegetation became sparser, the opposite was true.

A consolidation analysis was undertaken to estimate the maximum amount of settlement possible across each facility. The maximum amount of consolidation settlement calculated was 80 mm and 200 mm for EW 1&2 TSF and EWED respectively. As the phreatic is in fact significantly lower, and expected to continue to drop with time, these values are considered upper bound estimates.

Two-dimensional surface water modelling has been conducted using HEC-RAS to analyse the performance of each designed hydraulic structure, and to assess the design flow conditions downstream of the facilities at the Peninsula Developmental Road. The surface water modelling validated the design of the spillways and outlet channels of each facility as well as the designed toe drain network.

6.9.4.2 Operational and Inactive TSFs

East Weipa 4 TSF

The current conceptual final landform within the East Weipa 4 is to direct rainfall runoff within Cell 1/Cell 3 into Cell 2 where the water will flow to the north and south via two external overflow channels. Due to the presence of the community and hospital to the east and north respectively of the East Weipa 4 complex, additional emergency overflow channel is planned to be built to the southwest of the facility to reduce the outflow. The proposed closure design for the East Weipa 4 TSF and the resultant final landform is expected to be further developed throughout the remaining life of the East Weipa operations.

West Weipa 2 TSF

The existing surface within the West Weipa 2 TSF currently slopes towards the centre of the facility where rainfall pools until it evaporates and/or seeps into the underlying tailings and sediments. The proposed closure design for the West Weipa 2 TSF and the resultant final landform is currently being reviewed and a closure study will be carried out in 2022.

G2 and G&X TSF

G2 Dam and G & X Dam have been decommissioned and revegetated . Part of the G2 Dam has been removed for the Evans Landing Landfill. These facilities are to remain as per the current final landform. For both TSFs, further work will be carried out to ensure they meet milestone criteria which will be determined through closure studies.

Andoom TSF

The current conceptual final landform for the Andoom TSF is to direct rainfall runoff within Cell A into Cell B where the water will flow to the north via a closure spillway.

The proposed design for the Andoom TSF and the resultant final landform is expected to be further developed throughout the remaining life of the Andoom mine area.

Torro TSF

For the Torro TSF the resultant final landform is expected following the final raise to RL55. The current conceptual final landform within the Torro TSF is to direct rainfall runoff from a centre ridgeline to the east and west via external closure spillways.

6.9.5 Cover design

The TSFs will be spread with a suitable growing medium (refer to Section 6.1.1) at an average thickness of approximately 200-600 mm and seeded with vegetation cover to minimise erosion.

Areas of the tailings where coarser tailings are present will require thicker cover, however those areas with finer clay-containing soils towards the centre of the facility will require reduced thickness. The use of fine

tailings from within the facilities may be appropriate for use in blending with coarser grained tailings to provide an appropriate topsoil medium.

Trials for alternative erosion resistant surface treatments (e.g. ironstone or ironstone and tailings mixture) are being conducted as part of the East Weipa 1&2 and East Weipa Emergency TSFs. These alternative treatments may be used if embankment reshaping is required to improve stability of the TSF embankments.

6.9.6 Tailings water management and erosion protection

Across the site, the decommissioning of the different TSF will include the tailings dam walls being seeded, primarily with grasses, to maintain a safe and stable slope and for erosion protection. Maximum overall slope angles on the perimeter embankments will be no more than 35°, except for East Weipa 1&2 which are rehabilitated with stable external slopes of up to 45°.

Where required, the rehabilitation of the TSF landforms have had (or will have in the future) temporary drainage pathways established to promote surface water runoff to spillways. The water management may also involve landforming activities to construct or widen channels and permit incidental rainfall water captured in TSF to flow to where it can be discharged by an overflow channel. If channels are required, they will be constructed to cater for significant volumes of water to pass through the channel in the event of a 1 in 10,000 AEP event.

Sediment mobilisation and erosion of the tailings surface is not expected post decommissioning due to the shallow slopes (typically <1%) which will result following final landform development.

Overflow channels will be revegetated with grass, to ensure topsoil is not eroded during periods of flow. Turf reinforcement matting may also be use if required to assist in mitigation erosion while vegetation is being established.

The outer slopes of some of the rehabilitated TSF perimeter embankments are already vegetated with a combination of trees, shrubs and grasses which reduces the risk of erosion. For each TSF, further detail on current status is presented above.

Closure activities (with the exception of those TSFs with agreements with DES for previous guidelines standards) will include the upgrade of existing spillways to meet ‘Probable Maximum Flood’ (PMF) water flow criteria and to meet the ‘Australian National Committee on Large Dams’ (ANCOLD) criteria with respect to the establishment of closure standard spillways. ANCOLD criteria stipulate that at the end of mine life, closure spillways should be designed for flows for all consequence categories, with an expected timeframe for facility life of 1,000 years. Given the volume and predicted velocity of water that can traverse from the TSF through the spillways and to the outlet channel, the installation of engineering rock armouring is typically undertaken across certain sections. The use of armouring using the most erosion resistant material that can be sourced is advocated to meet the ANCOLD design life of 1,000 years. The presence of rock armouring typically will not facilitate the establishment of vegetation in certain locations across the spillway as the vegetation will not be able to bind to soils. However the requirement to provide a safe and stable landform in accordance with ANCOLD requirements is perceived to be the most significant risk to mitigate. The establishment of vegetation will be achieved across all other features at the TSF to ultimately provide a landform that achieves the nominated PMLU.

The hydrogeological modelling indicates that the phreatic surface within the TSFs will rise during landform development (tailings deposition), however will fall rapidly once deposition has ceased. Over the long term the facilities are expected to behave like a normal landscape feature and experience seasonal changes.

6.10 Voids

No residual voids are proposed to be left as NUMAs following the completion of mining activities (refer to Section 5.0).

The MLs have several water slots, which are mostly sites that were excavated for borrow material for the construction of the TSFs or mined for kaolin. Some of the slots have a connection to the water table and others fill with water during the wet season and dry out in the dry season.

The following water slots will be backfilled, contoured and revegetated at closure, as part of the native ecosystem post mining land use, to form part of a stable landform and reduce the evaporation of water:

- Yonggar Slot
- Lanji Slot
- North Clay Hole
- Perry's Pond
- White Hole
- Grevillia Slot
- Arunta
- Area G
- Ken Ellis
- Trevally A
- Cod
- Denman's Swamp
- Lake Mcleod
- Lake Patricia
- Nanam Tawap Slot
- South Clay Hole

Backfill material for the slots will be sourced from nearby locations to reduce haulage distance (estimated settled dry density of 0.6 t/m^3).

6.11 Underground mining

There is no underground mining proposed or conducted at the Weipa Operations.

6.12 Built infrastructure

Built infrastructure within the MLs include water infrastructure, beneficiation plants, workshops, product stockpiles and other hardstand areas, conveyors and other fixed plant. As outlined in Section 1.2 there are some features under ML7024/6024 which may be transferred to third parties to support the ongoing function of Weipa township however this is subject to agreement and for the purposes of this PRCP, all infrastructure will be rehabilitated to achieve the approved PMLU – Native Ecosystems.

6.12.1 Decommissioning, demolition of infrastructure

Closure for the Infrastructure RA (RA2) will involve decommissioning, demolition and/or removal of infrastructure. Subsequently, the surface of the disturbed land will be rehabilitated back to native vegetation. The demolition analysis has assumed that concrete foundations and other underground benign materials will be removed to a depth of 300 mm below the surface, with an additional breaking-up of remaining materials by a further 500 mm. The mining equipment, infrastructure and plant will be removed and rehabilitated (unless agreement is reached with relevant stakeholders and the administering authority as per the details below).

Beyond the decommissioning, demolition and/or removal of infrastructure, the rehabilitation method for the land is the same as for 'Mined areas' as described in Section 6.1.2.

Buildings and infrastructure that are to remain are intended to be transferred to a third-party owner who will become responsible for ownership, liability, and ongoing management. The features will be made safe and transitioned in a condition agreed with by relevant third party/s. Section 1.2 provides the details of the infrastructure within ML7024/6024 which is planned to be transferred to a third-party.

6.12.2 Bore network

The aquifers should recharge significantly once abstraction for mining and related activities are reduced or removed. There is no remediation proposed other than localised bore decommissioning and rehabilitation of the disturbed area surrounding the bore.

Subject to agreement with regulators and Traditional Owners some facilities may be left in place at the completion of mining activities. However as this is subject to agreement and for the purposes of this PRCP, all infrastructure will be rehabilitated to achieve the approved PMLU – Native Ecosystems.

The decommissioning of artesian bores will include grouting with concrete, capping, sealing and rehabilitating bore holes. Decommissioning will be undertaken in accordance with the *Minimum standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland*, WSS/2016/3189, Department of Natural Resources, Mines and Energy, Version 1.02, 19/12/201.

6.12.3 Contamination management

More than 50 years of mining and associated activity has resulted in a number of legacy sites, including disused landfill sites, decommissioned fuel and chemical storage facilities and decommissioned mineral processing plants. Since 2000, all of these sites have been listed in the RTW Contaminated Site Register. Several sites have been investigated (through Preliminary Site Investigations (PSIs)) to confirm the presence or absence of contamination in soil and groundwater by suitably qualified contractors. The PSIs have been undertaken at sites where the risk of contamination was thought to be high, based on previous desktop studies. These include (but are not limited to) the Lorim Point Industrial Precinct, bulk fuel storage facilities, the Evans Landing landfill, Andoom Service Bay and wash tower, Calcination Plant and disused landfills. At sites where contamination was identified, further investigation work has been performed to delineate the contamination and assess risks to human health or the environment.

The whole of ML7024 is registered with the State government on the contaminated site register, despite the known affected areas being relatively small, discrete locations associated with areas of previous mining and associated activities. The current RTW operation involves the storage and handling of large volumes of fuel, heavy oils and hazardous substances. All areas where these activities have been, and are being undertaken, are managed as suspected contaminated sites through the Contaminated Sites Management Program. Risk assessments are conducted to determine if sites require active remediation or passive remediation to align with the nominated PMLUs.

The RTW Contaminated Site Register and Program is an integral part in managing all contaminated sites to ensure their compliance post-closure. Closure planning shall include investigations into contaminated sites that may require specific remediation effort to achieve post-closure objectives.

Relevant rehabilitation milestone criteria are included in RM8 to provide a method to conduct contaminated land surveys, at relevant sites, by a suitable qualified person to facilitate that no residual contamination will impact on achieving the PMLU.

6.13 PRCP Implementation (PRCP Schedule)

RTW holds EAs for the mining operations (EA EPML00725113 and EA EPML00562613) and therefore, two PRCP Schedules are required. The PRCP Schedules have been prepared for submission to DES using the DES spreadsheet template ESR/2019/5103.xls. This section provides a summary of the PRCP Schedules including Rehabilitation Areas, Rehabilitation Milestones and associated criteria and key factors associated with the timeframes for achieving these milestones.

There are no proposed NUMAs for the project, therefore no Improvement Area or Management Milestones have been proposed.

The factors influencing when an area is available for rehabilitation, and when it is as soon as practicable for rehabilitation to commence is described in Section 2.3. The planned rehabilitation of mining areas in the PRCP Schedule captures the required flexibility and uncertainty in the scheduling of rehabilitation.

6.13.1 Conceptual Life of Mine Plan and Final Site Design

The approved PMLU for all disturbance areas is Native Ecosystem, with the Rehabilitation Milestones applying on the basis of Rehabilitation Area and the status of a site (being used currently for mining, planned for mining or infrastructure or currently undergoing rehabilitation). The final site design for Ely, Andoom, Weipa and Amrun respectively are shown in Figure 49 - Figure 53. The current Life of Mine Plan, which forms the basis of this PRCP is included, showing the PMLU for all areas. Outside of these areas, undisturbed areas will remain native ecosystems. Should the Life of Mine plan change (and anticipated disturbance extents), a PRCP amendment will be required.

6.13.2 Rehabilitation Areas

The operations are divided into Rehabilitation Areas with each Rehabilitation Area requiring its own unique combination of Rehabilitation Milestones to achieve the site PMLU.

For the PRCP, the mine ‘domains’ as referenced in the RMPs have been transitioned into the PRCP Schedule as the Rehabilitation Areas in Table 15, with their correlating previous mine domains and PMLU shown. The Rehabilitation Areas RA1 and RA2 are common across both the Weipa and Ely leases, while RA3 and RA4 only apply to the Weipa lease. The RAs are shown in Figure 54 - Figure 56.

Although East Weipa 1 Tailings Storage Facility (EW1) and East Weipa 2 Tailings Storage Facility (EW2) are provided as separate TSFs in Table D2 of the EA (EPML00725113), the two TSFs adjoin. There are no features present to distinguish two separate TSFs and they have been treated as the one TSF during operations. For closure planning purposes it has been assumed that EW1 and EW2 are treated as the same Rehabilitation Area, RA5.

Table 15: Relationship between mine domains, Rehabilitation Areas and PMLU

PRCP Schedule Rehabilitation Areas (RA)	Domains	Post-mining land uses (PMLU)
RA1 – Mined Areas including existing established rehabilitation	Mined Areas domains (Pre -2008 Mined area and Post -2008 Mined area excluding haul roads) Infrastructure – borrow pits (where adjacent to mined areas).	Native ecosystem
RA2 – Infrastructure	Infrastructure domains (including haul roads and borrow pits away from mined areas.	Native ecosystem
RA3 – West Andoom **not applicable to Ely Lease*	Mined Areas domains	Native ecosystem
RA4 - TSF **not applicable to Ely Lease*	TSF - East Weipa Tailings Storage Facility (EW)	Native ecosystem
RA 5 - TSF **not applicable to Ely Lease*	TSF – EW1 and EW2	Native Ecosystem
RA 6 - TSF **not applicable to Ely Lease*	TSF- Emergency Dam	Native Ecosystem
RA 7 - TSF **not applicable to Ely Lease*	TSF - West Weipa 2 (WW2)	Native Ecosystem
RA 8 - TSF **not applicable to Ely Lease*	TSF - G2 Dam	Native Ecosystem
RA 9 – TSF **not applicable to Ely Lease*	TSF - G&X Dam	Native Ecosystem
RA 10 - TSF **not applicable to Ely Lease*	TSF - Andoom	Native Ecosystem
RA 11 - TSF **not applicable to Ely Lease*	TSF - Torro	Native Ecosystem

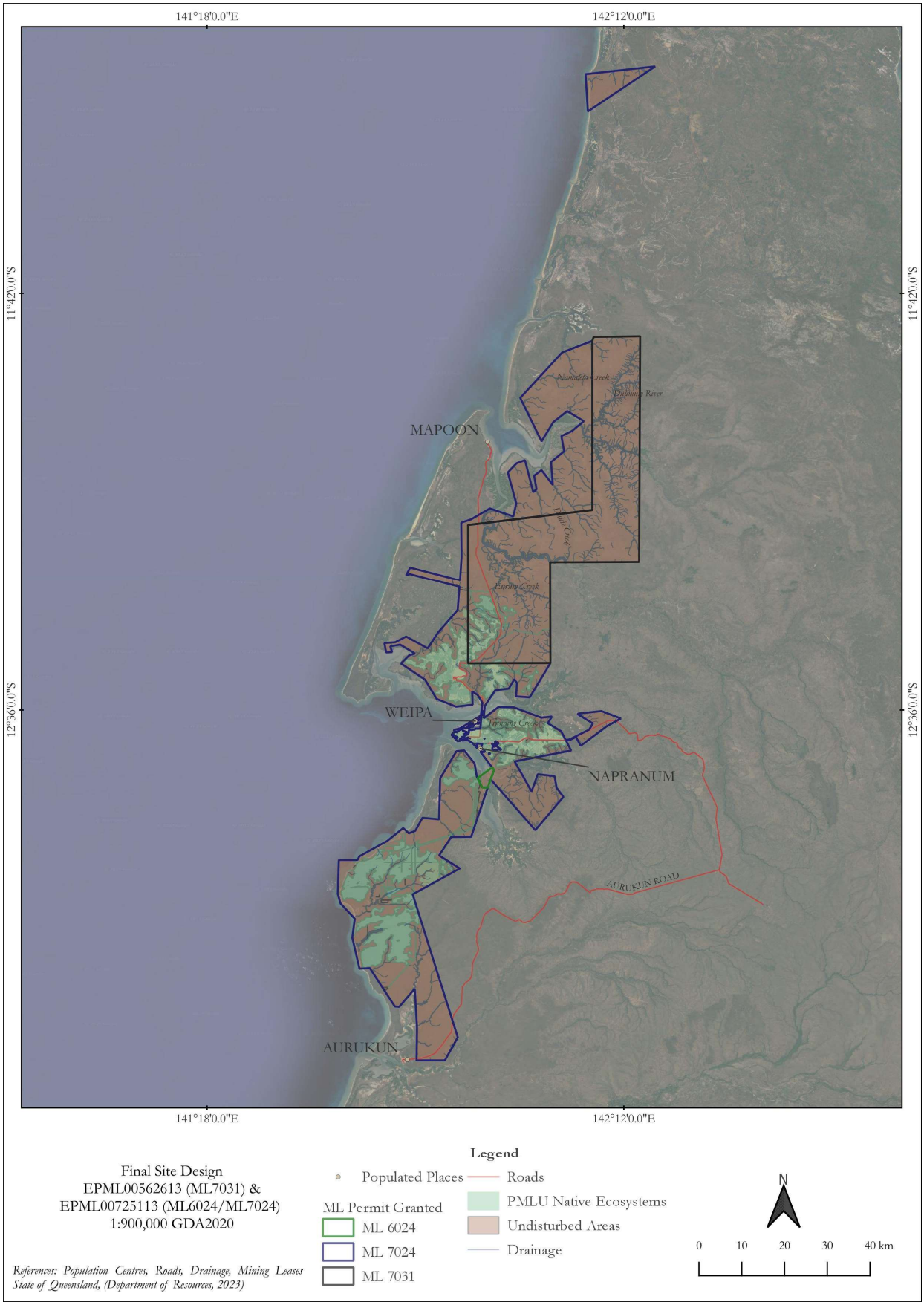


Figure 49 EPML00562613 (ML7031) & EPML00725113 (ML6024/ML7024) Final Site Design

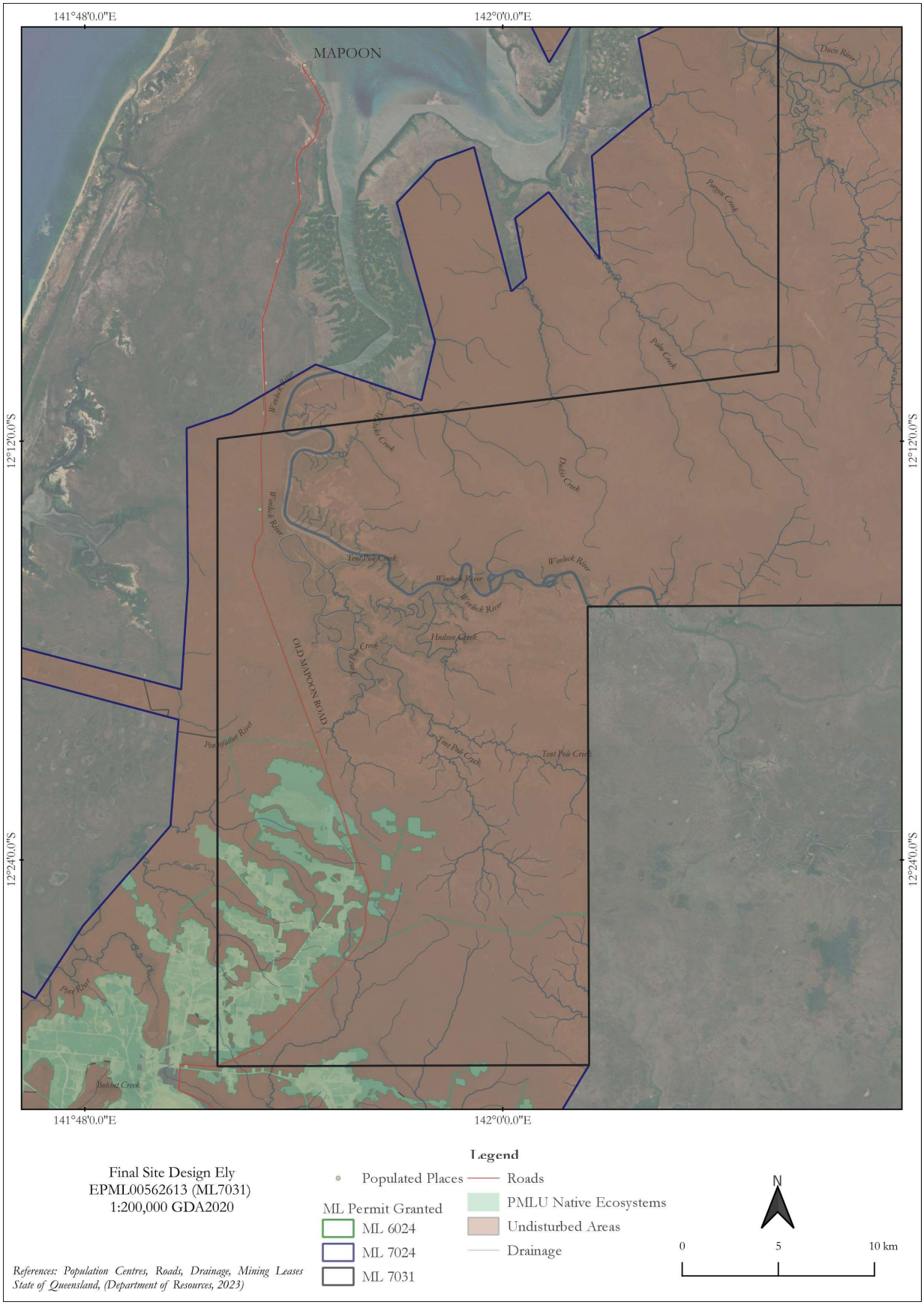


Figure 50: Final site design – EPML00562613 (ML7031) Ely

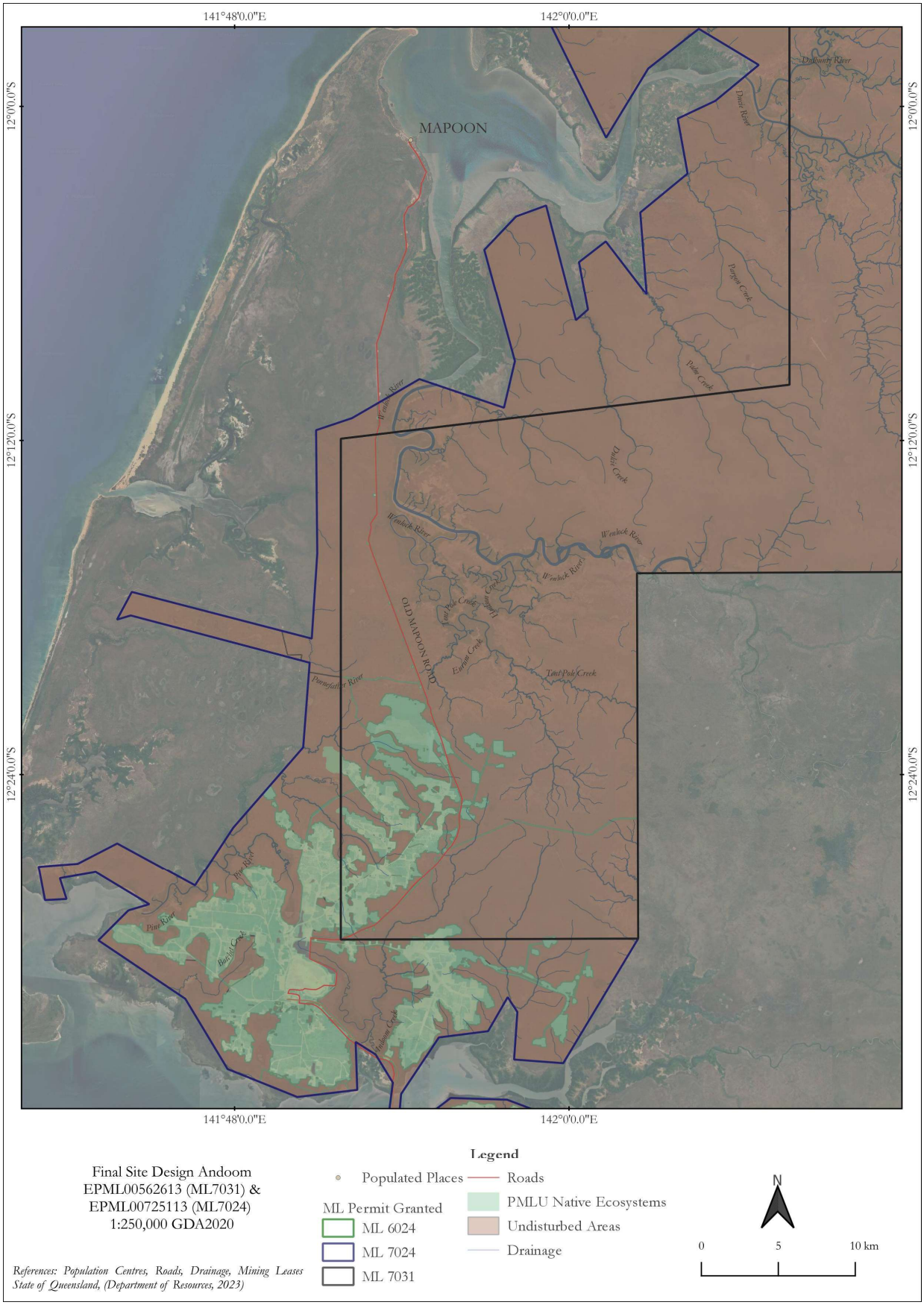


Figure 51: Final site design EPML00725113 (ML7024) – Andoom

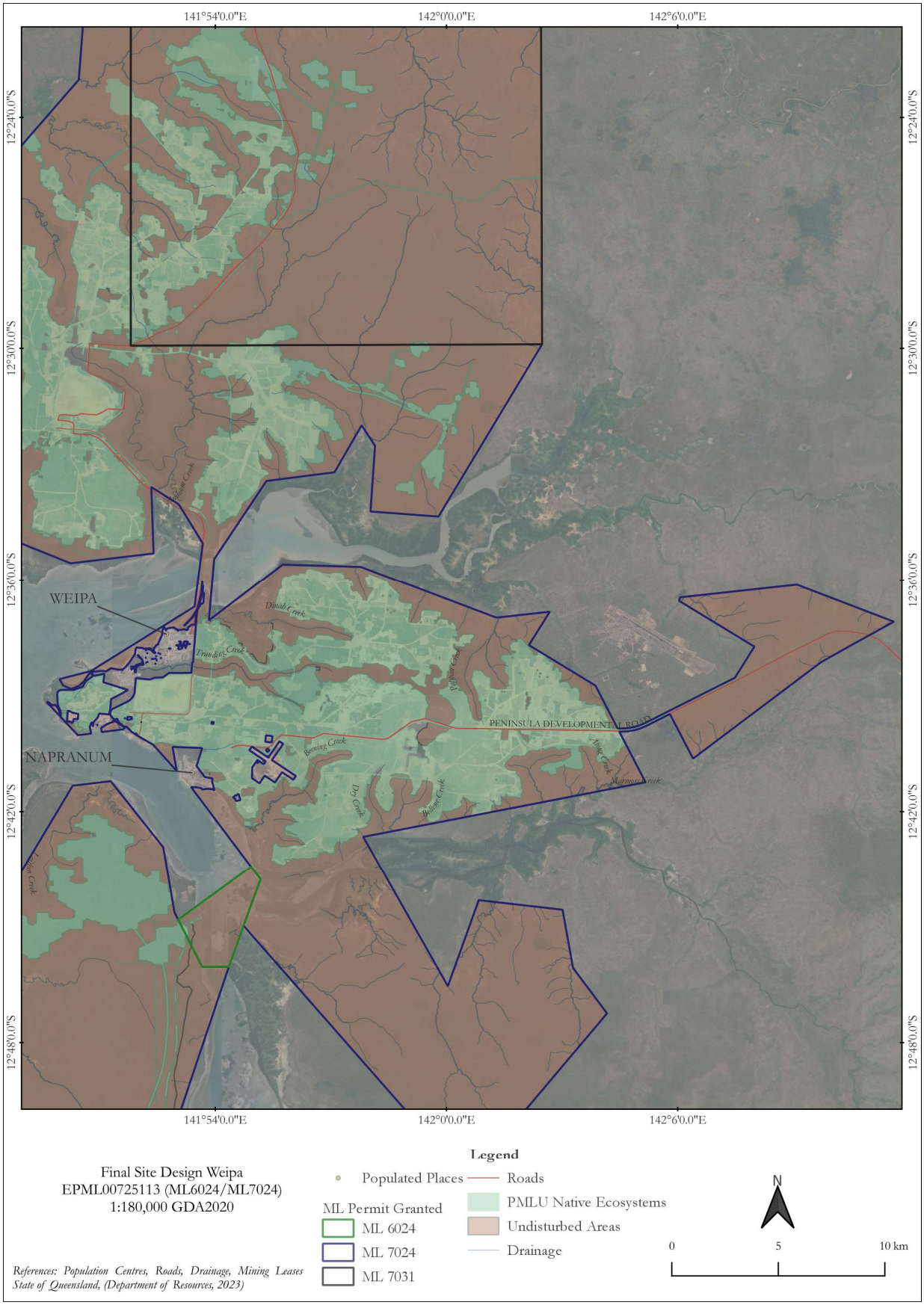


Figure 52 Final Site Design EPML00725113 (ML7024) – Weipa

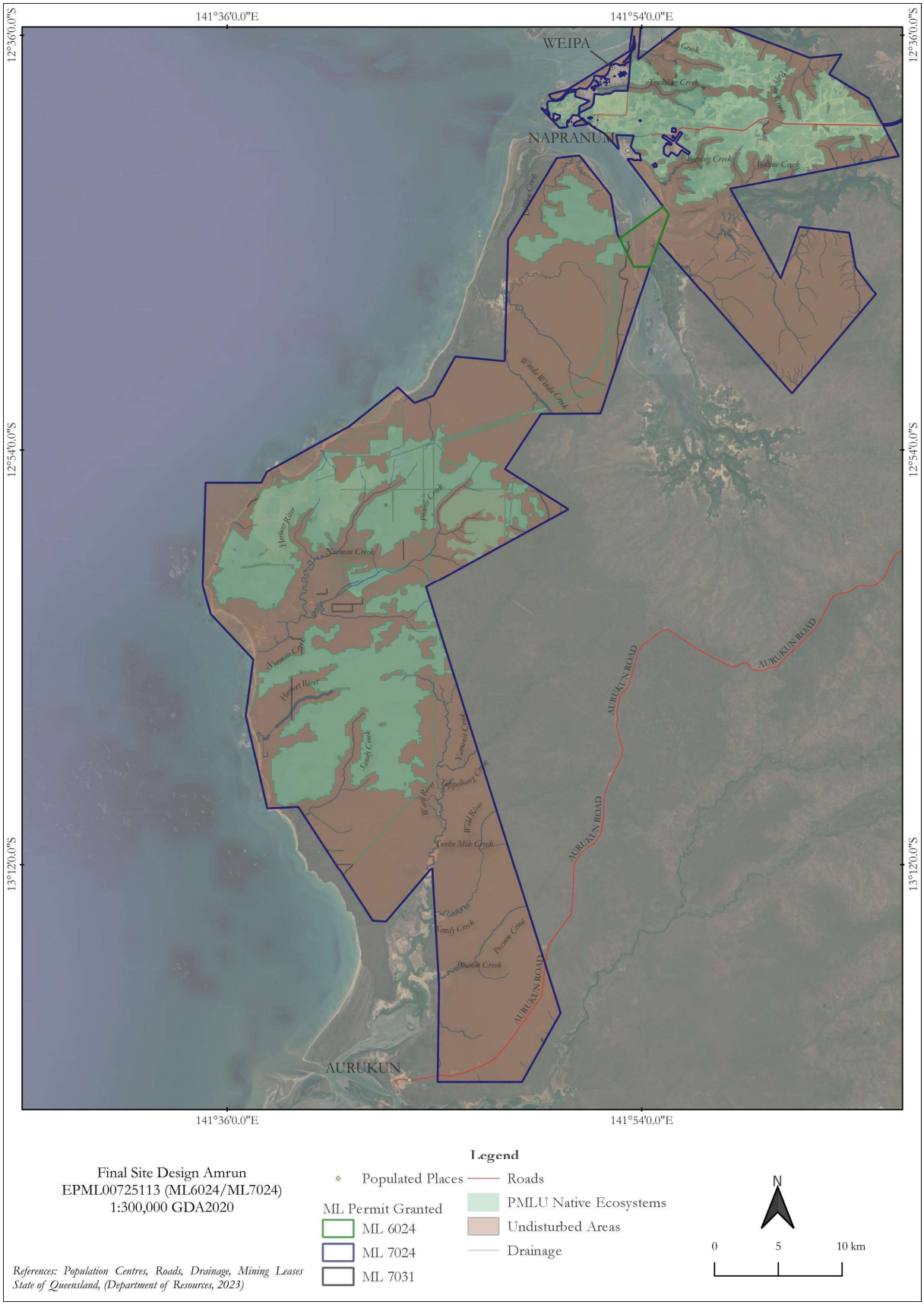


Figure 53 Final Site Design EPML00725113 (ML6024/ML7024) Amrun

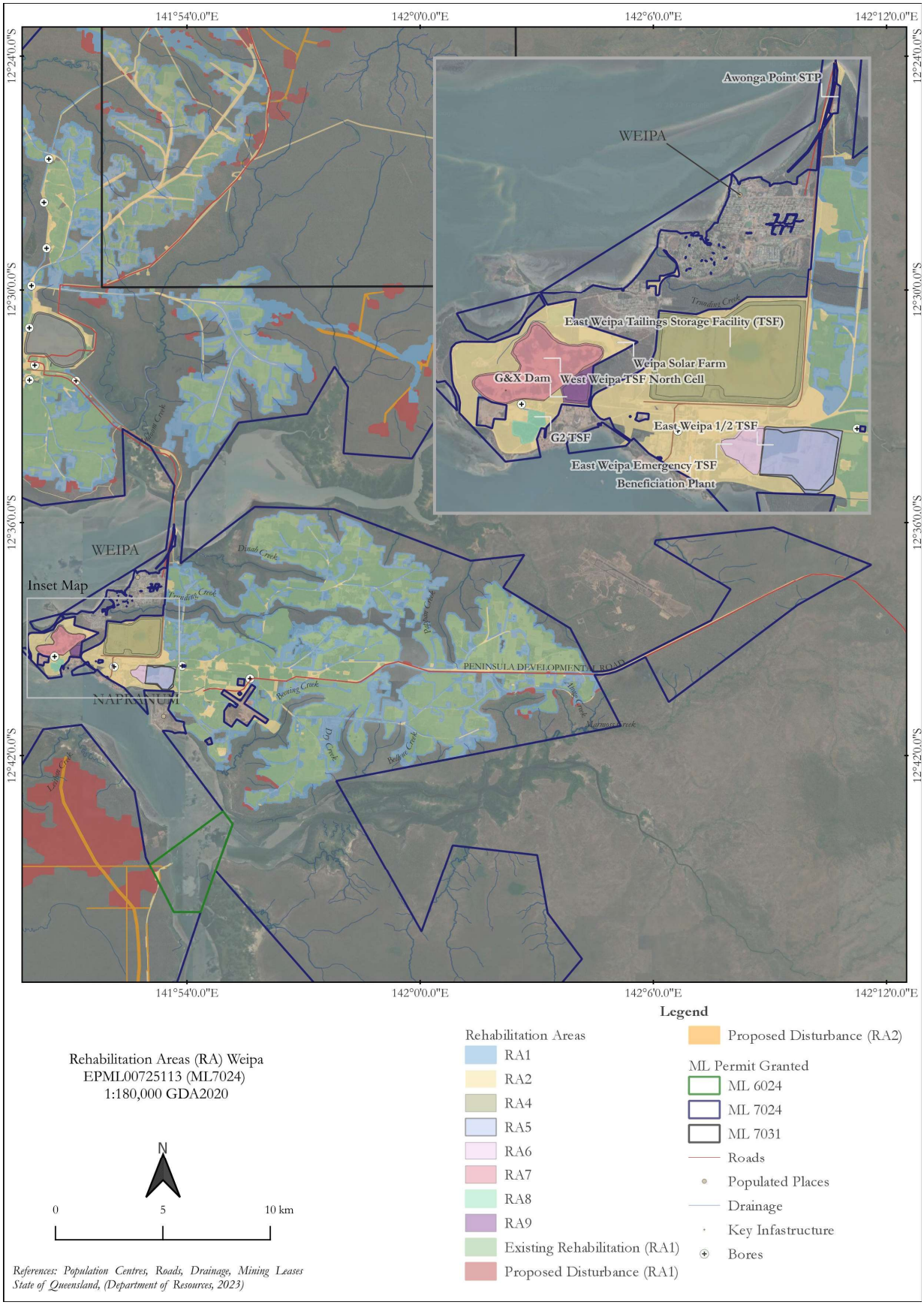


Figure 54 Weipa Rehabilitation Areas

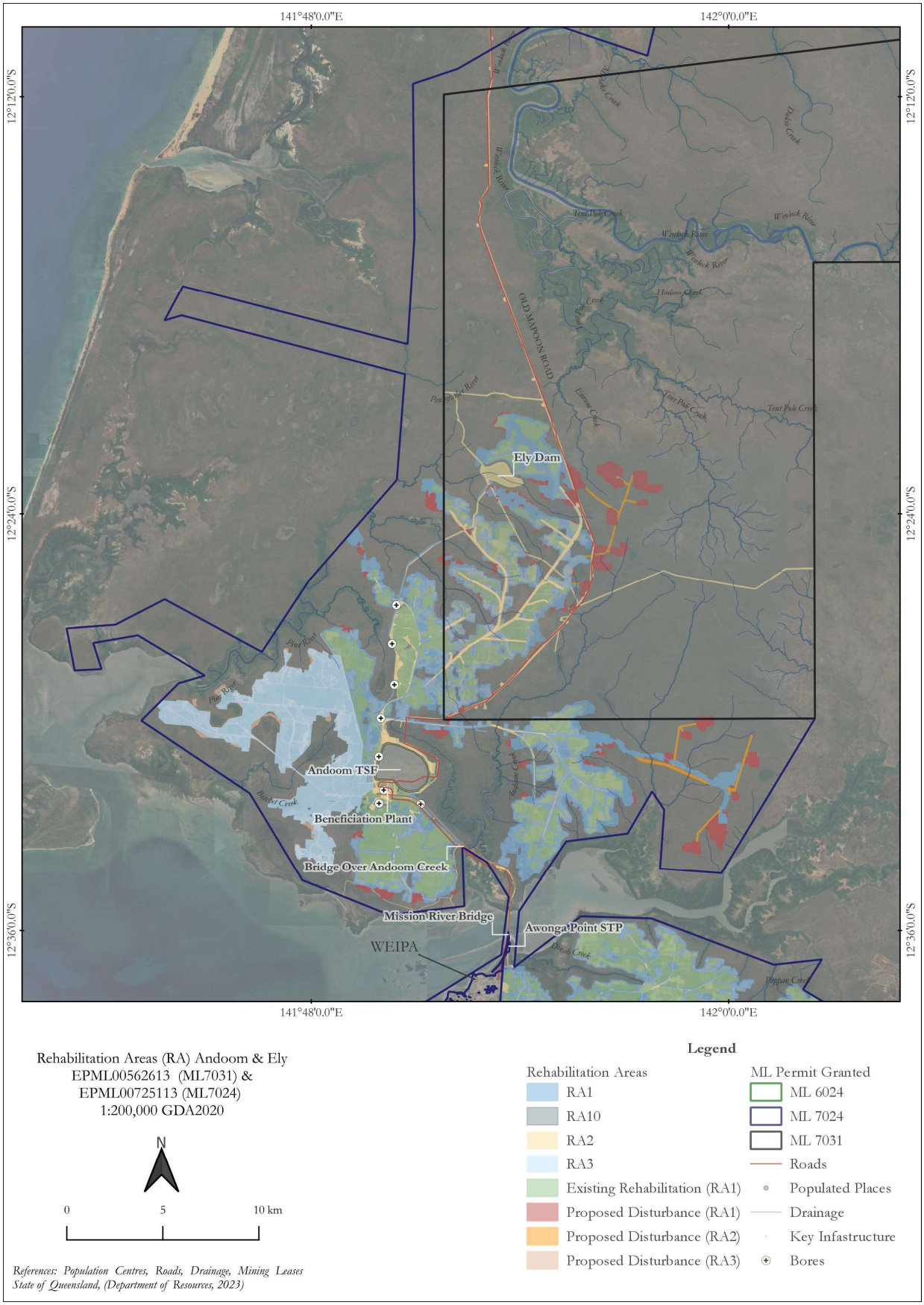


Figure 55: Andoom/Ely Rehabilitation Areas

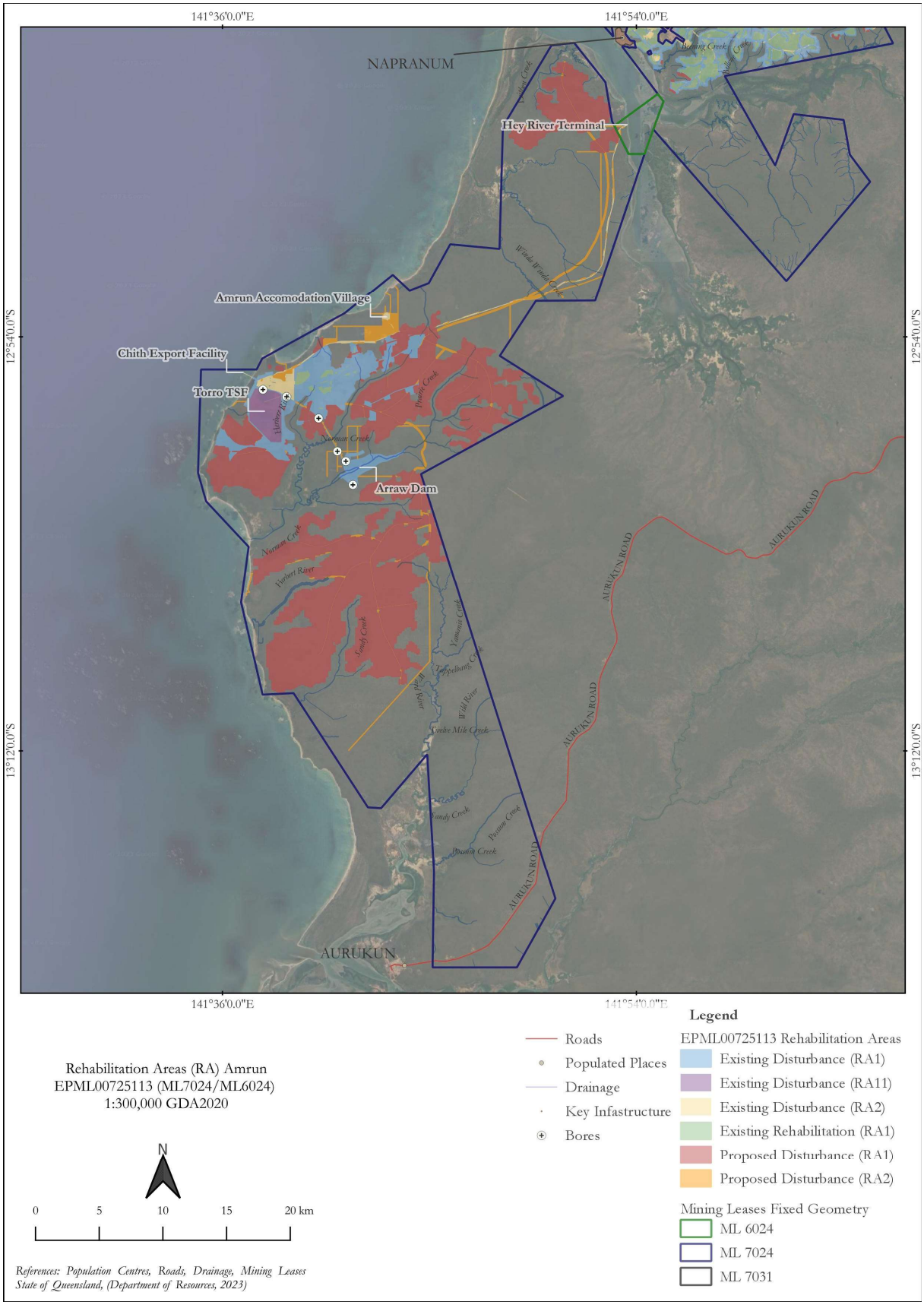


Figure 56 Amrun Rehabilitation Areas

6.13.3 Transitioning rehabilitation and closure outcomes into the PRCP Schedule

Development of rehabilitation objectives and completion criteria for RTW operations has been ongoing for over twenty years. During this time, research, traditional owner engagement, monitoring and operational learnings have driven continual improvements in rehabilitation practices and outcomes. In 2019 the RMP was updated to include completion criteria. These criteria were developed in consultation with DES and community consultation, specifically from the WCCCA and EBMPA. The methodology used to obtain the benchmark quantitative completion criteria have been derived from distributions of rehabilitation indicators observed at analogue reference sites (Appendix F). The rationale applied to determining appropriate completion criteria for rehabilitation at Weipa is discussed in detail in Appendix D of the RMP.

The RMPs completion criteria (Appendix E) have been transitioned into the PRCP Schedule framework as milestone criteria and aligned with the 'SMART' requirements of the PRCP Guideline where necessary.

6.13.4 Rehabilitation milestones and criteria

Rehabilitation Milestones have been developed which are representative of each significant step within the rehabilitation process. The Rehabilitation Milestones and the corresponding rehabilitation activities undertaken to achieve each milestone are presented in Table 16. Each Rehabilitation Milestone has detailed milestone criteria, which contain parameters that are measurable for achieving the milestone (Table 17). The criteria can be used to assess whether a Rehabilitation Milestone is achieved by the date stated in the PRCP schedule. A table demonstrating how the milestone criteria has been transitioned from LODs, and where milestone criteria has been derived from other sources, is provided in Table 18.

Table 16: Rehabilitation Milestones and description of activities

Rehabilitation Milestone	Description of activities
RM1 Infrastructure decommissioning and demolition	• Disconnect and terminate services such as water, electricity and gas. • Demolish and remove buildings (administration, accommodation, toilets, workshops, warehouses, etc.) • Remove surface treatments (e.g. bitumen, aggregate, etc.) • Remove fencing
RM2 Landform establishment (excluding TSF)	• Earthworks to achieve required landform and slopes where required • General reshaping and pushing/trimming of landform • Erosion and sediment control systems identified and in plan – may not be installed until topsoil is replaced in RM4, i.e. surface contouring, structures placed on surface (logs, gabions etc.)
RM3 Interim landform establishment (TSF only)	• Associated with Stage 1 works • Install additional materials (capillary breaks, geofabric, etc.) as required • Finalise engineering and design plans • Prepare engineering report on completed cover • Geotechnical stability assessment of rehabilitated landform • Installation of monitoring equipment
RM4 Surface prepared	• Source, cart and spread growth media (topsoil and/or subsoil) • Adding of ameliorants to improve soils as required • Ripping to ensure root penetration and water infiltration
RM5 Revegetation	• Scarification of surface prior to seeding • Direct seeding of target vegetation community species • Monitoring to determine vegetation is establishing
RM6 Native ecosystem established (excluding TSF)	• Monitoring to determine whether: o vegetation is self-sustaining. o species richness, diversity and density meets required criteria • Maintenance and remediation activities (as required)

Rehabilitation Milestone	Description of activities

RM7 Native ecosystem established (TSF only)	• Associated with Stage 1 works
	• Monitoring to determine whether:
	  o vegetation is self-sustaining.
	  o species richness, diversity and density meets required criteria
	• Maintenance and remediation activities (as required)

RM8 Achievement of PMLU to stable condition	• Contaminated land survey
	• Production water bore decommissioning
	• Monitoring to determine whether:
	  o vegetation is self-sustaining.
	  o species richness, diversity and density meets required criteria
	  o the land is safe, structurally stable, does not cause environmental harm and is able to sustain the PMLU

RM9 Final Landform establishment (TSF only)	• Associated with Stage 2 works • Finalise construction and maintenance plans and ensure certification by qualified person • Additional maintenance earthworks to achieve required landform and slopes where required • General reshaping and pushing/trimming to achieve final landform • Erosion and sediment control systems
RM10 Final Surface prepared (TSF Only)	• Associated with Stage 2 works • Source, cart and spread growth media (topsoil) • Adding ameliorants to improve or soils as required • Trim, rock rake and deep rip • Maintenance and remediation activities (as required)
RM11 Final Revegetation (TSF Only)	• Associated with Stage 2 works • Scarification of surface prior to seeding • Direct seeding • Weed management • Maintenance and remediation activities (as required)

RM12 Final Native ecosystem established (TSF only)	• Associated with Stage 2 works
	• Monitoring to determine whether:
	  o vegetation is self-sustaining
	  o species richness, diversity and density meets required criteria
	  o the land is safe, structurally stable, does not cause environmental harm and is able to sustain the PMLU
	• Maintenance and remediation activities (as required)

Table 17: Rehabilitation milestones and criteria

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
RM1 Infrastructure decommissioning and demolition	For all infrastructure a) All services disconnected and removed b) Buildings demolished and removed		✓		✓			✓			✓	✓
RM2 Landform establishment (excluding TSF)	a) Rehabilitated gradients constructed to maximum slope of 25% (1V:4H) for mined areas, and 20% (1V:5H) for borrow pits and rehabilitated slots b) Mine floor is contoured to reduce erosion potential where remnant mining has occurred	✓	✓	✓								
RM3 Interim landform establishment (TSF only)	a) Landform engineering designs addressing geotechnical and erosional stability, capping systems, cover and drainage design will be certified by a suitably qualified and experienced person b) Evidence that storage facilities are physically stable, as measured in accordance with following minimum geotechnical factors of safety adopted from ANCOLD: o Minimum Geotechnical Factors of Safety: ▪ Static drained and/or undrained with potential loss of containment: 1.5 ▪ Static drained and/or undrained with no potential loss of containment: 1.3 c) Evidence the appropriate risk assessment (for slope slippage) has been undertaken and the level of risk is acceptable. d) Evidence that required engineered structures are in place and functioning.				✓			✓			✓	✓

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
	e) Maximum overall slope angle of 35 degrees, with the exception of EW 1&2 with stable external slopes of up to 45 degrees. f) Monitoring equipment to determine tailing settlement and dewatering is installed											
RM4 Surface prepared	a) Placement of 300-600 mm of suitable growing medium b) Mine floor ripped to at least approximately 500 mm depth c) An assessment of soil health and suitability has been completed to confirm soil is suitable for target vegetation establishment	✓	✓	✓	✓			✓			✓	✓
RM5 Revegetation	a) Surface scarification is complete prior to seeding b) Seed mix appropriate to target vegetation community is applied in alignment with PRCP listed rehabilitation species listed in Table 12 of the planning part c) Ecosystem altering weed (Gamba Grass) abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained[3]	✓	✓	✓	✓	✓	✓	✓			✓	✓
RM6 Native ecosystem established (excluding TSF)	a) No unacceptable soil erosion is recorded during monitoring, whereby 'unacceptable' is defined as Active, Moderate to Severe Erosion into receiving waters or Active, Severe Erosion onto rehabilitation.	✓	✓	✓								

[3] This indicator has been specifically formulated to address the threat of ecosystem transforming weed species. Richardson et al. (2000) defines transformer weeds as invasive species which change the character, condition, form or nature of ecosystems over a substantial area relative to the extent. Weeds found at Weipa which have demonstrated this definition comprise Gamba Grass Andropogon gayanus (Appendix D RMP, RTAW (2019)

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
	b) Weed species abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained. c) Ground cover comprising leaf litter, grasses, or cryptogram to comprise 80% for dry woodland and 65% for wet woodland d) Tree density - total framework species >2m at: i. Pre-2008: 140 for dry woodland; 80 for wet woodland ii. Post-2008: 200 for dry woodland; 140 for wet woodland e) Diversity reaches reciprocal Simpson's index score (≥1.6 for dry woodland; ≥1.2 for wet woodland) i. Pre-2008: 1.6 for dry woodland; 1.2 for wet woodland ii. Post-2008: 3 for dry woodland; 1.2 for wet woodland f) for pre-2008 rehabilitation only: Collective foliage projective cover of Acacia/Grevillea/Dodonaea species, other than those classified as key substrata species, is less than 50% of all >1.5 m intercepts. g) for pre-2008 only: Vegetation health indicates the proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual.											

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
RM7 Native ecosystem established (TSF only)	a) Evidence that vegetation is resilient, self-sustaining and appropriate to control erosion on the landform **Sustainable land use** b) Minimum of two Dry Woodland framework species >2 m present c) Ecosystem altering weeds abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained d) The proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual. e) Monitoring and/or research has shown that vegetation regenerates after fire and meet presence of framework species criteria following a burn **Non-polluting** f) Evidence that surface water leaving rehabilitated site meets REMP requirements, in accordance with the water monitoring requirements (Section 8.5). **Stable landform** g) No unacceptable soil erosion. (Unacceptable erosion is that which: i. Causes instability or degradation of the landform ii. Will compromise land use/objectives)				✓	✓	✓	✓			✓	✓

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
RM8 Achievement of PMLU to stable condition	a) Rehabilitation Performance Monitoring demonstrates eligibility for progressive rehabilitation certification b) Development of soil A horizon and presence of leaf litter. Soil formation underway; presence of termitaria and breakdown of organic matter in soil horizon. c) Ecosystem altering weed (Gamba Grass) must be absent. d) Fire resilience to be measured by the following, or as new fire research requires: i) Following a recent fire (within the previous five years), all other completion criteria must be shown to have been met, demonstrating recovery ii) If site is long unburnt or has never been never burnt, monitoring of structurally and floristically similar rehabilitation must demonstrate that attributes relevant to other completion criteria could be expected to recover following a wildfire. e) Development of habitat features supportive of native fauna species i) that utilise dry woodland vegetation types; such as one or more woody sub-canopy layers and/or course woody debris (10 cm in diameter and >1 m in length) ii) that utilise wet woodland vegetation types; including surface water in some sites, suitable vegetation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
	strata (overstory and/or shrubs and/or rushes and sedges), local native plant species. f) Bores used for production water purposes decommissioned in accordance with the Minimum standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland (WSS/2016/3189) g) A contaminated land survey carried out by an appropriately qualified person indicates that no contamination unsuitable for the post-mining land use is occurring											
RM9 Final Landform establishment (TSF only)	a) The construction and maintenance design has been certified by an appropriately qualified person and consistent with conceptual closure design plans (previously submitted to DES) b) Long-term safety - Certification from an appropriately qualified person that the area is safe in the long-term. c) Stable landform - Certification from an appropriately qualified person that the area has achieved a stable condition and is likely to maintain a stable condition in the long-term, as measured in accordance with following minimum geotechnical factors of safety adopted from ANCOLD: o Minimum Geotechnical Factors of Safety: ▪ Static drained and/or undrained with potential loss of containment: 1.5				✓	✓	✓	✓	✓	✓	✓	

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
	▪ Static drained and/or undrained with no potential loss of containment: 1.3 d) Evidence the appropriate risk assessment (for slope slippage) has been undertaken and the level of risk is acceptable. e) Evidence that required surface drainage structures are in place f) Maximum overall slope angle of 35 degrees, with the exception of EW 1&2 with stable external slopes of up to 45 degrees.											
RM10 Final Surface prepared (TSF Only)	a) Placement of 200-600 mm of suitable growing medium b) Substrate ripped to at least approximately 500 mm depth c) An assessment of soil health and suitability has been completed to confirm soil is suitable for target vegetation establishment				✓	✓	✓	✓	✓	✓	✓	
RM11 Final Revegetation (TSF Only)	a) Surface scarification is complete prior to seeding (this may be in the form of ripping if undertaken immediately prior to seeding) b) Seed mix appropriate to target vegetation community is applied in alignment with PRCP listed rehabilitation species c) Ecosystem altering weeds abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained.				✓	✓	✓	✓	✓	✓	✓	
RM12 Final Native ecosystem	a) Evidence that vegetation is resilient, self-sustaining and appropriate to control erosion on the landform **Sustainable land use**				✓	✓	✓	✓	✓	✓	✓	

Rehabilitation milestones (RMs)	Milestone criteria	Rehabilitation Areas (RAs)										
		RA1	RA2	RA3	RA4	RA5	RA6	RA7	RA8	RA9	RA10	RA11
established (TSF only)	b) Minimum of two Dry Woodland framework species >2m present c) Ecosystem altering weed (Gamba Grass) must be absent. d) Vegetation health indicates the proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual. e) Monitoring and/or research has shown that vegetation regenerates after fire and meet presence of framework species criteria following a burn **Non-polluting** f) Evidence that surface water leaving rehabilitated site meets REMP requirements, in accordance with the surface and groundwater monitoring requirements (Section 8.5). **Stable landform** g) No unacceptable soil erosion. (Unacceptable erosion is that which: i. Causes instability or degradation of the landform ii. Will compromise land use/objectives)											

Table 18: Rehabilitation milestones and criteria

Rehabilitation milestones (RMs)	Milestone criteria	Relevant LOD
RM1 Infrastructure decommissioning and demolition	For all infrastructure a) All services disconnected and removed b) Buildings demolished and removed	a)- b) Rehabilitation Management Plan
RM2 Landform establishment (excluding TSF)	a) Rehabilitated gradients constructed to maximum slope of 25% (1V:4H) for mined areas, and 20% (1V:5H) for borrow pits and rehabilitated slots b) Mine floor is contoured to reduce erosion potential where remnant mining has occurred	a) Section 3.1 Rehabilitation Management Plan b) Not from LOD
RM3 Interim landform establishment (TSF only)	a) Landform engineering designs addressing geotechnical and erosional stability, capping systems, cover and drainage design will be certified by a suitably qualified and experienced person b) Evidence that storage facilities are physically stable, as measured in accordance with following minimum geotechnical factors of safety adopted from ANCOLD: o Minimum Geotechnical Factors of Safety: ▪ Static drained and/or undrained with potential loss of containment: 1.5 ▪ Static drained and/or undrained with no potential loss of containment: 1.3 c) Evidence the appropriate risk assessment (for slope slippage) has been undertaken and the level of risk is acceptable. d) Evidence that required engineered structures are in place and functioning. e) Maximum overall slope angle of 35 degrees, with the exception of EW 1&2 with stable external slopes of up to 45 degrees. f) Monitoring equipment to determine tailing settlement and dewatering is installed	a) Not from LOD, derived from Section 8.7 - Annual inspections of TSFs b) -d) Table 4 refers to- "Very low probability of slope slippage with serious consequence in regards to environmental harm" . ANCOLD criteria is not a LOD however is best practice adopted by the operation. Table 8 RMP "Evidence that storage facilities are physically stable" in adequately defining this phrase ANCOLD has been relied upon as best practice e) Section 3.2.2 Rehabilitation Management Plan f) Not a LOD, included to provide monitoring to ensure safe conditions to conduct earthworks
RM4 Surface prepared	a) Placement of 300-600 mm of suitable growing medium b) Mine floor ripped to at least approximately 500 mm depth c) An assessment of soil health and suitability has been completed to confirm soil is suitable for target vegetation establishment	a) & b) Section 6.3 Rehabilitation Management Plan c) Not from a LOD. Recommended as best practice

Rehabilitation milestones (RMs)	Milestone criteria	Relevant LOD
RM5 Revegetation	a) Surface scarification is complete prior to seeding b) Seed mix appropriate to target vegetation community is applied in alignment with PRCP listed rehabilitation species listed in Table 12 of the planning part c) Ecosystem altering weed (Gamba Grass) abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained[4]	a) Section 7.2 Rehabilitation Management Plan b) Section 7.3 Rehabilitation Management Plan c) Table 6 Section 5.3 Rehabilitation Management Plan
RM6 Native ecosystem established (excluding TSF)	a) No unacceptable soil erosion is recorded during monitoring, whereby 'unacceptable' is defined as Active, Moderate to Severe Erosion into receiving waters or Active, Severe Erosion onto rehabilitation. b) Weed species abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained. c) Ground cover comprising leaf litter, grasses, or cryptogram to comprise 80% for dry woodland and 65% for wet woodland d) Tree density - total framework species >2m at: i. Pre-2008: 140 for dry woodland; 80 for wet woodland ii. Post-2008: 200 for dry woodland; 140 for wet woodland e) Diversity reaches reciprocal Simpson's index score (≥1.6 for dry woodland; ≥1.2 for wet woodland) i. Pre-2008: 1.6 for dry woodland; 1.2 for wet woodland ii. Post-2008: 3 for dry woodland; 1.2 for wet woodland f) for pre-2008 rehabilitation only: Collective foliage projective cover of Acacia/Grevillea/Dodonaea species, other than those classified as key substrata species, is less than 50% of all >1.5 m intercepts. g) for pre-2008 only: Vegetation health indicates the proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual.	a) - g) Tables 6 & 7 Section 5.3 Rehabilitation Management Plan

[4] This indicator has been specifically formulated to address the threat of ecosystem transforming weed species. Richardson et al. (2000) defines transformer weeds as invasive species which change the character, condition, form or nature of ecosystems over a substantial area relative to the extent. Weeds found at Weipa which have demonstrated this definition comprise Gamba Grass Andropogon gayanus (Appendix D RMP, RTAW (2019)

Rehabilitation milestones (RMs)	Milestone criteria	Relevant LOD
RM7 Native ecosystem established (TSF only)	a) Evidence that vegetation is resilient, self-sustaining and appropriate to control erosion on the landform **Sustainable land use** b) Minimum of two Dry Woodland framework species >2 m present c) Ecosystem altering weeds abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained d) The proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual. e) Monitoring and/or research has shown that vegetation regenerates after fire and meet presence of framework species criteria following a burn **Non-polluting** f) Evidence that surface water leaving rehabilitated site meets REMP requirements, in accordance with the water monitoring requirements (Section 8.5). **Stable landform** g) No unacceptable soil erosion. (Unacceptable erosion is that which: iii. Causes instability or degradation of the landform Will compromise land use/objectives)	a) Table 8 Section 5.3 Rehabilitation Management Plan b) Table 8 Section 5.3 Rehabilitation Management Plan c) Exact wording: Weeds will be managed in accordance with the QLD Biosecurity Act (2014) - Criterion adopted under GBO to prevent release to the environment. d) Table 8 Section 5.3 Rehabilitation Management Plan e) Table 8 Section 5.3 Rehabilitation Management Plan f) Table 8 Section 5.3 Rehabilitation Management Plan and REMP (Table F4 of EA) g) Table 8 Section 5.3 Rehabilitation Management Plan -
RM8 Achievement of PMLU to stable condition	a) Rehabilitation Performance Monitoring demonstrates eligibility for progressive rehabilitation certification b) Development of soil A horizon and presence of leaf litter. Soil formation underway; presence of termitaria and breakdown of organic matter in soil horizon. c) Ecosystem altering weed (Gamba Grass) must be absent. d) Fire resilience to be measured by the following, or as new fire research requires: i) Following a recent fire (within the previous five years), all other completion criteria must be shown to have been met, demonstrating recovery ii) If site is long unburnt or has never been never burnt, monitoring of structurally and floristically similar rehabilitation must demonstrate that	a) Per domain based criterion specified in Tables 6-8 of the Rehabilitation Management Plan. b) – e) Table 6-8 of RMP (Legacy, Benchmark and TSF domains respectively). f) Not from LOD – best practice for decommissioning g) Not from LOD – from PRCP Guideline

Rehabilitation milestones (RMs)	Milestone criteria	Relevant LOD
	attributes relevant to other completion criteria could be expected to recover following a wildfire. e) Development of habitat features supportive of native fauna species i) that utilise dry woodland vegetation types; such as one or more woody sub-canopy layers and/or course woody debris (10 cm in diameter and >1 m in length) ii) that utilise wet woodland vegetation types; including surface water in some sites, suitable vegetation strata (overstory and/or shrubs and/or rushes and sedges), local native plant species. f) Bores used for production water purposes decommissioned in accordance with the Minimum standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland (WSS/2016/3189) g) A contaminated land survey carried out by an appropriately qualified person indicates that no contamination unsuitable for the post-mining land use is occurring	
RM9 Final Landform establishment (TSF only)	a) The construction and maintenance design has been certified by an appropriately qualified person and consistent with conceptual closure design plans (previously submitted to DES) b) Long-term safety - Certification from an appropriately qualified person that the area is safe in the long-term. c) Stable landform - Certification from an appropriately qualified person that the area has achieved a stable condition and is likely to maintain a stable condition in the long-term, as measured in accordance with following minimum geotechnical factors of safety adopted from ANCOLD: o Minimum Geotechnical Factors of Safety: ▪ Static drained and/or undrained with potential loss of containment: 1.5 ▪ Static drained and/or undrained with no potential loss of containment: 1.3 d) Evidence the appropriate risk assessment (for slope slippage) has been undertaken and the level of risk is acceptable. e) Evidence that required surface drainage structures are in place Maximum overall slope angle of 35 degrees, with the exception of EW 1&2 with stable external slopes of up to 45 degrees.	a) From EA b) & c) Not from LOD. Section 8.7 - Annual inspections of TSF for dam safety d) Tables 4 and 8 of Rehabilitation Management Plan e) Table 8 Rehabilitation Management Plan

Rehabilitation milestones (RMs)	Milestone criteria	Relevant LOD
RM10 Final Surface prepared (TSF Only)	a) Placement of 200-600 mm of suitable growing medium b) Substrate ripped to at least approximately 500 mm depth c) An assessment of soil health and suitability has been completed to confirm soil is suitable for target vegetation establishment	a) Section 3.3 of Rehabilitation Management Plan b) Section 6.6 of Rehabilitation Management Plan c) Table 8 Rehabilitation Management Plan
RM11 Final Revegetation (TSF Only)	a) Surface scarification is complete prior to seeding (this may be in the form of ripping if undertaken immediately prior to seeding) b) Seed mix appropriate to target vegetation community is applied in alignment with PRCP listed rehabilitation species c) Ecosystem altering weeds abundance (either individually or in aggregate) does not, and is unlikely to, prevent any other criterion being achieved or sustained.	a) - c) Rehabilitation Management Plan
RM12 Final Native ecosystem established (TSF only)	a) Evidence that vegetation is resilient, self-sustaining and appropriate to control erosion on the landform **Sustainable land use** b) Minimum of two Dry Woodland framework species >2m present c) Ecosystem altering weed (Gamba Grass) must be absent. d) Vegetation health indicates the proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual. e) Monitoring and/or research has shown that vegetation regenerates after fire and meet presence of framework species criteria following a burn **Non-polluting** f) Evidence that surface water leaving rehabilitated site meets REMP requirements, in accordance with the surface and groundwater monitoring requirements (Section 8.5). **Stable landform** g) No unacceptable soil erosion. (Unacceptable erosion is that which: i. Causes instability or degradation of the landform ii. Will compromise land use/objectives	a) - g) Rehabilitation Management Plan f) Also REMP (F14 of EA)

6.13.5 Key schedule timeframe considerations

Timeframes for milestones were determined from historic and current rehabilitation practices described in the existing RMPs and now described in Section 2.3 and Section 6.0. Key timing considerations which have been allowed for in the PRCP schedule are summarised in this section.

As described in Section 2.2.5, the life of Weipa mine operations is determined based on current ore reserves and varies across the mining areas. Infrastructure which supports mining operations will continue to be utilised throughout the operating life of the mine, and post cessation of mining to support rehabilitation activities. Section 2.3 describes factors which influence progressive and closure rehabilitation, including when land becomes available for rehabilitation. A summary of the current mine life and progressive rehabilitation availability is provided in Table 19.

Rehabilitation activities commence with landform establishment (RM2 mine areas and infrastructure and RM3 TSFs -RA4-11) followed by surface preparation (RM4) and revegetation (RM5). The landform establishment, surface preparation and revegetation seeding will typically be completed within the same year, within the constraints of the annual seed availability, and subject to the management treatments required where topsoil stockpiles are to be used. As described in Section 2.3.1.4, RM5 is scheduled on the assumption that no more than 1,200 ha of rehabilitation will be able to be seeded in any given year (across all rehabilitation areas on both mining leases), and a ten year delay has been factored into RM4 for 25% of rehabilitation in each five year period for topsoil management. Monitoring to demonstrate that the revegetation milestone has been achieved is typically conducted two years after the actual seeding, and therefore there is typically a two year delay between rehabilitated areas meeting RM4 and RM5 milestones. This is reflected in the schedule through 60% (three of the five years) of any one period progressing from RM4 to meet RM5 criteria, and 40% (two of the five years) progressing from the previous five-year period.

Also as described in Section 2.3.1.4, the progression of rehabilitation from surface preparation (RM4) to revegetation (RM5) on the trajectory to establishment of a native ecosystem is subject to many factors outside the control of RTAW. Given progress from RM4 to RM5 is already scheduled with a two-year delay (as described above) no further allowance is made for retreatment, however this will be monitored and may need to be accounted for in future updates to the schedule

The PRCP schedule combines both pre-2008 and post-2008 rehabilitation areas outside of the West Andoom area into a single ‘Mined Areas’ Rehabilitation Area (RA1). As described in Section 2.3.1.3, the scheduling has considered that most historic rehabilitation (older than 2 years) has achieved milestone criteria for Rehabilitation Milestones 2, 4 and 5, and therefore start within the PRCP Schedule in RM5 (Native ecosystem established). Areas that have recently been rehabilitated (less than 2 years old) start within the schedule at RM4 (Revegetation).

Without an adequate remediation program, nor the ability to forecast change or transition to successful rehabilitation, the desired PMLU is at risk of not being achieved across the rehabilitated landscape. A ’Rehabilitation Assessment Tool’ model is in the final stages of refinement. Although any management interventions will be determined against varying states of rehabilitation, timing of implementation and transition remains uncertain. Existing rehabilitation in RM5 has consequently been scheduled with a delay factor of 15 to 20 years before progressing through to RM6 to ensure rehabilitation milestones can be achieved within a reasonable timeframe.

Following achievement of RM6 milestone criteria, it is assumed that rehabilitation will take a further five years to achieve the milestone criteria for RM8.

Progressive rehabilitation certification serves to verify that the operation is meeting its closure objectives and remove the area from its ongoing liability. RM8 provides milestone criteria indicating rehabilitation success as being eligible for progressive rehabilitation certification. At this stage there are no components on the MLs which have been progressively certified under the EP Act. Application for Progressive Rehabilitation

Certification for eligible parcels of rehabilitated land will be pursuant to consultation obligations with traditional owner Agreement Partners.

The West Andoom Rehabilitation Area (RA3), while planned to meet the same PMLU as all other Rehabilitation Areas, is severely deviated due to heavy Gamba Grass infestation. The schedule has been developed to acknowledge that management intervention at West Andoom will delay the progression of existing rehabilitation from surface preparation (RM4) to revegetation (RM5) for at least 20 years (actual timing for rehabilitation will be subject to seed availability constraints (Section 2.3.1.4) in conjunction with other progressive rehabilitation. Future rehabilitation at West Andoom will be considered available for rehabilitation once all existing rehabilitation has progressed through to RM5.

As described in Section 2.3.2 a general allowance of 10 years following cessation of mining has been provided for most infrastructure to be available for rehabilitation, which is reflected in the timing of commencement of Rehabilitation Milestone (RM1) for the Infrastructure (RA2) and TSF (RA4) Rehabilitation Areas. Once rehabilitation commences, rehabilitation of infrastructure areas is expected to progress through the Rehabilitation Milestones within the same timeframe as the mined areas as described above.

As described in Section 6.9.1, the TSFs have a 2-stage decommissioning and closure strategy including a 20 year ‘control and monitor’ phase before final closure and rehabilitation. This strategy is scheduled in the PRCP as occurring over approximately 20 years with interim TSF milestones (RM3, RM4, RM5 and RM7) followed by final TSF milestones (RM9, RM10, RM11 and RM12). The two-stage rehabilitation process is assumed to apply for the older East Weipa and Andoom TSFs only, and not for Torro TSF to be rehabilitated at the end of mining operations.

Rehabilitation milestones have a completion date of the 10 December. This timeframe has been nominated in accordance with the requirements of the PRCP Guideline such that the annual reporting period for all sites across Queensland will be the same day (10 December) to allow consistent reporting on a state-wide basis.

Table 19: Life of Mine and progressive rehabilitation availability

Relevant activity	Predicted durations	Size (ha)	Progressive rehabilitation availability
RA1 – Mined Areas including existing established rehabilitation, future mined areas and borrow areas adjacent to mining areas.	ML7024/ML6024 East Weipa: Present to approximately 2024 Andoom: Present to approximately 2027 Amrun: Present to approximately 2062 ML7031. Ely: Present to approximately 2027	ML7024/ML6024 : 48,023ha ML7031: 5,383 ha	Mined areas are progressively rehabilitated as described in Section 2.3.1, with more than 15,038 ha of established native ecosystem rehabilitation across both ML7024 and ML6024 and 2635 ha across ML7031.
RA2 – Infrastructure including haul roads and future infrastructure areas	East Weipa: Present to approximately 2034 Andoom: Present to approximately 2037 Amrun: Present to approximately 2072 Ely: Present to approximately 2037	ML7024/ML6024: 5,560 ha ML7031: 798 ha	Infrastructure areas are available for rehabilitation following the cessation of mining as described in Section 2.3.2.
RA3 – West Andoom *not applicable to Ely Lease (ML7031)	Present to 2027	4,166	West Andoom rehabilitation has commenced. As described in Section 2.3.1.3, the PRCP schedule includes an allowance of 20 years for the West Andoom area to enable research and development, integrated weed control and monitoring activities to be undertaken.
RA4 – Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	East Weipa 4 TSF: Present to approximately 2034. Deposition occurring now however in accordance with 126(D)(5)(b) of the EP Act, additional ore may be processed across ML7024 (including East Weipa, Andoom and Amrun) that may require this TSF to remain operational.	442 ha*	Progressive rehabilitation not able to commence until at least 10 years is required following cessation of tailings deposition. This timeframe is required to ensure that dewatering and consolidation is occurring which is needed to safely provide access for heavy machinery to commence infrastructure decommissioning and demolition of the decant systems

Relevant activity	Predicted durations	Size (ha)	Progressive rehabilitation availability
RA5 - Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	East Weipa 1&2 TSF: Tailings deposition has ceased and TSF is undergoing progressive decommissioning and rehabilitation. The first milestone proposed in the schedule is for further revegetation works from 2023.	136 ha*	Historical activities completed included interim landform establishment and surface preparation. Performance monitoring is conducted when the rehabilitation is >8 years old and such the next rehabilitation milestone occurs for a duration of 10 years. Stage 2 batter reprofiling works are anticipated to commence following the achievement of native ecosystem establishment during 2038.
RA6 - Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	Emergency Dam: Tailings deposition has ceased and TSF is undergoing progressive decommissioning and rehabilitation. The first milestone proposed in the schedule is for further revegetation works from 2023.	45 ha*	Historical activities completed included interim landform establishment and surface preparation. Performance monitoring is conducted when the rehabilitation is >8 years old and such the next rehabilitation milestone occurs for a duration of 10 years. Stage 2 batter reprofiling works are anticipated to commence following the achievement of native ecosystem establishment during 2038.
RA7 - Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	West Weipa: This TSF is non-operational however an upgrade to the spillway is planned for 2023. In accordance with 126(D)(5)(b) of the EP Act, additional ore may be processed across ML7024 (including East Weipa, Andoom and Amrun) that may require this TSF to remain operational. TSF would remain unavailable for rehabilitation until approximately 2034	170ha*	Progressive rehabilitation not able to commence until at least 10 years is required following cessation of tailings deposition. This timeframe is required to ensure that dewatering and consolidation is occurring which is needed to safely provide access for heavy machinery to commence infrastructure decommissioning and demolition of the decant systems
RA8 - Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	G2 Dam: Decommissioned and mostly rehabilitated. The first milestone proposed in the schedule is for further revegetation works on the batters from 2026.	21 ha*	TSF already decommissioned and mostly rehabilitated. Minor batter reprofiling works to occur

Relevant activity	Predicted durations	Size (ha)	Progressive rehabilitation availability
RA9 - Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	G & X Dam: Decommissioned and mostly rehabilitated. The first milestone proposed in the schedule is for further revegetation works on the batters from 2026.	27 ha*	TSF already decommissioned and mostly rehabilitated. Minor batter reprofiling works to occur
RA10 - Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	Andoom TSF: Present to approximately 2037. Deposition occurring now however in accordance with 126(D)(5)(b) of the EP Act, additional ore may be processed across ML7024 (including East Weipa, Andoom and Amrun) that may require this TSF to remain operational.	519 ha*	Progressive rehabilitation not able to commence until at least 10 years is required following cessation of tailings deposition. This timeframe is required to ensure that dewatering and consolidation is occurring which is needed to safely provide access for heavy machinery to commence infrastructure decommissioning and demolition of the decant systems
RA11 - Tailings Storage Facilities *not applicable to Ely Lease (ML7031)	Torro TSF: Present to approximately 2072	858 ha*	Required for tailings storage until all ore processing is complete at Amrun

*** Number of hectares inclusive of surface area and batters**

7.0 Risk Assessment

In accordance with the PRCP Guideline a risk assessment workshop was undertaken to identify the risks of a stable condition of land not being achieved and to propose how the risks will be managed or minimised. As per section 126C(1)(f) of the EP Act, the focus of the risk assessment related to the risk of a stable condition being achieved for the transitioned post mine land use (PMLU).

7.1 Methodology

The aspects of risk assessment as described by the AS ISO 31000:2018: Risk Management – Guidelines (Standards Australia, 2018) were included in the risk assessment workshop:

- Risk identification – sources of risk, areas of impacts, events and causes, potential for consequences
- Risk analysis – causes of risk, positive and negative consequences, and likelihood of consequences occurring
- Risk evaluation – analysis to determine what risks need to be managed and prioritised
- Risk treatment – select and implement options for addressing identified risks.

The risk assessment objective was to create a comprehensive list of risks based on events, which may impede, delay or accelerate the rehabilitation of land to a stable condition. As per the PRCP Guideline, the workshop identified risks that were within, and outside of, RTW's ability to control, to the extent these risks impact on the completion of milestones.

The outcomes of the risk assessment have been considered when determining the PRCP milestones in the PRCP Schedule.

The risks associated with the ability to return the RAs to a stable PMLU were analysed using qualitative (and where possible quantitative) criteria to assess likelihood and consequences. The consequence assessment was evaluated separately for environmental, health and safety, licence to operate/reputational, and community consequences, with the most serious consequence considered when assessing the overall risk ranking.

The likelihood and consequences criteria tables are provided in Appendix F together with the risk matrix.

7.2 Risk assessment findings

This section provides an assessment of the potential risks of a stable condition being achieved for the PMLU if rehabilitation and closure activities are undertaken as is currently proposed. Table 20 provides the risks identified together with the risk treatment (controls) in place and proposed to lower the risk.

The highest ranked risks were weed infestations preventing the achievement of a PMLU, failure to identify an adequate intervention for existing 'deviated' rehabilitation, and inability to source topsoil and cover material resulting in reduced quality of rehabilitation.

Table 20: Risk assessment findings

Risk	Potential causes	Potential Impacts	Existing Controls	Likelihood	Most serious consequence	Overall risk rank	Proposed treatments	PRCP Schedule relationship	Where addressed in the PRCP	Risk owner
Environment										
Significant increase in previously unknown contamination found or known contamination, reduces ability to achieve PMLU	• Existing soil contamination could be more extensive than currently estimated • Minor landfill areas around Weipa town contain unknown quantities of asbestos	PMLU not achieved or significant delays in achieving PMLU	• Extensive mapping of existing contaminated land sites • Existing studies for major existing sites • Contaminated Land register and management plan	Unlikely	Moderate	Class II	• Contaminated site investigations will be undertaken by suitably qualified professionals prior to relinquishment • Remediation of contaminated sites undertaken prior to relinquishment	Contaminated site investigations are to be conducted at a suitable time to allow for remediation to be conducted prior to relinquishment.	Section 6.12.3	RTW Environmental Manager/ Advisor
Ecosystem altering weed infestations prevent achieving PMLU (relates to multiple types of weeds)	• Inability to address legacy of non-native vegetation (weeds, introduced pastures, etc) • Stockpiled topsoil contains high weed seedbank • Weeds are imported from offsite	PMLU not achieved or significant delays in achieving PMLU	• Weed strategy (developed with Dept Ag & RTW) in place, including Weed Management Plan and Guideline Enforcement of existing Quarantine zone at West Andoom; strict weed hygiene controls for mine development and production activities, and restricted general access. • Existing annual weed management program (across	Almost certain	Very high	Class IV	• Ongoing research and development • Monitoring techniques using remote sensing/ LiDAR • Alternative land management practices developed by research and development activities • Embarking on partnership agreement with leading research organisation; CSIRO	• To accommodate weed treatment of stockpiled topsoil the seeding (RM5) of rehabilitation may be delayed by up to 10 years. • To accommodate treatment of encroaching weed species and wildfires (refer to risk below) ecosystem establishment (RM6) may be	Section 6.1.2 Section 0	RTW Mine Services Manager

Risk	Potential causes	Potential Impacts	Existing Controls	Likelihood	Most serious consequence	Overall risk rank	Proposed treatments	PRCP Schedule relationship	Where addressed in the PRCP	Risk owner
			all of Weipa and Ely Operations) • Resources are allocated for 4-month period to actively work to control Gamba grass spread via ground-based control program. • Scalping topsoil methodology by burying weed seedbank under 'non-infested' topsoil • Strict weed hygiene controls for HME and LV movements from Weipa/Andoom Operations to Amrun Operations • Weed infested stockpiled topsoil is to be treated prior to seeding.					delayed by up to 5 years. • To accommodate the development of management intervention at West Andoom, the progression of rehabilitation has been delayed by 20 years.	Section 2.3.1	
Bushfires/Wildfires within rehabilitated mining areas negatively impact revegetation and delay achieving the PMLU	Bushfires negatively impact framework species reducing the ability to achieve PMLU	PMLU not achieved or significant delays in achieving PMLU	• Rehabilitation protection on-ground burn program • Broader lease hazard reduction burn program • Rehabilitation planning and internal fire break network	Possible	Moderate	Class III	•Deliberate introduction of fire in mature rehabilitation and deviated rehabilitation (transition model)	To accommodate treatment of encroaching wildfires and weed species (refer to risk above) ecosystem establishment (RM6) may be delayed by up to 5 years.	Section 2.3.1	RTW Land and Rehabilitation Specialist
An adequate intervention/remediation program to manage existing deviated	• Unable to develop an adequate intervention	Deviated rehabilitation does not achieve PMLU or	• Weed spray program.	Likely	High	Class IV	• Rehabilitation Assessment Tool: Rehabilitation	To accommodate the development and implementation	Section 2.3.1.3	RTW Mine Services Manager

Risk	Potential causes	Potential Impacts	Existing Controls	Likelihood	Most serious consequence	Overall risk rank	Proposed treatments	PRCP Schedule relationship	Where addressed in the PRCP	Risk owner
rehabilitation cannot be developed resulting in not achieving PMLU)	model or program designed to transition deviated rehabilitation • Inability to forecast change and/or transition to desired PMLU	significant delays in achieving PMLU.	• Rehabilitation Monitoring program • Completion criteria (established 2019)				Benchmark Analysis (in final stages of refinement) • Comprehensive statistical data interpretation of rehabilitation monitoring results against completion criteria • Determination of sufficient rehabilitation maintenance effort to achieve PMLU • Implementation, monitoring, and evaluation feedback	of the state and transition model the achievement of PMLU (RM8) for existing rehabilitation is delayed by up to 15 years.		
Long-term climate change not modelled and incorporated into rehabilitation planning and PMLU not achieved	Long-term climate modelling not incorporated into rehabilitation planning and/or rehabilitation strategy	PMLU not achieved or significant delays in achieving PMLU	• Use long-term industry-accepted modelling to inform rehabilitation planning • Adaptive rehabilitation planning	Rare	Moderate	Class II		Use of long-term modelling within rehabilitation planning will allow for early identification of deviations from the PRCP schedule.	Section 2.1.2.1	RTW Land and Rehabilitation Specialist
Traditional Owners, communities and stakeholders										
Assumed 'community' and 'public' infrastructure to remain for community use post mining are not agreed to by community by closure, which impacts achieving the PMLU	• No formal agreement for infrastructure to remain post closure	Final agreed land use may not meet current PMLU or significant delays in achieving PMLU	Ongoing consultation as per the ongoing consultation plan.	Unlikely	Moderate	Class II	• Revised completion criteria may be required • Completed within town transition and closure planning process	Ongoing consultation will allow for early identification of changes to the PRCP schedule.	Section 3.2	Communities & Communication Manager

Risk	Potential causes	Potential Impacts	Existing Controls	Likelihood	Most serious consequence	Overall risk rank	Proposed treatments	PRCP Schedule relationship	Where addressed in the PRCP	Risk owner
Implementation										
Rehabilitation establishment methodologies do not achieve PMLU	Ineffective rehabilitation methodologies and establishment Change in revegetation techniques, unexpected dry/wet/cyclonic periods resulting in lower performance than expected	PMLU not achieved or significant delays in achieving PMLU	• Proven methodologies in northern operations. • Establishment trials pending in southern operations.	Unlikely	Moderate	Class II	• Amrun establishment trials to validate existing methodology • Ongoing review of best practice and trial methods	Rehabilitation trials will test the rehabilitation methodologies for Amrun to demonstrate achievement of the PRCP schedule.	Section 8.10	RTW Land and Rehabilitation Specialist
Native seed availability and quality impacting on the ability to achieve PMLUs	Unable to source enough seed to rehabilitate planned areas and achieve individual milestones, criteria and ultimately PMLUs	PMLU not achieved or significant delays in achieving PMLU	Seed collection program	Unlikely	Moderate	Class II	Native seed availability can be offset by tubestock, Develop seed strategy for closure rehabilitation campaigns	Local sourced seed availability is the most significant constraint on the amount of rehabilitation which can be completed annual.	Section 6.2.2	RTW Land and Rehabilitation Specialist
Rehabilitation engineering and design										
Post-closure mining area landform leads to unacceptable water flow, water pooling and other hydrological impacts impacting on the ability to achieve PMLU	• Final surface of areas mined and then rehabilitated will generally sit 3 - 5m below the pre-mining position • Potential for altered water flows to lead to water pooling/ inundation	PMLU not achieved or significant delays in achieving PMLU	• Assessment of potential water pooling/inundation incorporated into annual rehabilitation planning. • High-level landscape hydrology studies completed. • 'wet' woodland species seed mixes developed for rehabilitation of	Likely	Moderate	Class III	• Final landform and hydrology studies to be completed during formal closure studies	Hydrology studies allow for the planning of rehabilitation and drainage to established in accordance with the PRCP schedule.	Section 6.3	Rio Tinto Aluminium - Mine Planning Manager

Risk	Potential causes	Potential Impacts	Existing Controls	Likelihood	Most serious consequence	Overall risk rank	Proposed treatments	PRCP Schedule relationship	Where addressed in the PRCP	Risk owner
	during wet season		areas subject to water pooling/inundation.							
Inability to locally source suitable quantities of materials (e.g. topsoil, Archer River rock) to adequately rehabilitate areas disturbed by mining and infrastructure	• Insufficient volume of growth medium available • Material balance is inaccurate • Loss of topsoil due to poor handling or weed infestation • Existing topsoil stockpile quality is degraded due to weeds or loss of nutrients • Potential loss of topsoil through reduced vegetation cover	PMLU not achieved or significant delays in achieving PMLU	• Materials balance completed. • Topsoil is able to be supplemented with sub-soils to produce a suitable growth medium for rehabilitation.	Likely	High	Class IV	• Seek learning opportunities from Gove and other sites	To accommodate weed treatment of stockpiled topsoil and or to accommodate revival of severely depleted stockpiled soils, the seeding (RM5) of rehabilitation may be delayed by up to 10 years.	Section 6.1.2	RTW Mine Services Manager
TSF not 'physically stable' (as required in completion criteria) with potential for a safety threat to humans and infrastructure (at EW4) or sediment transport impacting adjacent waterways and vegetation communities	• Massive rainfall events (>1:1000 ARI) • Failure to achieve TSF construction & operation design specifications during remaining	• PMLU not achieved or significant delays in achieving PMLU • Sediment transport impacting adjacent waterways and	• Use of accepted industry standards for TSF operations and design • TSF design and operational plans • Design and construction are certified by suitably qualified and experienced person	Unlikely	Moderate	Class II	• Vegetation cover established on TSF embankments	East Weipa and Andoom TSF (RA4) closure activities are broken into two distinct phases: decommissioning and then final closure.	Section 6.9	RTW Water and Tailings Manager

Risk	Potential causes	Potential Impacts	Existing Controls	Likelihood	Most serious consequence	Overall risk rank	Proposed treatments	PRCP Schedule relationship	Where addressed in the PRCP	Risk owner
	operational life • Failure / slumping of constructed TSF wall due to inadequate design and/or construction • Earthquake causing failure of TSF • Vegetation failure not detected leading to erosion and geotechnical failure	vegetation communities • Safety threat to humans and infrastructure								
Stable landforms are not achieved on terminal mine boundaries, and all non-TSF Rehabilitation Areas with potential to not achieve the PMLU	• Battered slopes at terminal boundaries are not established at appropriate gradients causing erosion • Unknown water flow and inadequate erosion design.	• PMLU not achieved or significant delays in achieving PMLU • Sediment transport impacting adjacent waterways and vegetation communities • Safety threat	Specific rehabilitation treatments developed for terminal mine boundaries.	Possible	Low	Class II	• Rehabilitation planning improvements to focus on integration of mine planning, short-term machinery availability and constructability	Rehabilitation planning will allow for early identification of deviations from the PRCP schedule.	Section 6.13	RTW Mine Services Manager
Post closure care and maintenance										
Insufficient rehabilitation maintenance effort negatively impacts achievement of PMLU (potential delays to achieving PMLU)	• Maintenance is not undertaken as planned during operations or is of sub-	• PMLU not achieved or significant delays in achieving PMLU	Rehabilitation maintenance program developed	Unlikely	Moderate	Class II		Implementation of the rehabilitation maintenance program will allow for early correction of	Section 0	RTW Land and Rehabilitation Specialist

Risk	Potential causes	Potential Impacts	Existing Controls	Likelihood	Most serious consequence	Overall risk rank	Proposed treatments	PRCP Schedule relationship	Where addressed in the PRCP	Risk owner
	standard quality							deviations from the PRCP schedule.		
Monitoring is not adequate to demonstrate achievement of all PMLUs causing delay in achieving PMLU	Non-standard rehabilitation monitoring to demonstrate contamination, TSFs, etc has not yet been undertaken	• PMLU not achieved or significant delays in achieving PMLU	• Standard Rehabilitation and TSF Completion Criteria • Rehabilitation Benchmark Analysis (tool)	Unlikely	Moderate	Class II	• Eligibility of progressive rehabilitation certification to be commenced (demonstrated by Rehabilitation Benchmark Analysis outputs)	Implementation of the rehabilitation monitoring program will allow for early correction of deviations from the PRCP schedule.	Section 8.0	RTW Land and Rehabilitation Specialist
Acid Sulfate Soils are encountered during rehabilitation works, presenting a risk to achieving nominated milestones	Acid Sulfate Soils not mapped effectively	• Delay in achieving PMLU due to acidification of growth media.	• Mapping of Acid Sulfate Soils (Section Acid Sulfate Soils Management 6.7 • ASS Management protocols included in LUMP	Unlikely	Low	Class I	• Apply management protocols included in LUMP • Reassess if mine plan changes	Not considered in schedule.	Section 6.7	RTW Land and Rehabilitation Specialist

8.0 Monitoring and maintenance programs

The PRCP milestone criteria provide quantitative indicators of progress towards achieving overall rehabilitation or closure objectives. The final milestone for each RA is achievement of the relevant PMLU. A suite of monitoring and maintenance programs have been developed to collect data to support assessment against the relevant milestone criteria and provide a structured approach the management of areas toward each milestone throughout the progressive rehabilitation and closure process. In general, these monitoring programs aim to:

- assess rehabilitation progress towards the desired PMLU;
- identify areas that require remediation; and
- demonstrate compliance against milestone criteria.

Key monitoring and maintenance programs relevant to PRCP milestone criteria include:

1. Revegetation
2. Fauna
3. Weeds and pests
4. Surface and groundwater
5. PFAS
6. Erosion
7. TSFs
8. Fire

Monitoring of milestone criteria will commence as soon as possible after rehabilitation has commenced, or a previous milestone has been completed. Monitoring demonstrates that each rehabilitation activity has been completed, and the outcome achieves the requisite milestone criteria, hence tracking the progress of the rehabilitation process. Monitoring will also enable early identification of any rehabilitation problems and implementation of appropriate maintenance and remediation activities.

8.1 Revegetation monitoring and maintenance program

8.1.1 Revegetation monitoring

Revegetation monitoring aims to assess the establishment and ongoing development of revegetated areas. Those areas not performing are included in a maintenance remediation program. Ongoing management and manipulation trials at different ages of rehabilitation inform the development of an effective management framework where defined states can be predictably managed towards closure.

Revegetation monitoring generally includes the collection of data on a range of parameters covering the key compositional, structural and functional attributes that are desirable in a successfully rehabilitated native ecosystem. These include soil health, species diversity, tree composition and density, groundcover, recruitment, faunal utilisation and resilience to disturbance among others.

RTW has routinely undertaken revegetation monitoring, primarily of rehabilitated mined areas, since the 1970s in various forms. In addition to this, significant monitoring events aimed to improve understanding of the development of revegetation over time, and inform development of performance criteria, have included repeat monitoring of long-term transects in the 1990s and 2008–2009, with a ‘chronosequence’-designed research monitoring campaign conducted in 2009–2012.

These previous efforts have been behind the continuously improving methods and monitoring strategies at RTW to deliver the contemporary revegetation monitoring and maintenance program. This program consists of two key components (Figure 57

), further detailed below, described as:

- Early Assessment vegetation monitoring; and
- Performance Monitoring – monitoring rehabilitation development and performance against Completion Criteria.

Revegetation management is intrinsically related to fauna management, erosion management and weed and pest monitoring and management. These aspects are discussed separately in later sections.

A general background and further detail on the two key components of the revegetation monitoring program is provided below, as they relate to specific milestones.

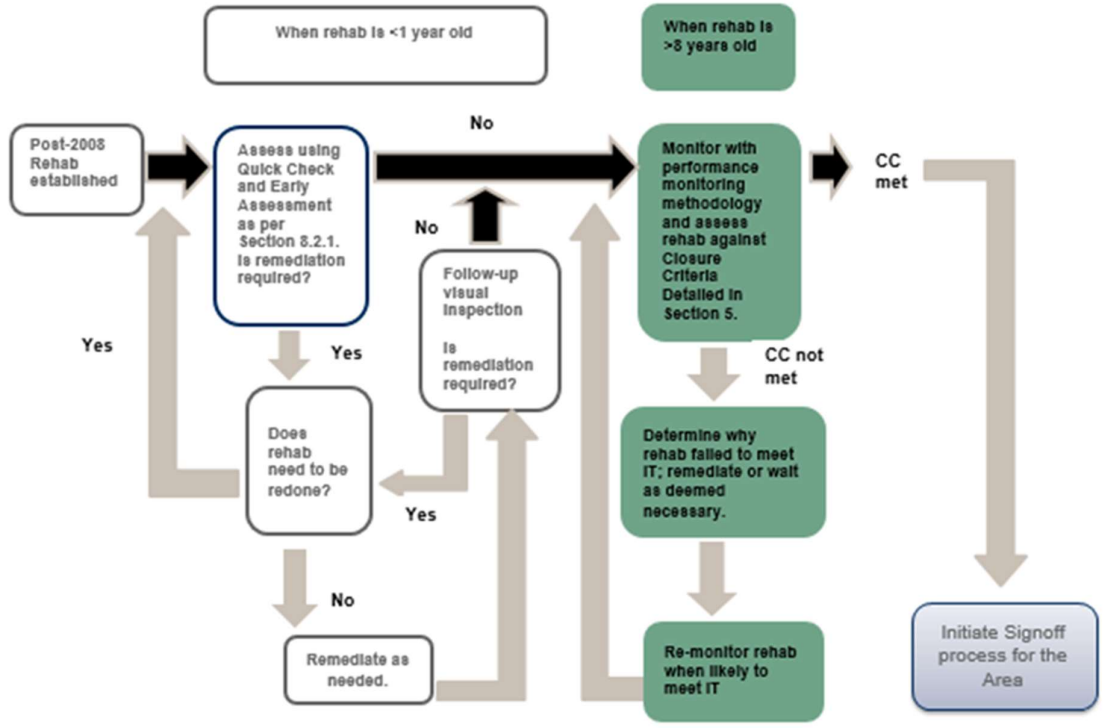


Figure 57: Rehabilitation monitoring procedure

8.1.1.1 Background

There is very strong evidence that initial floristic composition, established by the end of the first or second dry season, has a profound influence on the long-term prospects and likely developmental trajectories of rehabilitation (Norman *et al*. 2006). This data can inform the development of management interventions for sub-standard or “deviated” rehabilitation. Rehabilitation efforts focus on the initial establishment of floristic composition dominated by framework species derived from reference site monitoring at analogous land units (Table 5). Framework species dominance ensures maximum opportunity for establishment, effective competition, and the capture of site nutrient and plant-available water resources. These species give the revegetation its longer-term stability, predictability, and fire resistance. It is therefore desirable to establish a diverse range of these taxa and to also establish a diversity of taxa that are characteristic of different strata (canopy, mid and ground layers).

Conversely, if the initial floristic composition of the revegetation is strongly dominated by grasses, acacias or other woody shrubs, and has low densities of framework species, the possibilities of the site developing into a stable woodland ecosystem are less predictable and likely to be remote in the medium term (30 to 50 years) without active, and potentially costly, management intervention. Active management is therefore required for areas where framework species are absent at the end of the first dry season to ensure long-term rehabilitation success.

These ecological principles underpin the monitoring program at RTW, which focusses on monitoring relevant aspects of rehabilitation at the establishment stage and follow up with monitoring of rehabilitation development over time.

Considerable monitoring has been undertaken to help understand the development of rehabilitation over time. This has included:

- Repeat monitoring of long-term transects conducted three times in the 1990s and again in 2008/09 in conjunction with University of Queensland; and
- A campaign of monitoring conducted across 2009–2012 to develop a chronosequence of data for Weipa revegetation developmental trajectory and support justification of performance criteria, particularly formal completion criteria.

The 2009–2012 monitoring involved a total of 175 rehabilitated and 44 reference sites, some of which were monitored on several occasions to help understand trends related to temporal and/or disturbance transitions. The sites were mostly in Pre-2008 rehabilitation but also included some Post-2008 rehabilitation. The Pre-2008 sites were selected to encompass a range of rehabilitation ages and developing vegetation types, forming a 'chronosequence' of vegetation development over time. Post-2008 sites were all comparatively young and included both Dry Woodland and Wetland ecosystem types. Reference sites selected included those typical of areas mined, and those for which it was thought that rehabilitated sites might resemble to some extent (Table 12).

The monitoring procedure uses 10 m × 50 m plots, with 10 m × 10 m sub-plots. Parameters measured included density of individual framework species, combined density of framework species >2 m and <2 m, total species richness, ground cover, total foliage projective cover (FPC) >1.5 m, height, and diameter at breast height of trees >2 m.

These data have been the foundation to the agreed completion criteria for rehabilitation at RTW (Appendix E) which has been transitioned into PRCP Schedule milestone criteria for RM6 and RM8 in this PRCP (Section 6.13.4). These criteria generally reflect the key compositional, structural and functional features required in a successfully rehabilitated, native ecosystem post-mining land use.

8.1.1.2 Early assessment monitoring

In the wet-dry tropics, a major focus of monitoring is on assessing species composition and density within the first two to three years after establishment. For this early assessment, a range of standard vegetation survey techniques (e.g. belt transects) are generally employed. Data collected from this monitoring is used to refine establishment practices, or where potential problems are identified, to implement remediation if required such as enrichment plantings or other management interventions. In effect, early assessment serves as a useful quality assessment tool to confirm that rehabilitation has been carried out as per agreed procedures and is establishing satisfactorily.

When assessing initial rehabilitation establishment success, the following two procedures are used:

- The **Quick Check** survey is designed to improve the understanding of rehabilitation techniques, soil types, and the influence of climatic events on early rehabilitation establishment. The method is a simple site inspection that involves walking into each rehabilitated area at least 20 m from the edge and recording observations. General site details recorded include presence of key tree, shrub, grass, and weed species, and vegetation ground cover. Any problems that may require remediation/maintenance, such as developing erosion, are also noted.

- **Early Assessment** monitoring aims to quantify the establishment of native species, confirming which rehabilitated areas are successful, and those that require remediation/maintenance work. Monitoring plots of 100 m × 5 m are established and used to record ground cover, species richness, density of framework species, other native species, and woody weeds, and additional observations on erosion, weed dominance, and soil condition.

During the early assessment monitoring an assessment of erosion (type and severity) occurs where erosion is classified as:

- "Gully" - A channel more than 0.3 m deep
- "Rill" - Small channel up to 0.3 m deep
- "Sheet"- Uniform removal of soil from an area where there are no channels present
- "Tunnel"- Removal of subsoil by water whilst surface soil remains intact (McDonald, 1998)

These have been used in most rehabilitated areas for over 30 years and provide a valuable record of rehabilitation establishment. Using data from Early Assessment, RTW has developed internal establishment targets and uses these to assess whether rehabilitation establishment has been satisfactory.

8.1.1.3 Performance monitoring

Future monitoring to assess the progress of rehabilitation towards meeting long-term goals and objectives will take place as illustrated in Figure 57. The performance monitoring methodology is based on 500 m2 rehabilitation monitoring plots sampled at a rate of 1 per 20 ha. This plot size was found to be suitable for the purposes of monitoring rehabilitation development when used to assess rehabilitation from 2009 to 2012. Neldner *et al*. (2012) state that the Queensland Herbarium has adopted a 10m × 50m plot as the standard for secondary and tertiary monitoring sites (which is approximately the level of detail generally used in rehabilitation monitoring). They add that this plot size is widely accepted internationally and is often used in surveys in Australia; and for Queensland vegetation apart from rainforests, a comprehensively surveyed 500 m² plot captures the majority of the vascular plant diversity at a site. For sampling intensity for assessment of rehabilitation against completion criteria, a rate of one Rehabilitation Monitoring plot per 20 ha is used. The subsequent data is used to assess the following:

- Ground Cover – direct measurement of vegetation-grasses, litter, and cryptogam.
- Framework Species Presence - identification of tree and tall shrub framework species.
- Framework Species Density – counting numbers of each framework species and calculating their density in the rehabilitation monitoring plots.
- Species Richness – the total number of native plant species recorded in each Rehabilitation Monitoring plot
- Species Diversity – species diversity consists of three components: species richness, taxonomic diversity and species evenness. Species richness is a simple count of species, diversity is the genetic relationship between different groups of species, whereas species evenness quantifies how equal the abundances of the species are.
- Structural Composition – assessed by framework species density and ground cover
- Native Species Recruitment – assessed by the presence of framework species <2 m in older Rehabilitation Monitoring plots

- Weed Species – assessed through compliance with weed management procedures in accordance with the *Biosecurity Act 2014*
- Health and Resilience to Disturbance – measured by assessing the recovery of key parameters following fire
- Fauna – assessed using fauna surveys conducted in representative rehabilitated and reference sites including the presence of termitaria
- Course Woody Debris – assessed during Performance monitoring survey work.
- Soil horizon development – assessed by excavations at 25 m intervals along transect to assess leaf litter breakdown and soil formation processes.
- Canopy Composition – assessed during cover intercept assessment.

8.1.2 Revegetation maintenance and remediation

The rehabilitation monitoring program ensures that rehabilitation is assessed at important stages in its development against a series of relevant targets and completion criteria. Rehabilitation which is identified as not achieving particular targets is flagged for management through the remediation program. For some sites, this may simply mean waiting for several years until the failing corrects itself and the target is met. For others, active focus through the weed and/or fire management program may be required, while some sites may require active intervention, as discussed later.

The monitored parameters have been included in a GIS-enabled 'Rehabilitation Assessment Tool' and are compared against agreed completion criteria (transferred as RM6 and RM8 criteria). This tool calculates performance of rehabilitation from raw monitoring data captured in a set format. Therefore, management decisions can be made about the eligibility of rehabilitated portions for progressive signoff or remediation intervention required.

Continued integration of development data with rehabilitation success will ensure seed mixes and other rehabilitation variables can be modified according to continual improvement, facilitating commitments to adaptive management.

The aim is to apply the most cost-effective remediation methods at the correct time for the optimal improvement of the rehabilitation so that it can once again be managed as 'successful rehabilitation' and removed from the remediation program (noting however that it will still be subject to the default maintenance programs as per all rehabilitation).

8.2 Fauna monitoring and management

Fauna monitoring of rehabilitation and unmined reference areas is used to investigate trends in fauna communities and factors potentially affecting fauna occurrence in rehabilitated habitats, including comparison of different mine areas, effect of rehabilitation age, seasonal variation in fauna species occurrence, effect of distance from undisturbed habitat on fauna diversity and relative colonisation of rehabilitation, compared to the regional fauna community. Previous fauna monitoring has been conducted over three decades, specifically in 1981, 1996 and 2008/09, using generally similar survey techniques.

The potential benefits of adding fauna habitat features to rehabilitation were reviewed in 2012 and a trial was initiated to assess the practicality of adding log piles to new rehabilitation. These trials will subsequently be monitored to assess the performance of the log piles with respect to enhanced habitat opportunities that may be reflected by differences in the density and occurrence of ground fauna species that are likely to respond to the availability of such habitat features.

Vegetation monitoring provides considerable useful information on the development of fauna habitat including species composition, tree density, ground cover, vegetation structure, health, resilience, and other aspects of fauna habitat development. Evidence of the utilisation of rehabilitation by fauna is also collected during vegetation monitoring. Together with fauna survey data, this is important in determining whether fauna related milestone criteria have been met.

8.3 Weed monitoring and management

Annual weed surveys are undertaken to ensure the operation has an understanding of the location of the weed risk and is able to monitor the effectiveness of its control program. The following is undertaken:

- Annual surveys in all areas where gamba grass, and other target pest species, are known to occur. The surveys also consider adjacent disturbed and undisturbed areas to pick up any localised spread.
- Annual, vehicle-based weed patrols to survey all tracks and haul roads throughout the 'at risk' areas of the mining areas, and also select public tracks and other tracks on the leases.
- Weed control monitoring includes observations of weed distribution (and extent) prior to and following weed control efforts. Methods include transect based counts of weed species present.
- All participants in environmental survey activities (e.g. rehabilitation flora monitoring, preclearing assessments) are keenly aware of the weed situation and most pro forma include sections prompting for capture of at least observational information on weed encountered.
- Other RTW teams which move around the disturbed and undisturbed areas of the lease (e.g. civil maintenance teams) are also encouraged to report any observations of potential weeds.
- RTW also maintains up-to-date knowledge of the weed situation in the wider region, though discussion and collaboration with Department of Agriculture and Water Resources (DAFF) Biosecurity, WTA, Land & Sea Centres, Main Roads and Councils.

Routine weed management activities will be conducted to control the spread of invasive weeds into rehabilitated areas in the Amrun Project area. As detailed in the RTW Land Use Management Plan, the weed management strategy is achieved through the application of a number of control methodologies. Depending on the area within the lease and its priority, a different application of the controls will be applied. The hierarchy of controls include prevention, eradication, control and contain, monitor and research & development. Rehabilitation and how it relates to the broader landscape will govern which treatment methodology it receives, for example prevention or eradication.

Ongoing prevention into rehabilitated areas is achieved through early detection and control via annual weed surveys along with the routine and repeated patrolling of clean areas. In the instance that a priority weed is found in the prevention zone it is immediately destroyed. The key maintenance activities are determined and governed by the results of the rehabilitation monitoring program, principally the results of "Quick Check". Through the early identification of weed incursions the weed management program can be tailored to target the priority weed species. In the event that Quick Check data shows that a priority weed has established in an eradication zone then the weed control program will be adjusted to include these areas into the annual list of activities.

A significant risk to achieving PMLU of native ecosystem is the inability to address the legacy of non-native pasture trials, particularly Gamba Grass. For RTW to adequately address ecosystem altering weed management risks, it is essential to have a well-defined strategy in place. Such a strategy must be adaptable to cover the different species, conservation areas and the localised environments. Previous strategies have seen variable levels of success. Over the past decade, the weed situation on

RTW Weipa has been progressively deteriorating, despite significant effort and resource commitment by the company. A comprehensive review of the strategy is currently being undertaken in consultation with stakeholders to identify opportunities to improve outcomes including consideration of an adjustment of resourcing and control approaches.

The biological and physical characteristics of a targeted species along with the landscapes in which they occupy will more often than not entirely determine the success of any control program. It is important to carry out research and development opportunities to better understand the nature and behaviour of priority weeds existing onsite. Current R&D activities underway for weed management includes working with the relevant government agencies, investigation of alternative herbicides, investigation of alternative application techniques, and investigation of alternative mapping methodologies to improve accuracy and understanding of weed infestations.

8.4 Fire management program

The fire management program aims to excluding wildfires from rehabilitated land through construction and maintenance of fire access tracks and a prescribed burning program. The burning program generally focusses on areas adjacent to new rehabilitation. Prescribed burning is conducted early in the burning season, when fuel flammability is sufficient to carry a fire but low enough to maintain a relatively cool, low intensity burn.

An annual inspection of the fire break network is undertaken in March/April in preparation for identification of resourcing requirements. New rehabilitation areas from the previous season are identified and if their placement is alongside the terminal boundary of the mine the fire break network is extended to protect these areas from the ingress of wildfires.

The Fire Management Areas (FMA) within active mining areas relate directly to protection & ongoing maintenance of rehabilitation efforts and are listed by fire break name derived from mine blocks which determine the start and end point for each FMA. Fire regimes (frequency, season, intensity), recent history, FMA objectives, traditional owner group and resourcing are covered for rehabilitation, and cultural heritage assets. The proposed burning times are flexible as conditions relating to weather (rain, wind, relative humidity, temperature) and fuel cure rates are highly variable between and within seasons. The annual control burn program of rehabilitation is carried out from late July through to mid-August.

8.5 Surface and groundwater monitoring and management

After rehabilitation of the mined areas is undertaken, the surface water quality and that of groundwater, which may also express to surface watercourses, is not predicted to cause adverse changes to the receiving environment. Seepage from the TSFs at closure is also expected to not pose any adverse risk to the environment (just as it currently does not during the operational phase) (Rio Tinto Alcan 2011). As described in Sections 6.3 and 6.4, rehabilitation activities will ultimately result in the surface and groundwater conditions reflecting the “undisturbed” characteristics.

Two sets of complimentary water quality objectives are used in Queensland for water quality assessment:

- The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018). ANZG (2018) include comprehensive guidelines for the protection of a wide range of environmental values (for example the protection of aquatic ecosystems); and
- The Queensland Water Quality Guidelines (QWQG) (DEHP 2009a). The QWQG are consistent with, and an extension of, ANZG (2018). The QWQG take precedence over the

ANZECC/ARMCANZ (2000) guidelines, although the QWQG are derived from and default to ANZECC/ARMCANZ (2000) in many instances.

The Gulf Rivers area in which RTA Weipa operations occur does not have water quality objectives defined under the *Environmental Protection (Water and Wetland Biodiversity) Policy* 2019 or QWQG trigger values. The guidelines recognise that there are a great variety of ecosystem types across Queensland and allows flexibility in determining site specific trigger values (values that trigger further investigation or management action) and water quality objectives.

Water quality sampled down-gradient of rehabilitated TSFs, will provide a good indication of future post-closure surface water conditions.

Receiving environment water quality data has previously been used to set trigger levels for receiving waters which are defined within the respective REMPs and provide a measure by which potential adverse impacts can be detected. Trigger levels relevant to the TSFs are presented in Table 21. However, the trigger levels are also based on baseline receiving environment water quality data and therefore are representative of the undisturbed nature of the receiving environments. The trigger levels are also defined within the EA EPML00725113 within Table H4 for Weipa/Andoom, Table H6 for Amrun (to be updated consistent with the REMP through amendment).

Table 21: Receiving Water Trigger Levels

Quality Characteristic	Trigger Levels - freshwater	Trigger Levels – estuarine waters	Limit type
pH (pH unit)	5.4 (minimum) 6.3 (maximum)	7.0 (minimum) 8.5 (maximum)	Median measured over the wet season
Turbidity (NTU)	21	37	
Suspended Solids (mg/L)	8	30	
Aluminium[1] (µg/L)	90	104	
Dissolved oxygen (mg/L)	For interpretation purposes.		
Temperature (^{O}C)			
EC (µS/cm)			

[1] Trigger levels for aluminium apply if dissolved results exceed trigger.

As described in the PRCP Guideline presentation of a long time series of monitoring data is one way to demonstrate that the risk of rehabilitation or management failure is low and/or quantifiable. The REMP will provide a very long-term data set over the expected period prior to rehabilitation achieving the rehabilitation milestones within the PRCP schedule). The EAs are expected to remain in force for the rehabilitation activities for this period or until surrender. As described in the PRCP Guideline any risks that remain upon surrender and post-surrender will be accounted for under the residual risk framework.

8.6 PFAS monitoring and management

In recent years, RTW has become aware of the potential implications of previous use of chemical compounds commonly referred to as 'PFAS' (per- and poly-fluoroalkyl substances) on site, particularly the use of AFFF (aqueous film-forming foam) products as part of fire suppression systems and fire-fighting training exercises. A comprehensive investigation program has isolated the resultant affected groundwater, sediment and surface water locations and these are now actively monitored and managed in accordance with the RTW PFAS Monitoring and Management Program (MMP). The PFAS MMP is designed to manage PFAS risks on site and monitor for, identify, and describe any impacts of PFAS to environmental values of the receiving environment, including:

- Monitoring of surface water, groundwater and sediments at identified locations to assess the risk to the receiving environment and identify any potential change;
- Sampling and monitoring methodology in accordance with the National Environmental Management Plan for PFAS and the National Environmental Protection (Assessment of Contaminated Land) Measure 1999; and
- Remediation and management measures necessary for preventing or minimising impacts of PFAS to environmental values of the receiving environment, for example arrangements for managing PFAS-contaminated soil and water on site.

Outcomes of the PFAS Monitoring and Management Program will be routinely compiled by an appropriately qualified person as an annual report, including all monitoring results and interpretations.

In the long-term, any ongoing PFAS-related risks to human health and the receiving environment will be managed in accordance with the RTW Contaminated Site Register and Program (Section 6.12.3).

8.7 Erosion monitoring and maintenance program

Rehabilitation in mined land and infrastructure areas are usually comprised of relatively long, low-gradient slopes that are generally not subject to erosion. In the event of erosion potential impacts may include:

- Loss of topsoil
- Damage to flow control structures
- Creation of unsafe areas within rehabilitated sites
- Loss of vegetation sustainability

The probability of erosion occurring is greatest in newly rehabilitated areas before adequate vegetation cover is established. To address this, erosion is routinely monitored in conjunction with the rehabilitation flora monitoring program at the end of the wet-season.

Where erosion is detected in rehabilitation, the erosion is monitored during succeeding wet-seasons until either the erosion stabilises (usually resulting from successful vegetation establishment and development) or a decision is made to undertake remedial works. In general, if gully or rill erosion remains active at the end of the second wet-season consideration is given to its remediation. If, instead, the erosion shows evidence of stabilising, then observations are continued for a short amount of time to confirm that stability has been achieved.

The existing establishment

Monitoring for erosion and overall stability of rehabilitated TSFs is addressed specifically under the TSF monitoring and maintenance program (Section 8.8).

8.8 TSF monitoring and management

TSFs are monitored during operations to demonstrate stability and manage any operational risks. Monitoring data collected during operations is used to inform the closure design, as described above in Section 6.9.

Following stage 1 decommissioning activities, monitoring of the TSFs will continue. Monitoring will aim to gather suitable and sufficient data to enable verification of the milestone criteria. Where required to

assess TSF stability and rehabilitation performance monitoring data will be used to support further modelling analysis of the TSFs. TSF monitoring will include:

Geotechnical and erosional stability

- Visual evidence of failure or instability;
    - Through routine integrity inspections (detailed further below)
- Landform design and stability assessment
    - Confirmation of factors of safety as monitored using internal and/or perimeter nested piezometer network.
    - Erosion monitoring.
    - Settlement and consolidation analysis.
    - External slope and surface contour analysis, utilising LiDAR data, so similar.
- Hydrogeological assessment
    - Monitoring of phreatic levels as they continue to lower post-closure using internal and/or perimeter nested piezometer networks.

Surface treatment and drainage design performance

- Surface and downstream erosion and/or water quality monitoring (Section 8.8).
- Assessment of each designed hydraulic structure, including spillways, outlet channels and any designed toe drain networks.

Vegetation performance

- Generally undertaken in accordance with the revegetation monitoring program (Section 8.1)

Annual 'integrity' inspections shall be undertaken by a suitably qualified person, with the intent to:

- Inspect perimeter embankments (crests and downstream slopes) for evidence of failure of instability;
- Inspects overflow channels for evidence of instability, excessive erosion, etc.;
- Inspect the internal drains and channels for evidence of non-performance, siltation, erroneous vegetation establishment etc.; and
- Inspect downstream flow paths of any channel discharges and associated discharge pathways.

The inspections shall collect photographic evidence of the condition of the features within the facility at the time of the inspection, which will be used for evaluation and comparison of performance of the closure design between inspections. At the time of the first inspection, control points for photographs are to be developed such that valid year by year comparisons can be made and recorded. Additional integrity inspections may be undertaken at the discretion of RTA, particularly following periods of intense rainfall where rainfall runoff discharge from the facility is experienced.

Outcomes of the interim monitoring shall be used to confirm the final landform design to be implemented as the Stage 2 closure works, where required. Following any final TSF closure stage works, post-rehabilitation monitoring shall continue to demonstrate long-term stability and achievement of the final

milestone criteria. This post-closure monitoring may comprise a subset of the interim monitoring program described above, as deemed appropriate.

In response to the monitoring program results, remediation / maintenance measures may be required to reinstate any elements associated with the decommissioning and/or closure design of the facility which may impact on the stability of the facility if not remediated in an appropriate, manner or timeframe. A register of these maintenance measures shall be maintained and reviewed as part of the annual inspection program, with particular focus on works undertaken since the last inspection.

A benefit of the 2-stage closure strategy for the Weipa operations' TSFs, is that there the 20 year 'interim monitoring' phase ensures that RTW shall be available to manage the facilities, including undertake the monitoring program and implement whatever maintenance activities are shown to be required. For example, where unacceptable erosion is identified it shall be repaired, if vegetation fails to thrive active remediation can be implemented.

8.9 Monitoring and management of community and public infrastructure within the mining leases

RTW currently owns and operates some infrastructure that has been identified as potentially suitable for post-mining community or public use (see Section 1.2.4 for details). This includes infrastructure within ML7024, ML6024 and ML7031, and facilities within the WTA boundary but outside the ML's. RTW shall continue to operate and maintain this infrastructure until no longer required for mining-related purposes (which may include closure and post-closure activities in some cases).

As part of ongoing consultation with stakeholders, preferred options for post-mining uses for specific infrastructure on ML's shall be identified and, pending the administering authority's agreement, appropriate transition strategies put in place with future owners and operators. Until transfer to the agreed third party is completed, RTW shall continue to maintain the infrastructure in a safe condition, including implementing suitable inspection and maintenance regimes. Records of these activities shall be maintained and included in any transfer process.

8.10 Reporting

RTW will include an evaluation of the effectiveness of the PRCP schedule within the annual returns submitted for the relevant EAs. This evaluation will include:

- The environmental management carried out under the schedule.
- Whether any milestones to be completed under the PRCP schedule during the year have been met.

Whether the holder has complied with the conditions imposed on the PRCP schedule. Spatial information relating to the location of rehabilitation will be submitted as part of the Annual Returns.

8.11 Rehabilitation research program and trials

RTW has been implementing a structured rehabilitation research program for over 10 years now, including dedicated budgets, scientifically developed methodologies and evidence of continuous improvement in rehabilitation efficiencies and outcomes as a result. Examples of successful trials include:

- Direct seeding trials of key target species
- Fertiliser trial

- Intrinsic value of topsoil
- Time of sowing trial
- Secondary fertiliser application

Results of such trials and studies have been integrated to form the current, successful rehabilitation operations at Weipa. RTW is committed to continuously improve rehabilitation techniques and outcomes throughout the life of the mine. The RTW Rehabilitation Research Program consists of a number of projects that have been developed to address needs and opportunities identified through mine and rehabilitation planning, monitoring, risk assessment and stakeholder consultation. Key themes of the research program include:

- Rehabilitation Establishment;
- Rehabilitation Development;
- Resilience and Sustainability;
- Remediation; and
- Management of Spatial Data.

Rehabilitation trials currently underway or in a mature phase of planning are described in Table 22. This list should be considered a ‘snapshot in time’ and the overarching research programs (listed above) are ongoing; they may evolve to generate new or different trials and further opportunities or challenges arise, or as new results and information is obtained.

Table 22: Rehabilitation Trials

Research Trial	Trial Design	
Amelioration of stockpiled topsoil	Objective:	To improve the nutritional and biological values of topsoil that has been stockpiled, thus enhancing rehabilitation performance outcomes.
	Trial design:	Select areas of mine floor (available for rehabilitation) are prepared with topsoil sourced from stockpiles and sown, and subsequently tilled, with an sterile cover crop. Once established, the cover crop is incorporated into the soil and the process repeated the next growing season.
	Trial methodology and schedule (incl. commencement, duration):	Integrated into the annual wet season rehabilitation operations, the nominated areas are topsoiled and ripped then seeded with the sterile cover crop. The first phase of this trial commenced in the 2020/21 rehabilitation season, and the trial will continue for approximately 1-2 more seasons until meaningful results are obtained.
	Trial assessment and outcome implementation:	Monitoring of the trial will include assessment of cover crop performance over time and given certain management activities, soil nutrient and biological properties, and subsequent native species rehabilitation performance. Should this method be proven to deliver improved rehabilitation outcomes, it will be permanently integrated into the routine annual rehabilitation planning and implementation program at Weipa.
Amrun ripping trial	Objective:	To identify the optimal ripping methodology for Amrun mine areas to support successful rehabilitation outcomes (given that Amrun mine generally has a mine floor comprised of material that is easier to rip than that at NoE operations).
	Trial design:	A number of areas to be rehabilitated in the next couple of wet seasons shall be prepared with different ripping treatments, including: • Ripping depth: 0.5m vs <0.5m • Ripping intensity: single shank & track to tyne vs single shank & track-to-track vs triple-tyne & track to track. • All areas will otherwise receive the same rehabilitation treatment, eg seeded with dry woodland species mix.
	Trial methodology and schedule (incl. commencement, duration):	Dozers ripping tyne configurations will be modified to the different settings, efficiency and effectiveness during ripping operations shall be recorded. Otherwise, ripping will be undertaken as part of the routine annual rehabilitation operations during the 2021/22 and/or 2022/23 rehabilitation season. Conclusive results, especially those relating to longer term development of rehabilitation, may take years to assess.
	Trial assessment and outcome implementation:	Monitoring will focus on substrate (visual observations of substrate behaviour, photo records) and vegetation (species establishment and development shall be monitored in line with the routine rehabilitation monitoring program). Successful outcomes of the research will be integrated into the rehabilitation operations methodology.
A synergy of remote sensing and deep learning for mine site	Objective:	To develop and validate an ensemble analytical methodology for the use of airborne LiDAR, in conjunction with deep learning, to rapidly evaluate the rehabilitation status of post-mined areas
	Trial design:	This study is being undertaken as a PhD by X. Murray, at University of Southern Queensland.

Research Trial	Trial Design	
rehabilitation monitoring	Trial methodology and schedule (incl. commencement, duration):	• The PhD commenced in 2019 and is scheduled for completion by 2023 • Develop a convolutional neural network (CNN) algorithm that is trained to recognise the structure of a reference state (natural ecosystem) LiDAR plot in comparison to an active rehabilitation plot • Generate a support vector machine learning model that leverages and builds upon the results from the CNN analysis, forming an ensemble analysis methodology and creating a predictive surface of rehabilitation status. • Leverage statistical analysis via an ordinary least squares regression analysis to validate observed the correlations between this study's results and ground truth observation data.
	Trial assessment and outcome implementation:	In addition to the final thesis, a series of papers shall be published. To date, two papers are under review by the journal *Geocarto International.* • 'Rapid Assessment of Mine Rehabilitation Areas with Airborne LiDAR and Deep Learning' • 'A fusion of remote senses and cloud computing in the pursuit of automated mine rehabilitation monitoring' Successful outcomes of the research will be integrated into the rehabilitation monitoring program.
Palm Cockatoo Artificial Hollows Trial	Objective:	Increase utilisation of rehabilitation by the Palm Cockatoo (listed threatened species of the region)
	Trial design:	Rehabilitation takes a very long time to develop tree hollows suited to Palm Cockatoos. This trial will look at the effectiveness of artificial hollows placed in, or near, areas of rehabilitation to increase Palm Cockatoo nesting in the areas.
	Trial methodology and schedule (incl. commencement, duration):	In 2019 and 2020, 16 artificial hollows (of 2 designs) were installed on suitably large trees in East Weipa mine rehabilitation and/or buffers. Monitoring will continue for a number of years as Palm Cockatoo nesting activity is infrequent even in ideal, natural conditions. This trial is part of a larger program and related trials will be developed and implemented over the coming years.
	Trial assessment and outcome implementation:	All hollows have remote monitoring cameras attached to monitor for uptake and use. Temperature loggers have also been deployed in some natural & artificial hollows, to build a baseline of the environmental conditions in natural hollows and compare this to different artificial hollow design elements. Successful use by palm cockatoos will lead to further installation within various native woodland and mined land restoration areas around the Weipa region to hone in on the characteristics they prefer for breeding.
Amrun analogue sites	Objective:	Assess analogue sites at Amrun mine to determine relevance of existing analogue information, rehabilitation objectives and methods from Northern operations.
	Trial design:	Vegetation monitoring sites shall be established in undisturbed areas around the Amrun mine and surveyed using a methodology closely aligned to the current permanent monitoring (PM) survey method for Weipa's Northern operations, including photo collection
	Trial methodology and schedule (incl.	Plots of 500 m^2 shall be surveyed for percentage cover (ground, mid-canopy and canopy species), under 2 m woody vegetation stem density counts, above 2 m stem density counts – including height and DBH measurements, and ground cover species richness.

Research Trial	Trial Design	
	commencement, duration):	Surveys shall be conducted during 2021/22, including some repeat visits to account for senesced annual species (such as grasses and herbs).
	Trial assessment and outcome implementation:	The survey data shall be processed through the Weipa 'Rehabilitation Assessment Tool' to enable comparison of the various parameters with analogue sites monitored at Northern operations. If significant differences are identified, then studies will be undertaken to look at what Amrun-specific adaptations to the rehabilitation program are required.
Gamba grass strategy	Overall program	As part of its ongoing weed control program against Gamba grass, RT Weipa has previously undertaken a range of trials and adaptations to monitoring and controls methods. While control activities continue, the current research focus is to better understand a/ the challenge at hand (problem identification, mapping methods), and b/ examples of best practice and experience available from elsewhere (technology, equipment, control methods). From this, a series of trials may be undertaken to further hone the program at Weipa. For example, recently a small trial was completed to test one method of remote sensing to improve weed mapping efficiencies and effectiveness. This particular method did not prove feasible, but the work will inform future options selection and trials.

9.0 Conclusion

This transitional PRCP has been developed to meet the requirements under the EP Act and the PRCP Guideline for both the Weipa Operations (encompassing East Weipa, Andoom and Amrun (ML7024 and ML6024)) and Ely Operations (ML7031). It is recognised that as these sites operate under two separate EAs (EA EPML00725113 and EA EPML00562613) two PRCPs are required. This PRCP will be submitted separately to meet the requirements for both EAs.

The mining operations have occurred since 1963 and will continue to 2062. The town of Weipa was constructed as a mining town and RTW (or the previous owners of the operation) have developed infrastructure that supports the town (e.g. Awonga Point and Lorim Point sewage treatment plans, the Evans Landing landfill, the potable water network, the power station, the airport, the main public access road through the ML).

Section 2.0 provides the baseline information for the site, which has been assembled from pre-mining surveys or government databases. Section 2.2 provides the project description and how the areas to be mined are cleared, stripped, mined and rehabilitated with the aim of minimising land disturbance while maintaining bauxite ore availability. The bauxite is processed at beneficiation plants located at Weipa, Andoom and Amrun and the tailings are pumped to four active TSFs. The operation also includes railway lines, ship loading facilities, power generation, water supply bores and dams, plus other ancillary infrastructure.

The site meets the criteria for a transitional PRCP and therefore information from existing land outcome documents has been used throughout the report. The PRCP does not deviate from the previously agreed PMLUs, rehabilitation objectives, milestones and closure outcomes. However, it does re-structure the information to fit the requirements of the PRCP and PRCP Schedule.

The PMLU for the majority of the mining operations is ‘native, self-sustaining woodland vegetation comprising a variety of species, which in turn supports native fauna’. This PMLU has been agreed to with the TO Groups under the WCCCA. The Weipa town and community infrastructure, including some permanent surface water storages are proposed to remain on site with agreement and written authorisation.

The PRCP presents the rehabilitation methodology (Section 6.0) based on the knowledge of the baseline environment (Section 2.0), understanding of how the environment is affected by mining (Section 2.2), and the subsequent proposed rehabilitation to meet the Rehabilitation Milestones within the PRCP Schedule.

The methods for progressive rehabilitation of the mining area are well understood and monitoring of rehabilitation over time has resulted in improved methods. The surface preparation, backfilling, topsoil spreading, species selection and seeding process is well refined and occurs as part of the mining operations. The interaction with the surface water and groundwater after rehabilitation is also understood, with areas subject to flooding seeded with ‘wet species mix’.

The conceptual hydrogeological models for the area indicate that post mining, the rehabilitation using the ‘waste bauxite’ and subsoil is expected to have a marginal change to the hydrogeology. Rehabilitation of mined areas would lead to a lower than original ground level, resulting in some ponding in the restored areas. Drainage channels constructed in the landscape for closure will drain surface water to the natural watercourses to prevent ponding.

Bauxite tailings contain no added chemicals and are geochemically benign. The proposed two stage rehabilitation and closure strategies for the TSFs aim to minimise risks such as failure to achieve a stable landform or achieving the PMLU. Existing management controls include the use of accepted industry standards for TSF operations and design and that the TSF design, construction and closure are certified by suitably qualified and experienced person.

The assessment of potential contaminants posing a risk to environmental values of the receiving environment highlighted that, for the mining activities and closure planning, no contamination to local surface or groundwater systems is expected.

Topsoil materials balance indicates a slight deficit of topsoil for Andoom and a more significant deficit at East Weipa linked to the long history of the site and the variable operational and record keeping practices during this time. Current mine planning and development earthworks recording practices have since been vastly improved, and now include a topsoil inventory tracking program. The key strategy proposed to address the deficit includes returning the topsoil material blended with waste/overburden material.

Section 7.0 presents the risk assessment undertaken to identify the risks of a stable condition of land not being achieved and other risks that may be present at closure and how these risks will be managed or minimised. The highest ranked risks were no additional intervention of existing 'failed' rehabilitation, weed infestations preventing the achievement of a PMLU, and inability to source topsoil and cover material resulting in reduced quality of rehabilitation. Measures that will be implemented to lower the likelihood of this occurring include, continuing to implement weed strategies and programs, and for the topsoil material deficit using learnings from other sites and blending topsoil with waste material where possible.

Monitoring of rehabilitation will occur to demonstrate milestone criteria are being met and that the final milestone for achieving the PMLU is complete. It is recognised that some rehabilitation failure will occur (based on previous monitoring) and maintenance of rehabilitation will occur for repairs. This has been factored into the PRCP Schedules.

RTW are committed to further studies and investigations to further refine the rehabilitation and closure strategy.

The PRCP Guideline has been used in the preparation of this PRCP, and a checklist against the requirements is provided in Appendix A.

10.0 Reference list

Atlas of Living Australia (ALA) 2020. Available from: https://www.ala.org.au/.

ANZECC/ARMCANZ (2000). *ANZECC & ARMCANZ water quality guidelines*. Available from: https://www.waterquality.gov.au/anz-guidelines/resources/previous-guidelines/anzecc-armcanz-2000.

ANZG, 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Available from: https://www.waterquality.gov.au/anz-guidelines .

Biggs, A.J.W. and Philip, S.R. (1995). *Soils of Cape York Peninsula*. Qld Department of Primary Industries, Mareeba. ISSN 0811-9007. Available from: https://www.publications.qld.gov.au/dataset/f8fbc5f1-3fa7-4849-b04d-3ab581c5d03d/resource/e90e1bcf-477a-4f22-96e2-f6d90f3a4163/download/cypqv95001soilsofcapeyorkpeninsula.pdf.

Bowen, H.J.M. (1979). *Environmental Chemistry of the Elements*. Academic Press.

Bureau of Meteorology (2017). *Climate data* online. http://www.bom.gov.au/climate/data/, accessed 20 May 2020.

Church, J.A., P.U. Clark, A. Cazenave, J.M. Gregory, S. Jevrejeva, A. Levermann, M.A. Merrifield, G.A. Milne, R.S. Nerem, P.D. Nunn, A.J. Payne, W.T. Pfeffer, D. Stammer and A.S. Unnikrishnan (2013). Sea Level Change. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Sourced from: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter13_FINAL.pdf.

Dames and Moore (1996). *Draft environmental impact study for the ELY Bauxite project*, Alcan South Pacific Pty Ltd.

Department of Environment and Heritage Protection (DEHP) (2009). Queensland Water Quality Guidelines, Version 3, ISBN 978-0- 9806986-0-2. Available from: https://environment.des.qld.gov.au/water/pdf/water-quality-guidelines.pdf.

Department of Environment and Heritage Protection (DEHP) (2012). *Determining dams containing hazardous waste*. Department of Environment and Heritage Protection, Queensland Government.

Department of Environment and Science (DES) (2019). *Climate change in the Cape York region*. Sourced from: https://www.qld.gov.au/environment/climate/climate-change/resources/science.

Department of Environment and Science (DES) (2020). WildNet Database. Available from: https://www.qld.gov.au/environment/plants-animals/species-information/wildnet.

EPA (1998). *Draft guidelines for the Assessment and Management of Contaminated Land in Queensland*. Qld Environmental Protection Agency.

Godwin, M. (1985). *Land Units of the Weipa Region, Cape York Peninsula*. Queensland Parks and Wildlife Service. Available in the National Library of Australia collection, https://catalogue.nla.gov.au/Record/1767425.

Gunness, A.G., Lawrie, J.W. and Foster, M.B. (1987). *Land Units of the Weipa Environs 1:24 000 Map and Explanatory Notes*. Report to Comalco Aluminium Limited, Weipa.

Neldner V.J. and Clarkson J.R. (1995). *Vegetation Survey and Mapping of Cape York Peninsula*. Cape York Peninsula Land Use Strategy, Office of the Co-ordinator General and Queensland Department of Environment of Heritage, Brisbane. Available from: https://www.researchgate.net/profile/Victor-Neldner/publication/255687231_Neldner_VJ_and_Clarkson_JR_1995_Vegetation_Survey_and_Mapping_of_Cape_York_Peninsula_Cape_York_Peninsula_Land_Use_Strategy_Office_of_the_Co-

ordinator_General_and_Queensland_Department_of_Environment_o/links/54d4166a0cf25013d028fcca/Neldner-VJ-and-Clarkson-JR-1995-Vegetation-Survey-and-Mapping-of-Cape-York-Peninsula-Cape-York-Peninsula-Land-Use-Strategy-Office-of-the-Co-ordinator-General-and-Queensland-Department-of-Environment.pdf.

Norman, M. A., J. M. Koch, C. D. Grant, T. K. Morald, and S. C. Ward. 2006. Vegetation succession after bauxite mining in western Australia. *Restoration Ecology*, v. 14, no. 2, p. 278-288. 10.1111/j.1526-100X.2006.00130.x.

Queensland Herbarium (2019). *Regional Ecosystem Description Database (REDD)*. Version 11.1 (April 2019). Queensland Department of Environment and Science, Brisbane. Available from: https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/download.

Rio Tinto Alcan (2011). *South of Embley Project – Queensland Environmental Impact Statement.*

Rio Tinto Alcan (2013). *South of Embley Project – Commonwealth Environmental Impact Statement.*

Rio Tinto Weipa (2014). *Land Use Management Plan*.

Rio Tinto Weipa (2015). *Land Use Management Plan – South of Embley River.*

Rio Tinto Weipa (2019a). *Rehabilitation Management Plan*. A plan prepared for submission to DES in compliance with requirements of EA No. EPML00725113 (Weipa/Andoom areas).

Rio Tinto Weipa (2019b). *Rehabilitation Management Plan*. A plan prepared for submission to Queensland DES in compliance with the requirements of Environmental Authority (EA) No. EPML00562613 (Ely area).

Rio Tinto Weipa (2019c). *Interim Rehabilitation Management Plan – South of Embley River*. A plan prepared for submission to DES in compliance with requirements of Environmental Authority (EA) No EPML00725113 (Amrun area).

Roberts, S.C. (1994). *Long Term Ecological Stability of Native Revegetation Following Bauxite Mining at Weipa*, North Queensland. Masters Thesis, Department of Agriculture, University of Queensland. Available from: https://espace.library.uq.edu.au/view/UQ:310964.

Sattler, P. and Williams, R. (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Queensland EPA, Brisbane. Available in the National Library of Australia collection, https://catalogue.nla.gov.au/Record/2956630.

Schwenke, G.D. (1996). *Soil Organic Matter Dynamics in the Post-Mining Landscape at Weipa, North Queensland*. Doctoral Thesis, Department of Agriculture, University of Queensland. Available from: https://espace.library.uq.edu.au/view/UQ:310963.

Setterfield, S. and Williams, R.J. (1996). Patterns of Flowering and Seed Production in *Eucalyptus miniata* and *E. tetrodonta* in a Tropical Savanna Woodland, Northern Australia. *Australian Journal of Botany* 44, 107-122. https://doi.org/10.1071/BT9960107.

Weipa Town Authority. (2019). *Weipa Town Planning Scheme 2019*. Available at: https://www.weipatownauthority.com.au/downloads/file/350/town-planning-scheme-v1-0.

Appendix A: PRCP checklist

Table A1: PRCP Checklist (as per Section 6 of the DES application form)

PRCP Requirement	Requirement met? (Yes / NA)	PRCP Section No.	Justification
Project description			
Describe the following: • Each resource tenure, including the area of each tenure, to which the application relates	Yes	Section 2.2 and 2.2.1	
• The relevant activities to which the application relates	Yes	Section 2.2.2	
• The likely duration of the relevant activities	Yes	Section 2.2.5	
Include a detailed description, including maps, of how and where the relevant activities are to be carried out.	Yes	Section 2.2.2	Figure 30 to 36
Consultation			
Include details of the consultation undertaken by the applicant in developing the proposed PRCP.	Yes	Section 3.0 and Appendix C	
Include details of how the applicant will undertake ongoing consultation in relation to the rehabilitation to be carried out under the plan.	Yes	Section 3.0 and Appendix D	
Post-mining land use			

PRCP Requirement	Requirement met? (Yes / NA)	PRCP Section No.	Justification
State the extent to which each proposed post-mining land use identified in the proposed PRCP Schedule for the plan is consistent with the outcome of consultation with the community in developing the PRCP.	Yes	Section 3.0 and 4.0	
State the extent to which each proposed post-mining land use identified in the proposed PRCP Schedule for the plan is consistent with any strategies or plans for the land of a local government, the State or the Commonwealth.	Yes	Section 4.0	
Non-use management area			
State the extent to which each proposed non-use management area identified in the PRCP Schedule for the plan is consistent with the outcome of consultation with the community in developing the PRCP.	NA	NA	There are no NUMAs proposed as part of this PRCP
State the extent to which each non-use management area identified in the PRCP schedule for the plan is consistent with any strategies or plans for the land of a local government, the State or the Commonwealth.	NA	NA	There are no NUMAs proposed as part of this PRCP
For each proposed non-use management area, state the reasons the applicant considers the area cannot be rehabilitated to a stable condition because of a matter mentioned in section 126D (2).	NA	NA	There are no NUMAs proposed as part of this PRCP
For each matter mentioned in the requirement above, include copies of reports or other evidence relied on by the proponent for each proposed non-use management area.	NA	NA	There are no NUMAs proposed as part of this PRCP
Rehabilitation and management methodology			
For each post-mining land use, state the applicant's proposed methods or techniques for rehabilitating the land to a stable condition in a way that supports the RM under the proposed PRCP Schedule.	Yes	Section 6.0	

PRCP Requirement	Requirement met? (Yes / NA)	PRCP Section No.	Justification
For each non-use management area, state the applicant's proposed methodology for achieving best practice management of the area to support the management milestones under the proposed PRCP Schedule for the area.	NA	NA	There are no NUMAs proposed as part of this PRCP
Risk assessment			
Identify the risks of a stable condition for land described as a post-mining land use not being achieved, and how the applicant intends to manage or minimise the risks.	Yes	Section 7.0	
PRCP Guideline			
Include any other information prescribed by the administering authority in the Guideline – Progressive Rehabilitation and Closure Plans (ESR/2019/4964)	NA	NA	Other information provided throughout the plan based on current knowledge
Include the spatial information required in the Guideline – Progressive Rehabilitation and Closure Plans (ESR/2019/4964).	Yes	NA	Provided separately to DES
Other information			
Include the other information the administering authority reasonably considers necessary to decide whether to approve the PRCP Schedule.	Yes	NA	Other information provided throughout the plan based on current knowledge
PRCP Schedule			
Include a PRCP schedule prepared using the PRCP schedule template (ESR/2019/5103)	Yes		Attached seperately
Include maps showing all of the land mentioned in the PRCP schedule, as it relates to being progressively rehabilitated.	Yes	Section 6.13.1 and Section 6.13.2	Figure 49 to 56

Appendix B: PRCP Schedule

Final PRCP Schedules have been provided separately with this submission.

Appendix C: Community consultation register

RT Weipa Stakeholder Engagement Register – Consultation carried out in developing the PRCP.

Key land outcome consultation prior to development of PRCP, including rehabilitation completion criteria consultation						
Consultation Date	**Consultation Type**	**Stakeholder**	**Attendee**	**Information Provided**	**Topics of discussion/ issues considered**	**Outcomes/ ongoing commitments**
27th Sept 2010	Formal Meeting	Traditional Owners - WCCCA	Indigenous Directors and Committee Members	Presentation regarding rehabilitation and Completion Criteria at Weipa	RTAW Rehabilitation History The Rehabilitation process at Weipa What are criteria and why are they so important?	Formal endorsement of Rehabilitation and Closure Relinquishment working group; to ensure ongoing program of land rehabilitation to native bushland and engagement with traditional owners to develop agreed completion criteria, can continue
May-August 2012	On Country Workshops – Deriving Cultural Values.	Traditional Owners	Algnith Traditional Owners Peppan Traditional Owners Thanikwithi Traditional Owners Wathyn Traditional Owners	Identification of plants and animals that Traditional Owners considered most important to be returned to the land after mining and the cultural framework that creates the significance of the priority plants.	Deriving Traditional Owner cultural values for rehabilitation completion criteria.	Deriving Cultural Values Report 2012; Background information on beliefs, values, stories, uses, or practices which define the significance of a particular species was collated from literature review and field interviews and meetings. Commitment to include findings into completion criteria development.
16 May 2013	Formal Meeting	Traditional Owners - EBMPA	Environment & Heritage Sub-Committee Members	Environmental Management Update: Deriving Cultural Values report. Hydrological Studies. Ethnobotanical Project. Broader lease fire program.	Confirmation that information gathered in 2012 during Deriving Cultural Values workshop, from each traditional owner group was correct and accurate regarding topics as follows: -care of topsoil -completion criteria -seed collection -types of plants and trees in rehabilitation -access to country -weed management -fire management -ongoing traditional owner engagement	Ongoing quarterly consultation.
04 Nov 2013	Formal Meeting	Traditional Owners - WCCCA	Environment and Heritage Sub-Committee members	Rehabilitation Management Plan (RMP) submitted to DEHP – in compliance with EA requirement	Development of interim completion criteria, inclusive of deriving cultural values workshop outcomes.	ML7024 Rehabilitation Management (RMP) submitted to Qld DEHP. Ongoing quarterly consultation on Environmental Management.

RT Weipa Stakeholder Engagement Register – Consultation carried out in developing the PRCP.

Consultation Date	Consultation Type	Stakeholder	Attendee	Information Provided	Topics of discussion/ issues considered	Outcomes/ ongoing commitments
12 Nov 2015	Formal Meeting	Traditional Owners - EBMPA	Environment and Heritage Sub-Committee members	Rehabilitation Management Plan (RMP) submitted to DEHP – in compliance with EA requirement	Development of interim criteria, inclusive of deriving cultural values workshop outcomes. Annual Rehabilitation Plan	Ely Rehabilitation Management Plan (RMP) submission to Qld DEHP. Ongoing quarterly consultation on Environmental Management.
9 Aug 2017	Formal Meeting	Traditional Owners - WCCCA LR&T Members	Land Relinquishment and Transfer (LR&T) Sub-Committee members	Review of East Weipa on country closure camps; Collaboration on what successful mine closure looks like.	Cessation of mining – PMLU Environmental Management – Land Rehabilitation Environmental Management - Buffers Traditional Owner Land Access Protecting Cultural Heritage Sites through Closure and Relinquishment Rehabilitation of Cultural Heritage Sites.	Ongoing consultation
15 Feb 2018	Formal Meeting	Traditional Owners - EBMPA	Environment & Heritage Sub-Committee members	Environmental management update.	Review of 2012 Deriving Cultural Values study	Ongoing consultation
6 Feb 2019	Formal Meeting	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members	Annual Land & Rehabilitation Report; presentation of refined completion criteria.	Recommendation to endorse Annual Land & Rehabilitation Report.	Refined completion criteria included in update to RMP, submitted to Qld DES
14 Feb 2019	Formal Meeting	Traditional Owners – EBMPA	Environment & Heritage Sub-Committee members	Land & Rehabilitation Report; presentation of refined completion criteria.	Recommendation to endorse refined completion criteria update in RMP.	Refined completion criteria included in update to RMP, submitted to Qld DES

RT Weipa Stakeholder Engagement Register – Consultation carried out in developing the PRCP.

Consultation during development of PRCP						
Consultation Date	**Consultation Type**	**Stakeholder**	**Attendee**	**Information Provided**	**Topics of discussion/ issues considered**	**Outcomes/ ongoing commitments**
23 Mar 2020	Formal pre-transition meeting	DES, Qld	DES representatives	PRCP transition process overview	RTW sites for transition.	Ongoing consultation to determine transition timeframe.
05 Feb 2020	Formal Meeting	Traditional Owner – WCCCA	Environment & Heritage Sub-Committee members	Introduction to Development of PRCP.	Intent of PRCP. For RTW it means ensuring existing land and rehabilitation outcomes, and ongoing engagement strategies are preserved.	To provide ongoing updates on progress of PRCP development. RTW to provide draft PRCP for WCCCA review as per ILUA obligations by Q2,2021.
13 Feb 2020	Formal Meeting	Traditional Owners – EBMPA	Environment & Heritage Sub-Committee members.	Introduction to Development of PRCP.	Intent of PRCP. For RTW it means ensuring existing land and rehabilitation outcomes, and ongoing engagement strategies are preserved.	To provide ongoing updates on progress of PRCP development. RTW to provide draft PRCP for EBMPA review as per ILUA obligations by Q2,2021.
13 May 2020	Informal pre-transition meeting	DES, Qld	Principal Environmental Officer, Minerals & Northern Compliance, DES Principal Environmental Officer, Environmental Services & Regulation, DES Manager, Environmental Services, DES	PRCP transition process overview	Consultant engaged. PRCP Guideline gap analysis commissioned.	Transition timeframe agreed.
05 Aug 2020	Formal Meeting	Traditional Owners - WCCCA	Environment & Heritage Sub-Committee members.	Update on PRCP development.	Notice to transition to PRCP received. Consultation process to continue regarding PRCP development. No changes to existing agreed land outcomes, or engagement/consultation obligations prescribed in ILUA.	Formal endorsement of changes to RMP to include Completion Criteria.
13 Aug 2020	Formal Meeting	EBMPA E&H	Environment & Heritage Sub-Committee members	Update on PRCP development	Notice to transition to PRCP received. Consultation process to continue regarding PRCP development. No changes to existing agreed land outcomes, or engagement/consultation obligations prescribed in ILUA	Formal endorsement of changes to RMP to include Completion Criteria.
17 Dec 2020	Annual Rehabilitation Bus Tour – on country	Traditional Owners – EBMPA	Environment & Heritage Sub-Committee members	Collaborative discussion	Rehabilitation success in relation to completion criteria and concept of rehabilitation certification.	Ongoing consultation on country via continued annual bus tours.
30 Nov 2020	Meeting	Weipa Town Authority	RT Weipa Core Services Manager (Weipa Town Authority Manager)	Weipa Township consideration in PRCP	Ongoing negotiation (with State Government) on Weipa township normalisation. Implications for PRCP scheduling.	Infrastructure to be retained to support township will be identified through Estimated Rehab Cost (ERC) and reflected in PRCP.

RT Weipa Stakeholder Engagement Register – Consultation carried out in developing the PRCP.

Consultation Date	Consultation Type	Stakeholder	Attendee	Information Provided	Topics of discussion/ issues considered	Outcomes/ ongoing commitments
03 Feb 2021	Formal Meeting	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members.	Update on PRCP development	Integration of Rehabilitation establishment, monitoring and evaluation, and Completion Criteria into PRCP. PRCP in relation to Progressive Rehabilitation Certification.	RTW to provide draft PRCP for WCCCA members to review at Q2,2021 meeting. Ongoing quarterly consultation.
11 Feb 2021	Formal Meeting	Traditional Owners – EBMPA	Environment & Heritage Sub-Committee members	Update on PRCP development	Integration of Rehabilitation establishment, monitoring and evaluation, and Completion Criteria into PRCP. PRCP in relation to Progressive Rehabilitation Certification.	RTW to provide draft PRCP for EBMPA members to review at Q2,2021 meeting. Ongoing quarterly consultation.
30 March 2021	Informal pre-lodgement meeting	DES, Qld	Principal Environmental Officer, Minerals & Northern Compliance, DES Principal Environmental Officer, Environmental Services & Regulation, DES	Draft schedule milestones and criteria (provided prior)	Review/ feedback of draft milestones and milestone criteria.	Ongoing consultation during development of PRCP
7 April 2021	Meeting	Weipa Town Authority	Weipa Town Authority CEO	Update on Weipa Township consideration in PRCP	Ongoing negotiation (with State Government) on Weipa township normalisation. Implications for Weipa Township in PRCP	Weipa township scheduling implications resolved.
8 April 2021	Informal pre-lodgement meeting	DES, Qld	Principal Environmental Officer, Minerals & Northern Compliance, DES Principal Environmental Officer, Environmental Services & Regulation, DES	PRCP key risks	Scheduling implications for key PRCP risk factors.	Ongoing consultation during development of PRCP.
21-22 April 2021	Annual Rehabilitation Bus tour – on country	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members	Collaborative discussion	Rehabilitation success in relation to completion criteria and concept of rehabilitation certification.	Ongoing consultation on country via continued annual bus tours.
05 May 2021	Formal Meeting	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members	Presentation of Draft PRC Plan & Schedule	Recommendation to provide any review comments back to RT Weipa for consideration into final PRC Plan and Schedule submission.	Consideration of WCCCA review comments to be integrated into final ML7024 PRCP submission.

RT Weipa Stakeholder Engagement Register – Consultation carried out in developing the PRCP.

Consultation Date	Consultation Type	Stakeholder	Attendee	Information Provided	Topics of discussion/ issues considered	Outcomes/ ongoing commitments
13 May 2021	Formal Meeting	Traditional Owners – EBMPA	Environment & Heritage Sub-Committee members	Presentation of Draft PRC Plan & Schedule	Recommendation to provide any review comments back to RT Weipa for consideration into final PRC Plan and Schedule submission.	Formal endorsement of ML7031 PRCP application to Qld DES at Coordination Committee meeting on 18th June 2021.
16 June 2021	Informal pre-lodgement meeting	DES, Qld	Principal Environmental Officer, Minerals & Northern Compliance, DES Principal Environmental Officer, Environmental Services & Regulation, DES Manager, Environmental Services, DES	Selective sections of RTW Draft PRCP (provided 26 May 2021)	Review of DES feedback comments.	RTW to address comments in PRCP and provide response to DES.
4 August 2021	Formal Meeting	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members	Provision of Draft PRC Plan & Schedule for comment.	WCCCA request for further information regarding implications for future land use.	Further consultation (workshop) to enable traditional owners to make confident, informed decisions regarding future land use.
8 October 2021	Workshop	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members Coordinating Committee members East Weipa Closure Sub-Committee members	Summary of PRCP framework in relation to existing WCCCA obligations and RT Closure Planning	PRCP commitments in relation to future land use options analysis. Differentiation between PRCP framework and RT Closure Studies regarding progressive rehabilitation and post mining land use options.	Traditional owner comfort and confidence with progressive rehabilitation commitments and land outcome content in PRCP. Clear PRCP relationship with existing WCCCA obligations to be included in Community Consultation section of PRCP.
11 October 2021	Workshop	Traditional Owners – EBMPA	Environment & Heritage Sub-Committee members Coordinating Committee members Emerging members	Summary of PRCP framework in relation to existing EBMPA obligations and RT Closure Planning	PRCP commitments in relation to future land use options analysis. Differentiation between PRCP framework and RT Closure Studies regarding progressive rehabilitation and post mining land use options.	Traditional owner comfort and confidence with progressive rehabilitation commitments and land outcome content in PRCP. Clear PRCP relationship with existing EBMPA obligations to be included in Community Consultation section of PRCP.
3 November 2021	Formal Meeting	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members	Provision of draft PRC Plan, and summary of workshop outcomes incorporated into PRC Plan	TSF geotechnical information to be clarified. Draft Final PRCP awaiting comment from DES and any further comment from WCCCA.	Final Draft PRCP to be provided to WCCCA prior to lodgement in alignment with WCCCA obligations.
12 November 2021	Meeting	Weipa Town Authority	Weipa Town Authority, CEO	Update on Weipa Township consideration in PRCP	Strategic and specific outcomes identified within the Weipa Town Planning Scheme which are considered to potentially influence PMLU.	Alignment of Weipa Town Planning Scheme into public and community infrastructure section of PRC Plan.

RT Weipa Stakeholder Engagement Register – Consultation carried out in developing the PRCP.

Consultation Date	Consultation Type	Stakeholder	Attendee	Information Provided	Topics of discussion/ issues considered	Outcomes/ ongoing commitments
3 December 2021	Formal Meeting	Traditional Owners – WCCCA	Environment & Heritage Sub-Committee members	Final Draft PRC Plan and Schedule provided.	TSF geotechnical information clarified. Responses to DES comments incorporated.	Environment & Heritage subcommittee refer PRCP to Coordinating Committee for consideration and endorsement.
6 December 2021	Formal Meeting	Traditional Owners – EBMPA	Environment & Heritage Sub-Committee members	Final Draft PRC Plan and Schedule provided	TSF geotechnical information clarified. Responses to DES comments incorporated.	Environment & Heritage subcommittee refer PRCP to Coordinating Committee for consideration and endorsement.
31 May 2022 – 2 June 2022	Formal Community Information Sessions	Traditional Owners – EBMPA	Traditional Owner groups signatories to the EBMPA; Northern Peninsula Area, Napranum, and Mapoon	PRC Plan and Schedule presented	Summary of formal engagement consultation to date regarding development of PRCP. Appropriate consultation processes to be followed with Traditional Owner groups during Closure consultation.	Confirmation of ongoing PRCP consultation plan via Agreement structure. Confirmation that Traditional Owner groups and nominated representatives will be engaged during ongoing Closure consultation.
2 November 2022	Meeting	Traditional Owners – WCCCA	Environment and Heritage Sub-Committee members	Update on formal PRCP submission	Confirmation of formal submission of PRCP, and subsequent Request for Further Information from State Govt.	Information Request response to be provided to members prior to resubmission.
3 November 2022	Meeting	Traditional Owners – WCCCA	East Weipa Closure Sub-Committee members	Overview of closure planning	Progress of MOU for consultation for closure process, discussion of proposed rehabilitation approach (as per PRCP) for closure	Continued updates on closure planning via WCCCA consultation process
3 November 2022	Meeting	Traditional Owners – WCCCA	Andoom Closure Sub-Committee	Overview of closure planning	Introduction to closure planning process, update on closure planning to date, discussion of proposed rehabilitation approach (as per PRCP) for closure.	Continued updates on closure planning via WCCCA consultation process
10 November 2022	Meeting	Traditional Owners – EBMPA	Environment and Heritage Sub-Committee members	Update on formal PRCP submission	Confirmation of formal submission of PRCP, and subsequent Request for Further Information from State Govt.	Information request response to be provided to members prior to resubmission.
13 December 2022	Meeting	Traditional Owners – EBMPA	EBMPA Closure Sub-Committee members	Overview of closure planning	Overview of closure planning process, update on closure planning to date, discussion of proposed rehabilitation approach (as per PRCP) for closure.	Updates on closure planning to continue to be provided within formal EBMPA communication processes, agreement to hold out of cycle meetings to discuss items as they pertain to closure
7 February 2023	Meeting	Traditional Owners – WCCCA	Environment and Heritage Sub-Committee members	Provision of RTW response to Information Request	RTW presented responses to matters from the State Gov Information Request.	Environment & Heritage subcommittee note the provision Information Request matters, and the intent for RTW to provide updated PRCP for comment at Q2 meeting.

RT Weipa Stakeholder Engagement Register – Consultation carried out in developing the PRCP.

Consultation Date	Consultation Type	Stakeholder	Attendee	Information Provided	Topics of discussion/ issues considered	Outcomes/ ongoing commitments
8 February 2023	Meeting	Traditional Owners – WCCCA	East Weipa Closure Sub-Committee members	Overview of closure planning	Overview of closure planning process, update on closure planning to date, discussion of proposed rehabilitation approach (as per PRCP) for closure, overview of Traditional Owner aspirations for post-mining, proposal for post-mining land use workshop.	Continued updates on closure planning via WCCCA consultation process
9 February 2023	Meeting	Traditional Owners – WCCCA	Andoom Closure Sub-Committee members	Overview of closure planning	Overview of closure planning process, update on closure planning to date, discussion of proposed rehabilitation approach (as per PRCP) for closure	Continued updates on closure planning via WCCCA consultation process
17 February 2023	Meeting	Traditional Owners – EBMPA	Environment and Heritage Sub-Committee members	Provision of RTW response to Information Request	RTW presented responses to matters from the State Gov Information Request.	Environment & Heritage subcommittee note the provision Information Request matters, and the intent for RTW to provide updated PRCP for comment at Q2 meeting.
2 May 2023	Meeting	Traditional Owners – WCCCA	Environment and Heritage Sub-Committee members	Provision of PRC Plan and Schedule inclusive of Information Request matters	Changes made to PRC Plan and Schedule relative to matters from the State Gov Information Request.	Environment &Heritage subcommittee refer PRC Plan and Schedule to Coordinating Committee for consideration, review and comment.
4 May 2023	Meeting	Traditional Owners – WCCCA	East Weipa Closure Sub-Committee members	Overview of closure planning	Update on closure planning process, update on closure planning to date, discussion of proposed rehabilitation approach (as per PRCP) for closure	Continued updates on closure planning via WCCCA consultation process
5 May 2023	Meeting	Traditional Owners – WCCCA	Andoom Closure Sub-Committee members	Overview of closure planning	Overview of closure planning process, update on closure planning to date, discussion of proposed rehabilitation approach (as per PRCP) for closure, discussion on MOU for consultation on closure	Continued updates on closure planning via WCCCA consultation process
12 May 2023	Meeting	Traditional Owners – EBMPA	Environment and Heritage Sub-Committee members	Provision of PRC Plan and Schedule inclusive of Information Request matters	Changes made to PRC Plan and Schedule relative to matters from the State Gov Information Request.	Environment &Heritage subcommittee refer PRC Plan and Schedule to Coordinating Committee for consideration, review and comment.
12 May 2023	On-country visit	Traditional Owners – WCCCA	East Weipa Closure Sub-Committee members	Overview of East Weipa mine area	Overview of current disturbance and closure planning, rehabilitation efforts to date and future (as per PRCP)	Continued updates on closure planning via WCCCA consultation process
19 May 2023	Workshop	Traditional Owners – WCCCA	East Weipa Closure Sub-Committee members	Post-mining land use workshop	Presentation on proposed closure plans and design, rehabilitation (per PRCP), Traditional Owner visions and aspirations	Continued updates on closure planning via WCCCA consultation process. Commitment to continue collaboration on closure outcomes

Appendix D: Community consultation plan

RT Weipa Stakeholder Consultation Plan – future commitments to consult regarding rehabilitation outcomes

Objective	Engagement Type	Proposed Consultation Frequency	Released Information	How feedback/ comments are considered
To provide progress reports on PRCP to Traditional Owners and obtain consensus on closure outcomes.	Coordinating Committee - Formal	Quarterly	Environmental Management System Updates: - consultation - Government Applications - Rehabilitation - post mining land use	Formal quarterly meeting minutes and actions. Feedback via formal process (subsequent quarterly meetings) as outlined in Agreement obligations. Incorporate recommendation into operational rehabilitation plans
To inform and receive recommendations on the PRCP from the Traditional Owners.	Sub-committee - Formal	Quarterly	Performance of rehabilitation	All recommendations considered and circulated to Coordinating Committee for endorsement. When required arrange specific engagement forum – e.g., workshop for PRCP
To ground truth the performance of rehabilitation and targeted consultation on performance and closure outcomes.	On country engagement	Annual	In field inspection of rehabilitation performance	Actions and concerns raised are addressed through to sub-committee and recommendations considered are circulated to Coordinating Committee for endorsement.

Appendix E: Completion Criteria for RTW

Completion Criteria for Legacy (Pre 2008) Mined Domain

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Methodology and notes
Stable landform	Landform design achieves appropriate erosion rates	Absence of soil erosion or present only at acceptable levels	No unacceptable soil erosion. Unacceptable erosion is defined as that which: • Appears likely to cause instability or degradation of the landform • Has the potential to compromise land use/objectives • Has the potential to deposit substantial alluvial sediment into receiving waters	Erosion is rarely observed to a degree likely to inhibit successful rehabilitation, given the internally draining, and low-relief landforms characterising Weipa's mine pits. Currently measured through Interim Assessment and Performance monitoring programs for Type (Gully, Rill, Sheet, None), Extent (Minor, Moderate, Severe) and Status (Active/Non Active) Unacceptable defined as Active, Moderate to Severe Erosion into receiving waters or Active, Severe Erosion onto rehabilitation.
Native, self-sustaining dry woodland vegetation comprising a variety of plant species, which in turn supports native fauna.	Soil Health	Development of soil A horizon and presence of leaf litter.	Development of soil A horizon and presence of leaf litter.	Soil properties evidenced by excavations at 75% of 4, 25m intercepts along transect where excavations are undertaken to 300mm. The assessing ecologist will note the presence and breakdown of organics and formation of A horizon. Terminitaria presence should be recorded in transect.

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Methodology and notes
Native, self-sustaining dry woodland vegetation comprising a variety of plant species, which in turn supports native fauna.	Soil Health	Soil formation processes underway	Presence of terminitaria and breakdown of organic matter in soil horizon.	Evidenced by excavations at 75% of 4, 25m intercepts along transect where excavations are undertaken to 300mm. The assessing ecologist will note the presence and breakdown of organics and formation of A horizon. Terminitaria presence should be recorded.
		Ground Cover and leaf litter	Ground cover comprising leaf litter, grasses, or cryptograms to comprise 80% of intercepts for an assessment plot.	Currently measured through Performance Monitoring and Interim Assessment intercept component.
	Self-sustaining dry woodland vegetation and fauna habitat established	Tree density – total framework species >2m	≥140 stems per ha of Pre-2008 Dry Woodland framework species >2m.	Key metric measured through Performance and Interim Assessment monitoring.
		Canopy composition	Collective foliage projective cover of Acacia mangium, Acacia auriculiformis, Acacia torulosa., Grevillea pteridifolia and Grevillea heliosperma is less than 50% of all >1.5 m intercepts.	Currently measured through Performance and Interim Assessment monitoring.
		Vegetation health	The proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained.	In Performance monitoring methodology density data records health status of individual plants. Those species exhibiting poor health are to be discounted from any density calculations.

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Methodology and notes
Native, self-sustaining dry woodland vegetation comprising a variety of plant species, which in turn supports native fauna.	Self-sustaining dry woodland vegetation and fauna habitat established	Diversity	Reciprocal Simpson's index score for the site ≥1.6.	Data collected measured through Performance Monitoring and Interim Assessment intercept component.
		Presence of weeds	Weed species abundance (either individually or in aggregate) does not and is unlikely to prevent any other criterion being achieved or sustained. Ecosystem transformer weeds must be absent (i.e. Gamba Grass). If a site is treated to remove ecosystem transformer weeds, monitoring in the subsequent year/s must determine that the treatment has been successful.	Weed presence and relative density is recorded during interim assessment/performance monitoring methodology.
		Resilience to fire	Following a recent fire (within the previous five years), all other completion criteria must be shown to have been met, demonstrating recovery. If the site is long unburnt or has never been burnt, monitoring of structurally and floristically similar rehabilitation must demonstrate that attributes relevant to other completion criteria could be expected to recover following a wildfire.	Reformulate this criterion, if necessary, after fire research is complete, or, integrate the findings of the fire research into all other relevant criteria, and omit this 'resilience to fire' criterion.
Native, self-sustaining dry woodland	Self-sustaining dry woodland vegetation and	Development of habitat suitable for native fauna species	The following habitat features must be present:One of more woody sub-canopy layers; Course woody debris (>1m), whether introduced	Currently measured through Performance Monitoring and Interim Assessment intercept component.

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Methodology and notes
vegetation comprising a variety of plant species, which in turn supports native fauna.	fauna habitat established.	that utilise dry woodland vegetation types in the area	or naturally-occurring; and An herbaceous layer inclusive of local perennial grasses.	
	Local native mammals, birds, reptiles, amphibians & invertebrates using the site (or likely to)	An effective termite decomposer fauna has developed	Recent termite constructs (mounds, arboreal nests, earthen workings in litter, on wood and on tree stems) are present, and there is evidence of termite-mediated decomposition of woody and other plant materials including specific evidence of litter or soil-wood feeding termite activity.	Photography and sampling of termite activity in performance and interim assessment monitoring plots confirms presence of wood feeding or soil-wood feeding termites.
		Native fauna re-colonisation	Evidence of native fauna re-colonisation as demonstrated by fauna monitoring of representative Pre-2008 Dry Woodland rehabilitation	Targeted fauna surveys, carried out as part of Rio Tinto's monitoring program are essential to confirm the success of recolonization by fauna.
Self-sustaining wetland vegetation community that	Self-sustaining wetland vegetation and fauna habitat	Framework species density	≥80 stems per ha of Pre-2008 Wetland framework species >2m	
		Diversity	Reciprocal Simpsons Index of ≥1.2	

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Methodology and notes
includes Melaleucas and other native plant species and supports native fauna	established in seasonally inundated areas	Canopy composition	Collective foliage projective cover of *Acacia*/*Grevillea*/*Dodonaea* species, other than those classified as key substrata species, is less than 50% of all >1.5 m intercepts.	Currently measured through interim assessment monitoring.
		Ground cover	Ground Cover and leaf litter Ground cover comprising leaf litter, grasses or cryptograms to comprise 65% of intercepts for an assessment plot.	Potentially subject to further refinement following fire study outcomes
		Vegetation Health	The proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual.	See comments for pre-2008 (Legacy Domain), Dry Woodlands
Self-sustaining wetland vegetation community that includes Melaleucas and	Self-sustaining wetland vegetation and fauna habitat established in	Presence of weeds	Weed species abundance (either individually or in aggregate), does not, and is unlikely to prevent any other criterion being achieved or sustained. Ecosystem transformer weeds must be absent. If a site is treated to remove ecosystem	See comments for pre-2008 (Legacy Domain), Dry Woodlands

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Methodology and notes
other native plant species and supports native fauna	seasonally inundated areas		transformer weeds, monitoring in the subsequent year must establish that the treatment has been successful.	
	Local native mammals, birds, reptiles, amphibians & invertebrates using the site (or likely to)	Development of habitat suitable for native fauna species that utilise wetland vegetation types in the area	Vegetation monitoring shows wetland fauna habitat is developing including: •Suitable vegetation strata (overstory and/or shrubs and/or rushes and sedges); •local native plant species	

Completion Criteria for Benchmark (Post 2008) Mined Area Domain

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Rationale, Notes
Stable landform	Landform design achieves appropriate erosion rates.	Absence of soil erosion or present only at acceptable levels.	No unacceptable soil erosion. Unacceptable erosion is defined as that which: •Appears likely to cause instability or degradation of the landform •Has the potential to compromise land use/objectives •Has the potential to deposit substantial alluvial sediment into receiving waters	Erosion is rarely observed to a degree likely to inhibit successful rehabilitation, given the internally draining, and low-relief landforms characterising Weipa's mine pits. Currently measured through Interim Assessment and Performance monitoring programs for Type (Gully, Rill, Sheet, None), Extent (Minor, Moderate, Severe) and Status (Active/Non Active) Unacceptable defined as Active, Moderate to Severe Erosion into receiving waters or Active, Severe Erosion onto rehabilitation.
Self-sustaining native dry woodland vegetation dominated by framework species that meets criteria derived from dry woodland reference sites and trials.	Soil Health	Development of soil A horizon and presence of leaf litter.	Development of soil A horizon and presence of leaf litter. .	Soil properties evidenced by excavations at 75% of 4, 25m intercepts along transect where excavations are undertaken to 300mm. The assessing ecologist will note the presence and breakdown of organics and formation of A horizon. Terminitaria presence should be recorded in transect.
		Soil formation processes underway	Presence of terminitaria and breakdown of organic matter in soil horizon.	Evidenced by excavations at 75% of 4, 25m intercepts along transect where excavations are undertaken to 300mm. The assessing ecologist will note the presence and breakdown of organics and formation of A horizon. Terminitaria presence should be recorded..

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Rationale, Notes
B (Cont.) Self-sustaining native dry woodland vegetation dominated by *Eucalypts, Corymbias, Erythrophleum* and other framework species that meets criteria derived from dry woodland reference sites and trials	Self-sustaining dry woodland vegetation and fauna habitat established; management requirements comparable to those of unmined dry woodland)	Ground Cover and leaf litter	Ground cover comprising leaf litter, grasses, or cryptograms to comprise 80% of intercepts for an assessment plot.	Currently measured through Performance Monitoring and Interim Assessment intercept component.
		Tree density – total framework species >2m	≥200 stems per ha of Post-2008 Dry Woodland framework species >2m.	Key metric measured through Performance and Interim Assessment monitoring.
		Diversity	Reciprocal Simpson's index scores for the site ≥3.	Data collected measured through Performance Monitoring and Interim Assessment intercept component.
		Presence of weeds	Weed species abundance (either individually or in aggregate), does not, and is unlikely to prevent any other criterion being achieved or sustained. Ecosystem transformer weeds must be absent. (Gamba grass). If a site is treated to remove ecosystem transformer weeds, monitoring in the subsequent year must establish that the treatment has been successful.	See comments for pre-2008 (Legacy Domain), Dry Woodlands
		Resilience to fire	Following a recent fire (within the previous five years), all other completion criteria must be shown to have been met, demonstrating recovery. If site is long unburnt or has never been never burnt, monitoring of structurally and floristically similar rehabilitation must demonstrate that attributes relevant to other completion criteria could be expected to recover following a wildfire.	Reformulate this criterion, if necessary, after fire research is complete, or, integrate the findings of the fire research into all other relevant criteria, and omit this 'resilience to fire' criterion.

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Rationale, Notes
Self-sustaining native dry woodland vegetation dominated by *Eucalypts, Corymbias, Erythrophleum* and other framework species that meets criteria derived from dry woodland reference sites and trials	Self-sustaining dry woodland vegetation and fauna habitat established; management requirements comparable to those of unmined dry woodland	Development of habitat suitable for native fauna species that utilise dry woodland vegetation types in the area	The following habitat features must be present: One of more woody sub-canopy layers; Course woody debris (>1m), whether introduced or naturally-occurring; and An herbaceous layer dominated by local perennial grasses.	Currently measured through Performance Monitoring and Interim Assessment intercept component.
	Local native mammals, birds, reptiles, amphibians & invertebrates using the site (or likely to)	An effective termite decomposer fauna has developed	Recent termite constructs (mounds, arboreal nests, earthen workings in litter, on wood and on tree stems) are present, and there is evidence of termite-mediated decomposition of woody and other plant materials.	Currently measured through Performance Monitoring and Interim Assessment intercept component.

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Rationale, Notes
Self-sustaining native dry woodland vegetation dominated by *Eucalypts, Corymbias, Erythrophleum* and other framework species that meets criteria derived from dry woodland reference sites and trials	Local native mammals, birds, reptiles, amphibians & invertebrates using the site (or likely to)	Development of habitat suitable for native fauna species that utilise dry woodland vegetation types in the area	The following habitat features must be present: One or more woody sub-canopy layers; Course woody debris (10 cm in diameter); and An herbaceous layer dominated by local perennial grasses.	Course woody debris can originate from the topsoil source, the rehabilitation itself, or be intentionally emplaced.
		Native fauna recolonization	Evidence of colonisation by fauna characteristic of Benchmark Domain Dry Woodland, as demonstrated by fauna monitoring of representative Transitional Domain Dry Woodland rehabilitation	See comments for pre-2008 (Legacy Domain).
Self-sustaining wetland vegetation community that includes Melaleucas, Lophostemon and wetland gums native plant species and supports native fauna	Self-sustaining wetland vegetation community that includes Melaleucas and other native plant species and supports native fauna	Framework species density	>140 stems per ha ofPost-2008 Wetland framework species >2m	Currently measured through Performance Monitoring and Interim Assessment intercept component.
		Diversity	Reciprocal Simpsons Index returns a value of >1.2	See diversity rationale for wetland sites;
		Ground cover	Ground Cover and leaf litter Ground cover comprising leaf litter, grasses, or cryptogram to comprise 65% of intercepts for an assessment plot.	

Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria	Rationale, Notes
Self-sustaining wetland vegetation community that includes Melaleucas, Lophostemon and wetland gums native plant species and supports native fauna	Self-sustaining wetland vegetation community that includes Melaleucas and other native plant species and supports native fauna	Vegetation Health	The proportion of plants with significant health problems should not prevent any other criterion from being achieved and sustained. A significant health problem is one which is likely to substantially curtail the normal lifespan of the affected individual.	See comments for pre-2008 (Legacy Domain), Dry Woodlands
		Presence of weeds	Weed species abundance (either individually or in aggregate), does not, and is unlikely to prevent any other criterion being achieved or sustained. Ecosystem transformer weeds must be absent. If a site is treated to remove ecosystem transformer weeds, monitoring in the subsequent year must establish that the treatment has been successful.	See comments for pre-2008 (Legacy Domain), Dry Woodlands
		Local native mammals, birds, reptiles, amphibians & invertebrates using the site (or likely to	Development of habitat suitable for native fauna species that utilise wetland vegetation types in the area	Vegetation monitoring shows wetland fauna habitat is developing including: • Surface water in some sites; •Suitable vegetation strata (overstory and/or shrubs and/or rushes and sedges); •local native plant species

TSF and Infrastructure Closure Criteria

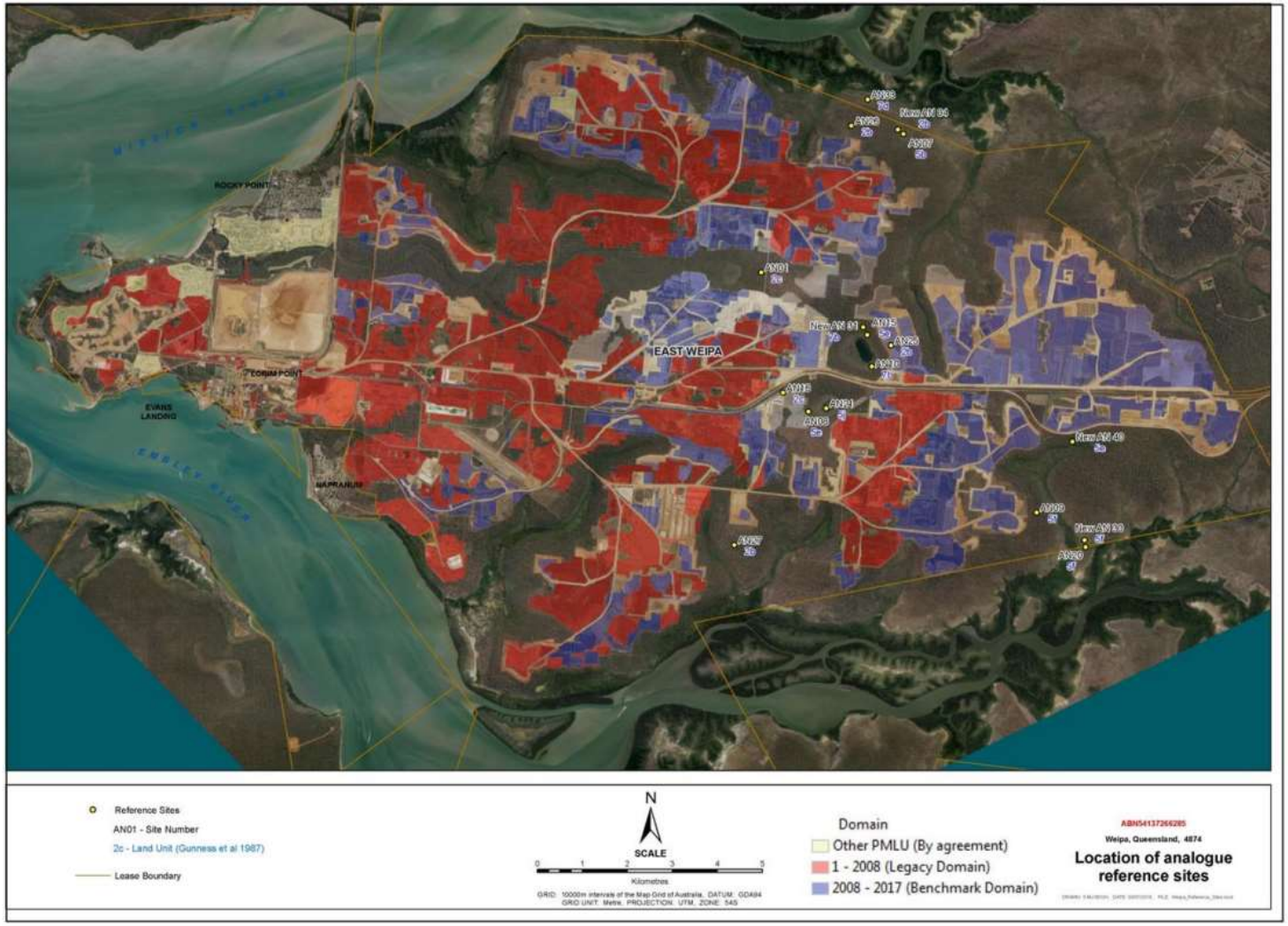
Mine Domain	Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria
Tailings Storage Facilities	Long-term safety	The site is safe for humans and fauna, now and in the foreseeable future	Tailings storage facilities are geotechnically stable	Evidence that storage facilities are physically stable
	Non-polluting	Surface water remain uncontaminated	Surface water monitoring	Evidence that surface water leaving rehabilitated site meets REMP requirements
		Dust levels at sensitive human receptors meet EA conditions	Dust monitoring in sensitive receptor areas	Evidence that dust levels do not exceed EA limits.
	Stable landform	Landform design achieve appropriate erosion rates	Soil erosion is acceptable	No unacceptable soil erosion. Unacceptable erosion is that which: • Causes instability or degradation of the landform • Will compromise land use/objectives
			Engineered structures to control water flow off outer batters	Evidence that required engineered structures are in place and functioning
		Slopes	Slope angles acceptable	Maximum overall slope angle of 35° (* with the exception of EW Dam 1&2)
		Vegetation cover to minimise erosion	Vegetation type and density	Evidence that vegetation is resilient, self-sustaining and appropriate to control erosion on the landform
		Very low probability of slope slippage with serious consequence in regards to environmental harm	Geotechnical and geochemical studies of existing structures	Evidence the appropriate risk assessment has been undertaken and the level of risk is acceptable.

Mine Domain	Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria
	Sustainable land use	Establish specified self-sustaining natural vegetation	Presence of framework species	Minimum of two Dry Woodland framework species >2m present
			Presence of weed species	Weeds will be managed in accordance with the QLD Biosecurity Act (2014)
			Vegetation health	Evidence of good health (plants healthy, no significant disease or nutrient deficiency problems)
			Resilience of vegetation	Monitoring and/or research has shown that they regenerate after fire and meet presence of framework species criteria following a burn.
Infrastructure - Final Voids	Long-term safety	The site is safe for humans and fauna, now and in the foreseeable future	Safety assessment	Audit of the site to confirm stability and safety acceptability
	Non-polluting	As per Tailings Storage Facilities		
	Stable landform	As per Tailings Storage Facilities (excluding max. slope)		
	Sustainable Land Use	As per mined land (pre 2008 domain)	Hydrological studies to establish water levels and connectivity	Evidence the receiving environment is not adversely impacted by discharge from specified water body
			Water quality monitoring	Evidence that water quality meets relevant guidelines

Mine Domain	Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria
Infrastructure – Slots (rehabilitated)	Long-term safety	The site is safe for humans and fauna, now and in the foreseeable future	Safety assessment of contoured ground level	Fill material intact with acceptable settling and weathering
	Non-polluting	Surface water remain uncontaminated	Surface water monitoring	Reports confirm that surface water leaving rehabilitated site does not contain contaminant levels above relevant guidelines
		Soil remains uncontaminated	Soil quality monitoring	Reports confirm that soil in filled in areas does not contain contaminants above relevant guidelines
		Dust levels at sensitive human receptors meet EA conditions	Dust monitoring in sensitive receptor areas	Evidence that dust levels do not exceed EA limits.
	Stable landform	Landform design achieve appropriate erosion rates	Soil erosion is acceptable	No unacceptable soil erosion. Unacceptable erosion is that which: • Causes instability or degradation of the landform • Will compromise land use/objectives
		Vegetation cover to minimise erosion	Vegetation type and density	Evidence that vegetation is resilient, self-sustaining and appropriate to control erosion on the landform
	Sustainable land use	As per Tailings Storage Facilities.		
	Long-term safety	The site is safe for humans and fauna, now and in the foreseeable future	Safety assessment of contoured ground level	Fill material intact with acceptable settling and weathering

Mine Domain	Rehabilitation Goal	Rehabilitation Objective/s	Indicators	Completion Criteria
Infrastructure - Water (rehabilitated)	Non-polluting	As per Infrastructure – Slots (rehabilitated)		
	Stable landform	As per Infrastructure – Slots (rehabilitated)		
	Sustainable land use	As per Tailings Storage Facilities		
Infrastructure - Water	Water infrastructure, such as the water supply dams, may be left in place.	Subject to agreement with regulators and Traditional Owners some facilities may be left in place. Otherwise, RTWO commitment is to remove structures at closure and rehabilitate as per Infrastructure – Water (rehabilitated)	NA	NA
Infrastructure – Plant	Some plant infrastructure may be left in place, otherwise rehabilitated as per Mined area domain.	Subject to agreement with regulators and Traditional Owners some facilities may be left in place. Otherwise, RTWO commitment is to remove structures at closure and rehabilitate	NA	NA
Infrastructure – Civil	Some civil infrastructure is likely to be left in place, otherwise rehabilitate as per Mined area domain.	Subject to agreement with regulators and Traditional Owners some facilities will be left in place.	NA	NA

Appendix F: Location of analogue reference sites



Appendix G: Risk assessment criteria tables

This appendix provides the criteria used to assess the likelihood and consequences during the risk assessment. The likelihood and consequences criteria tables are provided in Table E1 and Table E2. These two factors were then analysed to determine the level of risk in the matrix in Table E3.

Table E1: Qualitative criteria for likelihood

Likelihood probability	Description (single events)
Almost certain	>75%
Likely	50% - 75%
Possible	20% - 50%
Unlikely	5% - 20%
Rare	<5%

Table E2: Qualitative criteria for consequence

	Consequence				
Description	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Health and safety	Low level short term inconvenience or symptoms. Typically a first aid case with no medical treatment	Injury or illness requiring medical treatment. Typically a medical treatment case injury or illness	Injury / illness with moderate damage or impairment (<30% on impairment scale) to one or more persons	Single fatality or severe permanent impairment to a person (>30%) e.g. loss of hand or lower limb (at knee), paraplegia	Multiple fatalities or severe permanent impairment to multiple people (<5 people)
Environment	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm to the environment that is localized, of short-duration, effects no sensitive receptors and is quickly and easily rectified (e.g. within a shift).	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm on the environment that is localized, effects no sensitive receptors and is rectified or reversed within a few days to weeks of work effort, or a few days to weeks of natural recovery.	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm on the environment that is largely localized but starts to be unconfined, effects sensitive receptors and is rectified or reversed within weeks to months of work effort, or weeks to months of natural recovery.	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Harm on the environment that is unconfined, effects sensitive receptors and is rectified or reversed within months to years of work effort, or months to years of natural recovery.	An unplanned or unpermitted or unintended event; or a series of chronic or cumulative events results in: Widespread, environmental harm that is rectified or reversed within several years to decades of work effort, or years to decades of natural recovery. Irreversible harm to localized but sensitive receptors.
Landholders/traditional owners and stakeholders	Informal disapproval from local stakeholders, manageable by site personnel with limited additional effort.	Stakeholder actions resulting in operational or commercial impacts equivalent in value to days to weeks of operational inefficiency at a tier 1 asset.	Stakeholder actions resulting in operational or commercial impacts equivalent in value to days to weeks of production from a tier 1 asset.	Stakeholder actions and / or rent seeking resulting in operational or commercial impacts equivalent in value to weeks to months of	Stakeholder actions and / or rent seeking resulting in operational or commercial impacts equivalent in value to months to years of production

	Consequence				
Description	**Very low**	**Low**	**Moderate**	**High**	**Very high**
	No significant residual impact on reputation.	Formal public disapproval from local stakeholder(s) requiring specific local management response. Some residual local reputational impact, with potential accumulate over time	Organised local action / prolonged formal high profile disapproval influencing policy, regulation, commercial and / or social activity at the local level.	production from a tier 1 asset, but not compromising financial viability. Organised formal action influencing relevant policy, regulation, commercial and / or social activity at the national level.	from a tier 1 asset, compromising the financial viability of the asset and driving a minor formal impairment disclosure. Organised formal action at the international level influencing relevant policy, regulation, commercial or social activity across multiple jurisdictions.
Communities	Short term loss of trust with communities, repaired within days. Damage to cultural heritage site or item of low significance	Loss of trust with communities taking weeks to months to resolve. Non-disruptive organised opposition. Damage to cultural heritage site or item of moderate significance. Ad hoc complaints about some aspects of agreement or commitments	Loss of trust with communities that cannot be resolved through routine procedures. Disruptive organised opposition. Mitigatable damage to cultural heritage site of high local or national significance. Material non-conformance with agreements or commitments	Widespread, sustained opposition from communities. Blockades resolved with routine procedures. Major negative impact on communities' economic viability. Irreparable damage to cultural heritage site of high local significance. Most aspects of agreements or commitments not met and independent mediation required to resolve the impasse	Sporadic or short term (ie weeks) interruptions to operations and projects, due to: Systemic opposition from communities that impacts community trust at other Rio Tinto assets. Blockades not resolved by routine procedures. Sporadic outbreaks of violence, directed at company assets or people. One-off deployment of public security as a result of a communities issue. Loss of

	Consequence				
Description	**Very low**	**Low**	**Moderate**	**High**	**Very high**
					community's economic viability. Irreparable damage to cultural heritage site/s of national significance. Complete failure of agreement or commitment

Table E3: Qualitative risk assessment matrix

	Most serious consequence				
Likelihood	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Almost certain	Class II	Class III	Class IV	Class IV	Class IV
Likely	Class II	Class III	Class III	Class IV	Class IV
Possible	Class I	Class II	Class III	Class IV	Class IV
Unlikely	Class I	Class I	Class II	Class III	Class IV
Rare	Class I	Class I	Class II	Class III	Class III