NOTICE OF INTENT

for the NT EPA

for the

REHABILITATION OF THE FORMER RUM JUNGLE MINE SITE

29 June 2016 v1.3

PREPARED AND SUBMITTED BY:

DEPARTMENT OF MINES AND ENERGY

NORTHERN TERRITORY GOVERNMENT

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Project overview

The proposed action is the rehabilitation of the former Rum Jungle mine site (Rum Jungle) and its satellite sites of Mount Burton and Mount Fitch, expected to commence in 2017 subject to the provision of additional funding.

Unique environmental context of this NOI

This project is unusual in that it does not represent a greenfields development project. Instead, it is a legacy mine rehabilitation project which aims to provide a significant improvement upon the current environmental condition of the site, to restore life to land, cultural values and water resources at and downstream of Rum Jungle.

Historical context

The Rum Jungle uranium ore body was discovered in 1949 and was mined for uranium, copper, nickel and lead from 1954 to 1971 using open pit methods. The Commonwealth Government, under the Atomic Energy Act, engaged a contractor to undertake the mining and milling activities.

The mining and placement methods used for waste rock and process tailings during this time resulted in the generation of substantial volumes of acid and metalliferous drainage (AMD). Ongoing oxidation of sulfide minerals in the waste, followed by annual wet season leaching of soluble oxidation products released large concentrations of copper, other heavy metals and acid into the surrounding environment.

In the early 1960s, the significant environmental impacts of the mining activities and the resulting pollution of the East Branch of the Finniss River (East Branch), primarily caused by AMD, were recognised in correspondence between the Australian Atomic Energy Commission and the Northern Territory Administration (National Archives of Australia, 1962/1824). The Commonwealth Government initiated an aesthetic clean-up of the mine site in 1977.

The government also formed the Rum Jungle Working Group to develop rehabilitation options for the site. The outcome of this technical assessment and planning effort was a four-year rehabilitation project funded by the Commonwealth Government and undertaken from 1982-1986. The total cost was $18.6 million (Allen & Verhoeven 1986, in DME, 2013), the major proportion of which was spent treating highly contaminated water in the Main pit. The Final Project Report (Allen and Verhoeven, 1986 in DME, 2013) provided a full description of the remediation project, including the rationale for the rehabilitation and the results of preliminary monitoring.

Following completion of this rehabilitation project, the results from the 1993–1998 monitoring period concluded that the rehabilitation objectives, 'reflected contemporary thinking in mine site rehabilitation and were considered appropriate and practical

considering the scope of the problems to be dealt with and the level of resources available' (Kraatz, 2002 in DME 2013). Monitoring identified that all four key objectives were successfully achieved (Kraatz and Applegate, 1992; Kraatz, 1998; Pidsley, 2002 in DME 2013). The key objectives for the 1980's rehabilitation works were:

- Major reduction in pollution in the Finniss River system
- Reduction in public health hazards
- Reduction in pollution contained in the open cut pits
- Aesthetic improvements including revegetation

However, this work did not result in a final condition for the site that meets contemporary water quality standards. Furthermore, previous mining and rehabilitation activities were undertaken without input from the joint traditional owners of the site – Kungarakan and Warai. Additional problems also arose with how to manage wildfire, weeds, feral animals, and access.

National Partnership Agreement

As part of the 2009 Federal Budget, the Commonwealth Government committed $7.048 million over a four-year period for the environmental management of Rum Jungle (Commonwealth Government, 2009 in NT DME, 2013). To manage this commitment, the Northern Territory Government and the Commonwealth Government entered into a *National Partnership Agreement on the management of the former Rum Jungle mine site* (NPA). Under the terms of the NPA, the Commonwealth and Northern Territory Government committed to improving the management of Rum Jungle in a way that is consistent with the interests of stakeholders, particularly traditional Aboriginal owners by:

- Improving the understanding of the current state of the environment
- Improving site management
- Developing an improved rehabilitation strategy, which may lead to future rehabilitation works under new agreements.

Current project

The final output of the NPA was the finalisation of the *Conceptual Rehabilitation Plan for the former Rum Jungle mine site* (DME, 2013). This plan details a conceptual **preferred rehabilitation strategy** for the future. In 2013, a new Project Agreement (Stage 2) was signed between the Commonwealth and Northern Territory Government. Stage 2 involves developing the rehabilitation strategy from concept to implementation-ready by 30 June 2016 including detailed engineering designs and costs of the proposed works.

The preferred rehabilitation strategy involves dewatering and backfilling one of the former mine pits, known as Main pit, with material from the existing waste rock dumps. The remaining waste rock, and any residual contaminated soil across the site, will be

consolidated in a new, purpose-built waste rock dump proposed for construction in the northern area of the site. Leading practice landform and cover designs will be developed and implemented for the in-filled pit and the new waste rock dump with cover materials to be sourced from an off-site borrow pit. All covers will be revegetated with native species. Important cultural aspects of the landscape will be taken into account and wherever possible, protected or reinstated.

The earliest possible start date for the proposed action is May 2017 (Dry Season 2017). The proposed rehabilitation works will likely be undertaken over an 8 year period, with major construction and operational works to be carried out during the dry seasons of those years. The construction schedule has been carefully planned to ensure impacts from rehabilitation works are eliminated or minimised as far as practicable. Temporary covers will be placed over waste rock dumps to minimise generation of AMD. The proposed disturbance footprint including the areas on the Rum Jungle site, the widening of existing roads and creation of new sections of haul road, the offsite borrow pit area on the Finniss River Land Trust east of Rum Jungle mine and the removal of material at both Mount Fitch and Mount Burton is 242 hectares. The Rum Jungle Conceptual Rehabilitation Plan (DME, 2013) is an important reference which supports this Notice of Intent.

Current state of the environment

The landscape at Rum Jungle has been significantly degraded from mining and to some extent previous rehabilitation activities. Even though revegetation was undertaken on some of these disturbed areas, many have become dominated by grassy weeds and have since been subjected to hot fires. There is both physical and chemical degradation of current landforms on site from the weathering of waste materials and mobilisation via surface and groundwater pathways.

The upper reaches of the East Branch Finniss River on site (i.e. central mining area) are ephemeral systems where the physical site aesthetics change significantly between the wet and dry seasons. During high-flow rainfall, the diversion channel directs water through the East Branch and through inflows to Main and Intermediate pits. This water flow strategy was adopted as part of the previous rehabilitation works to improve the surface water quality of the pits. During the dry season (e.g. May–November) water bodies evaporate and salt efflorescence becomes more pronounced, particularly where seepage occurs directly to the riverbed (e.g. toes of Main and Intermediate waste rock dumps).

The results of previous waste characterisation investigations identified that waste materials stored on site including materials located in waste rock dumps (WRDs), contaminated soils and sediments were found to contain sulfides and elevated concentrations of metals (aluminium [Al], cadmium [Cd], cobalt [Co], copper [Cu],

magnesium [Mg], nickel [Ni], selenium [Se], uranium [U], sulphate [SO_4] and zinc [Zn]), which generate acid and metalliferous drainage (AMD).

The AMD currently affecting the East Branch of the Finniss River and the Finniss River downstream of the mine contain concentrations of cobalt, copper and nickel that exceed Australian and New Zealand Environment and Conservation Council (ANZECC) water quality guideline trigger values for the protection of aquatic ecosystems during low-flow periods in the river. Copper concentrations exceed the trigger values in the East Branch under all flow conditions. These metals can precipitate onto the riverbed and re-mobilise in the 'first flush' of contaminants in the river system. The first flush can be detrimental to aquatic ecology due to the elevated metal concentrations.

A comprehensive groundwater investigation identified localised groundwater contamination on the site in the copper extraction area between the Main and Intermediate pits.

Investigations also identified localized contamination of soil with metals that require clean up, including the operations areas, Old tailings area and fluvial areas.

Fire is common in the landscape around and within Rum Jungle. Between 2004 and 2011 almost one quarter of a 130 km^2 area surrounding Rum Jungle was burnt every year (DME, 2013). Managing outbreaks of fire in and around Rum Jungle is an ongoing issue and will continue to be an issue into the future, particularly given the increase in high fuel-load weeds, such as Gamba grass (*Andropogon gayanus*) and Mission grass (*Cenchrus polystachios*).

Feral animals in the Pine Creek bioregion where Rum Jungle is situated, include cane toads, black rats, wild dogs, horses, pigs, swamp buffalo, cattle, and sambar deer (NT NRM Infonet website, 2012). Price and Baker (2003) noted that the distribution of feral animals across the Coomalie Shire was very poorly known and that the control of pigs and cats should be given priority.

Disturbed areas on site are highly impacted by weeds, particularly Gamba grass. Gamba grass was identified as 'probably the most serious environmental problem' in the region (Price and Baker, 2003). The Coomalie Shire lies within the Gamba Grass Management Zone, which imposes a legal obligation on landholders to contain existing infestations and eradicate any smaller or new infestations. Mission grass and *Mimosa pigra* also pose threats to Rum Jungle as they occur in the region.

A weed survey was undertaken by Wildman Land Management in November/December 2010 and April 2011. The survey found that the Rum Jungle site is extensively infested with exotic and weed species with at least 22 weed species currently known to occur on the site. The Borrow area report (EcOz, 2016), also notes that the existing vegetation

communities within the FRLT Borrow Area, are compromised by widespread and dense infestation of Gamba Grass (Andropogon gayanus).

A 5 Year Weed Management Plan (Attachment E) was developed for Rum Jungle based upon the history and the present status of weed infestations and the surrounding region. Understanding the growth cycle, dispersal and colonisation mechanisms of weeds and efficient methods of disrupting these are key elements of the Plan. The biological context these infestations occur in, such as native vegetation, landscape processes and land use specific to Rum Jungle are also important. The current 5-year weed management, due to lapse on 30 June, will need to be renewed for the next 5 years and incorporate some of the new disturbances associated with the Rum Jungle rehabilitation and propose suitable actions to address them during and post-rehabilitation.

Table 1 Declared weed species recorded at Rum Jungle

Declared weed class, NT (Weed Management Act 2001)	Declared Weed Species	Weed of National Significance
A – to be eradicated or B – growth and spread to be controlled (within respective management zones)	Gamba Grass Andropogon gayanus	Yes
	Mimosa Mimosa pigra	Yes
B - Growth and spread to be controlled	Coffee Bush Leucaena leucocephala	
	Grader Grass Themeda quadrivalvis	
	Hyptis Hyptis suaveolens	
	Mission Grass Cenchrus polystachios	
	Neem Azadirachta indica	
	Olive Hymenachne Hymenachne amplexicaulis	Yes
	Paddy's Lucern Sida rhombifolia	

Declared weed class, NT (Weed Management Act 2001)	Declared Weed Species	Weed of National Significance
	Sicklepod Senna obtusifolia	
	Snakeweed Stachytarpheta spp.	
	Spinyhead Sida Sida acuta	
	Para Grass Urochloa mutica	

There is no current cropping land within the boundaries of Rum Jungle.

Rum Jungle currently consists of the following features

- three waste rock dumps – Main, Intermediate and Dysons
- two water-filled mine pits – Main and Intermediate
- one mine pit backfilled with tailings and overlain with contaminated soil - Dysons

Plate 1, Plate 2, **Plate 3** and **Plate 4** show current site landforms and visual evidence of impacted water and land.

Plate 1 Aerial oblique view of Intermediate (foreground) and Main waste rock dumps, Intermediate (left foreground) and Main water filled pits

Plate 2 Salt efflorescence and seepage in the diversion channel at the toe of Intermediate waste rock dump, Rum Jungle (NT DME)

Plate 3 Aerial oblique view of Dysons backfilled pit, Rum Jungle (NT DME)

Plate 4 Salt efflorescence from seepage downslope of Dysons backfilled pit, Rum Jungle (NT DME)

Project title

Rehabilitation of the former Rum Jungle Mine site (Rum Jungle)

1. Proponent

The Department of Mines and Energy, on behalf of the Northern Territory Government

2. Address of proponent and contacts

GPO BOX 4550, Darwin NT 0801

Ron Kelly, Chief Executive Officer

Phone: (08) 8999 5332

Email: ron.kelly@nt.gov.au

2.1 Supporting the proponent

The current *Project Agreement on the management of the former Rum Jungle mine site (Stage 2)* between the Commonwealth and Northern Territory (NT) is current until 30 June 2016. Under this agreement the Commonwealth is providing funding to the NT Department of Mines and Energy to project-manage activities to develop the preferred rehabilitation strategy from concept to implementation-ready. The Department of Mines and Energy is also supported by the Rum Jungle Working Group, tasked to provide oversight to the rehabilitation project. As per the Project Agreement the Working Group includes representative from:

- Department of Mines and Energy
- Commonwealth Department of Industry, Innovation and Science,
- Commonwealth Supervising Scientist Division of the Department of Environment
- Northern Land Council

The DME has engaged a number of expert consultants throughout the rehabilitation project planning to provide baseline studies and inform development of the rehabilitation design. These reports have been provided as attachments to this NOI.

3. Project Location

The coordinate points for the project areas are shown in **Table 2 – 7.** Locations are shown in Error! Reference source not found.. The coordinates were determined using the nline EPBC Act Interactive Mapping Tool. GIS shapefiles (projection GDA94) have been provided for all areas.

3.1 Street address of the site

- Rum Jungle mine site: 847 Rum Jungle Road, Batchelor, NT 0845
- Mount Burton: 397 White Road, Rum Jungle NT 0822
- Mount Fitch: 1580 Litchfield Park Road, Charlotte NT 0822
- FRLT Borrow Area: 710 Batchelor Road, Rum Jungle NT 0822

3.2 Lot description and Tenement Details

The tenure designation of:

- Rum Jungle is Section 2968 Hundred of Goyder, held as vacant Northern Territory Crown Land.
- Mount Burton is Section 981 Hundred of Goyder, held as freehold land
- Mount Fitch is Northern Territory Portion 3283, held as Crown Lease in perpetuity 862
- Finniss River Lands Trust Borrow Area is Section 2940 Hundred of Goyder, held as Aboriginal Freehold in the possession of the Finniss River Land Trust

Refer Figure 2

Table 2 Rum Jungle project area boundary coordinates

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-12	58	33.64	131	0	41.65
2	-12	58	41.38	131	1	36.73
3	-12	59	26.99	131	1	36.3
4	-12	59	31.74	131	1	29.78
5	-12	59	31.7	131	1	25.28
6	-12	59	34.8	131	1	25.5
7	-13	0	1.69	131	0	51.55
8	-13	0	1.84	131	0	43.06
9	-12	59	43.12	131	0	9.43
10	-12	59	35.7	130	59	59.46
11	-12	59	27.85	130	59	59.06
12	-12	59	26.95	131	0	2.63

13	-12	59	23.82	131	0	1.84
14	-12	59	24.54	130	59	58.81
15	-12	59	10.18	130	59	57.55
16	-12	59	10.03	130	59	54.28
17	-12	58	39.43	130	59	54.42
18	-12	58	39.43	131	0	4.86
19	-12	58	37.09	131	0	4.86

Table 3 Mount Fitch project area coordinates

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-12	57	0.25	130	57	3.89

Table 4 Mount Burton project area coordinates

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-12	58	44.17	130	57	56.71

Table 5 FRLT Borrow Area project area boundary coordinates. Borrow pits are within boundary

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-12	58	39.84	131	4	57.64
2	-12	58	39.81	131	5	0.99
3	-12	58	33.32	131	5	0.94
4	-12	58	33.51	131	5	34.05

5	-12	58	23.89	131	5	33.97
6	-12	58	23.34	131	5	54.03
7	-12	59	44.36	131	5	53.85
8	-12	59	44.28	131	5	11.4
9	-12	58	52.43	131	5	10.97
10	-12	58	52.32	131	4	57.75

Table 6 Coordinates for Borrow Pit Haul Road

Location Point	**Latitude**			**Longitude**		
	Degrees	**Minutes**	**Seconds**	**Degrees**	**Minutes**	**Seconds**
1	-12	58	44.98	131	1	36.51
2	-12	58	48.32	131	1	39.71
3	-12	58	49.15	131	1	43.44
4	-12	58	48.53	131	1	45.85
5	-12	58	14.4	131	2	31.56
6	-12	58	12.02	131	2	34.56
7	-12	58	0.76	131	2	45.33
8	-12	57	56.18	131	2	53.11
9	-12	57	53.29	131	2	58.22
10	-12	57	52.45	131	3	1.67
11	-12	57	52.69	131	3	5.21
12	-12	57	53.62	131	3	7.8
13	-12	57	59.42	131	3	15.46
14	-12	58	2.27	131	3	18.02
15	-12	58	5.57	131	3	19.93

16	-12	58	11.35	131	3	21.7
17	-12	58	19.26	131	3	23.83
18	-12	58	22.34	131	3	25.77
19	-12	58	24.43	131	3	28.34
20	-12	58	25.73	131	3	31.8
21	-12	58	25.86	131	3	35.13
22	-12	58	24.91	131	3	41.79
23	-12	58	24.88	131	3	44.71
24	-12	58	25.75	131	3	48.49
25	-12	58	30.28	131	3	58.13
26	-12	58	30.48	131	4	1.87
27	-12	58	29.49	131	4	4.83
28	-12	58	17.01	131	4	18.19
29	-12	58	15.87	131	4	20.67
30	-12	58	15.75	131	4	22.96
31	-12	58	17.25	131	4	34.36
32	-12	58	18.91	131	4	37.86
33	-12	58	21.54	131	4	40.67
34	-12	58	32.56	131	4	48.77
35	-12	58	34.91	131	4	51.26
36	-12	58	39.83	131	4	59.17

Table 7 Coordinates for site access road

Location Point	**Latitude**			**Longitude**		
	Degrees	**Minutes**	**Seconds**	**Degrees**	**Minutes**	**Seconds**

1	-13°	0'	27.33"	131°	0'	10.88"
2	-13°	0'	25.93"	131°	0'	13.10"
3	-13°	0'	23.79"	131°	0'	15.20"
4	-13°	0'	21.55"	131°	0'	17.24"
5	-13°	0'	19.34"	131°	0'	19.21"
6	-13°	0'	16.94"	131°	0'	21.38"
7	-13°	0'	14.32"	131°	0'	23.75"
8	-13°	0'	11.85"	131°	0'	25.99"
9	-13°	0'	9.34"	131°	0'	28.22"
10	-13°	0'	6.85"	131°	0'	30.49"
11	-13°	0'	4.85"	131°	0'	32.27"
12	-13°	0'	2.34"	131°	0'	33.58"
13	-12°	59'	59.83"	131°	0'	33.95"
14	-12°	59'	57.87"	131°	0'	33.71"
15	-12°	59'	56.03"	131°	0'	32.96"

3.3 Location description

Rum Jungle is located near Batchelor in the Northern Territory, approximately 105 kilometres, by road, south of Darwin. See Figure 3. Rum Jungle is declared a Restricted Area under the *Soil Conservation and Land Utilisation Act*. The DME, through National Partnership Agreements with the Commonwealth are the project managers for the site.

At a regional scale, Rum Jungle is situated close to two conservation areas. The northern boundary of the 1800 km^2 Litchfield National Park is approximately eight kilometres to the south-west of the site, while the Darwin River Dam catchment is less than two kilometres north of the site (DLPE, 2000 in DME, 2013).

While three proposed water supply dams are also within, or close to, the Coomalie Shire, only the catchment of the proposed Mount Bennett Dam includes Rum Jungle. Located to the south of Rum Jungle is the township of Batchelor which is the main entry point for Litchfield National Park. Batchelor also provides tourist-related services to the 280,000 visitors who visit the park each year (Coomalie Community Government Council, 2012 in DME, 2013).

Rum Jungle comprises approximately 650 hectares of relatively elevated ground, bisected by wet season ephemeral streams that feed into the East Branch of the Finniss River. The East Branch joins the Finniss River, part of the Darwin Coastal bioregion, about eight kilometres downstream of Rum Jungle then flows west for about 60 kilometres before emptying into Fog Bay.

The vegetation within previously rehabilitated areas at Rum Jungle is composed of mostly grass species, with significant weed infestations – predominantly gamba grass – which has restricted native vegetation re-colonisation, leading to erosion and degradation of the existing covers on the waste rock dumps.

The Finniss River Land Claim No.39 was lodged by the Northern Land Council on behalf of claimants on 20 July 1979, under section 50(1)(a) of the *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA). Rum Jungle formed part of the area subject to the claim. An inquiry into the claim was conducted by the Aboriginal Land Commissioner, who recommended that the majority of land subject to the claim, including Rum Jungle, be granted to Aboriginal Land Trusts established under ALRA. Kungarakan and Warai people were found to be the traditional Aboriginal owners of Rum Jungle and other areas subject to claim. The majority of the land recommended for grant was vested in two Aboriginal Land Trusts. No decision on the potential grant of Rum Jungle has yet been made, pending the outcome of negotiations between the Commonwealth Government, the Northern Land Council and Kungarakan and Warai people about the future of the site, including rehabilitation.

The Mount Burton mine site is located approximately four kilometres west of the main Rum Jungle site, on the north flank of a low ridge. An open pit was mined to a depth of

35 metres between October and November 1958. The Mount Burton Mine produced 6000 tonnes of uranium–copper ore, including 2400 tonnes of bogum (below ore grade uranium material) and 1400 tonnes of copper ore. Approximately 100,000m3 of overburden were placed in a waste rock dump located immediately east of the open pit (Figure 4), this currently occupies an area of 2.2 Ha. The pit was allowed to flood after mining ceased in 1958. The Finniss River is 200 metres west of the open pit. Overflow from the pit flows into Mount Burton Spring Creek to the north of the pit, which then flows into the Finniss River. After mining ceased, the land that Mount Burton mine is situated on was converted to private freehold in 1965 and remains occupied by the same family today. There has been no post-mining remediation of the site.

The Mount Fitch site is approximately 3.5 kilometres northwest of Mount Burton mine on a low rise east of the Finniss River. In 1966, exploration drilling was carried out to a depth of 130 metres and a small open pit was excavated for process evaluation. However, the ore was not recovered and was left in the pit (Davy, 1975). A small overburden heap, covering 0.7 Ha is located directly south of the pit (see Figure 5). The pit itself was allowed to fill with water following completion of activities in 1969. Presently, the land on which Mount Fitch is situated is held by the Northern Territory as a form of Crown Lease. There has been no post-mining remediation of this site.

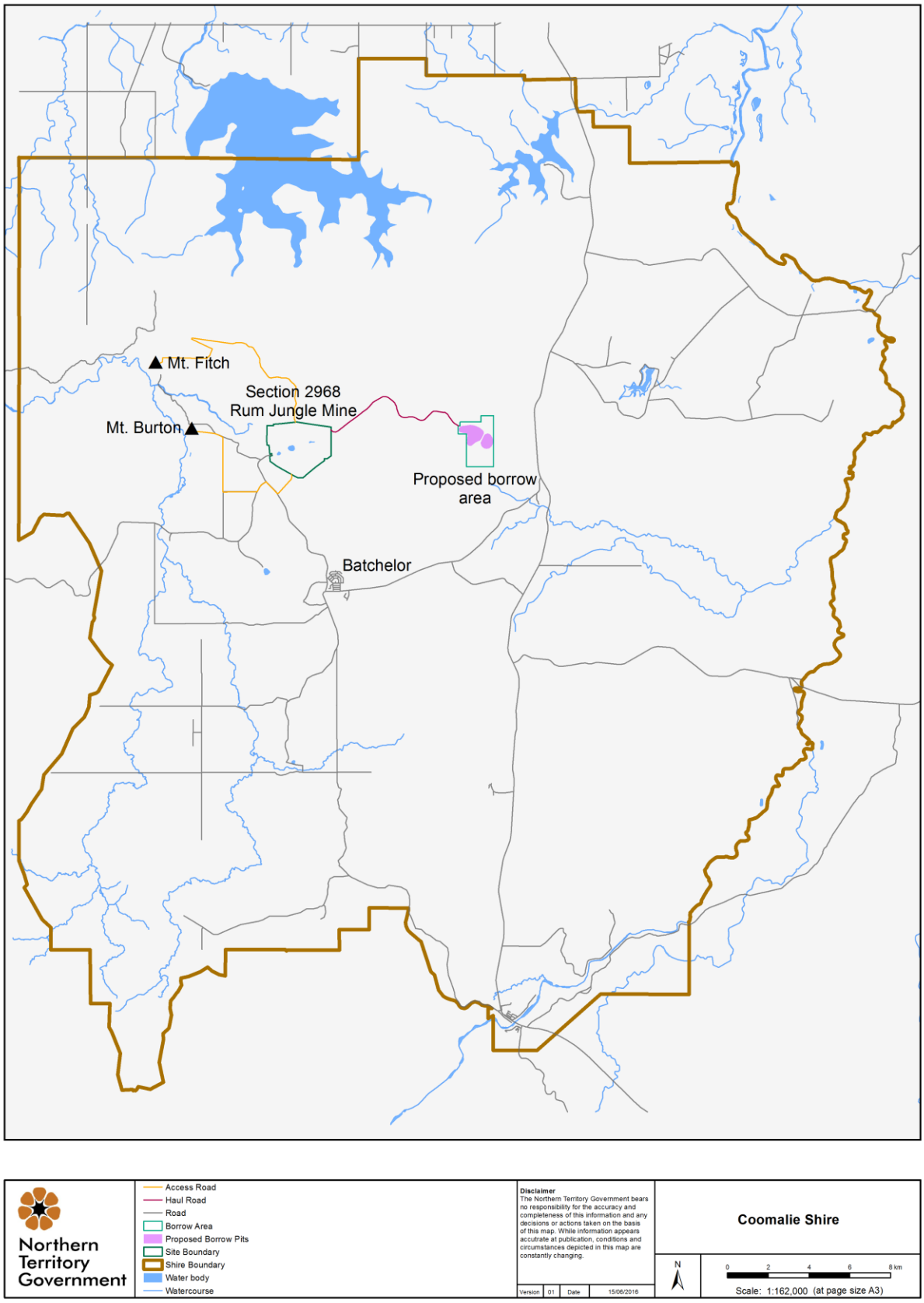

Figure 1 Project area and location within the NT

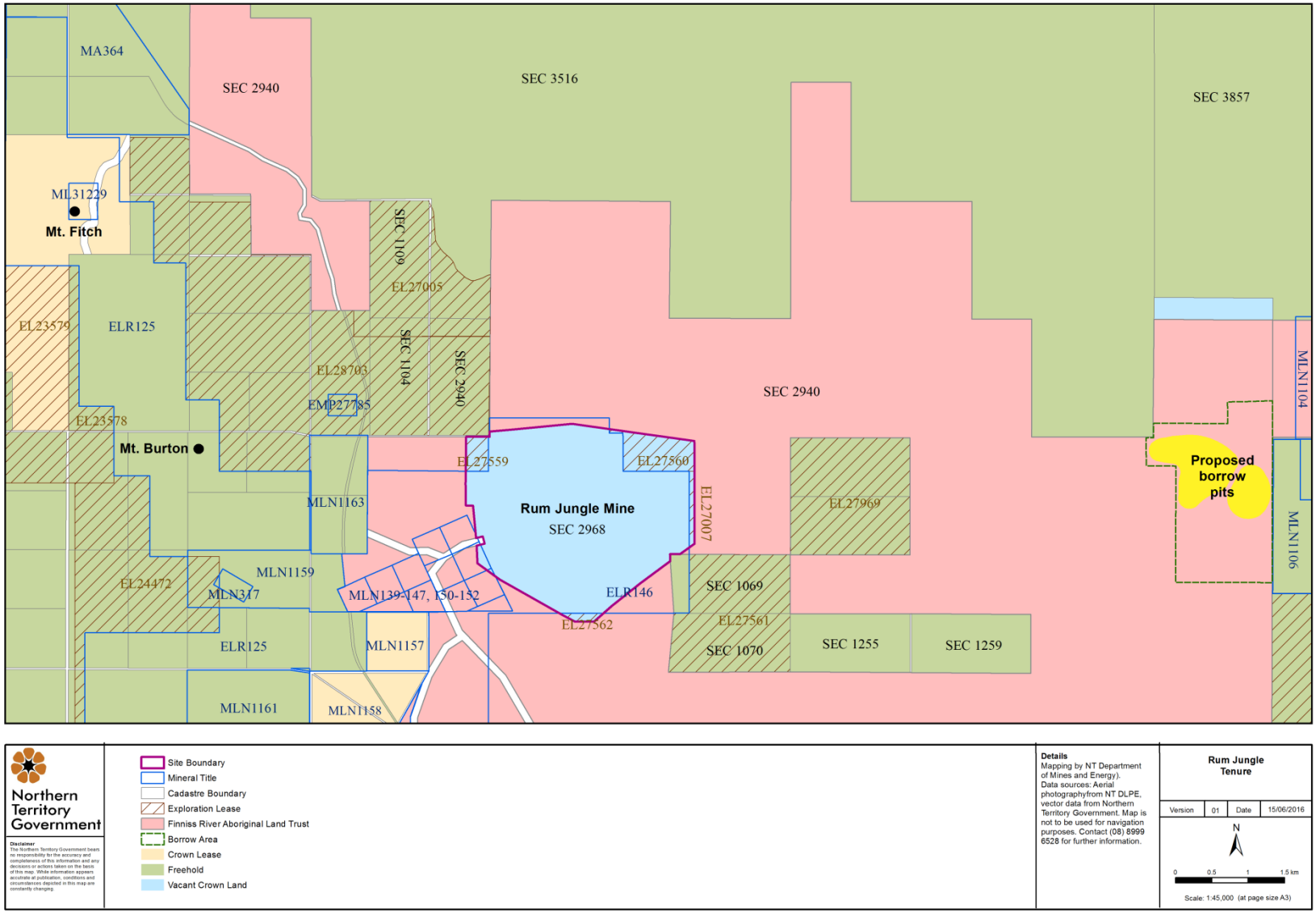

Figure 2 Tenure map and surrounds

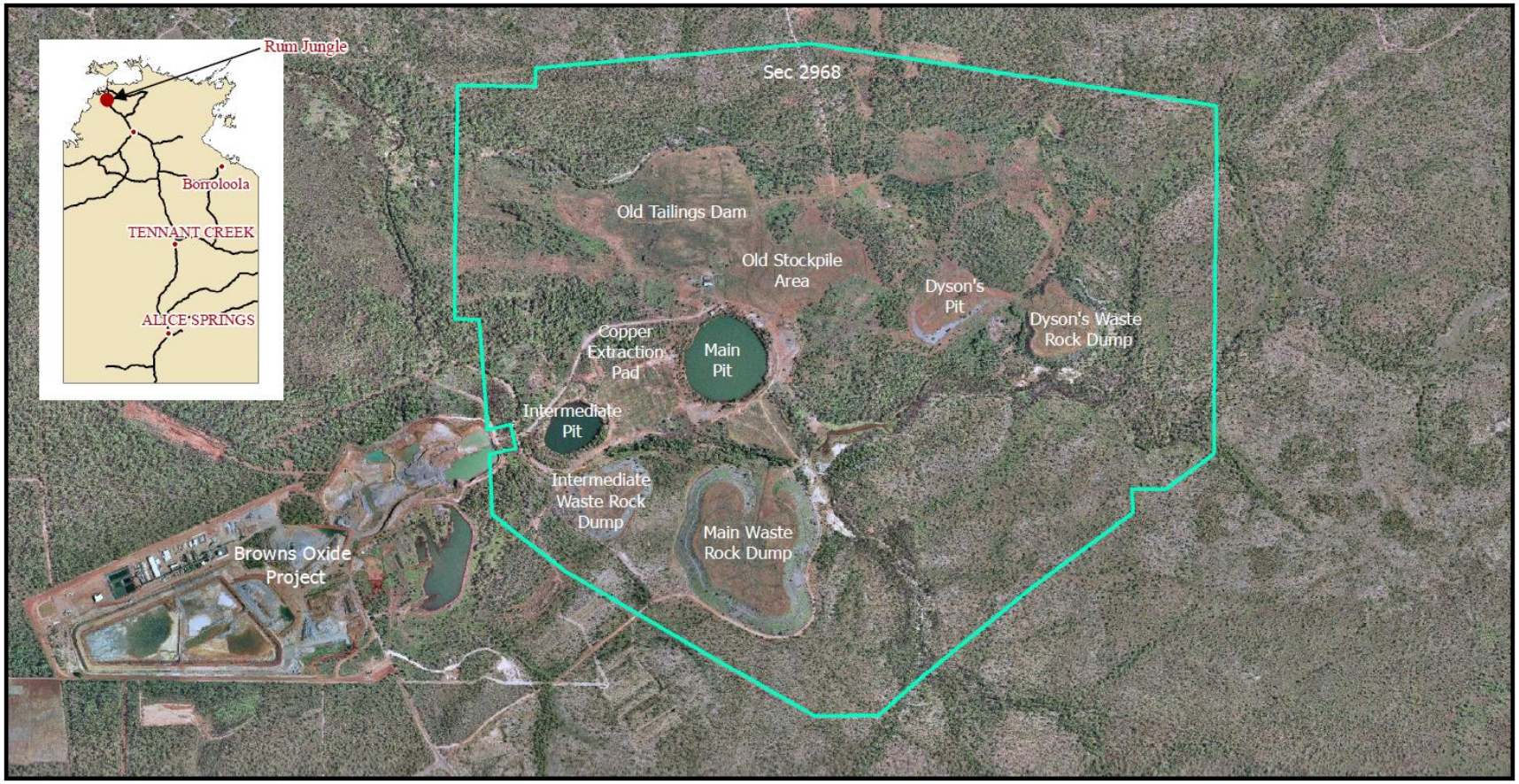

Figure 3 Current site layout Rum Jungle

Figure 4 – Mount Burton

Northern Territory Government

Mt. Fitch Site

Details
Mapping by NT Department of Mines and Energy, Rum Jungle Rehabilitation Project.
Data sources: Aerial photographyfrom NT DLPE, vector data from Northern Territory Government. Map is not to be used for navigation purposes. Contact (08) 8999 6498 for further information.

Version	01	Date	8/07/2015

0 20 40 60 80 m

Scale: 1:2,219 (at page size A3)

Figure 5 - Mount Fitch

3.4 Local government area

Rum Jungle, Mount Burton, Mount Fitch and the Finniss River Lands Trust Borrow Area are all located within the Coomalie Shire, an area governed by the Coomalie Community Government Council. Error! Reference source not found. shows the local government rea.

3.5 Sensitive areas - heritage values of places

The existence of this former mine within sensitive Warai and Kungarakan areas and is a significant source of distress for the traditional Aboriginal land owners. Sacred sites and sites considered culturally sensitive by the Kungarakan and Warai are detailed in the Aboriginal Areas Protection Authority (AAPA) certificate (**Attachment A**). These sites are well understood and addressed during site inductions.

Two of the sacred sites identified in the AAPA certificate are currently impacted by previous mining activities and rehabilitation works are proposed for these sites in order to clean up the impact. The rehabilitation works proposed for the sacred sites are seen as desirable by the traditional Aboriginal land owners.

The first sacred site is the Main pit, where the original East Branch once flowed. The proposed rehabilitation will involve dewatering, backfilling and covering the Main pit, and re-instating the East Branch through the cover system. The second sacred site is a large site located in the south-east corner at Rum Jungle. The site includes part of Fitch Creek which has been heavily impacted by seepage from the Main WRD, salts are expressed in the creek each dry season when the creek ceases to flow. The clean-up of these salts is proposed as part of the rehabilitation.

Mitigation measures will be put in place to ensure no unnecessary disturbance will occur at these sacred sites, all works will be focused on re-instating the areas as close to their original state as possible. The rehabilitation of the sacred sites will aid the healing of the area for the traditional Aboriginal land owners.

Eighteen heritage features, six aboriginal archaeological sites and eleven isolated artefacts were found at Rum Jungle during the heritage survey undertaken in 2011 (Earthsea, 2011). The 18 heritage features come from three different site occupation eras; the World War II era, the period of the mine's operation and post mine operation. See Attachment F for further information. The proposed rehabilitation will impact the historic mining infrastructure that remains at Rum Jungle, this includes the sheds, concrete slabs, water tank, drill rig etc. Remaining heritage features, aboriginal archaeological sites or artefacts and isolated artefacts will be avoided where possible, or appropriately removed and stored during rehabilitation.

The removal of some heritage features is unlikely to affect the significance or value that Rum Jungle holds for the traditional Aboriginal land owners.

3.6 Sensitive environmental values

Rum Jungle and site access

According to the EPBC Act Matters of National Environmental Significance search tool 15 listed threatened species potentially occur at Rum Jungle, these species are shown in Table 8, Attachment B and Attachment C. The search included a buffer of 1km around Rum Jungle. No listed threatened ecological communities were identified as potentially occurring at Rum Jungle or within the 1km buffer. The search of the NT Flora and Fauna Atlas databases revealed records of a further five listed species, the Pale Field-Rat, the plant *Cycas armstrongii* and three species of goanna; the Floodplain Monitor and Mertens and Mitchells Water Monitors. See Table 9.

The likelihood of the 15 listed threatened species actually occurring at Rum Jungle was determined by Eco Logical (2014) (Attachment D), when only 11 threatened species were identified. This assessment was based on ecological characteristics of the species as determined from threatened species information sheets, field guides, and other published information. The results of the likelihood assessment are provided below in Table 8 and Figure 6. As the Rum Jungle area is not considered key habitat for the survival of populations of any of these species the plan outlines general measure to mitigate impacts on their habitat as opposed to specific measures for each species.

FRLT Borrow Area and Haul Road

The EPBC Protected Matters Search revealed 10 birds, 13 terrestrial mammals, three terrestrial reptiles and seven plants species. An assessment of likelihood was made for each of these species based upon their ecology and known distribution and population trends (Table 8). This assessment considered the Partridge Pigeon and Black-footed Tree-rat as likely to occur in the project area.

An additional nine species were considered to possibly occur in the region. The birds, Red Goshawk, Gouldian Finch, Masked Owl, mammals Fawn Antechinus, Northern Brush Tailed Phascogale and Bare-rumped Sheathtail Bat and the plants Acacia praetermissa, Atalaya brevilata, Helicteres macrothrix as possibly occurring in the area.

The likelihood of the thirty-three listed threatened species actually occurring at the FRLT Borrow Area and along the haul road was determined by EcOz Environmental Consultants (2016), see Attachment E. This assessment was based on:

- An EPBC Protect Matters Search of the Pine Creek bioregion (accessed on 27/5/2016). The project area lies in the Pine Creek Bioregion which covers an area of 28 520 km2. Land types are mainly hilly to rugged ridges with undulating plains. Vegetation communities include eucalypt woodlands, with patches of monsoon forests. A search on the entire bioregion was used as it provides a comprehensive list of matters protected under the EPBC.

- A search of the NT Flora and Fauna Atlas Databases for all listed (EPBC and TPWC) threatened species recorded within 10 km of the project area.
- Consideration of literature on the distribution and habitat of threatened species identified in the database searches to assess the likelihood of these species occurring in the project area.
- An examination of aerial imagery of the project area with vegetation communities delineated at a 1:10,000 scale.
- A ground-truthing of vegetation communities and consideration of threatened species habitat was undertaken by a qualified ecologist and botanist between 17 and 18 May 2016. This involved:
- visiting all of the vegetation communities identified from aerial photography, describing the vegetation and making an assessment of habitat quality considering the threatened species that are known or likely to occur in the area
- active searching for threatened flora species in appropriate habitat in the project area.
- An assessment was then made of the likely impact upon threatened species from the proposed clearing for borrow and the haul road.

Mt Fitch

According to the EPBC Act Matters of National Environmental Significance search tool fifteen listed threatened species potentially occur at Mt Fitch, these species are shown in Table 8 and Attachment F. The search included a buffer of 1km around the proposed work area at Mt Fitch. No listed threatened ecological communities were identified as potentially occurring at Mt Fitch or within the 1km buffer.

Mt Burton

According to the EPBC Act Matters of National Environmental Significance search tool sixteen listed threatened species potentially occur at Mt Burton, these species are shown in Table 8 and Attachment G. The search included a buffer of 1km around the proposed work area at Mt Burton. No listed threatened ecological communities were identified as potentially occurring at Mt Burton or within the 1km buffer.

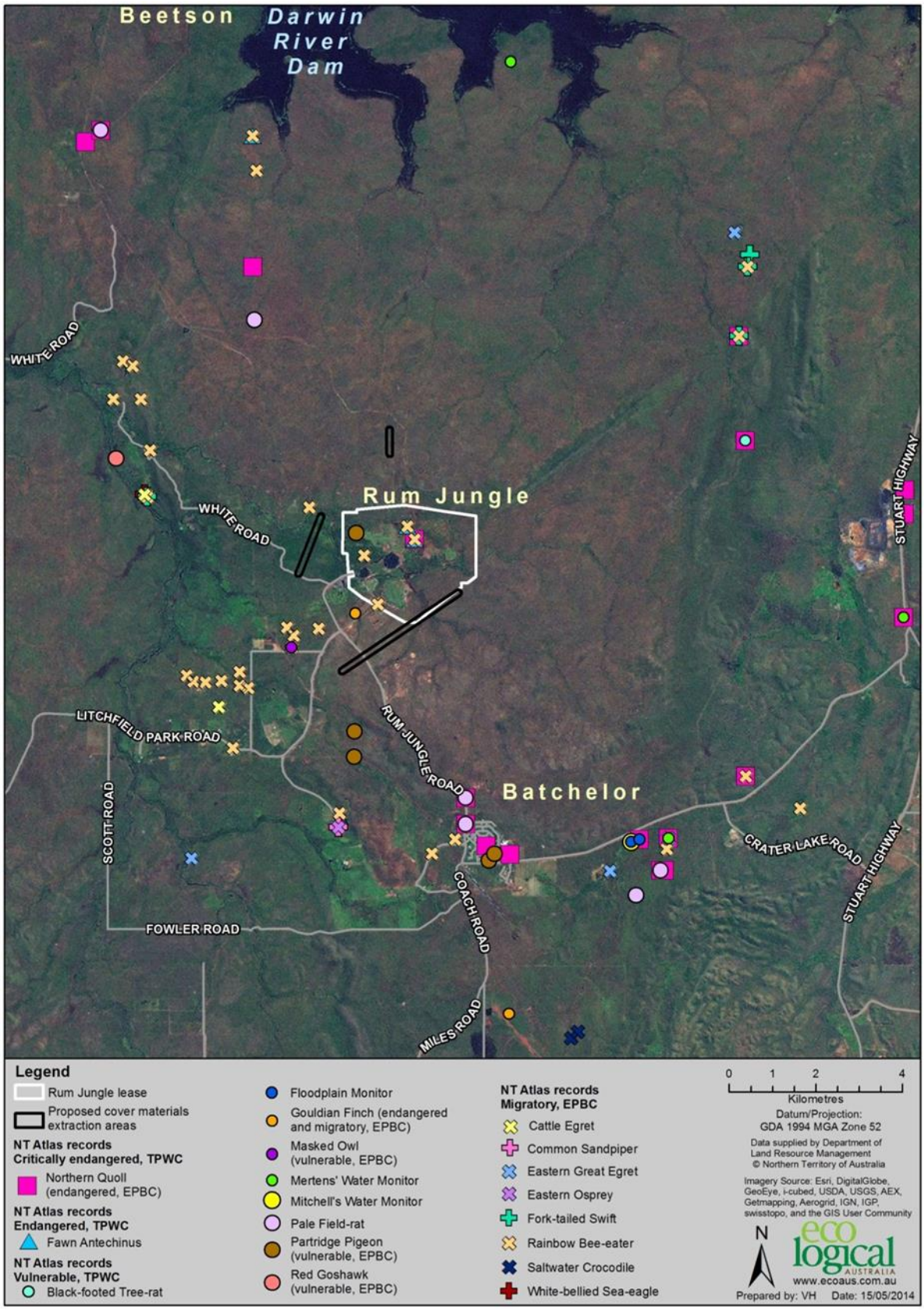

Figure 6 Listed threatened and migratory species records within 10 km of Rum Jungle covering the areas of Mt Burton, Mt Fitch, Haul Road and Borrow Area. (Eco Logical Australia 2014)

Table 8 Likelihood Analyses for EPBC Listed Threatened Species within the Rum Jungle project area.

Common Name	EPBC Status	EPBC Protected Matters Results#	Likelihood of Occurrence*				Reasoning
			1. Rum Jungle Mine**	2. Borrow Pit and Haul Roads	3. Mt Burton	4. Mt Fitch	
Birds							
Red Goshawk *Erythrotriorchis radiatus*	Vulnerable	Species or species habitat known to occur within area	May	May	May	May	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016, EcOz, 2016). Most recent records are from the adjacent Browns Oxide Site (Tidemann 2002; EMS 2005).
Gouldian Finch *Erythrura gouldiae*	Endangered	Species or species habitat known to occur within area	Unlikely	May	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016; EcOz, 2016).
Partridge Pigeon (eastern) *Geophaps smithii smithii*	Vulnerable	Species or species habitat known to occur within area	Known	May	Unlikely	Unlikely	Records of this species were obtained during the recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016) and adjacent Browns Oxide surveys (Tidemann 2002; EMS 2005).
Australian Painted Snipe *Rostratula australis*	Endangered	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). No suitable habitat (EcOz, 2016).
Masked Owl (northern) *Tyto novaehollandiae kimberli*	Vulnerable	Species or species habitat Known to occur within area	Unlikely	May	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016).
White-throated Grasswren *Amytornis woodwardi*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable habitat (EcOz, 2016)

Yellow Chat (Alligator River) *Epthianura crocea tunneyi*	Endangered	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable habitat (Ecoz, 2016)
Northern Shrike-tit *Falcunculus frontatus whitei*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No records in the Coomalie region (EcOz, 2016)
Mammals							
Fawn Antechinus *Antechinus bellus*	Vulnerable	Species or species habitat known to occur within area	May	May	May	May	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). Most recent records are from the adjacent Browns Oxide Site (EMS 2005).
Brush-tailed Rabbit-rat, Brush-tailed Tree-rat *Conilurus penicillatus*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). Outside current known range (EcOz, 2016).
Northern Quoll *Dasyurus hallucatus*	Endangered	Species or species habitat known to occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). Most recent records are from the adjacent Browns Oxide Site (EMS 2005). Broad-scale declines of this species have been documented across the entire top end (Brathwaite & Griffiths 1994), especially in conjunction with the introduction of the Cane Toad (*Rhinella marinus*) (Woinarski et al. 2010). Presumed regionally extinct (EcOz, 2016).
Arnhem Leaf-nosed Bat *Hipposideros (diadema) inornata*	Endangered	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable roosting habitat (EcOz, 2016).

Ghost bat *Macroderma gigas*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016).
Black-footed Tree-rat *Mesembriomys gouldii gouldii*	Endangered	Species or species habitat known to occur within area	May	May	May	May	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). Most recent records are from the adjacent Browns Oxide Site (EMS 2005). Evidence sited during recent fauna survey (EcOz, 2016).
Golden-backed Tree-rat *Mesembriomys macrurus*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	Presumed regionally extinct (EcOz, 2016).
Northern Hopping-Mouse *Notomys aquilo*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	Outside known range (EcOz, 2016).
Narbalek (Top End) *Petrogale concinna canescens*	Endangered	Species or species habitat likely to occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). No suitable habitat (EcOz, 2016).
Northern Brush-tailed Phascogale *Phascogale pirata*	Vulnerable	Species or species habitat likely to occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). Most recent records are from the adjacent Browns Oxide Site (EMS 2005).
Bare-rumped Sheathtail Bat *Saccolaimus saccolaimus nudicluniatus*	Critically Endangered	Species or species habitat likely to occur within area	Unlikely	May	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016).

Water Mouse (False Water-rat) *Xeromys myoides*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable habitat (EcOz, 2016).
Arnhem Rock-rat	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable habitat (EcOz, 2016).
Reptiles							
Plains Death Adder, *Acanthophis hawkei*	Vulnerable	Species or species habitat known to occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Ecological 2014; EcOz 2015; DME 2016). No suitable habitat (EcOz, 2016).
Arnhem land Skink, *Bellatorias obiri*	Endangered	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable habitat (EcOz, 2016).
Gulf snapping turtle, *Elseya lavarackorum*	Endangered	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable habitat (EcOz, 2016).
Yellow snouted gecko, *Lucasium occultum*	Endangered	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	Outside known range (EcOz, 2016).
Fish							

Freshwater Sawfish, *Pristis pristis*	Vulnerable	Species or species habitat likely to occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Hydrobiology 2014; 2015).
Plants							
Helicteres macrothrix (also known as Helicteres sp. Glenluckie Creek)	Endangered	Species or species habitat known to occur within area	Unlikely	May	Unlikely	Unlikely	No evidence of this species found during recent fauna surveys (Hydrobiology 2013; Ecological 2014).
Acacia praetermissa	Vulnerable	Species or species habitat may occur within area	Unlikely	May	Unlikely	Unlikely	No evidence found during recent Flora report (EcoLogical, 2014; EcOz, 2016))
Atalaya brevialata	Critically Endangered	Species or species habitat may occur within area	Unlikely	May	Unlikely	Unlikely	No evidence found during recent Flora report (EcoLogical, 2014; EcOz, 2016))
Eleocharis retroflexa	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No evidence found during recent Flora report (EcoLogical, 2014; EcOz, 2016))
Goodenia quadrifida	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	No suitable habitat (EcOz, 2016).
Brennan's native Hibiscus, *Hibiscus brennanii*	Vulnerable	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	Outside known range (EcOz, 2016).

Trigger plant, *Stylidium ensatum*	Endangered	Species or species habitat may occur within area	Unlikely	Unlikely	Unlikely	Unlikely	Outside known range (EcOz, 2016).

According to the EPBC Act Matters of National Environmental Significance search tool.
*Likelihood of occurrence within Rum Jungle. Definitions: 'Known' = the species has been recorded within the lease within recent fauna surveys. 'May' = the species has been recorded historically, or good habitat exists for the species. 'Unlikely' = a very low to low probability that a species uses the lease. The species may or may not occur locally or regionally, however based on the known habitat requirements of the species, and habitat available within the site, the site is considered unlikely to be suitable or marginal at best. Based on the known habitat requirements of the species, the lease lacks the required habitat.
**Includes general site access.

Table 9 TPWC species

Threatened Species	TPWC Status	Habitat & Distribution	Main Threat	Likelihood of presence Rum Jungle mine site	Likelihood of Presence Mt Burton/ Mt Fitch	Likelihood of presence borrow pit/haul road
Rattus tunneyi **Pale Field-rat**	VU	**Habitat:** Historically occurred in a wide range of habitats, but is now primarily in tropical grassland (Aplin *et al.* 2008). **Distribution:** Kimberley, Western Australia, coastal Northern Territory, coastal Queensland and northern New South Wales (Aplin *et al.* 2008).	The exact factor is unknown but it presumed to be the loss of its preferred creek line habitats to degradation by introduced mammals (Aplin *et al.* 2008).	Possible	Possible	Possible
Cycas armstrongii **Cycad**	VU	**Habitat:** This species occurs in open grassy woodland where adequate drainage appears to be a limiting factor (Kerrigan *et al.* 2006) **Distribution:** Endemic to the Top End of the Northern Territory with populations on the Tiwi Islands and Cobourg Peninsula (Kerrigan *et al.* 2006)	The main threat associated with this species is land clearing for urban Darwin development. Additionally a changed fire regime also appears to be of concern (Kerrigan *et al.* 2006).	Known	Known	Known
Merten's Water Monitor *Varanus mertensi*	VU	**Habitat:** Edges of watercourses and lagoons – seldom seen far from water but may explore during the wet season in search of new watercourses (Christian 2004). **Distribution:** This species is found across	This species experiences significant declines due to cane toad poisoning (Griffiths & McKay 2005; Doody *et al.* 2009).	Known	Known	Unlikely No suitable habitat

		northern Australia from Cape York Peninsula to the Kimberley (Christian 2004).				
Mitchell's Water Monitor *Varanus mitchelli*	VU	**Habitat:** In mostly freshwater riparian areas, it has also been found on the edges of mangroves (Schultz & Doody 2004). **Distribution:** This species occurs in the Top End and Kimberley regions (Schultz & Doody 2004).	This species experiences significant declines due to cane toad poisoning (Doody *et al.* 2009.)	Possible	Known	Unlikely No suitable habitat

Further information on the monitors can be found in EcOz 2014 – Attachment H.

4. Project Description

Rum Jungle is a highly disturbed landscape, not only from past mining activities but also from the rehabilitation process in the 1980's when substantial borrow pits were created in order to create covers on the waste rock dumps and backfilled pit.

The proposed action (rehabilitation of Rum Jungle) aims to address the long-term environmental legacy issues at Rum Jungle and the satellite sites of Mount Fitch and Mount Burton caused by the generation of AMD. The proposed rehabilitation action addresses the rehabilitation objectives which were developed in consultation with stakeholders during the National Partnership Agreement (2009-2013).

4.1 National Partnership Agreement

As part of the 2009-10 budget, the Commonwealth Government committed over $7 million over a four-year period for the environmental management of Rum Jungle (Commonwealth Government, 2009). In order to manage this commitment, the Northern Territory and Commonwealth Governments entered into a four-year National Partnership Agreement (NPA) on the management of the former Rum Jungle mine site. The objectives of the NPA were to improve site maintenance and environmental monitoring activities, and to develop an improved rehabilitation strategy for the site consistent with the views and interests of stakeholders, particularly the joint traditional Aboriginal owners of the site – Kungarakan and Warai. The NPA has been driven by the Northern Territory Department of Mines and Energy (DME), with technical oversight from the Rum Jungle Working Group, comprised of Northern Territory and Commonwealth Government agencies and the Northern Land Council.

The NPA was completed on schedule and on budget on 30 June 2013 including the submission of the Conceptual Rehabilitation Plan which was endorsed by the sites traditional Aboriginal owners and accepted by the former Commonwealth Minister for Resources Energy and Tourism and Commonwealth Cabinet.

4.2 Project Agreement

In August 2013 a new Project Agreement was signed between the Commonwealth and Northern Territory Government for Stage 2 of the project. The activities under this new agreement include:

- preparation of a detailed engineering design, drawings and costs (including supporting investigations);
- scheduling arrangements (project management);
- stakeholder engagement; and
- ongoing site monitoring and maintenance.

These tasks are necessary to allow for costing the preferred rehabilitation strategy to a satisfactory level of accuracy to secure capital works funding, and for all regulatory and preparatory work to be completed for implementation in Stage 3. Stage 2 is due to be completed by 30 June 2016.

4.3 Environmental approvals – the NOI and EPBC referral

The submission of this Notice of Intent (NOI) fulfils the requirement of relevant environmental approvals for the Stage 3 implementation works for this project. A separate EPBC Referral document has been prepared and submitted (June 2016). Refer Section 5.

4.4 Preferred Rehabilitation Strategy

The **rehabilitation objectives** aim to create a landscape that:

- Is safe for people and wildlife
- Is chemically, radiologically and physically stable
- Has a significantly reduced contaminant load (associated with AMD) travelling beyond the boundaries of the site
- Supports sustainable land uses by traditional Aboriginal owners of the area with few, if any, limitations
- Encourages beneficial alternative post-rehabilitation land uses.

The Kungarakan and Warai are recognised as joint traditional owners of the Rum Jungle site. Their objectives for rehabilitation and post-rehabilitation land use are summed up in their vision for the site. As they do not differentiate between environment and culture, their vision is largely drawn from their cultural and social principles:

> *Kungarakan and Warai desire that Rum Jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources. In modern society, this may include development of commercial operations that are managed according to Kungarakan and Warai traditional principles.*

The post-mining landform must be returned as close as possible to the landform that existed before mining, with no detrimental impacts on the downstream environment or on the neighbours of Kungarakan and Warai who live downstream.

To Kungarakan and Warai, rehabilitation of the physical landscape will allow spiritual healing of the country. The following outcomes are required for their vision and for the healing process to be achieved:

- culturally appropriate preservation of Aboriginal cultural heritage
- re-establishment of the original landform as far as achieving the best outcomes allows

- removing or neutralising pollution sources
- removing any risk of radiological hazard
- remediating polluted groundwater
- stopping surface water from being polluted
- restoring flora and fauna species endemic to the site and its immediate surrounds
- maximising employment and business opportunities throughout the rehabilitation process.

The rehabilitation is focussed on relocating the most-reactive (AMD forming) waste to the Main pit void, with residual waste (less reactive) being relocated to a new purpose built Waste Rock Dump (WRD) to the north. Approximately thirty percent of the total volume of waste material currently stored on site will be used to refill Main pit, significantly reducing the current above ground waste at Rum Jungle. The northern location was primarily selected for the above-ground WRD as it is positioned away from sacred sites and is not significantly affected by flood. Leading practice cover and landform designs will be developed for the WRD to prevent AMD and all previously disturbed areas will be revegetated with native species.

The DME has developed completion criteria for the proposed works – refer **Attachment I.**

Figure 7 shows the proposed new site layout following rehabilitation.

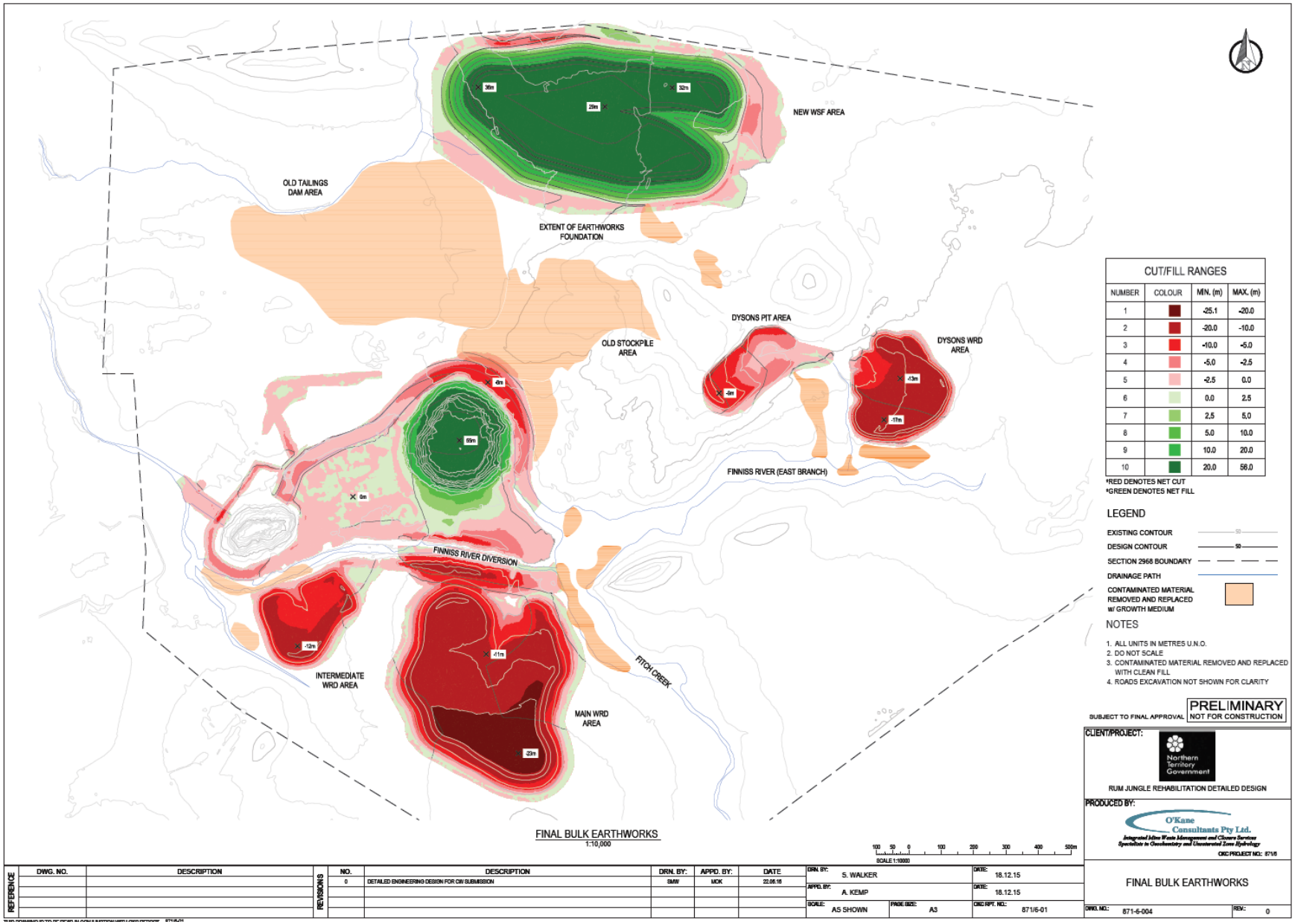

Figure 7 Predicted Rum Jungle site features after implementation of the preferred rehabilitation strategy (DME, 2013)

In summary, the rehabilitation works will involve:

- Dewatering of Main pit during the Wet Season. Surface and groundwater flows and quality will be monitored closely during dewatering. It is anticipated that contaminated water will be encountered at depth and this water will be treated through a water treatment system and released during the wet season when the river is flowing to provide maximum dilution.
- Dredging of historic tailings currently located at the base of Main pit. Tailings will be filter pressed, temporarily (short-term) stockpiled and consolidated to a new purpose built WRD in the northern location on site.
- Waste material from Dyson's backfilled Pit (to grade), Intermediate WRD and a portion of Main WRD (most reactive waste) will be relocated to Main pit following de-watering and dredging of tailings.
- Residual waste from Main WRD, Dysons WRD and contaminated soils (including from fluvial areas) will be consolidated to the new WSF.
- All waste will be mixed with lime prior to being relocated to either Main pit or the new WSF.
- Leading practice cover and landforms designs will be utilised in the construction of covers over the Main pit, Dysons pit and new WRD. This will comprise of clays, soils and growth mediums and be revegetated with locally collected native tree species. The design of the Main pit cover will include the reinstatement of East Branch of the Finniss River to as far as practicable, its pre-mining course.
- A seepage collection system will be constructed to collect any seepage encountered beneath the new WSF. This seepage will be directed to Intermediate pit to be passively treated.
- Borrow pits will be excavated to extract necessary material for the cover construction. Borrow pits has been carefully selected and a Fauna and Flora assessment of the area has been carried out (See Attachment E, Borrow pit and haul road investigation).
- The Mount Burton WRD will be excavated and transported to Rum Jungle for long-term disposal in the WSF at Rum Jungle.
- The small overburden heap at Mount Fitch, located directly south of the pit and some surface disturbance is evident to the west, will be relocated into the Mount Fitch Pit.

- Landform design and revegetation will be undertaken on disturbed areas following rehabilitation works, including WRD footprint areas, old tailing dam area, old borrow pits, haul roads etc.
- Weed and fire management programs will be implemented to assist in the successful establishment of native vegetation (see Attachment J for Weed Management Plan).
- Intermediate pit will remain as a water-filled void for use as a passive water treatment system. Intermediate pit will act as a flow through system, similar to the current site configuration, to provide annual flushing of the pit during the Wet Season in order to meet water quality targets.
- Important cultural aspects of the landscape will continue to be taken into account and wherever possible, actions to protect or reinstate them will be incorporated into the final design.
- Access tracks will be upgraded to ensure the rehabilitation works are implemented in a safe and timely manner, this includes construction of haul roads and a bridge to provide all weather access during construction.

Volumes of material which will be relocated to Main are summarised in Table 10.

Table 10 Total Main Pit waste backfill components (O'Kanes, 2016; Detailed Design Report)

Source of Waste to Main Pit	Volume (m^3)
Main WRD	1,324,180
Intermediate WRD	781,150
Dysons Pit Backfill	511,500
Dysons WRD (Coarse)	150,000
Lime Addition	29,540
Main Pit Ramp	20,570
Total to RL 58.5	**2,816,940**

The WSF will be located in the northern location (refer to Figure 7). The WSF has been specifically designed to provide a long-term containment of all materials types with the exception of material classed as PAF I waste, which will be relocated to Main pit. Waste allocated to the WSF includes dewatered tailings from Main Pit, waste from Main, Main North and Dysons WRD, waste from Mount Burton, and contaminated soils from the copper extraction area, Old Tailings Dam area, Old

Stockpile area, material from fluvial areas and from miscellaneous salt-affected soils across site (Table 11).

Table 11 Total Waste to New WSF.

Source of Waste to New WSF	**Volume (m^3)**
Main WRD	3,328,090
Main North WRD	151,800
Dysons WRD	1,112,985
Copper Extraction Area	144,000
Old Tailings Area	264,000
Finniss River new excavation	226,600
Pit Levees	144,500
Dried Tailings	574,934
Mt Burton	169,400
Old Stockpile Area	396,000
Drill Rig Site	34,200
Eastern Valley	13,000
Salt affected soils - Dysons	58,500
Salt affected soils - Finniss	65,250
Salt affected soils - West	13,000
Lime addition	15,906
Total	**6,712,165**

The predicted site layout after the implementation of the preferred rehabilitation strategy is shown in Figure 7. Alternatives considered prior to arriving at this preferred rehabilitation strategy are explained below.

4.5 Alternatives to preferred scenario

The **do nothing scenario**, while discussed in the context of rehabilitation planning, was not included in the rehabilitation scenarios for consideration during the technical expert and stakeholder options ranking process. This is because it does not address the environmental, Commonwealth Government and traditional Aboriginal owner objectives, nor standards for radiological and environmental protection which are relevant to a former mine site. Rum Jungle in its current condition, if left un-rehabilitated, will continue to generate pollution and limit land use/access and provide a source of conflict with traditional Aboriginal owners. The onsite pollution and resulting environmental impacts downstream of Rum Jungle will worsen over time as soil covers further degrade and weathering processes accelerate the rate of acid and metalliferous drainage from waste rock and tailings. Other areas of in situ contamination which were not rehabilitated in the 1980's will continue to interact with, and contaminate, surface and groundwater. There is no evidence to demonstrate that this contamination will be naturally attenuated or exhausted in the short or long term, so mitigation measures are essential if environmental impacts are to be addressed.

If sites are left un-rehabilitated they will inevitably lead to increasing liability over time. As a developed nation, within the Asia-Pacific region there are additional reputational risks for Australia if no action were to be taken. Through the Department of Foreign Affairs and Trade (DFAT) (formerly AusAID) Australia promotes leading practice mining methods to developing countries via its Leading Practice Sustainable Development in Mining series, so effective rehabilitation and closure of Rum Jungle provides an ideal opportunity for the Commonwealth Government to demonstrate the application of this leading practice knowledge. Implementation and communication of this case study will further elevate the reputation of the Commonwealth Government in the region.

Five potential **rehabilitation scenarios** were developed and assessed to evaluate how each scenario addressed the rehabilitation objectives. As stated previously, these objectives were developed through consultation with stakeholders, including the two traditional Aboriginal owner groups.

The five scenarios evaluated included;

Scenario 1—Re-cover waste rock dumps in situ

This scenario focused on constructing new cover systems over the existing waste landforms and did not involve any major relocation of waste materials. It also included clean-up of contaminated land.

Scenario 2—Backfill Intermediate and Main pits then consolidate remaining waste rock into the Main waste rock dump

This scenario involved backfilling the Main and Intermediate pits and consolidating and re-covering all residual waste rock into the Main waste rock dump. This would substantially reduce the amount of waste rock stored at the surface.

Scenario 3—Backfill the Intermediate and Main pits and consolidate remaining waste rock into Dysons waste rock dump

This scenario involved backfilling the Main and Intermediate pits and consolidating all remaining waste rock into Dysons waste rock dump and constructing a cover system over the waste rock dump. This approach is similar to Scenario 2; however, in Scenario 3, waste material from the Main waste rock dump is moved and consolidated into the Dysons waste rock dump, which moves the waste away from its close proximity to drainage, however it creates a larger landform to be covered, rehabilitated and managed and is close to culturally sensitive sites.

Scenario 4—Backfill Main and Intermediate pits and consolidate the remaining waste rock to a new facility in the former tailings dam area

The preferred rehabilitation strategy is based on a modification of Scenario 4, as outlined in the Conceptual Rehabilitation Plan, 2013. This involves:

- The construction of a new purpose built WSF in an area sited above selected flood levels, on the northern boundary of the Rum Jungle (see Figure 7), and is comprised of excess waste material which cannot be accommodated in the Main Pit void; this includes excess materials from Dysons, Main and Main North WRDs, and other site contaminated materials;
- Utilise Intermediate Pit as a water detention/dilution reservoir. Main Pit will be dewatered (and backfilled). A refinement of the rehabilitation strategy (from that outlined in the CRP) is to retain Intermediate Pit in its current open state, rather than dewater and backfill. This is to provide strategic flexibility (storage/treatment capacity) utilising Intermediate Pit as a surface water storage reservoir and long term surface water buffer;
- Dewatering Main Pit and if required treating the water to meet applicable discharge requirements;
- Backfilling Main Pit with waste rock considered to have the highest potential to produce Acid and Metalliferous Drainage. The material is to be selectively sourced from Dysons backfilled pit area, Intermediate WRD and Main WRD. Lime will be incorporated into the waste as it is backfilled into the pit;
- Construction of a cover system over the Main and Dysons Pit and the new WSF; and
- Construction of other features for water treatment, potentially including wetlands or reactive barriers.

Scenario 5—Backfill Main Pit and leave the Intermediate pit as a lake.

This scenario involved backfilling the Main pit, leaving Intermediate pit as a lake and consolidating residual waste rock to the Main waste rock dump. More waste material would remain above ground however the Intermediate pit lake would provide some buffering of water quality under this scenario.

These rehabilitation scenarios are documented in detail in the Conceptual Rehabilitation Plan, (DME, 2013).

4.6 Selection of preferred strategy

All rehabilitation scenarios were evaluated using Multiple Accounts Analysis (MAA). MAA is a tool for evaluating different options or alternatives for a project, by weighing the relative benefits and costs (or losses) of a variety of independent factors. MAA is an open and transparent process where stakeholders can provide input to alternatives and evaluate the alternatives in an objective and systematic way. This process enables stakeholders to be engaged in the scoring process as well as consideration and evaluation of multiple perspectives, in addition to cost. Stakeholders including indigenous and other government perspectives through the Rum Jungle Working Group were included in the MAA process. The evaluation process focused on four key categories, or 'accounts':

1. Environmental performance
2. Cultural considerations
3. Technical feasibility; and
4. Financial cost to implement

The key findings for each scenario are summarised below in **Table 12**.

Table 12 Summary of prioritisation process, using MAA, for Rum Jungle

Account	Score or ranking	Alternative Rehabilitation Scenarios					
		0 No Rehabilitation	#1 Re-Cover WRDs & Dyson's Pit	#2 Backfill the pits (re-cover *in situ*)	#3 Backfill the pits (consolidate to Dyson's Area)	#4 Backfill the Main Pit (consolidate to Old Tailings Dam area)	#5 Backfill the Main Open Pit & re-cover *in situ*
Environmental (W=9)	Account Score	3.3	4.3	6.6	4.4	8.0	6.9
Cultural (W = 9)	Account Score	1.3	2.3	4.6	5.0	8.1	3.9
Technical (W = 7)	Account Score	4.3	3.9	5.4	3.3	7.3	5.7
Overall	MAA Score	2.9	3.5	5.5	4.3	7.8	5.5
	Ranking	-	5	3	4	1	2
Total Cost (in millions $AUS)		n/a	$64	$100	$113	$109	$79

Note: Scenarios are scored on a scale of 1 (worst) to 9 (best) for each account and then the scenarios are ranked based on the MAA score
W = account weight used to determine the MAA score

Scenario 4 demonstrated the best performance against environmental, cultural and technical aspects, and therefore received the highest overall MAA score and a ranking of 1. Those scenarios which didn't perform as well received a lower MAA score and ranking.

The current preferred strategy is a product of continual refinement, incorporating the outcomes of further investigations, including flood modelling, geotechnical investigations into the proposed WRD footprint, numerical modelling and engineering design workshops held in February and July 2015 known as Failure Modes and Effects Analysis (refer Attachment K). These workshops were attended by technical experts in a range of fields and focussed on undertaking a detailed risk assessment of implementing the preferred design. Following the completion of these workshops and various technical investigations, the final preferred strategy was selected and endorsed by the traditional owners. Key refinements made to Scenario 4, since the completion of the Conceptual Rehabilitation Plan in 2013, included shifting the proposed Waste Rock Dump to the northern location on site to avoid flood inundation during the Wet Season and dredging of the tailings in Main pit prior to backfilling, following geotechnical uncertainties with consolidation of the historic tailings at the base of the pit.

5. Legislative consent and licensing requirements for approval

This Notice of Intent (NOI) has been prepared as part of the Northern Territory environmental impact assessment process, under the Northern Territory *Environmental Assessment Act*. This document details the potential on and off site environmental impacts of the proposed rehabilitation, as well as the proposed management actions and requirements to prevent, minimise or mitigate these impacts.

A referral under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required and has been lodged because the proposed rehabilitation triggers the following *matters protected* by the EPBC Act:

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Protection of the environment from nuclear actions (sections 21 and 22A)

Approval will also be required from the AAPA (Aboriginal Areas Protection Authority) for implementation of the rehabilitation strategy. A final draft application has been prepared by DME.

6. Site environmental factors

The waters draining from Rum Jungle flow into the East Branch Finniss River which flows into the Finniss River, which is part of the Darwin Coastal bioregion, and subsequently into Fog Bay. Both the Finniss River coastal floodplain and Fog Bay are designated Sites of Conservation Significance due to internationally significant wildlife aggregations, including shorebirds, waterbirds, seabirds, and marine turtles (Harrison et al., 2009). Beneficial Uses of 'aquatic ecosystem protection' and 'recreational water quality and aesthetics' were declared for the waters of Fog Bay under the *Water Act 1992* in March 1998.

Terrestrial flora and fauna surveys conducted by Eco Logical Australia (2014) identified the following information:

- Twenty six vegetation mapping units at Rum Jungle.
- The undisturbed areas of Rum Jungle were found to host a broad variety of native vegetation communities ranging from terrestrial vine forest and woodlands to riparian woodlands and wetlands.
- The majority of the revegetated sites however, had been invaded by or were dominated by Gamba Grass (Andropogon gayanus).
- Field survey recorded 126 terrestrial fauna species on the site, including 20 that had not previously been recorded and two listed as threatened.
- Seven vertebrate pest species recorded from Rum Jungle.
- Four terrestrial fauna species listed as threatened under the Territory Parks and Wildlife Conservation Act (TWPC) or Environment Protection and Biodiversity Conservation Act (EPBC) legislation have been recorded at Rum

Jungle (including two observed during this survey), and four have been assessed as likely to occur.

- An electrofishing survey of Main and Intermediate pits recorded six fish species and one crustacean. None are listed as threatened and no threatened aquatic species are likely to occur within Rum Jungle.

A project completed by Hydrobiology in 2013 (2013a and 2013b – **Attachments L & M**) has identified the relevant **environmental values for the Finniss system**, using the ANZECC/ARMCANZ (2000b) framework. As part of this process, cultural values were discussed with traditional Aboriginal owners. The health of the river, its ability to flow freely, the abundance and well-being of Totem and other culturally and spiritually significant organisms, and traditional foods were identified as particularly important cultural values.

To help assign environmental values and water quality objectives, the Finniss system was divided into nine discrete zones based on geomorphic type, habitat, ecological condition, and extent of disturbance. The condition, environmental values, recovery potential, and, therefore, targets are variable along the river system.

The suite of identified environmental values are:

- aquatic ecosystems
- wildlife habitats
- primary recreation
- secondary recreation
- visual recreation
- cultural and spiritual values
- industrial use
- aquaculture
- drinking water
- irrigation
- stock water
- farm supply

Not all values are relevant to each zone, except aquatic ecosystems and cultural and spiritual values, which are significant for every zone. Water quality objectives were developed for each zone, for each water quality parameter, by selecting the lowest ANZECC/ARMCANZ (2000b) default trigger value identified for any environmental value in that zone. Trigger values were defined for water, sediment, soil quality, radiation parameters, and selected radionuclides. Water quality trigger values for

copper, manganese, and zinc, which are characteristic of the site's metal solute fingerprint.

The aquatic ecosystem survey undertaken by Hydrobiology (2015a – **Attachment N**) found little evidence of an impact from the mine on aquatic biota within the Finniss River (downstream of the East Branch Finniss River), but did record strong evidence that the mine continues to impact the aquatic ecosystem within the East Branch Finniss River itself.

Key findings from the impact assessment include:

- Water quality data showed a clear indication of increased metal concentrations in the isolated pools in the East Branch reaches of the mine site during the dry season, which were then flushed down the system after the first flows of the season. Generally, each river zone was found to have individual exceedances of the WQOs for a number of parameters, against default WQOs, including some tributaries outside the mine. Sediment quality data also showed some exceedances of ANZECC/ARMCANZ (2000) Interim Sediment Quality Guidelines (ISQG) for certain parameters (notably Cu, Ni, Pb, As, Cd and Zn) for certain river zones. Overall, there was a trend of elevated metal concentrations in the mine area that declined downstream. Refer **Attachment O** Impact Assessment (Hydrobiology 2015b).
- There does not appear to have been any relationship between possible mine site drainage and the distribution of terrestrial vertebrates downstream of the mine.
- The riparian fauna and bush tucker survey showed a significant difference in Riparian Condition Index between the Finniss River and the East Branch, for both wet and dry season data, but there was no difference in species richness.
- Analysis of radionuclides in fish, mussel and plant tissues showed that none of the patterns of radionuclide activity concentrations in fish and mussel tissues were consistent with a substantial source from the Rum Jungle mine area.
- No indication of elevated bioaccumulation in specimens in the Finniss River downstream of the East Branch, and also no indication of increased bioaccumulation downstream of the abandoned Mount Burton mine (**Attachment O**).

The findings of the impact assessment (Hydrobiology, 2015b – **Attachment O**) and aquatic ecosystem survey (Hydrobiology, 2015a – **Attachment N**) completed in 2015 enabled Hydrobiology to refine the default WQOs, based on ANZECC/ARMCANZ (2000), to locally-derived water quality objectives (LDWQOs) for post-rehabilitation monitoring.

Rehabilitation activities proposed by the action may result in short-term impacts on the aquatic ecosystem on the mine site and downstream relative to current biodiversity. A construction phase sensitivity analysis was undertaken by Hydrobiology (2015c – **Attachment P**) noting that as the East Branch is intermittent, most recruitment to sites on that tributary is driven by upstream movement or aerial recruitment from the perennial waters of the main Finniss River. Therefore, a temporary reduction in biodiversity during construction at a site due to deterioration of water quality would be rapidly recovered if, as expected, water quality improves when construction stops, and should be able to recover to the targeted levels of biodiversity if the overall LDWQOs are achieved post rehabilitation (Hydrobiology, 2015c).

The sensitivity analysis provides guidance on acceptable increases in the concentration of key parameters impacting the downstream aquatic ecosystem. These concentrations will form LDWQOs for the rehabilitation/action (Table 13).

Table 13 Recommended LDWQOs based on field data and biological responses at key monitoring sites

River Zone	Sites	Recommended WQO (All taxa) Cu µg/L	Zn µg/L	Ni µg/L	Co µg/L	Al µg/L	Fe µg/L	Mn µg/L	EC µS/cm	SO_4 mg/L	Mg mg/L
2	EB@G_Dys	60.2	210.5	130.4	89	236	300	**759**	**2985**	1192	86.6
2	EB@GS200	60.2	210.5	130.4	89	236	300	**795**	**2985**	1192	86.6
3	EB@GS327	27.5	180	43.1	25.9	150	300	**443**	**2985**	997	86.6
3	EB@GS097	27.5	180	43.1	25.9	150	300	**443**	**2985**	997	86.6
4	EBusFR	7.86	180	32.5	3.6	117	300	**228**	**427**	761	33.2
6	FR@GS204	3.4	26.1	20	2.8	117	300	**140**	**190.7**	594	33.2

During rehabilitation the waste material contained in WRDs on site, as well as other contaminated material, will be re-located to a new purpose-built waste storage facility (WSF) in order to reduce the impacts from AMD. During the waste removal, there is the potential for poorer quality water and sediment loads to enter the aquatic ecosystem. Mitigation measures will be put in place to avoid this from occurring (refer Section 4 and 12), including all waste movement activities to occur during the dry season.

Overall the rehabilitation at Rum Jungle will result in a reduction in AMD and restoration of the former mine site. Without the rehabilitation action the mine site would continue to impact on aquatic ecosystem (Hydrobiology, 2015).

Terrestrial ecosystem impacts are proposed as part of the rehabilitation action. The key areas for vegetation clearing include approximately 32.2 hectares for the new WSF, 36.4 ha for the access and haul roads, and 102.1 ha for the proposed borrow area located off-site 8km east of the Rum Jungle Site. Majority of remaining works

will occur within previously disturbed areas. Mitigation measures are described in Section 4 and 12, including the need to minimise the destruction of native, weed free, ecosystems on the mine site.

EcOz (**Attachment E**) conducted a likelihood analysis of threatened flora and fauna species listed in the area proposed as a borrow pit and associated haul road. The vegetation assessment is discussed in Table 14.

Robertson GeoConsultants Inc evaluated the degree and timing of future improvements in groundwater and surface water quality after the preferred rehabilitation strategy has been implemented (**Attachment BB**).

Table 14 Description of vegetation communities mapped in the proposed borrow area

Vegetation community	Common species	Habitat quality for threatened species	Area in clearing footprint (ha)	Photo
Low open woodland	Canopy: *Canarium australis, Corymbia bella, Corymbia confertiflora, Corymbia latifolia* (dominant)*, Eucalyptus tectifica, Erythrophleum chlorostachys, Terminalia grandifolia* Mid-storey: *Brachychiton diversifolia, Buchanania obovata, Cycas armstrongii, Ficus aculeata, Livistona humilis, Pandanus spiralis, Persoonia falcata, Petalostigma pubescens, Planchonia careya.* Ground: *Andropogon gayanus, Brachychiton megaphyllus, Cartonema spicatum, Chrysopogon fallax, Chrysopogon latifolius, Crotalaria sp., Flemingia sp., Grewia retusifolia, Heteropogon contortus, Pseudopogonatherum irritans, Schizachyrium fragile, Themeda triandra*	The quality of this habitat for threatened species is compromised by widespread and dense infestation with Gamba Grass	21.7	

Eucalyptus miniata woodland/open forest	Canopy: *Corymbia confertiflora, Corymbia foelscheana, Erythrophleum chlorostachys, Eucalyptus miniata* (dominant) Mid storey: *Brachychiton diversifolius, Buchanania obovata, Corymbia confertiflora, Corymbia latifolia, Cycas armstrongii, Ficus aculeata, Livistona humilis, Pandanus spiralis, Planchonia careya, Terminalia ferdinandiana* Ground: *Andropogon gayanus, Bossiaea bossiaeoides, Brachychiton megaphyllus, Buchnera linearis, Cartonema spicatum., Chrysopogon fallax, Chrysopogon latifolius, Distichostemon hispidulus, Flemingia sp., Gomphrena canescens, Grewia retusifolia, Premna sp., Stylidium sp.*	The quality of this habitat for threatened species is compromised by widespread and dense infestation with Gamba Grass	76.7	
Eucalyptus miniata/Eucalyptus tetrodonta open forest	Canopy: *Corymbia bleeseri, Corymbia clavigera, Eucalyptus miniata* (co-dominant), *Eucalyptus tetrodonta* (co-dominant) Mid-storey: *Acacia spp., Buchanania obovata, Cycas armstrongii, Erythrophleum chlorostachys, Gardenia megasperma, Livistona humilis, Persoonia falcata, Terminalia ferdinandiana* Ground: *Bossiaea bossiaeoides Brachychiton megaphyllus, Buchnera linearis, Cartonema spicatum., Chrysopogon latifolius, Flemingia sp., Gomphrena canescens, Grevillea dryandri, Heteropogon contortus, Pseudopogonatherum irritans, Schizachyrium fragile, Sorghum plumosum, Sorghum timorense, Stylidium sp.*	Very large trees with large hollows, well developed shrub layer suggesting an intermediate fire history.	Haul road	
Rainforest	Canopy: *Acacia auriculiformis, Canarium australianum, Carpentaria acuminata, Cassia fistula, Erythrophleum chlorostachys, Ficus virens var. virens, Litsea glutinosa, Maranthes corymbosa, Sygizium sp., Tamarindus indica, Terminalia*	This rainforest patch is overwhelmingly dominated by the introduced plant *Cassia*	1.8 ha	

	erythrocarpa Mid-story: *Ficus aculeata, Trema tomentosa* Ground: *Acanthus sp., Amorphophallus paeoniifolius, Calopogonium mucunoides, Hyptis suaveolens, Sida acuta, Triumfetta sp.*	*fistula* and may have developed a closed canopy in relatively recent times.		
Paperbark swamp	Canopy *Corymbia clavigera, Corymbia polycarpa, Melaleuca spp (dominant)., Lophostemon lactifluus, Xanthostemon paradoxus* Mid-storey: *Buchanania obovata, Brachychiton megaphyllus, Livistona humilis Planchonia careya, Nauclea orientalis, Livistona humilis, Timonius timon.* Ground: *Andropogon gayanus, Chrysopogon fallax, Eriachne sp., Imperata sp*., *Sorghum intrans, Sorghum timorense, Themeda triandra*		1.9	

7. Existing marine and land uses

Existing land uses at Rum Jungle are focussed primarily upon management of this former mine site, including site investigations, monitoring and maintenance.

Indigenous land uses have been largely disrupted by historic mining operations, however traditional Aboriginal owners have been actively engaged in the site investigations, monitoring and maintenance of the site since the commencement of the NPA.

The marine environment is not impacted by Rum Jungle now or by the proposed rehabilitation works.

8. Waste management and pollution control

The Rum Jungle conceptual rehabilitation plan (NT DME, 2013) outlines the waste management measures which are planned for the rehabilitation of the site. Section 4 provides a summary of how management of existing wastes at Rum Jungle will lead to a smaller waste footprint which should lead to reduced AMD and radiological impacts.

The majority of the proposed rehabilitation activities will be undertaken in areas of previous disturbance (through mining or previous rehabilitation) and new areas of disturbance will be minimised as much as practicable.

In the short-term, adverse impacts are likely to result from the proposed action as earthworks required to relocate substantial quantities of sulfidic and metaliferous waste rock, borrow pits and access roads which will expand the disturbance area. However, mitigation strategies will be developed and implemented to reduce these impacts, including an eight-year construction period with major earthworks conducted over the Dry Season (May to November) and temporary soil covers placed over Waste Rock Dumps to prevent AMD during the Wet Season. Levees will be constructed during the construction period to protect certain works (e.g. dewatering and backfilling of Main pit). The potential long-term benefits for the environment, specifically in terms of AMD and radiological sources, outweigh the short-term impacts.

The design and scheduling of rehabilitation takes into account the local conditions at Rum Jungle, for example works will only be undertaken during the Dry Season (e.g. May to November) over a 214 day construction period each year to minimise potential impacts from AMD. Refer **Attachment Q** Design Report and **Attachment R** Construction Schedule. Temporary soil covers will be placed over WRD's, environmental monitoring, pit dewatering and water treatment will occur during the Wet Season.

The detailed design phase of the rehabilitation strategy is due to be completed by 30 June 2016. The detailed design includes control measures to mitigate environmental impacts during rehabilitation works (**Attachment Q**). Detailed investigations have been completed by Robertson GeoConsultants Inc on the physical and geochemical characteristics of waste rock and contaminated soils, prioritisation of waste rock for relocation to the Main pit or new WRD, estimate neutralant required and propose a geochemical QC program to be implemented during rehabilitation to ensure PAF waste rock is correctly relocated and appropriately amended with neutralant before placement (**Attachment S**).

Management plans will be needed for the construction phase of this rehabilitation plan and have been developed as part of the detailed design for the following:

- Environmental Management Plan
- Air quality
- Biodiversity
- Cultural Heritage
- Environmental Occupational Health and Safety
- Hazardous Substances and Dangerous Goods
- Noise and Vibration
- Radiation
- Water

Management Plans are provided at **Attachment CC**.

The values which must be protected include:

- sensitive indigenous cultural heritage sites (this already occurs through the DME and Warai and Kungarakan induction);
- the East Branch of the Finniss River water quality to mitigate further contamination – water management, cover design, new landform design, sediment control, and revegetation as part of remediation works;
- terrestrial ecosystems disturbed by further vegetation clearance and soil removal as part of extraction of construction materials for covers and foundations; and
- radiological safety for people working on the site - radiation management plan.

9. Other environmental factors

One of the three key objectives of the NPA was an improved understanding of the current state of the environment at Rum Jungle which was needed to achieve the

other two objectives of the NPA, which were improved site management and an improved rehabilitation strategy.

The Rum Jungle Project Team undertook a detailed literature review and gap analysis of all historical reports, monitoring data, and work programs undertaken for the site dating back to the 1950s. Key areas where data and information were lacking or non-existent were identified. After the literature review and gap analysis was completed, a list of projects was developed to fill data gaps and help the project team better understand the health and safety and environmental and cultural heritage aspects of the site.

These studies include internal projects (undertaken by the project team) and external projects (undertaken by consultants). Both the historical, long-term monitoring programs and recent investigations create the knowledge base for the preferred rehabilitation strategy for Rum Jungle.

The baseline studies undertaken by the DME to date include:

- contaminated soil assessments (**Attachment S and T**)
- geochemical characterisation of waste (**Attachment S**)
- Surface water quality and contaminant load (**Attachment U**)
- rainfall–runoff modelling
- pit limnology (**Attachment V**)
- hydrogeology (**Attachment W, X**)
- cover design
- weed management (**Attachment J**)
- Main pit backfill (**Attachment Y**)
- Waste storage facility investigations (**Attachment Z**)
- environmental values (**Attachments L-O**)
- flora and fauna (**Attachment D, E, H**)

The current environmental monitoring program includes water monitoring sites shown in **Figure 8**. Environmental monitoring at the site as evolved during the NPA and now Stage 2 activities, it is anticipated that this process will continue and environmental monitoring may again change in response to the proposed rehabilitation works.

Community consultation and engagement is an integral part of the current detailed design Stage 2 Project Agreement and will continue to remain an important part of the project during implementation. This is because of the multiple stakeholders and the need to be mindful of the post-mining land owners and users throughout the project.

10. Aboriginal and sacred sites clearance

As the traditional Aboriginal owners, Kungarakan and Warai, do not differentiate between environment and culture, their vision is largely drawn from their cultural and social principles.

> *Kungarakan and Warai desire that Rum Jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources. In modern society, this may include development of commercial operations that are managed according to Kungarakan and Warai traditional principles.*

Traditional Aboriginal owners indicate that for them water quality is the pivotal aspect of rehabilitation at Rum Jungle. Water is linked to the creation cycle embodied in the local landscape and it has an intrinsic value embodied in Aboriginal law, which includes responsibility to protect the health of the immediate environment and the health of neighbouring clans. While concerns over water quality may be the fundamental driver for the final landform design, traditional Aboriginal owners are also concerned about ensuring that appropriate flora and fauna are in the post-rehabilitation landscape. Kungarakan and Warai require the site to be rehabilitated to a standard that allows them to pass their culture and belief systems onto future generations.

Earthsea (2011) found a number of archaeological scatters and sites considered culturally sensitive or significant to traditional Aboriginal owners. In addition, there are a number of sacred sites and sites of significance to traditional Aboriginal owners which are detailed in the current AAPA Certificate (**Attachment A**).

The current AAPA certificate is in place to cover investigative works under the current agreement and a new application for a certificate covering the proposed rehabilitation works has been prepared and will be submitted to the AAPA in the near future.

11. Description of timing of proposed action

The rehabilitation project has been broken down into stages outlined in **Figure 9** with implementation and construction stage expected to take approximately 8 years. The detailed design for the project is underway currently as Stage 2.

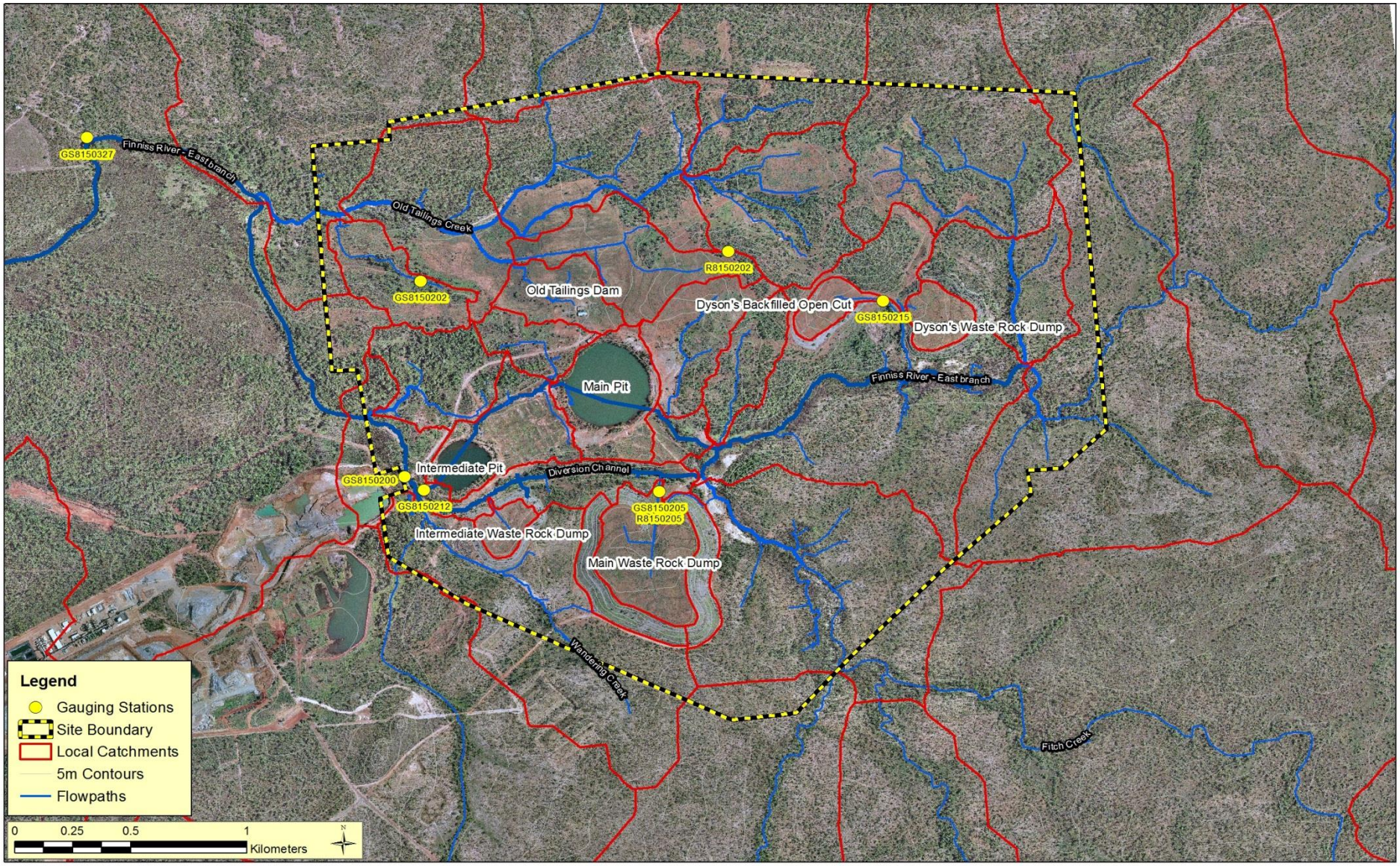

Figure 8 Current surface water catchments and gauging stations at Rum Jungle

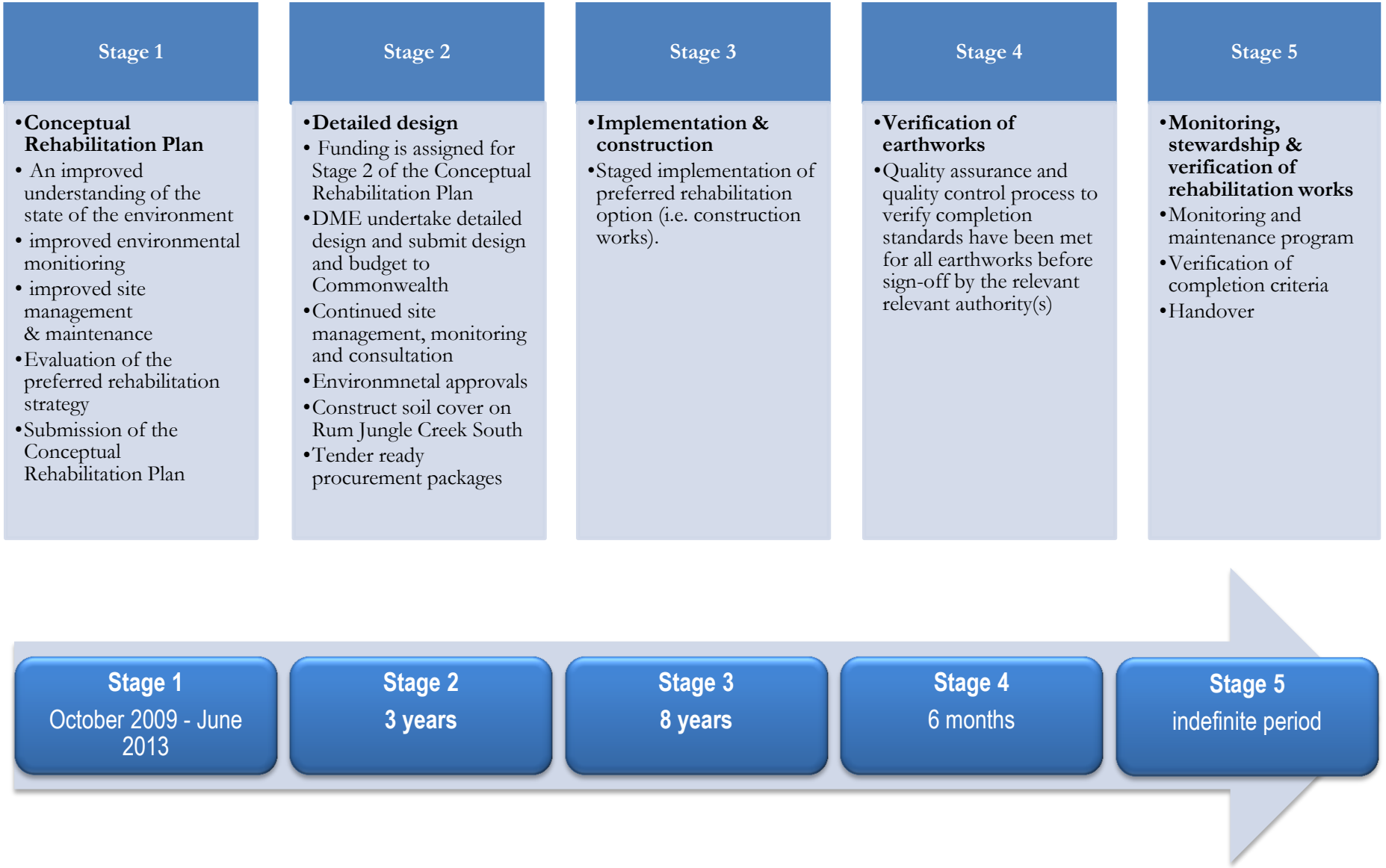

Figure 9 Stages of rehabilitation planning and implementation for Rum Jungle

12. Environmental commitments

On 22 June 2016 the DME lodged a referral of proposed action under the *Environment Protection and Biodiversity Conservation Act* with the Commonwealth Department of Environment. A copy of this referral was provided to the NT EPA, via email, on 23 June 2016.

Details regarding listed threatened species (under Commonwealth and NT legislation), likelihood analysis of occurrence of these species within the project area and mitigation measures are detailed earlier in this document.

An assessment of potential environmental impacts has been undertaken, identifying the following activities (**Table 15**) and mitigation measures proposed to avoid, reduce or minimise impacts.

Table 15 Potential environmental; impacts and control measures to avoid or reduce impacts

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
Land Use				
Land Use	Inappropriate land use	➢ Ensure appropriate consultation is undertaken with stakeholders prior to rehabilitation ➢ Ensure clear expectations of end land use are understood and agreed to prior to rehabilitation	➢ Communication strategy developed in 2009 to ensure effective communication outcomes are achieved	Communication and consultation will continue throughout all phases of the project.
Biodiversity				
Biodiversity (Vegetation clearing)	Potential impact on native flora and fauna as a result of clearing native vegetation and fauna habitat on Finniss River Land Trust for sourcing borrow material and hauling material to Rum Jungle	➢ AAPA certificate obtained for proposed borrow area ➢ Land use application and approvals process undertaken to obtain relevant approval to develop proposed borrow area ➢ Vegetation clearing restricted to the approved area of development (if approved) ➢ Effective stakeholder consultation, strategy to be developed ➢ Rehabilitation design, and management and monitoring plan (to be developed) for proposed borrow area address the objectives of the TOs and is achievable by proponent	➢ Rehabilitation maintenance and monitoring program (to be developed)	Refer to construction schedule (Attachment R) Biodiversity management Plan (Attachment AA)

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
Biodiversity (Vegetation clearing)	Potential impact on native flora and fauna as a result of clearing native vegetation and fauna habitat at Rum Jungle during rehabilitation	➢ Protected areas/restricted areas will be marked to avoid disturbance ➢ Areas proposed for vegetation clearing will be appropriately marked/identified to avoid unplanned clearing ➢ Threatened species management (to be developed) implemented ➢ Dust mitigation activities undertaken ➢ Weed management (to be developed) effectively undertaken ➢ Detailed design specifications and construction schedule requirements met	➢ Rehabilitation maintenance and monitoring program (to be developed)	Refer to construction schedule (Attachment R) Biodiversity management Plan (Attachment AA)
Biodiversity (Threatened species)	Potential impact on EPBC threatened fauna species as a result of habitat destruction No threatened EPBC flora species were identified at Rum Jungle Potential impact on the clearing of the TPWS vulnerable *Cycas armstrongii.* This species is locally common, and the regional population is unlikely to be impacted by the rehabilitation.	➢ Identified EPBC threatened fauna species are unlikely to be significantly impacted as a result of rehabilitation ➢ Destruction of fauna habitat will be minimised during rehabilitation ➢ Relocation of *Cycas armstrongii* in known disturbance areas will be undertaken where possible, in consultation suitably qualified botanists/ecologists ➢ Threatened species known, likely or possibly using sites will be managed in accordance with the Biodiversity Management Plan	➢ Rehabilitation maintenance and monitoring program (to be developed)	Refer to construction schedule (Attachment R) Biodiversity management Plan (Attachment AA)
Biodiversity (Revegetation) During rehabilitation	Unsuccessful revegetation as a result of poor establishment, early uncontrolled fire, weed invasion etc.	➢ Detailed design specifications met ➢ Revegetation design specifications met ➢ Effective implementation of fire management and weed management plan (to be developed) ➢ Erosion and sediment control plan implemented (to be developed as part of principal contractor scope)	➢ Rehabilitation maintenance and monitoring program (to be developed) ➢ Early intervention for remediation	Refer to construction schedule (Attachment R) Biodiversity management Plan (Attachment AA)

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
Biodiversity (Revegetation) Post-rehabilitation	Failure to establish desired ecosystem regime	➢ Effective implementation of post-rehabilitation fire management and 5-year weed management plan	➢ Post-rehabilitation maintenance and monitoring program (to be developed) ➢ Completion criteria met	Revegetation monitoring and maintenance will continue post-rehabilitation Refer to post-rehabilitation maintenance and monitoring program. Biodiversity management Plan (Attachment AA)
Biodiversity (Weeds) During rehabilitation	Potential impact on native flora and flora due to the invasion of weeds (introduced species) during rehabilitation Potential impact on constructed landforms and revegetated areas	➢ 5-year weed management plan, including wash down requirements and appropriate control or eradication of identified weeds ➢ Access and contractor controls	➢ Rehabilitation maintenance and monitoring program (to be developed)	Refer to construction schedule (Attachment R) Biodiversity management Plan (Attachment AA) 5-year Weed Management Plan (Attachment J)
Biodiversity (Weeds) Post-rehabilitation	Potential impact on native flora and flora due to the invasion of weeds (introduced species) post-rehabilitation Potential impact on constructed landforms and	➢ Post-rehabilitation weed management plan implemented	➢ Post-rehabilitation maintenance and monitoring program (to be developed) ➢ Completion criteria met	Weed management will continue post-rehabilitation Refer to post-rehabilitation

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
	revegetated areas			maintenance and monitoring program Biodiversity management Plan (Attachment AA) 5-year Weed management Plan (Attachment J)
Biodiversity (Feral animals) During rehabilitation	Potential impact on native flora and flora due to the invasion of feral animals Potential impact on constructed landforms and revegetated areas	➢ Biodiversity management plan, or similar, to be compiled and implemented at least until ecosystem well established	➢ Rehabilitation maintenance and monitoring program (to be developed)	Refer to construction schedule (Attachment R) Biodiversity management Plan (Attachment AA)
Biodiversity (Feral animals) Post-rehabilitation	Potential impact on native flora and flora due to the invasion of feral animals Potential impact on constructed landforms and revegetated areas	➢ Post-rehabilitation feral animal management plan implemented	➢ Post-rehabilitation maintenance and monitoring program (to be developed) ➢ Completion criteria met	Feral animal management will continue post-rehabilitation Biodiversity management Plan (Attachment AA)

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
Biodiversity (Uncontrolled Fire) During rehabilitation	Potential impact to native flora and fauna, and revegetated areas	➢ Fire management plan implemented, including appropriately located and sized fire breaks, controlled burning, ongoing maintenance of fire breaks etc. ➢ 5-year Weed management plan to be implemented effectively to assist in reducing fuel loads for uncontrolled fires.	➢ Rehabilitation maintenance and monitoring program (to be developed)	Refer to construction schedule (Attachment R) Biodiversity management Plan (Attachment AA)
Biodiversity (Uncontrolled Fire) Post-rehabilitation	Potential impact to native flora and fauna, and revegetated areas	➢ Post-rehabilitation fire management plan implemented, including appropriately located and sized fire breaks, controlled burning, ongoing maintenance of fire breaks etc. ➢ Post-rehabilitation weed management plan to be implemented effectively to assist in reducing fuel loads for uncontrolled fires	➢ Post-rehabilitation maintenance and monitoring program (to be developed) ➢ Completion criteria met	Fire management will continue post-rehabilitation Refer to post-rehabilitation maintenance and monitoring program, to be developed. Biodiversity management Plan (Attachment AA)
Water				
Surface Water (Pollution) During rehabilitation	Offsite discharge of contaminated surface water during rehabilitation due to: • Flooding of WRD foundations • Failure of surface water management system	➢ Meet locally derived water quality objectives - construction phase ➢ Rehabilitation maintenance and monitoring program ➢ Accurate site wide water balance including seepage	➢ Detailed design specifications and plans ➢ Rehabilitation maintenance and monitoring program (to be developed) ➢ Locally derived water quality	Refer to construction schedule (Attachment R)

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
	• Flooding/cyclone/storm event • Geotechnical failure of WRD • Geochemical failure of WRD • Failure of lateral drainage in WRD • Failure to cover exposed waste materials prior to wet season/incorrect scheduling of waste placement • Failure to incorporate sufficient lime with waste rock • Failure of WRD liner • Insufficient borrow material for cover system • Erosion gullies on constructed landforms • Failure of cover system • Poor vegetation establishment on constructed landforms • Failure of the water treatment plant • Failure of diversion leading to ingress of water during dewatering • Failure to meet water discharge license conditions • Failure of dewatering/recovery bores leading to ingress of groundwater during dewatering • Failure of pit wall stability leading to contaminated sediments polluting Main pit water • Insufficient removal of contaminated materials and groundwater in Copper Extraction Area • Erosion of clean fill placed over residual contaminated material leading to mobilisation of contaminated material • Groundwater levels higher than expected in CEA leading to groundwater expressing itself in new channel and discharging off-site • Geotechnical failure of intermediate pit	➢ Effective surface water management structures including levees ➢ Adequate controls for potential flooding ➢ Detailed design specifications met ➢ Minimise exposed waste material at any given time ➢ Maintain and update construction schedule ➢ Monitor BOM website ➢ Accurate material balance ➢ Effective erosion and sediment control system ➢ Suitable cover materials for cover system ➢ Revegetation specifications met Weed and fire management plan implemented ➢ Intermediate pit will act as a buffer for contaminated water during the dry season ➢ Water treatment plant, to treat and release contaminated water, constructed to specifications with capacity to cope with additional water ➢ Additional water treatment requirements due to ingress of contaminated groundwater, surface water or pit wall failure	objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Surface water management developed by experts in the field: - Water Technology's flood/hydrological modelling, surface water management design and site wide water balance ➢ Construction schedule (Attachment T) ➢ Material balance calculations based on data from the following investigations undertaken by experts in the field: - RGC waste characterisation report - Soil contamination investigation report - O'Kane/SLR borrow assessment report ➢ Erosion and sediment control plan (to be developed) ➢ Revegetation design ➢ Weed management plan ➢ Fire management plan (to be developed)	

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
	walls leading to loss of volume in intermediate pit for passive water treatment			
Surface Water (Pollution) Post-rehabilitation	Offsite discharge of contaminated water post-rehabilitation due to: • Flooding of WRD foundation • Failure of surface water management system • Flooding/cyclone/storm event • Geotechnical failure of WRD • Geochemical failure of WRD • Failure of lateral drainage in WRD • Failure of WRD liner • Erosion gullies on constructed landforms • Failure of cover system • Unsuccessful revegetation • Failure to meet water discharge license conditions • Erosion of clean fill placed over residual contaminated material leading to mobilisation of contaminated material	➢ New WRD constructed to design specifications to withstand extreme flood events ➢ Meet locally derived water quality objectives - post-rehabilitation ➢ Post-rehabilitation maintenance and monitoring program ➢ Effective post-rehabilitation surface water management structures ➢ Effective erosion and sediment control system ➢ Post-rehabilitation weed and fire management plans implemented	➢ Post-rehabilitation maintenance and monitoring program (to be developed) ➢ Completion criteria met ➢ Locally derived water quality objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Surface water management developed by experts in the field: - Water Technology's flood/hydrological modelling, surface water management design and site wide water balance Post-rehabilitation weed and fire management plans (to be developed)	Surface water monitoring and assessment will continue post-rehabilitation Refer to post-rehabilitation maintenance and monitoring program
Groundwater (Pollution) During rehabilitation	Localised contamination of groundwater during rehabilitation due to: • Flooding of WRD foundations • Flooding/cyclone/storm event • Geotechnical failure of WRD • Geochemical failure of WRD • Failure of lateral drainage in WRD • Failure to cover exposed waste materials prior to wet season/incorrect scheduling of waste placement • Failure to incorporate sufficient lime with	➢ Dewatering bores installed around Main pit ➢ Meet locally derived water quality objectives - construction phase ➢ Accurate groundwater model ➢ Rehabilitation maintenance and monitoring program ➢ Accurate site wide water balance including seepage ➢ Effective surface water management structures ➢ Adequate controls for potential flooding	➢ Detailed design specifications and plans ➢ Rehabilitation maintenance and monitoring program (to be developed) Groundwater modelling undertaken by experts in the field (RGC) ➢ Locally derived water quality objectives developed by experts in the field: - Hydrobiology Impact assessment report (Attachment P)	Refer to construction schedule (Attachment R)

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
	waste rock • Hydrogeological regime not behaving as predicted/modelled • Insufficient borrow material for cover system • Failure of cover system • Poor vegetation establishment • Failure of WRD liner • Failure to meet water discharge license conditions • Failure of dewatering/recovery bores leading to ingress of groundwater during dewatering • Insufficient removal of contaminated material and groundwater in Copper Extraction Area (CEA) • Groundwater levels higher than expected in CEA leading to groundwater expressing itself in new channel and discharging off-site	➢ Detailed design specifications met ➢ Minimise exposed waste material at any given time ➢ Maintain and update construction schedule ➢ Monitor BOM website ➢ Accurate material balance ➢ Effective erosion and sediment control system ➢ Suitable cover materials for cover system ➢ Revegetation specifications met Weed and fire management plans implemented ➢ Intermediate pit will act as a buffer for contaminated water during the dry season ➢ Water treatment plant, to treat and release contaminated water, constructed to specifications with capacity to cope with additional water ➢ Additional water treatment requirements due to ingress of contaminated groundwater, surface water or pit wall failure	➢ Surface water management developed by experts in the field: - Water Technology's flood/hydrological modelling, surface water management design and site wide water balance ➢ Construction schedule (Attachment T) ➢ Material balance calculations based on data from the following investigations undertaken by experts in the field: - RGC waste characterisation report - Soil contamination investigation report - O'Kane/SLR borrow assessment report ➢ Erosion and sediment control plan (to be developed) ➢ Revegetation design (to be developed) ➢ 5-year Weed management plan ➢ Fire management plan (to be developed)	
Groundwater (Pollution) Post-rehabilitation	Localised contaminated groundwater post-rehabilitation due to: • Flooding of WRD foundation • Flooding/cyclone/storm event • Geotechnical failure of WRD • Geochemical failure of WRD • Failure of lateral drainage in WRD • Hydrogeologic regime not behaving as predicted/modelled • Failure of cover system • Poor vegetation establishment • Failure of WRD liner	➢ Contaminated groundwater treated in copper extraction pad area ➢ Accurate groundwater model ➢ Meet locally derived water quality objectives - post-rehabilitation ➢ Post-rehabilitation maintenance and monitoring program ➢ Effective post-rehabilitation surface water management structures ➢ Effective erosion and sediment control system ➢ Post-rehabilitation weed and fire management plans implemented	➢ Post-rehabilitation maintenance and monitoring program (to be developed) ➢ Completion criteria met ➢ Groundwater modelling undertaken by experts in the field (RGC) ➢ Locally derived water quality objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Surface water management developed by experts in the field: - Water Technology's	Groundwater monitoring and assessment will continue post-rehabilitation Refer to post-rehabilitation maintenance and monitoring program

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
			flood/hydrological modelling, surface water management design and site wide water balance ➢ Post-rehabilitation weed and fire management plans	
Water (Flooding/Storm/Cyclone) During rehabilitation	Site flooding, as a result of a storm event or cyclone, leading to surface water contamination and sedimentation off site	➢ Predicting cyclone/severe weather event, monitor BOM ➢ Effective surface water management structures ➢ Landforms designed to withstand significant weather events ➢ Adequate controls for potential flooding ➢ Newly disturbed areas revegetated as soon as practical Stockpiled soils suitability located on high ground and outside flood zones ➢ Emergency management plans in place ➢ Infrastructure built to cyclone code specifications ➢ Hazardous substances stored appropriately and MSDSs maintained	➢ Detailed design specifications and plans ➢ Locally derived water quality objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Surface water management developed by experts in the field: - Water Technology's flood/hydrological modelling and surface water management design ➢ Construction schedule (Attachment T) ➢ Erosion and sediment control plan (to be developed) ➢ Revegetation design	Refer to construction schedule (Attachment R)
Soil				
Soil (Contaminated) Erosion and sedimentation	Offsite release of contaminated materials/sediments during rehabilitation due to:	➢ Rehabilitation maintenance and monitoring program ➢ Detailed design specifications met ➢ Effective erosion and sediment control system	➢ Rehabilitation maintenance and monitoring program (to be developed) ➢ Erosion and sediment control plan (to be developed)	Refer to construction schedule (Attachment R)

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
During rehabilitation	• Flooding of WRD foundations • Flooding/cyclone/storm event • Geotechnical failure of WRD • Failure of lateral drainage in WRD • Failure to cover exposed waste materials prior to wet season/incorrect scheduling of waste placement • Erosion gullies on constructed landforms • Failure of surface water management system • Failure of cover system • Poor vegetation establishment • Dust generation • Failure of diversion leading to ingress of water during dewatering and mobilisation of tailings • Failure of pit wall stability leading to mobilisation of contaminated sediments • Error is classification, cut-off levels or depth of contaminated soil leading to remaining contaminated soil on site and additional volume for incorporation into new WRD • Erosion of clean fill placed over residual contaminated material leading to mobilisation of contaminated material • Failure to remove and place the replacement material before the wet season leading to large scale erosion of unconsolidated materials in Copper Extraction Area	➢ Surface water management system ➢ Adequate controls for potential flooding ➢ Minimise exposed waste material at any given time ➢ Maintain construction schedule ➢ Monitor BOM website ➢ Suitable cover materials used for cover system ➢ Revegetation specifications met Weed and fire management plans implemented ➢ Water treatment requirements due to ingress of contaminated groundwater, surface water or pit wall failure ➢ Contaminated land auditor will assess the classification of contaminated land and effective recovery during rehabilitation	➢ Locally derived water quality objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Construction schedule (Attachment T) ➢ Material balance calculations based on data from the following investigations undertaken by experts in the field: - RGC waste characterisation report - Soil contamination investigation report - O'Kane/SLR borrow assessment report ➢ Surface water management developed by experts in the field: - Water Technology's flood/hydrological modelling and surface water management design ➢ Revegetation design ➢ Weed management plan ➢ Fire management plan (to be developed)	
Soil (Contaminated) Erosion and sedimentation Post-rehabilitation	Offsite release of contaminated materials/sediments post-rehabilitation due to: • Flooding of WRD foundations • Flooding/cyclone/storm event • Geotechnical failure of WRD	➢ Post-rehabilitation maintenance and monitoring program Effective erosion and sediment control system ➢ Surface water management system ➢ Adequate controls for potential flooding	➢ Post-rehabilitation maintenance and monitoring program (to be developed) ➢ Erosion and sediment control plan (to be developed) ➢ Locally derived water quality	Erosion and sedimentation monitoring will continue post-rehabilitation

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
	• Failure of lateral drainage in WRD • Erosion gullies • Failure of surface water management system • Failure of cover system • Poor vegetation establishment • Dust generation	➢ Revegetation specifications met Weed and fire management plans implemented	objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Construction schedule (Attachment T) ➢ Material balance calculations based on data from the following investigations undertaken by experts in the field: - RGC waste characterisation report - Soil contamination investigation report - O'Kane/SLR borrow assessment report ➢ Surface water management developed by experts in the field: - Water Technology's flood/hydrological modelling and surface water management design ➢ Revegetation design ➢ Weed management plan ➢ Fire management plan (to be developed)	Refer to post-rehabilitation maintenance and monitoring program
Soil (Pollution) During rehabilitation	Localised impact to soil due to run-off or leaching of hazardous substances, e.g. hydrocarbons, chemicals etc.	➢ Detailed design specifications met ➢ Effective bunding of chemical containment areas and refuelling stations ➢ Any spills will be reported and cleaned up in a timely manner ➢ Appropriate training will be provided to all relevant staff. Material Safety Data Sheets (MSDS) will be made available for all substances on site ➢ Personal Protective Equipment will be provided and worn by all staff ➢ Specialised equipment required for cleaning up spills will be made available in the relevant work areas	➢ Rehabilitation maintenance and monitoring program (to be developed) ➢ Erosion and sediment control plan (to be developed) ➢ Locally derived water quality objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Construction schedule (Attachment T) ➢ Surface water management developed by experts in the field:	Refer to construction schedule (Attachment R)

Environmental Aspect	Potential Environmental Impact	Proposed Control Measures	How the measure is expected to be effective	Timeframe/Workplan for the measure
		➢ Contaminated soils will disposed on appropriately ➢ Surface water management system ➢ Effective erosion and sediment control system	- Water Technology's flood/hydrological modelling and surface water management design	
Air and Noise				
Air (Dust) During rehabilitation	Dust generation due to vegetation clearing, hauling, and other general ground disturbance leading to: • Localised damage to vegetation • Sedimentation of waterways • Loss of clean topsoil/subsoil material	➢ Water trucks will be used to reduce dust generation during rehabilitation ➢ Where practicable, construction activities during rehabilitation will be undertaken to avoid dust generation ➢ Air quality management plan enacted	➢ Rehabilitation maintenance and monitoring program (to be developed) ➢ Erosion and sediment control plan (to be developed) ➢ Locally derived water quality objectives developed by experts in the field: - Hydrobiology Impact assessment report ➢ Construction schedule (Attachment T) ➢ Surface water management developed by experts in the field: - Water Technology's flood/hydrological modelling and surface water management design	Refer to construction schedule (Attachment R) Air Quality management Plan
Noise and Vibration During rehabilitation	• Use of heavy machinery, e.g. haul trucks, during rehabilitation leading to noise disturbance to local community and local fauna	➢ Traffic Management Plan to be created ➢ Limit speed of vehicles ➢ Use of low tonal alarms where possible ➢ Well-designed blasting activities ➢ Restrict noisy work to daytime hours ➢ Use quiet equipment where possible ➢ Design layout of site to factor location of sensitive receptors ➢ Noise and Vibration management plan enacted	➢ No community complaints ➢ No monitoring exceedances ➢ No damage to any sensitive receptors	Refer to construction schedule (Attachment R) Noise and Vibration Management Plan

13. Proposed rehabilitation and decommissioning

Detailed design of the preferred rehabilitation strategy is the function of the Stage 2 design under the current Project Agreement. Decommissioning has been incorporated into this design (**Attachment Q and R**)

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Attachment A AAPA Certificate

Attachment B EPBC Act Protected Matters Report

Attachment C EPBC Report Site Access

Attachment D Ecological Flora and Fauna

Attachment E EcoZ Borrow Pit and Haul Road investigation

Attachment F EPBC Report Mt Fitch

Attachment G EPBC Report Mt Burton

Attachment H Finniss River Terrestrial Fauna Survey EcOz

Attachment I Completion Criteria

Attachment J Weed Management Plan

Attachment K Failure Modes and Effects Analysis 2015

Attachment L Hydrobiology Environmental Values Phase 1 (2013a)

Attachment M Hydrobiology Environmental Values Phase 2 (2013b)

Attachment N Hydrobiology Rum Jungle Aquatic Ecosystem (2015a)

Attachment O Hydrobiology Impact Assessment (2015b)

Attachment P Hydrobiology Construction Phase Sensitivity Analysis (2015c)

Attachment Q Design Report

Attachment R Construction Schedule

Attachment S Physical and Geochemical characteristics of Waste Rock and Contaminated Materials

Attachment T Soil contamination report CSA Global

Attachment U Surface water quality and contaminant load assessment (RGC Phase 3 Stage 2)

Attachment V Pit bathymetry survey

Attachment W Groundwater flow and transport model

Attachment X Groundwater remediation strategy copper extraction area

Attachment Y Main pit backfill study

Attachment Z Waste Storage Facility Investigations

Attachment AA Biodiversity Management Plan

Attachment BB Environmental Performance Assessment for the Preferred Rehabilitation Strategy

Attachment CC Management Plans