



Review of terrestrial ecology surveys relevant to the Rum Jungle EIS

DEPARTMENT OF PRIMARY
INDUSTRY AND RESOURCES



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EXECUTIVE SUMMARY

The Department of Primary Industries and Resources has proposed the rehabilitation of the former Rum Jungle mine site, located 6 km north of Batchelor, Northern Territory.

This project requires assessment under the *Environmental Assessment Act* (Northern Territory) at the level of an Environmental Impact Statement (EIS). EcOz Environmental Consultants (EcOz) were engaged to respond to the terrestrial ecology information requirements of the EIS Terms of Reference.

Regionally, there have been numerous general and targeted studies of the terrestrial vegetation, flora and fauna. They were undertaken to inform this project, as well as the Browns Oxide and Yarram projects adjacent to the Rum Jungle mine site. These surveys covered:

- Vegetation mapping
- General flora and fauna biodiversity
- Targeted threatened species.

The purpose of this report is to summarise these studies and then collate the results in order to describe the existing environment within which the project will be undertaken.

Vegetation

Woodlands comprised the largest vegetation group within the Rum Jungle mine site – occurring in the north, south and east areas. The most commonly-represented vegetation map units are *Eucalyptus tetradonta* and *E. miniata* open woodland, and *E. tetradonta*, *E. miniata* and *Erythrophleum chlorostachys* woodland to open forest. These two are very similar in composition, but the former is generally more open and often lower in stature. Grassland communities occur in the centre and western areas of the mine site, typically invasions of either previously-rehabilitated or degraded former woodlands by Gamba Grass or other weeds.

Mt Burton is a barren waste rock dump that is bordered to the north, east and west by a large patch of wet vine forest. Mt Fitch consists of *Eucalyptus* and *Corymbia* open woodland, and small patches of dry vine thicket. Cattle are grazed at this site. The gravel and low permeability material borrow areas consist of *Eucalyptus* woodland communities and drainage woodland communities.

Gamba Grass (*Andropogon gayanus*) is the most widespread weed within the Rum Jungle region – recorded across the extent of the mine site, but at highest densities in the north-west, central and south-west areas. The species also occurs across the extent of the waste rock dump at Mt Fitch, and in the vicinity of the waste rock dump at Mt Burton. All the non-riparian vegetation within the low permeability material borrow area is heavily infested by Gamba Grass. In the granular material borrow area, Gamba Grass predominately occurs – sometimes in dense patches – in the riparian areas and drainage lines. In many places, the infestations are so heavy they have significantly altered the vegetation and severely compromised the ecological integrity of the area.

Many other weed species have been recorded during surveys – including 22 species on the mine site in 2018. Eleven of these are declared weeds, including four Weeds of National Significance: Gamba Grass (*Andropogon gayanus*), Grader Grass (*Themeda quadrivalvis*), Mimosa (*Mimosa pigra*) and Olive Hymenachne (*Hymenachne amplexicaulis*).

In the past ten years, the majority of the project footprint has been burnt over ten times, with the exception of a small patch of monsoon vine forest on the eastern border of Rum Jungle mine site that has burnt seven times, and Mt Burton, which has only burnt once or twice (with the wet vine forest to its south remaining unburnt).

Significant vegetation

The project footprint contains three significant vegetation types:

- **Monsoon vine thicket**, present as:
 - Dry vine forest on the western edge of the Rum Jungle mine site, and in small patches to the north of the Mt Fitch pit.
 - Wet rainforest to the north and west of the Mt Burton waste rock dump.

These vegetation types are also likely to be groundwater-dependent ecosystems.

- **Riparian vegetation** along all the rivers, creeks and streams. The extent of this vegetation type is greater along the West Branch of the Finnis River and Meneling Creek, than it is along the East Branch of the Finnis River and the watercourses within the granular material borrow area.
- **Large hollow-bearing trees** are likely to be present in the *Eucalyptus tetradonta* / *miniata* woodland to open forest in the centre and north of the Rum Jungle mine site. In the granular material borrow area, trees that may be hollow-bearing were largely limited to occurring along drainage lines outside of the borrow pit boundaries. The *Eucalyptus* woodland communities contain some hollow-bearing trees, but these are occasional.

Threatened species

Seven terrestrial threatened species have been recorded within the project footprint:

- **Darwin Cycad** – common in areas of *Eucalyptus* woodland within the Rum Jungle mine site and the granular material borrow area, wherever there are low weed infestations.
- **Partridge Pigeon** and **Black-footed Tree-rat** – some recent records in *Eucalyptus* woodland in the north of the Rum Jungle mine site and the granular material borrow area.
- **Mertens' Water Monitor** – common along both branches of the Finnis River, including upstream of the Rum Jungle mine site.
- **Mitchell's Water Monitor** – some recent records on the West Branch of the Finnis River.
- **Northern Quoll** and **Fawn Antechinus** – a few historic records within the *Eucalyptus* woodland within the Rum Jungle mine site, the most recent from 2008.

The latter two species have not been recorded in at least the past decade, despite having being surveyed for on more than one occasion. As such, they are unlikely to be extant within the project footprint. The remaining species are all considered likely to still be present.

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Project footprint	1
1.2	Context	1
1.3	Scope	2
1.4	Report structure.....	2
2	GENERAL ENVIRONMENT	9
2.1	Weather and climate	9
2.2	Land use.....	9
2.3	Bioregion	10
2.4	Surface water	10
2.5	Land systems	13
2.6	Fire	15
3	VEGETATION	17
3.1	Surveys	17
3.1.1	Region.....	17
3.1.2	Project footprint	17
3.2	Results	20
3.2.1	Vegetation communities.....	20
3.2.2	Threatened species.....	35
3.2.3	Weeds.....	37
3.2.4	Threatened Ecological Communities	43
3.2.5	Significant vegetation	43
3.2.6	Groundwater-dependent ecosystems	55
3.3	Previous revegetation at the mine site	55
4	FAUNA	56
4.1	Surveys	56
4.1.1	Region.....	56
4.1.2	Project footprint	56
4.2	Results	60
4.2.1	General biodiversity	60
4.2.2	Threatened species.....	60
4.2.3	Pest animals.....	64
5	THREATENED SPECIES	65
5.1	Categories	65
5.2	Likelihood of occurrence	66
6	REFERENCES	69

Appendices

APPENDIX A	THREATENED SPECIES 'LIKELIHOOD OF OCCURRENCE' ASSESSMENT
APPENDIX B	EPBC PROTECTED MATTERS SEARCH TOOL REPORT
APPENDIX C	SUMMARY OF PAST SURVEYS
APPENDIX D	ECO LOGICAL - FLORA AND FAUNA SURVEYS OF THE FORMER RUM JUNGLE MINE SITE REPORT
APPENDIX E	SUPPLEMENTARY ECOLOGY SURVEY REPORT FOR THE RUM JUNGLE EIS
APPENDIX F	ECOZ WEED SURVEY REPORT

Tables

Table 2-1. Land system characteristics for the Rum Jungle project footprint.....	13
Table 3-1. Vegetation communities in the Rum Jungle mine site (as per Eco Logical 2014).....	23
Table 3-2. Vegetation communities in the granular material borrow survey area (EcOz 2019)	31
Table 3-3. <i>Cycas armstrongii</i> density estimates within and proximate to project footprint	35
Table 3-4. Most common weed species within a 30 km radius of the Rum Jungle mine site.....	37
Table 3-5. Weeds recorded during the 2018 survey of Rum Jungle mine site	39
Table 4-1. Summary of fauna surveys conducted partly or fully within the project footprint.....	57
Table 4-2. Number of species recorded during regional fauna surveys encompassing the project footprint .	60
Table 4-3. List of threatened terrestrial species recorded in the project footprint (highlighted) and the surrounding region.....	61
Table 4-4. Pest animals that are known, or likely, to occur within the project footprint	64
Table 5-1. Threatened species 'likelihood of occurrence' assessment (medium and high likelihood species only)	67

Figures

Figure 1-1. Map of Rum Jungle project footprint	3
Figure 1-2. Aerial image of Rum Jungle mine site.....	4
Figure 1-3. Aerial image of Mt Burton.....	5
Figure 1-4. Aerial image of Mt Fitch.....	6
Figure 1-5. Aerial image of granular material borrow area	7
Figure 1-6. Aerial image of low permeability material borrow area.....	8
Figure 2-1. Graph of mean monthly climate statistics for the region	9
Figure 2-2. Map of surface water features within the project footprint.....	12
Figure 2-3. Map of land systems within the project footprint	14
Figure 2-4. Map of fire history across the Rum Jungle region	16
Figure 3-1. Map of all flora survey sites within the region.....	18
Figure 3-2. Map of all flora survey sites within the Rum Jungle mine site (Eco Logical 2014)	19
Figure 3-3. Map of vegetation communities in the region (Metcalf 2002).....	21
Figure 3-4. Map of vegetation communities in the Rum Jungle site (Eco Logical 2014)	24
Figure 3-5. Photographs of Eucalypt woodland (map unit 10) in the north-west of Rum Jungle.....	25
Figure 3-6. Photographs of mining landform areas in the centre of Rum Jungle that have become grassland	26
Figure 3-7. Photograph of the historic waste dump at Mt Burton	27
Figure 3-8. Photographs of the Mt Fitch site – between the waste rock dump and the pit (top), and of the side of the waste rock dump (bottom)	28
Figure 3-9. Photographs of Eucalyptus mid woodland (map unit 1) in the granular material borrow area.....	29

Figure 3-10. Photograph of previously-disturbed Eucalyptus low open woodland (map unit 2a) in the granular material borrow area.....	29
Figure 3-11. Photograph of Eucalyptus mid open woodland (map unit 2) in the granular material borrow area	30
Figure 3-12. Map of vegetation communities in the granular material borrow area.....	32
Figure 3-13. Photograph of the low permeability material borrow area taken from the northern boundary towards the east	33
Figure 3-14. Map of vegetation communities in the low permeability material borrow area	34
Figure 3-15. Map of suitable Darwin Cycad habitat within the project footprint.....	36
Figure 3-16. Photograph of burnt trees surrounded by Gamba Grass (located outside western border of mine site)	40
Figure 3-17. Photograph of high density infestation of Gamba Grass, Perennial Mission Grass and Mimosa at Mt Fitch	40
Figure 3-18. Photograph of the high density infestation of Gamba Grass at the low permeability material borrow area.....	41
Figure 3-19. Map of the extent of Gamba Grass infestations at Rum Jungle mine site (EcOz 2018)	42
Figure 3-20. Photograph of West Branch riparian vegetation (near confluence).....	44
Figure 3-21. Photograph of East Branch riparian vegetation (downstream of the mine site)	44
Figure 3-22. Photographs of riparian vegetation community in the centre of Rum Jungle	46
Figure 3-23. Photographs of riparian vegetation (top) and an aerial view (drone image) of drainage line (bottom) in the granular material borrow area.	47
Figure 3-24. Photograph of the rainforest adjacent to Mt Burton.....	49
Figure 3-25. Map of rainforest adjacent to Mt Burton	50
Figure 3-26. Photograph of vine thicket community in the west of mine site.....	52
Figure 3-27. Map of vine forest within the Rum Jungle mine site	53
Figure 3-28. Map of vine forest within Mt Fitch.....	54
Figure 4-1. Map of all fauna survey sites within the region.....	58
Figure 4-2. Map of historic threatened species records in the vicinity of the project footprint	63
Figure 5-1. The IUCN red list categories of risk for species	65

ACRONYMS

CR	Critically Endangered
dbh	diameter at breast height
DENR	Department of Environment and Natural Resources (Northern Territory)
DPIR	Department of Primary Industries and Resources
EIS	Environmental Impact Statement
EN	Endangered
<i>EPBC Act</i>	<i>Environment Protection and Biodiversity Conservation Act (1999)</i> (Commonwealth)
GDE	groundwater-dependent ecosystem
IUCN	International Union for Conservation of Nature
NT	Northern Territory
NVIS	National Vegetation Information System
ToR	Terms of Reference
<i>TPWC Act</i>	<i>Territory Parks and Wildlife Conservation Act</i> (Northern Territory)
VU	Vulnerable
WoNS	Weeds of National Significance

1 INTRODUCTION

The Department of Primary Industries and Resources (DPIR) has proposed the rehabilitation of the former Rum Jungle mine site, located 6 km north of Batchelor, Northern Territory.

This project requires assessment under the *Environmental Assessment Act* (Northern Territory) at the level of an Environmental Impact Statement (EIS). EcOz Environmental Consultants (EcOz) were engaged to respond to the information requirements pertaining to terrestrial flora and fauna that are presented in the EIS Terms of Reference (ToR).

Regionally, there have been numerous general and targeted studies for vegetation, flora and fauna. The purpose of this report is to summarise these studies and then collate the results in order to describe the existing environment within which the project will be undertaken. This report is not a risk assessment, as it does not take into account project activities or their potential impacts on ecological values.

1.1 Project footprint

For the purpose of this report, the *project footprint* includes the areas of land that will be directly disturbed by project activities, as well as adjacent areas that could be indirectly impacted by the project activities – for example, surrounding habitats that could be affected by emissions of dust and/or noise, or downstream habitats that could be impacted by changes in surface water or groundwater flows. This footprint is depicted in Figure 1-1 and encompasses:

- The area of land that will be directly disturbed by land-clearing and project works, buffered by a few hundred metres to allow for noise and/or dust disturbance. Areas disturbed by project works consists of:
 - Rum Jungle mine site (Figure 1-2)
 - Mt Burton waste rock dump (Figure 1-3)
 - Mt Fitch overburden heap (Figure 1-4)
 - Granular material borrow area and the haul road corridor connecting this to the mine site (exact route yet to be confirmed) (Figure 1-5)
 - Low permeability material borrow area (Figure 1-6).
- The East Branch of the Finnis River downstream of the former Rum Jungle mine site to the junction with the Finnis River proper.
- The West Branch of the Finnis River downstream of the Mt Burton site to the junction with the Finnis River proper.

1.2 Context

In preparation for this project, as well as for other projects on nearby land, many ecological surveys have been undertaken. These surveys have covered a broad range of areas, including vegetation communities, faunal assemblages, threatened fauna and flora species, and invasive species. This report collates data from surveys conducted between 2002 and 2019 within the project footprint and the wider region. That information will be used in the EIS to inform an assessment of the potential impacts that project activities could have on environmental values.

1.3 Scope

This report covers the terrestrial flora and fauna values. It compiles the relevant information from previous studies and presents supplementary information to address the information requirements in Section 2.2.1 of the EIS ToR, namely:

Provide updated results of targeted surveys for threatened species in areas where vegetation is to be cleared as part of the Proposal.

The presence or likely presence of species listed under the EPBC Act and/or the Territory Parks and Wildlife Conservation Act 1976, including but not limited to:

- *Partridge pigeon (eastern) (Geophaps smithii smithii) and black-footed tree-rat (Mesembriomys gouldii gouldii)*
- *suitable habitat for listed threatened species*
- *the presence, or likely occurrence, of introduced and invasive species*
- *listed threatened communities.*

Quantify and map values associated with sensitive or significant vegetation types and ecosystems including but not limited to:

- *Cycads*
- *Riparian vegetation*
- *Groundwater dependent ecosystems.*

1.4 Report structure

To address the scope described above, this report is structured as follows:

- Section 1 Introduction.**
- Section 2** Desktop review of the **general environmental** context of the project (climate, land use, bioregions, surface water, land systems and fire history).
- Section 3** Methods and results of **vegetation** surveys within the project footprint, including targeted surveys for significant vegetation, threatened flora and weeds.
- Section 4** Methods and results of **fauna** surveys within the project footprint and the surrounding region, including targeted surveys to identify the presence (or likely presence) of threatened species.
- Section 5** 'Likelihood of occurrence' assessment using desktop information and previous survey results to determine which **threatened species** have a reasonable likelihood of occurring within the project footprint.
- Section 6 References.**

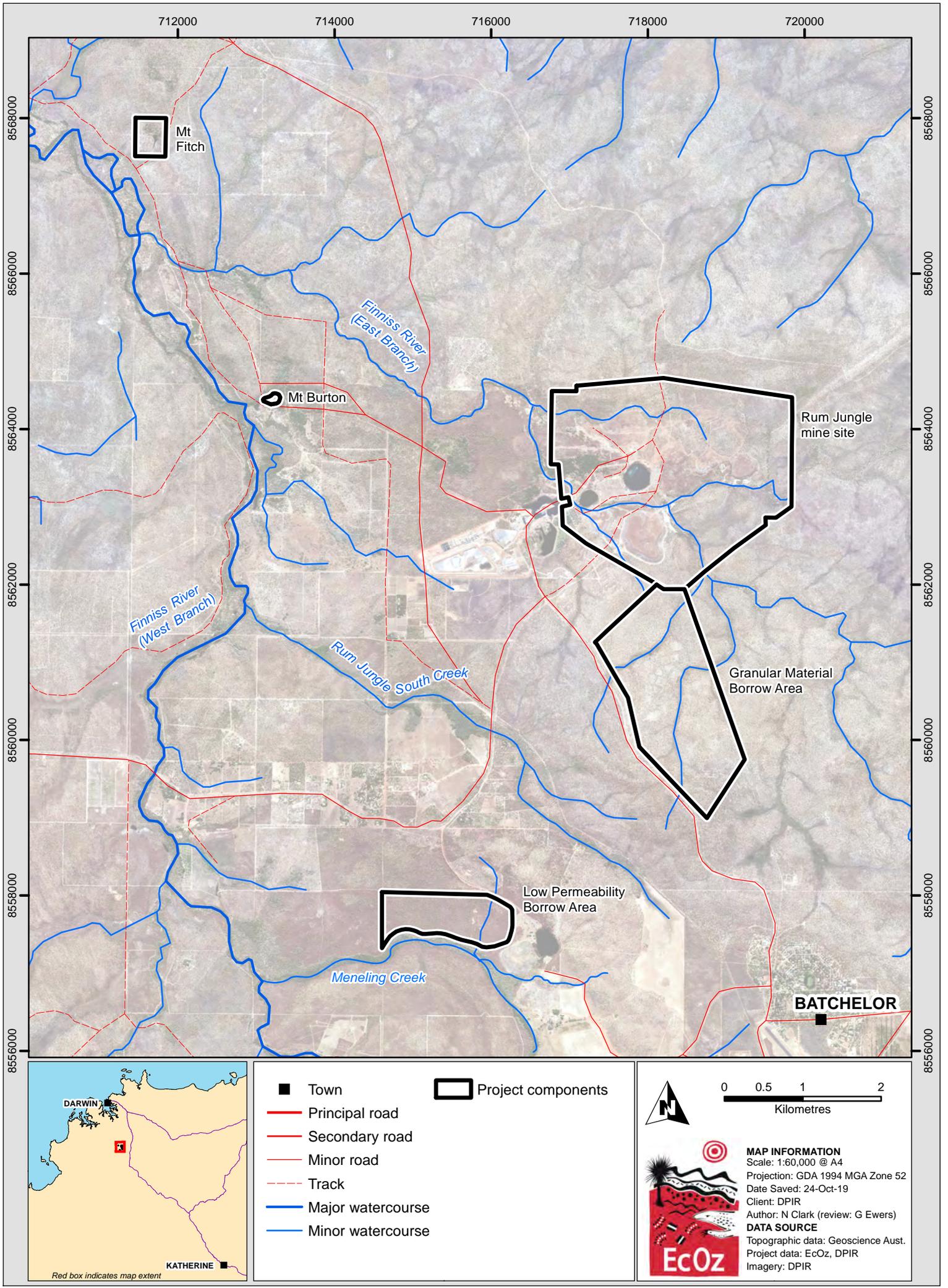
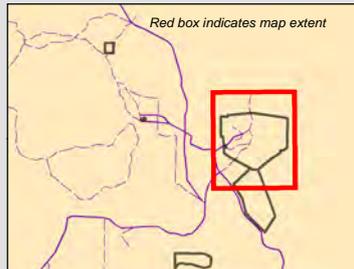
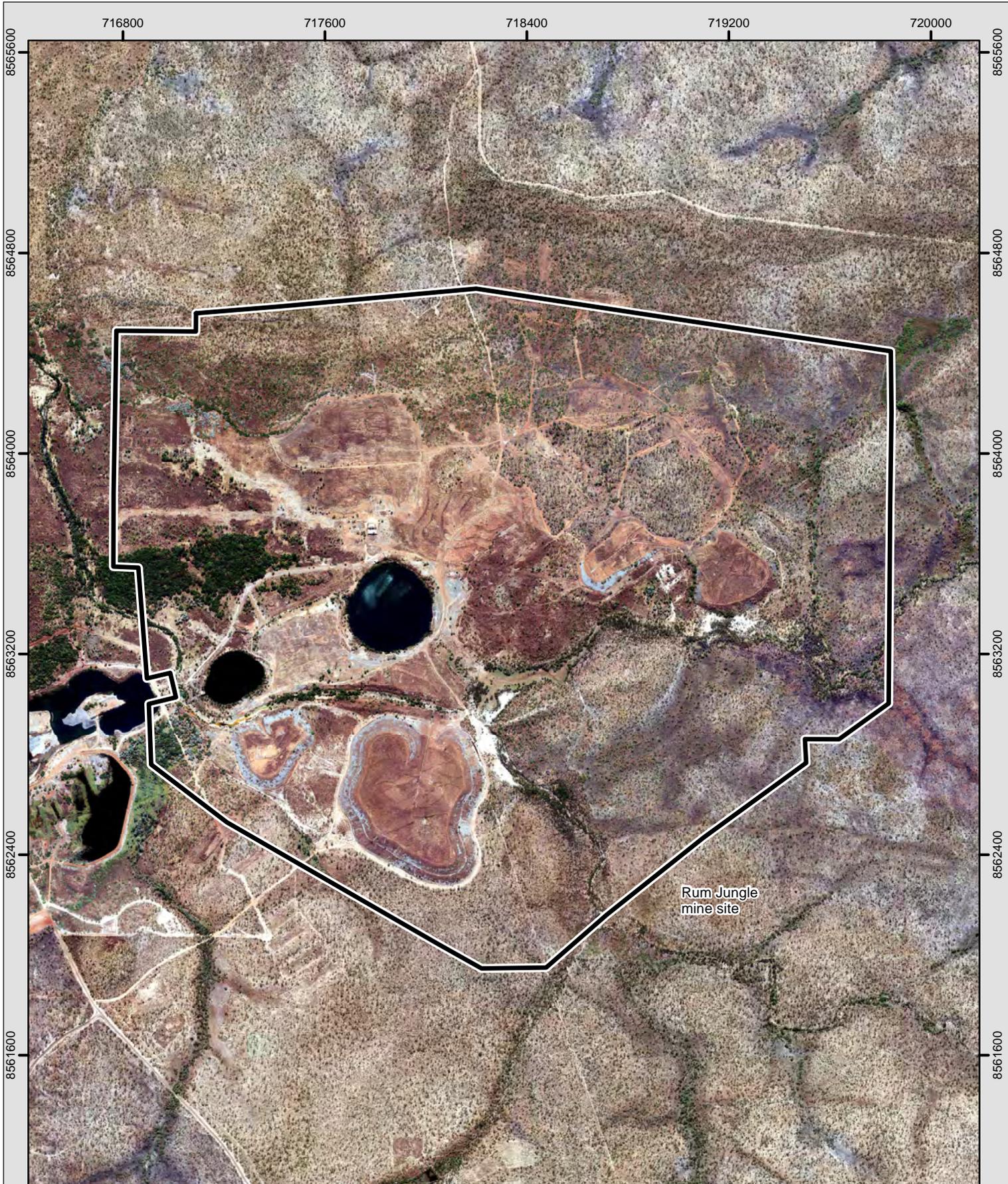
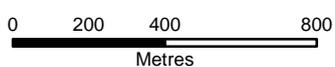


Figure 1-1. Map of Rum Jungle project footprint

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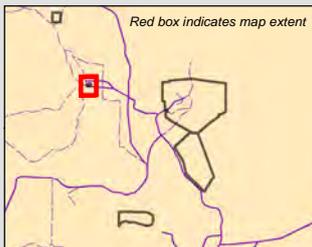
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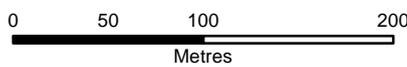
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 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 1-2. Aerial image of Rum Jungle mine site



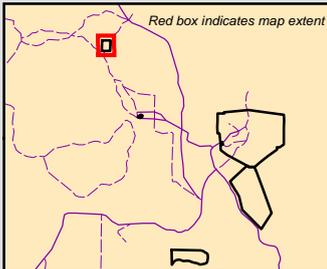
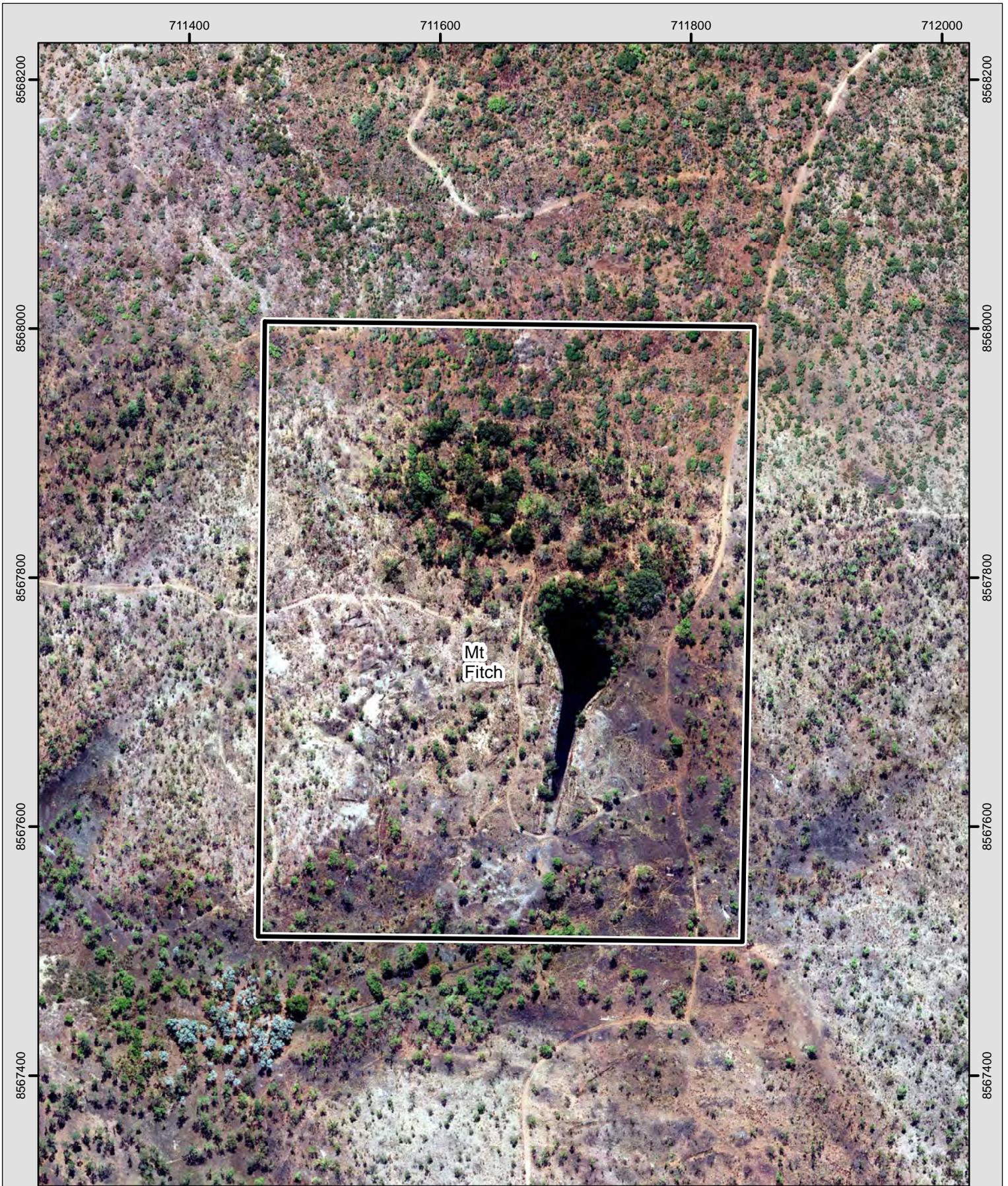
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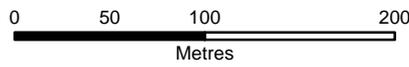
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 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 1-3. Aerial image of Mt Burton



 Project components

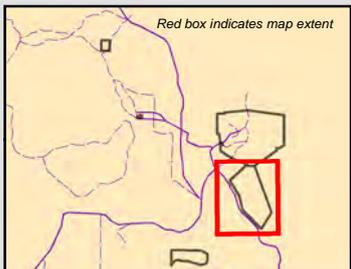


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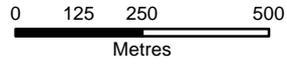
Figure 1-4. Aerial image of Mt Fitch



Granular Material
Borrow Area



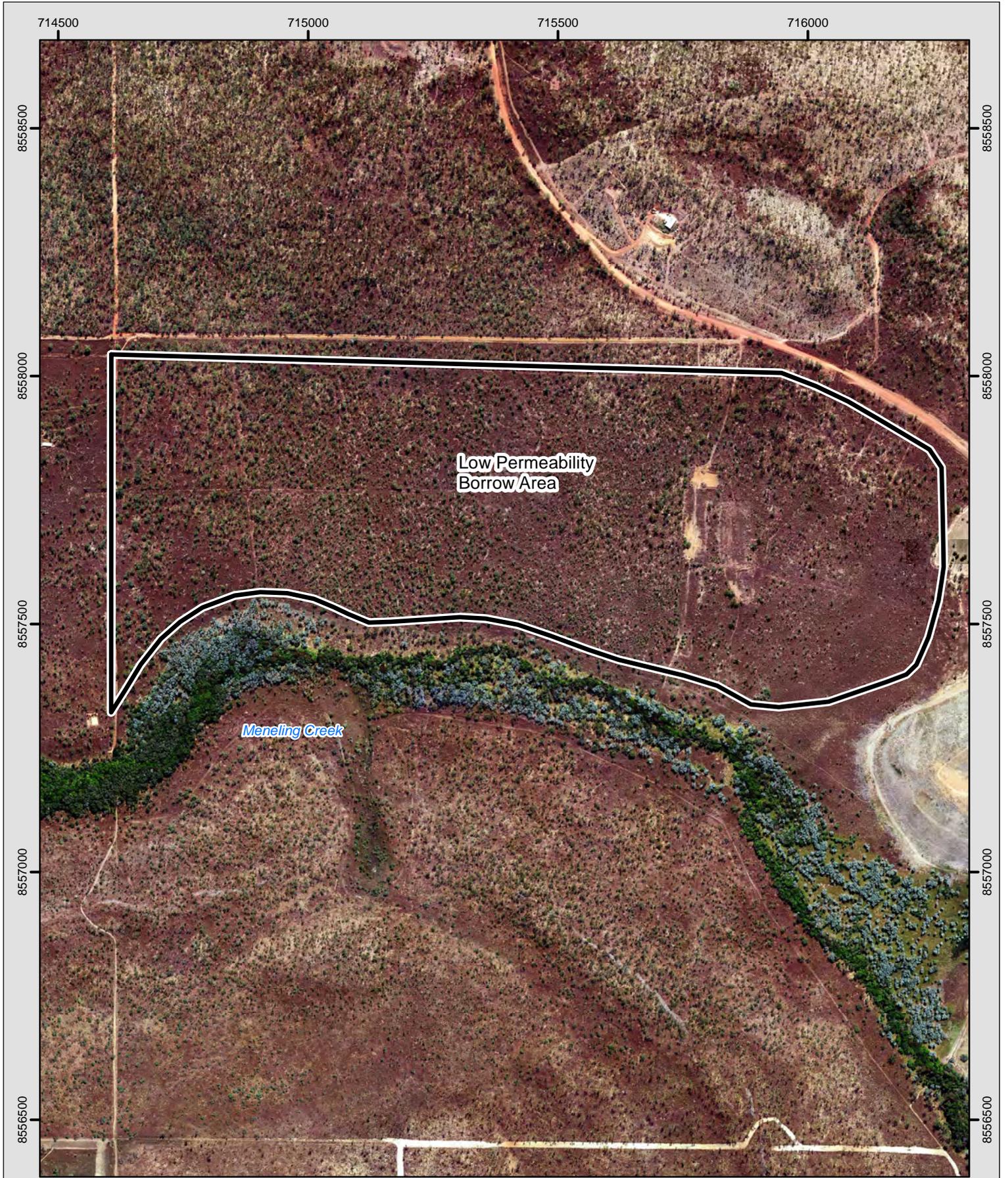
 Survey areas



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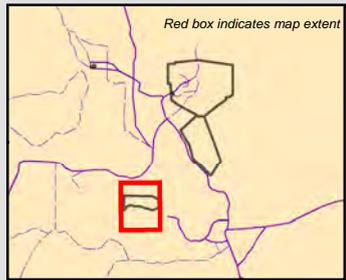
DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 1-5. Aerial image of granular material borrow area

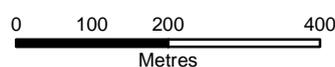


Low Permeability
Borrow Area

Meneling Creek



 Project components



MAP INFORMATION
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 Projection: GDA 1994 MGA Zone 52
 Date Saved: 25-Oct-19
 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 1-6. Aerial image of low permeability material borrow area

2 GENERAL ENVIRONMENT

This section presents the over-arching environmental context within which the project will occur. A description of vegetation is presented in Section 3.2.

2.1 Weather and climate

The region has a tropical climate with a distinct Dry season (approximately April to October) and Wet season (November to March). Climate statistics obtained from the nearest Bureau of Meteorology climate station at Batchelor Airport (station number 014272) are presented in Figure 2-1. The mean minimum temperatures range from 16.5°C in the Dry season to 24.1°C in the Wet season. Mean maximum temperatures range from 31.5°C in the Dry season to 36.8°C in the Wet season. The mean relative humidity ranges from 53% in the Dry season to 90% in the Wet season. The annual average rainfall in the region is 1,588 mm. The wettest months are December through to March. The region can experience cyclones, typically between the months of November and April.

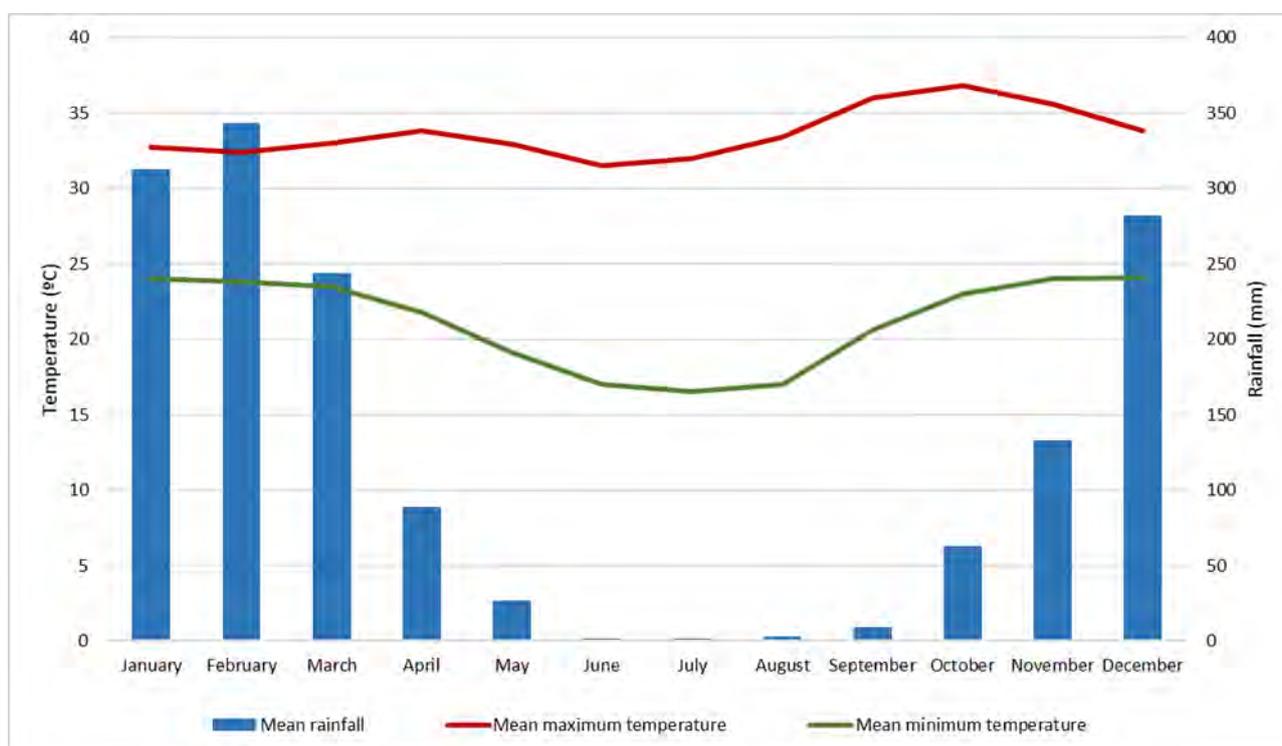


Figure 2-1. Graph of mean monthly climate statistics for the region

2.2 Land use

Prior to the Rum Jungle mine, some of the project footprint was already a modified natural landscape that had varying levels of disturbance from previous exploration and mining-related activities. Rum Jungle was an operational mine between 1954 and 1971, predominantly producing uranium oxide and copper concentrate. The main areas of disturbance were in the central and south-west area of Rum Jungle, as well as the Mt Fitch pit and Mt Burton waste rock dump.

Surrounding land uses include mining, mineral exploration, horticulture and agricultural uses, the Batchelor township, and Litchfield National Park (park boundary is approximately 9 km south-west of the project

footprint). To the north and east are large tracts of undeveloped land associated with the Darwin River Dam catchment.

Mt Burton is now a private property with a residence approximately 200 m to the south-west. Mt Fitch is also located on private property and is used for grazing cattle.

The Rum Jungle mine site is proximate to the proposed Yarram Iron Ore Project, and next to the former Browns Oxide Project (abutting the western side of the Rum Jungle site). The Browns Oxide Project mined copper, cobalt and nickel between 2007 and 2009. Prior to this, the area was bushland, associated primarily with mid-high *Erythrophleum chlorostachys*, *Eucalyptus miniata*, *Corymbia* sp. woodland. The site is currently in care and maintenance. As with Rum Jungle, mining at Browns Oxide intercepted sulphidic waste rock, which is currently being managed as part of the care and maintenance program. The Browns Oxide site is also within the catchment of the East Branch of the Finnis River.

2.3 Bioregion

Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale, thus providing a useful means for simplifying and reporting on more complex patterns of biodiversity (NSW 2003). NT bioregions are described in Baker et al. (2005).

The project footprint is located within the Pine Creek bioregion which occupies approximately 28,500 km² and comprises foothill environments west of the western Arnhem Land sandstone massif. The major vegetation types are *Eucalypt* tall open forests and woodlands. There are also significant areas of monsoon rainforest patches, *Melaleuca* woodlands, riparian vegetation and tussock grasslands.

2.4 Surface water

The project area exists within the Finnis River catchment. In this report, that watercourse is referred to as the Finnis River (main or trunk) until a confluence where it branches into the East and West Branches. As shown in Figure 2-2, the majority of the project footprint is within the catchment of the East Branch. The exceptions are Mt Fitch and Mt Burton, which are adjacent to the West Branch, and the low permeability material borrow area, which is adjacent to Meneling Creek (which flows into the West Branch).

The Finnis River is dynamic in terms of flow and sediment processes, the key elements of which include monsoonal/season rainfall, high rates of sediment delivery from an eroding mine landscape, a sand-bearing geology, and high groundwater connectivity (Hydrobiology 2013).

The following summary of the two branches has been constructed from information in Metcalfe (2002):

- The West Branch (and, indeed, the main Finnis River) is a large, permanent watercourse. It typically has steep banks (3 to 5 m high) that are terraced, a relatively-extensive floodplain, and is characterised by sandy, heavily-vegetated levees. There are billabongs associated with the watercourse and floodplains, and downstream it flows through the Finnis River Coastal Floodplain Site of Conservation Significance, which supports several listed threatened species.
- The East Branch is a semi-permanent stream within a distinct channel that dries to a number of pools in the late dry season. The bed is typically broad with low, earthy banks 1 to 3 m high with abundant sandy to rocky mid-stream shoals. Although riparian vegetation on the East Branch shows obvious signs of degradation, it currently supports a reasonable density and diversity of riparian species. The East Branch riparian corridor typically merges rapidly with surrounding Eucalypt woodland areas; there is little to no surrounding floodplain areas.

Metcalf (2002) also conducted surveys along Rum Jungle Creek (which lies between Meneling Creek and the East Branch), and described it as a small, permanent spring-fed stream that joins the West Branch River. The creek is characteristically an incised channel 0.5 to 1.5m deep flowing within a relatively-narrow corridor of dense riparian vegetation. That description of structure and vegetation is applicable to Meneling Creek.

During operation, Rum Jungle Mine delivered substantial pollution – primarily caused by acid rock drainage – into the East Branch, causing severe detriment to the water and sediment quality downstream, and appreciable detriment in the main Finniss for 15 km downstream of the junction with the East Branch (based on measures made in 1973/4; cited in Hydrobiology 2013). Remediation of Rum Jungle mine site began in 1983, but post-remediation studies did not occur until the 1990's. Field and experimental studies conducted in the 1990's showed substantial reductions in the annual loads of metal delivered into the Finniss River via the East Branch, as well as greater reductions in the water concentrations of the metals and acidity in the East Branch and main Finniss River (Hydrobiology 2013).

In 2013, Hydrobiology classified the three zones within the East Branch as highly disturbed (based on various conservation values). Zones upstream of East Branch in the Finnish River, and from East Branch to Florence Creek were both classified as having slightly-moderately disturbed ecosystems.

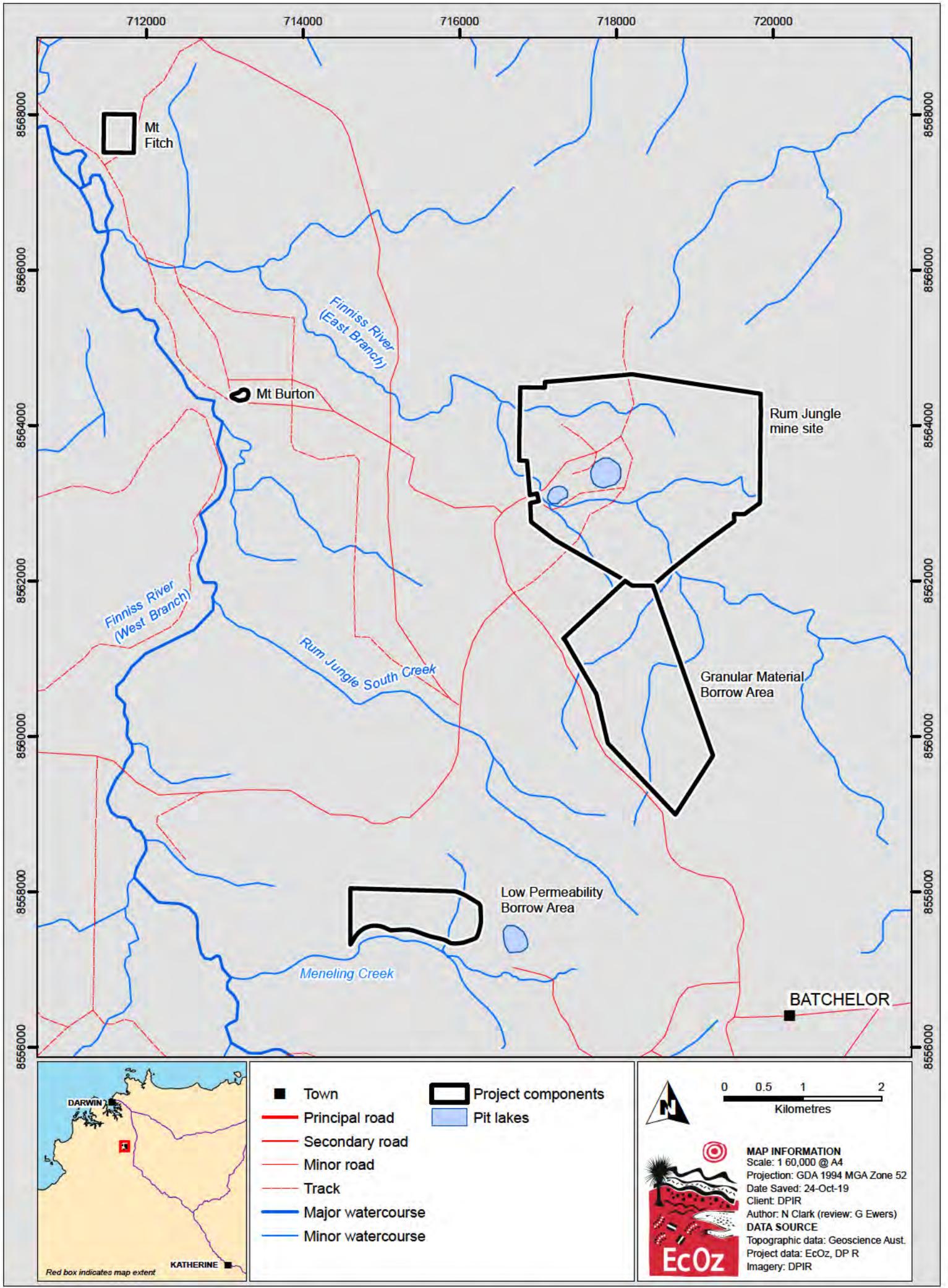


Figure 2-2. Map of surface water features within the project footprint

2.5 Land systems

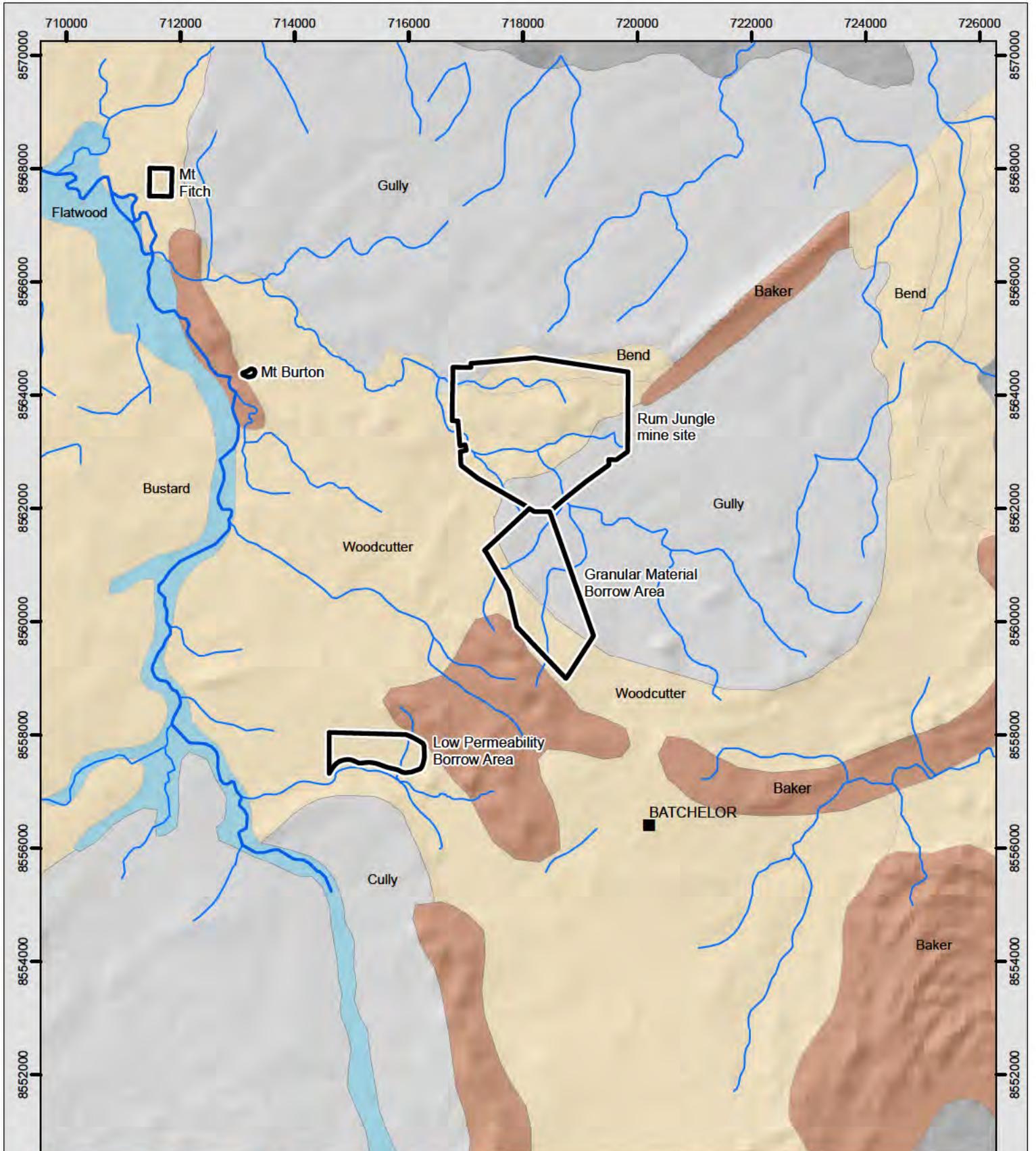
Christian and Stewart (1968) define a land system as ‘an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation’. These have been mapped by across the NT by the government and are at a significantly smaller scale than a bioregion (i.e. bioregions constitute many different land systems).

NTG mapping at 1:250,000 shows that the project footprint occurs within six different land systems. These systems – as well as adjacent ones – are mapped in Figure 2-3, and their characteristics are outlined in Table 2-1. Finer scale, land unit mapping only covers a minor proportion of the project footprint and so has not been included in this report.

Table 2-1. Land system characteristics for the Rum Jungle project footprint

Name	Class	Landform	Soil	Vegetation*
Effington	Alluvial floodplains	Level to gently undulating alluvial floodplains of dominantly sandy alluvium	Kandosolic, Tenosolic and Chromosolic Redoxic Hydrosols. Uniform gradational and texture contrast sandy soils.	Mid-high woodland of <i>Melaleuca viridiflora</i> , <i>C. polycarpa</i> , <i>Melaleuca nervosa</i> , <i>E. bigalerita</i> , <i>C. latifolia</i> over <i>Chrysopogon fallax</i> , <i>Pseudopogonatherum spinescens</i> , <i>Eriachne trisetata</i> .
Flatwood		Level to gently undulating alluvial floodplains of dominantly silty alluvium	Kandosolic and Chromosolic Hydrosols. Mottled yellow earths and duplex soils.	Mid-high open woodland of <i>Melaleuca viridiflora</i> <i>C. polycarpa</i> , <i>Melaleuca nervosa</i> , <i>C. latifolia</i> , <i>C. grandifolia</i> over <i>Chrysopogon fallax</i> , <i>Pseudopogonatherum spinescens</i> , <i>Eriachne spp.</i>
Gully	Granite plains and rises	Undulating terrain developed on granite, schist, and gneiss.	Kandosols and chromosols. Red massive earths and mottled yellow duplex soils.	Woodland of <i>C. confertiflora</i> , <i>C. foelscheana</i> , <i>E. chlorostachys</i> , <i>Terminalia canescens</i> , and <i>Petalostigma</i> species over perennial grasses (<i>Heteropogon triticeus</i> , <i>Themeda australis</i> , <i>Sorghum plumosum</i>).
Bend	Sandstone plains and rises	Undulating low strike ridges and rises on folded Burrells Creek greywacke, sandstone and siltstone.	Kandosols and rudosols. Skeletal soils and shallow gravelly loams.	Mid-high woodland of <i>C. latifolia</i> , <i>C. foelscheana</i> , <i>E. polysciada</i> , <i>E. tectifera</i> , <i>Erythrophleum chlorostachys</i> over tropical tall grass (<i>Sorghum spp.</i> , <i>Heteropogon spp.</i> , <i>Chrysopogon spp.</i>).
Bustard		Very low ridges and hills on Lower Proterozoic sediment and intervening alluvial flats.	Kandosols. Lithosols with minor shallow yellow massive earths and earthy sandy soil.	Low shrubland of <i>E. spp.</i> , <i>Xanthostemon paradoxus</i> and <i>Buchanania spp.</i>
Woodcutter		Very gently upland surface; probably developed on Tertiary sediments overlying carbonate-rich Lower Proterozoic rocks.	Kandosols. Deep red massive earths and yellow massive earths.	Mid-high woodland of <i>Erythrophleum chlorostachys</i> , <i>E. miniata</i> , <i>C. confertiflora</i> , <i>C. papuana</i> and <i>Petalostigma</i> species over perennial grasses (<i>Heteropogon triticeus</i> , <i>Chrysopogon latifolius</i> and <i>Imperata cylindricus</i>).

* C. = *Corymbia*, E. = *Eucalyptus*



■	Towns		Land systems
▭	Project components	■	Sandstone hills
—	Major watercourse	■	Sandstone plains & rises
—	Minor watercourse	■	Granite plains & rises
		■	Alluvial floodplains

MAP INFORMATION
 Scale: 1 90,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 25-Oct-19
 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DP R
 Imagery: DPIR

Figure 2-3. Map of land systems within the project footprint

2.6 Fire

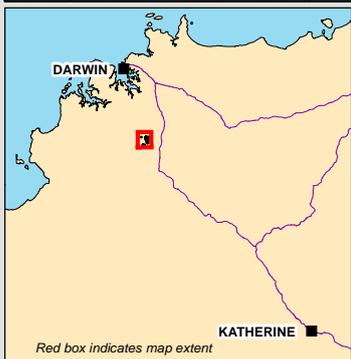
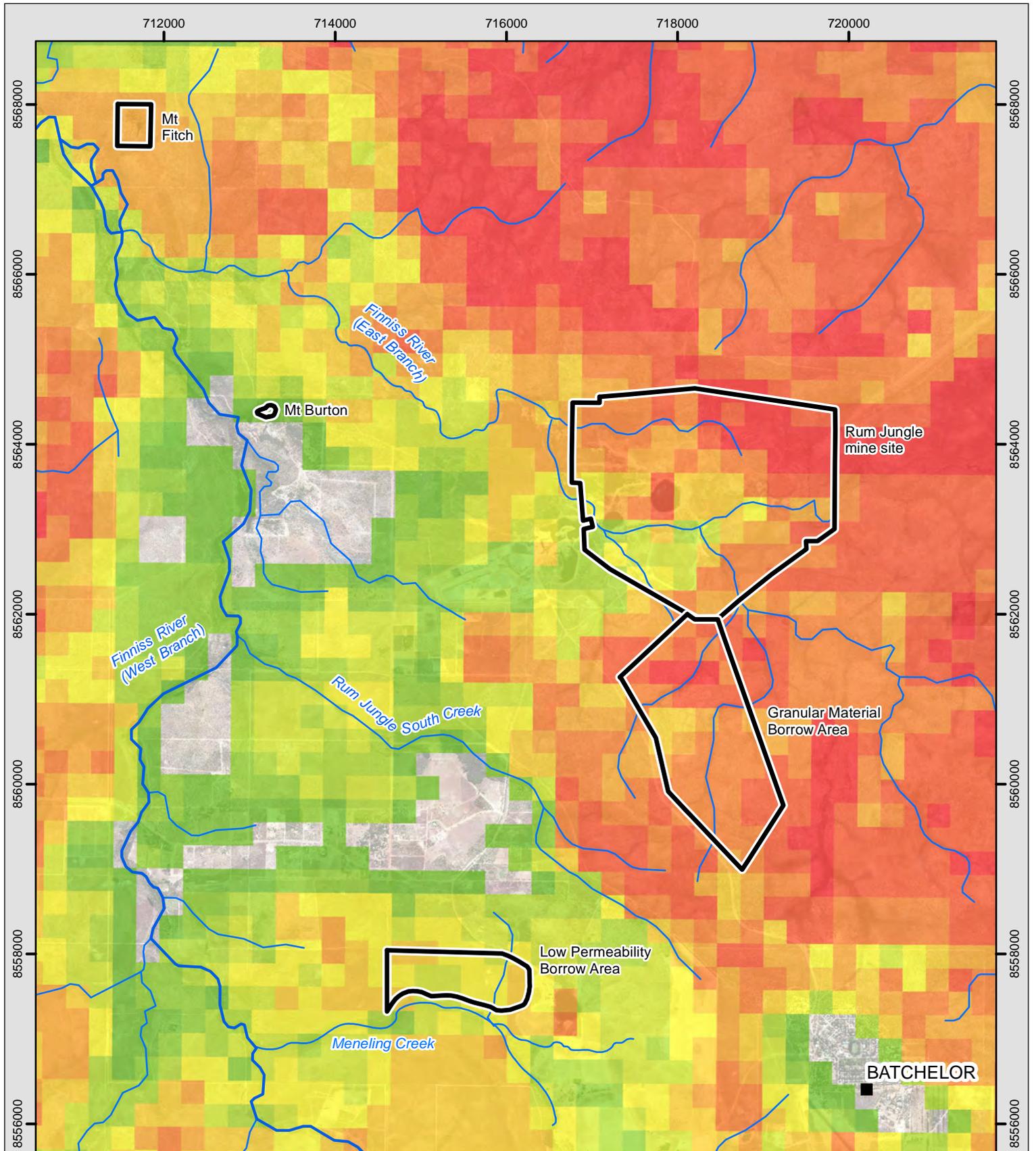
The northern savannas constitute the most fire-prone landscapes in Australia (Russell-Smith & Whitehead 2015), and regular fires have always been a natural part of the environment in the Top End. However, frequent fires can result in fewer flora species and reduced structural complexity (McKay 2017), both of which can also significantly diminish the habitat quality for fauna.

Regional fire history and fire scar mapping was obtained through the [Northern Australia Fire Information](#) website. The majority of the project footprint was last burnt between 2017 and 2019 – see map at Figure 2-4. In the past ten years, the majority of the project footprint has been burnt every year – this is a very high frequency, likely to the detriment of native species – see Price and Baker (2007).

The small patch of monsoon vine forest on the eastern border of mine site has burnt seven times, and Mt Burton, has only burnt once or twice (with the wet vine forest to its south remaining unburnt). The entire extent of the granular material borrow area was burnt in 2018. The western half of the low permeability material borrow area was most recently burnt in 2017, but the eastern half not since 2013.

Late burn fires are typically hotter than those occurring earlier in the Dry season. They are often anthropogenic in origin (i.e. not caused by lightning), and their effect on native flora and fauna is usually more detrimental. These hotter, more intense fires affect not just the ground and mid strata, which have evolved to adapt to fire, but also the more fire-sensitive canopy stratum.

In the last ten years, the granular material borrow areas have experienced late burns between two and three times; the low permeability material borrow area none at all. Of all the fires across the mine site, there has been only one that occurred late in the Dry season.



<ul style="list-style-type: none"> ■ Towns — Major watercourse — Minor watercourse ▭ Project components 	<p>No. of years burnt (2009 to 2018)</p> <table border="0"> <tr> <td style="background-color: #90EE90;">once</td> <td style="background-color: #FFD700;">6 times</td> </tr> <tr> <td style="background-color: #90EE90;">twice</td> <td style="background-color: #FFA500;">7 times</td> </tr> <tr> <td style="background-color: #90EE90;">3 times</td> <td style="background-color: #FF8C00;">8 times</td> </tr> <tr> <td style="background-color: #90EE90;">4 times</td> <td style="background-color: #FF69B4;">9 times</td> </tr> <tr> <td style="background-color: #90EE90;">5 times</td> <td style="background-color: #FF0000;">10 times</td> </tr> </table>	once	6 times	twice	7 times	3 times	8 times	4 times	9 times	5 times	10 times
once	6 times										
twice	7 times										
3 times	8 times										
4 times	9 times										
5 times	10 times										

MAP INFORMATION
 Scale: 1:60,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 24-Oct-19
 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 2-4. Map of fire history across the Rum Jungle region

3 VEGETATION

This section describes the vegetation and flora surveys that have been previously undertaken for this project, as well as for adjacent projects.

3.1 Surveys

Since 2002, there have been vegetation surveys covering the various project sites. Some were commissioned for the Rum Jungle project and so targeted sites relevant to the project; the remaining surveys were for other projects (such as Browns Oxide) which incidentally included certain parts of the Rum Jungle project footprint. All of these surveys are described below, with the results collated in Section 3.2.

3.1.1 Region

Metcalf (2002) surveyed vegetation communities within a 37.5 km² area centred on the (then) proposed Browns Oxide mine site. The extent of the survey area encompassed the Rum Jungle mine site and Mt Burton. The survey methodology described in the report by Metcalfe (2002) – although pre-dating the *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping* (Brocklehurst et al. 2007) – is in alignment with that guideline.

3.1.2 Project footprint

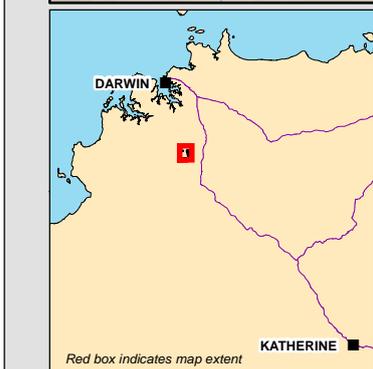
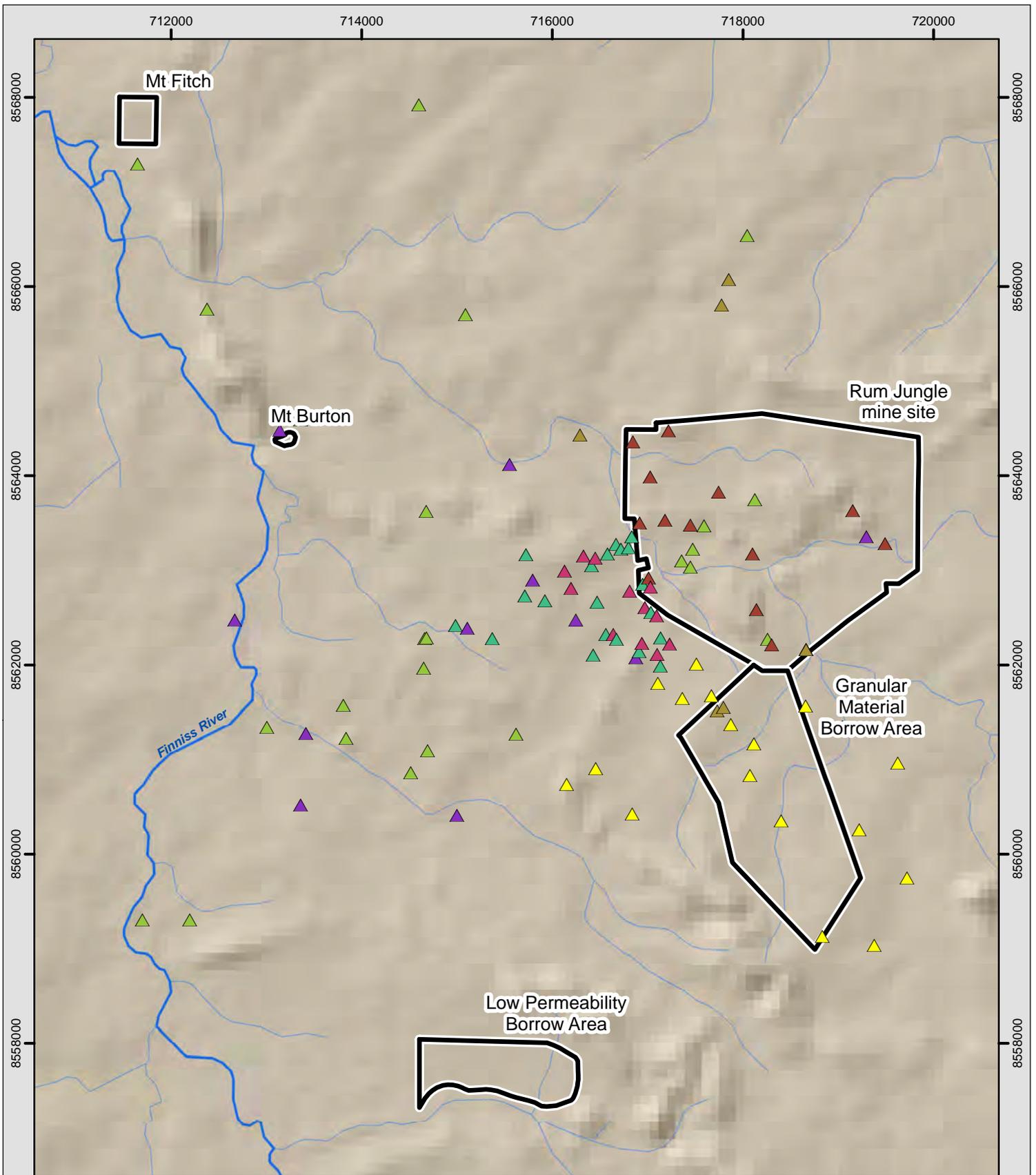
Vegetation communities

Vegetation surveys have been undertaken within all the components of the project footprint. The locations of survey sites are mapped in Figure 3-1 and summarised as follows:

- **Rum Jungle.** Eco Logical (2014) undertook a detailed vegetation mapping survey that involved 190 sites (on average 1 site per 3.4 ha), including 15 detailed survey sites and 175 rapid survey sites – see Figure 3-2. The survey methodology is detailed in Section 3.3.2 of Appendix D of this report.
- **Mt Burton** by Metcalfe (2002) and by GHD (2009); **Mt Fitch** by Metcalfe (2002). These are the only surveys of these sites, both undertaken for the Browns Oxide project. The portions of these two sites that will be disturbed by this project are previously-disturbed areas with either no vegetation or else heavy weed infestations (see Section 3.2.2). Therefore, more up-to-date or detailed vegetation mapping for those sites is not considered necessary.
- **Granular material borrow area.** EcOz (2019) undertook a vegetation mapping survey that involved 19 sites – see Figure 3-12 and Section 3 in Appendix E.
- **Low permeability material borrow area.** EcOz (2019) used a drone to take aerial imagery of the site, and supplemented the image with onsite photographs at ground level. The density of Gamba Grass was such that doing a standard vegetation survey was not possible; see Section 3 in Appendix E.

Egan (2005) and URS (2010) also undertook vegetation surveys for the Browns Oxide project. The areas surveyed have since been significantly disturbed for the development of the project, rendering their data redundant for use in this report.

Each survey used a methodology following that prescribed in Brocklehurst et al. (2007). These guidelines present standard methods for collecting, describing, classifying and mapping vegetation in the Northern Territory, which are consistent with the national standards in the National Vegetation Information System (NVIS).



Survey	
▲	Eco Logical (2014)
▲	Metcalfe (2002)
▲	Egan (2005)
▲	GHD (2009)
▲	URS (2010)
▲	Eco Logical (2015) full sites
▲	EcOz (2019)

MAP INFORMATION
 Scale: 1:55,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 16-Oct-19
 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: Shaded relief, Landsat

Figure 3-1. Map of all flora survey sites within the region

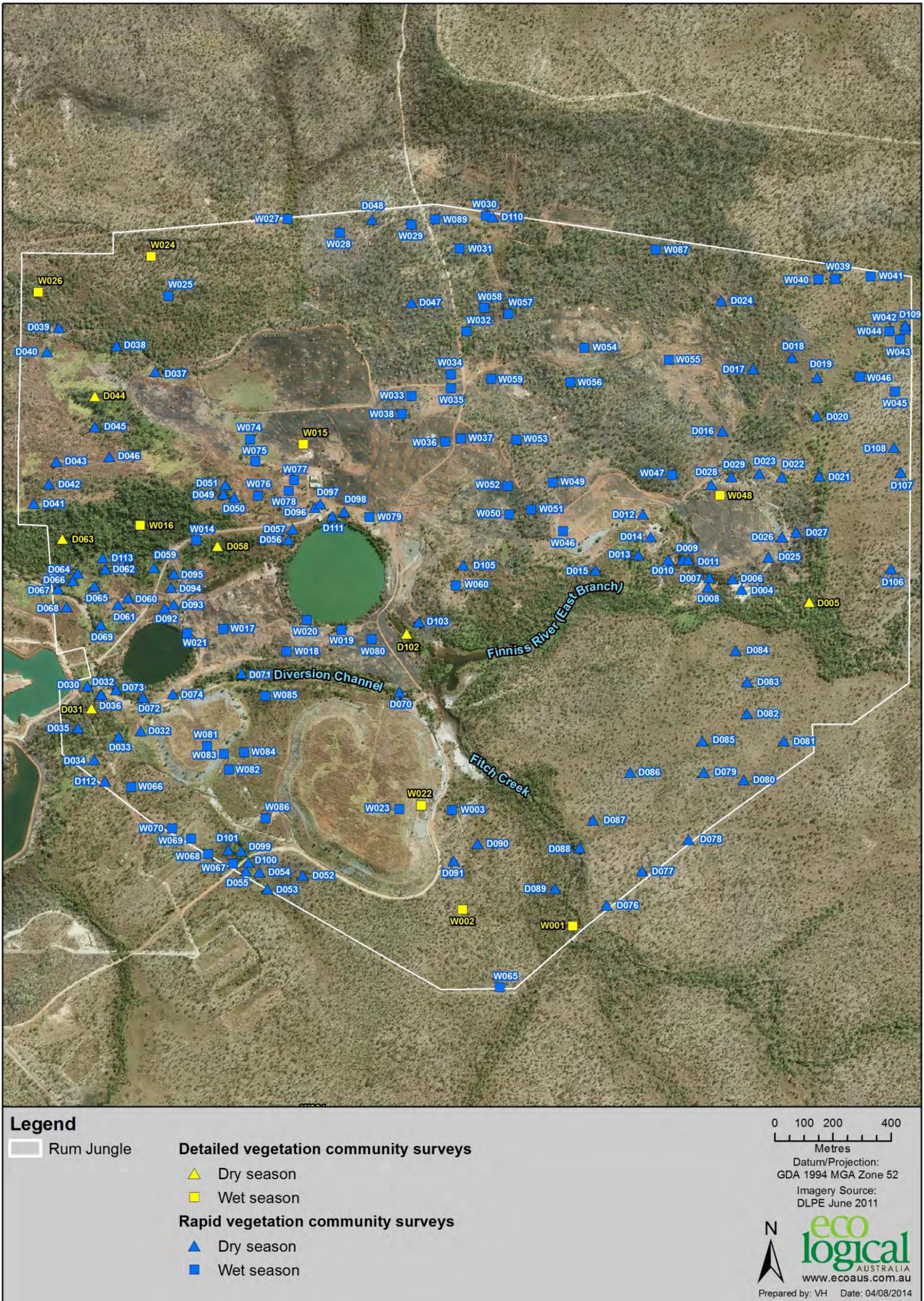


Figure 3 2. Map of all flora survey sites within the Rum Jungle mine site (Eco Logical 2014)

Weeds

All the surveys mentioned above included records of weed species, as well as a general description of the extent and abundance of weed infestations. Only the mine site has had a comprehensive and systematic weed survey. This was undertaken by Wild Man (2011-12), and repeated in 2018 by EcOz to inform a revision of the Weed Management Plan— see Appendix F. The survey was developed with reference to the *Northern Territory Weed Data Collection Manual* (WMB 2015). The entire site was surveyed by creating a field map displaying a 100 m grid of numbered weed points within the survey boundary. Weed densities observed while traveling between each point were recorded and applied to each weed point number. In areas containing large areas of Gamba Grass (i.e. with a density greater than 50 % cover), the boundaries of patches were traversed and weed records within the patch were projected onto the associated weed points. This method was mainly used on waste rock dumps and in dense patches in the north-west corner.

Threatened species

During all the surveys described in Section 3.1, only one threatened flora species has been recorded in the vicinity of the project footprint – Darwin Cycad (*Cycas armstrongii*). Moreover, as discussed in Section 3.2.2, this is the only threatened flora species likely to occur in the project footprint.

Targeted surveys for Darwin Cycad have occurred to inform this project. In 2014, Eco Logical undertook transect surveys in the Rum Jungle site to estimate the local abundance of the species. Two transect lines were placed in suitable undisturbed woodland habitat in the north of Rum Jungle (10 m x 200 m) and in the south (40 m x 710 m). Density estimates were then determined by extrapolating the number of plants per transect to the number of plants per hectare. Eco Logical used the same methodology in 2015, when surveying proposed cover material extraction areas adjacent to the Rum Jungle site. Again, density estimates were taken by counting individual plants along two transects; one (10 m x 650 m) in undisturbed woodland south of Rum Jungle, the other (8 m x 1.3 km) in woodland to the west that had a dominant understory of Gamba Grass – see map at Figure 3-1.

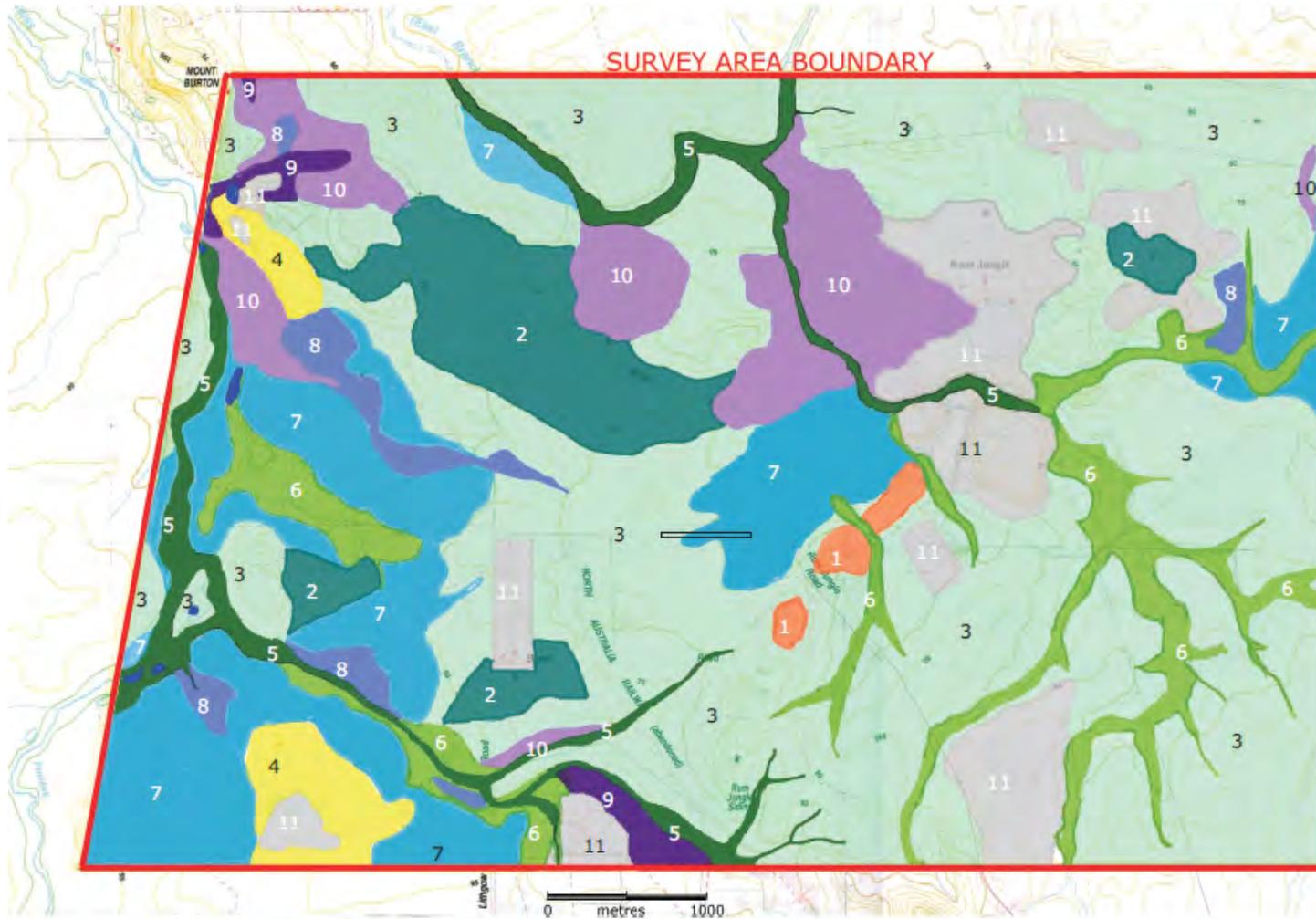
3.2 Results

This section collates the results from the various surveys described above, and details the vegetation communities, weeds, significant vegetation types and threatened flora species present within the project footprint.

3.2.1 Vegetation communities

Region

Metcalf (2002) identified and described 10 vegetation communities for the region – see Figure 3-3. The dominant vegetation comprises mainly *Eucalyptus*-dominated woodland and open woodland communities (59% of survey area). This vegetation community – also known as savanna – is common, widespread and characteristic of the region generally. The remaining vegetation was predominantly riparian habitats, *Lophostemon* communities associated with low-lying drainage areas, and Ghost Gum open woodlands and Paperbark communities on surrounding floodplains.



KEY - VEGETATION MAP

BROWNS POLYMETALLIC PROJECT

MAP UNIT	VEGETATION COMMUNITY
UPLAND EUCALYPT COMMUNITIES	
1	<i>Eucalyptus phoenicea</i> /E. <i>Meseri</i> open woodland
2	<i>Eucalyptus tetradonta</i> /E. <i>minuta</i> / <i>Erythrophloeum chlorostachys</i> woodland
3	<i>Eucalyptus tetradonta</i> /E. <i>minuta</i> open woodland to woodland
4	Mixed Eucalypt woodland
DRAINAGE AREAS	
5	Riparian corridor
6	<i>Lophosiemum</i> open woodland communities
7	<i>Eucalyptus papuana</i> /E. <i>fodschiana</i> / <i>Metaleuca</i> spp. open woodland
8	Paperbark woodland to open woodland communities
MONSOON FOREST COMMUNITIES	
9	Monsoon vine-forest
10	<i>Acacia auriculiformis</i> woodland communities
OTHER	
11	Previous mining areas, disturbed sites & rehabilitation areas

Figure 3-3. Map of vegetation communities in the region (Metcalf 2002)

Rum Jungle mine site

Eco Logical (2014) recorded 29 vegetation communities within the mine site (excluding areas that were not surveyed due to cultural reasons). These can be assigned to five broad vegetation groups:

- **Woodlands** comprised the largest vegetation group, and occur in the north, south and east areas. The most commonly-represented vegetation map units are *Eucalyptus tetradonta* and *E. miniata* open woodland (map unit 8), and *Eucalyptus tetradonta*, *E. miniata* and *Erythrophleum chlorostachys* woodland to open forest (map unit 10). These two are very similar in composition, but the former is generally more open and often lower in stature. Map unit 10 (occurring across 75 ha, mostly in the north and northwest of Rum Jungle) comprised the tallest and densest Eucalypt woodlands on the mine site – see photographs at Figure 3-5. The soils are likely to be deeper than those of the other Eucalypt woodlands in the area. Typically, species composition and stand structure of woodlands in the Top End are influenced by the soils, especially by their degree of saturation in the Wet season (Bowman 1986); however, the more recent invasion of Gamba Grass, and changes to the frequency and intensity of fires, are now primary influences in determining species' composition and stand structure. Map unit 8 is predominantly to the south and east of previously-disturbed areas.
- **Grassland** communities in the centre and western areas, typically invasions of either previously-rehabilitated or degraded former woodlands by Gamba Grass or other weeds – see photographs at Figure 3-6.
- **Riparian zones and wetlands** occur in small areas throughout much of the mine site, and encompass riparian corridors of streams and creeks, and alluvial plains – see photograph at Figure 3-22. This significant vegetation type is discussed in more detail in Section 3.2.5.
- **Vine forest** dominated by *Acacia auriculiformis* occurs as a large patch (~16 ha), and a number of smaller degraded remnant patches, within the vicinity of north of the Intermediate Pit – see photograph at Figure 3-26. This sensitive vegetation type is discussed in more detail in Section 3.2.5.
- **Other** vegetation occurs as areas of sparse and patchy regrowth – including batter slopes, old disused tracks and other clearings.

The vegetation types are listed in Table 3-1 and mapped at a 1:10,000 scale in Figure 3-4. Each map unit is described in more detail in the Eco Logical report presented in Appendix D. In a broader context, the vegetation communities of the mine site are well represented in the bioregion.

Table 3-1. Vegetation communities in the Rum Jungle mine site (as per Eco Logical 2014)

Broad group	Map unit	Vegetation type
Vine forests	1	<i>Acacia auriculiformis</i> vine forest
Woodlands	2	<i>Acacia auriculiformis</i> woodland to open forest
	3	<i>Acacia auriculiformis</i> open woodland
	4	<i>Corymbia bella</i> , <i>Corymbia polycarpa</i> , <i>Corymbia foelscheana</i> open woodland to woodland
	5	<i>Erythrophleum chlorostachys</i> , <i>Terminalia ferdinandiana</i> open woodland
	6	<i>Eucalyptus tectifica</i> , <i>Corymbia polysciada</i> , <i>E. miniata</i> woodland
	7	<i>Eucalyptus tetradonta</i> , <i>E. miniata</i> , <i>Corymbia bleeseri</i> open woodland to woodland
	8	<i>Eucalyptus tetradonta</i> , <i>E. miniata</i> open woodland
	9	<i>Eucalyptus tetradonta</i> , <i>E. miniata</i> , <i>Corymbia polysciada</i> open woodland
	10	<i>Eucalyptus tetradonta</i> , <i>E. miniata</i> , <i>Erythrophleum chlorostachys</i> woodland to open forest
	Grasslands	12
13		Gamba Grass grassland to closed grassland with isolated palms/shrubs/trees
14		Gamba Grass grassland to closed grassland
15		Mixed native grasses closed grassland with isolated palms/shrubs
16		Mixed native grasses, Gamba Grass closed grassland
17		<i>Sorghum intrans</i> sparse grassland to open grassland with isolated palms/shrubs
18		<i>Sorghum intrans</i> , Gamba Grass grassland with isolated shrubs
19		Para Grass, Guinea Grass grassland to closed grassland
Riparian zones and wetlands	20	Riparian grassland
	21	<i>Grevillea pteridifolia</i> , <i>Pandanus spiralis</i> , <i>Melaleuca viridiflora</i> open woodland
	22	<i>Lophostemon grandiflorus</i> , <i>Melaleuca</i> spp. woodland to open forest
	23	<i>Melaleuca</i> spp. woodland to open forest
	24	<i>Melaleuca viridiflora</i> woodland to open forest
	25	Riparian <i>Acacia auriculiformis</i> woodland to closed forests
	26	Riparian corridor of <i>Acacia auriculiformis</i> , <i>Lophostemon</i> spp., <i>Melaleuca</i> spp. woodland to open forest
Other	27	Bare, with patchy regrowth
	28	Waterbodies
	29	Cleared

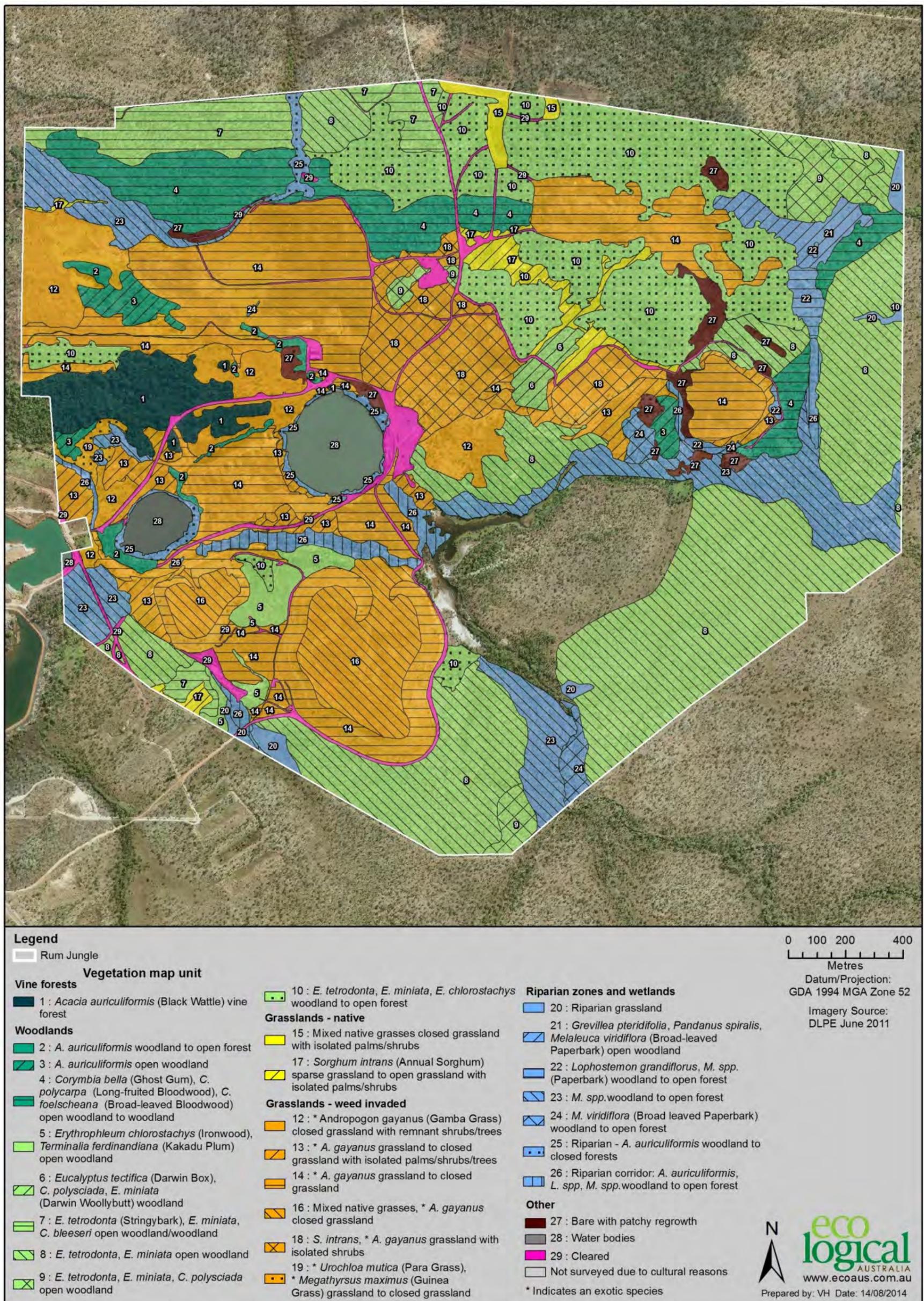


Figure 3 4. Map of vegetation communities in the Rum Jungle site (Eco Logical 2014)



Figure 3-5. Photographs of Eucalypt woodland (map unit 10) in the north-west of Rum Jungle



Figure 3-6. Photographs of mining landform areas in the centre of Rum Jungle that have become grassland

Mt Burton

The Mt Burton project footprint is a barren waste rock dump that is bordered to the north, east and west by a large patch of wet vine forest – see photographs at Figure 3-7. As it is a significant vegetation type, that vine forest is discussed in Section 3.2.5. To the south is a Cypress Pine (*Callitris intratropica*) grove planted by the landowner. The area has medium levels of weed infestations – as discussed in Section 3.2.3.



Figure 3-7. Photograph of the historic waste dump at Mt Burton

Mt Fitch

GHD (2009) described three different vegetation types within the Mt Fitch area:

- *Eucalyptus miniata* and *Corymbia polysciada* woodland to open woodland
- *Corymbia bella* and *Corymbia polysciada* open riparian woodland
- Open monsoon vine forest.

The actual area that will be disturbed by this project, however, is an already disturbed area from previous mining activities – see photographs at Figure 3-8. The site is also used to graze cattle. There are high levels of weed infestations across Mt Fitch – as discussed in Section 3.2.3. As it is a significant vegetation type, the vine forest is discussed in Section 3.2.5.



Figure 3-8. Photographs of the Mt Fitch site – between the waste rock dump and the pit (top), and of the side of the waste rock dump (bottom)

Granular material borrow survey area

Within the vicinity of the granular material borrow area, there are nine vegetation communities described by EcOz (2019) –six *Eucalyptus* communities and three drainage communities. Two of these – Community 1a and 2a – contain vegetation at various levels of regrowth after having been previously quarried. These are listed in Table 3-2 and mapped at Figure 3-12, with further details in Section 3 of Appendix E. Some example photographs are provided at Figure 3-9, Figure 3-10 and Figure 3-11. *Eucalyptus* community 1 (*Eucalyptus tetradonta* +/- *Eucalyptus miniata*, *Erythrophleum chlorostachys* mid woodland) was the widest spread, occurring across 45 % of the granular material borrow survey area.



Figure 3-9. Photographs of Eucalyptus mid woodland (map unit 1) in the granular material borrow area



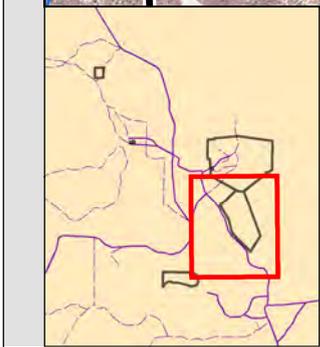
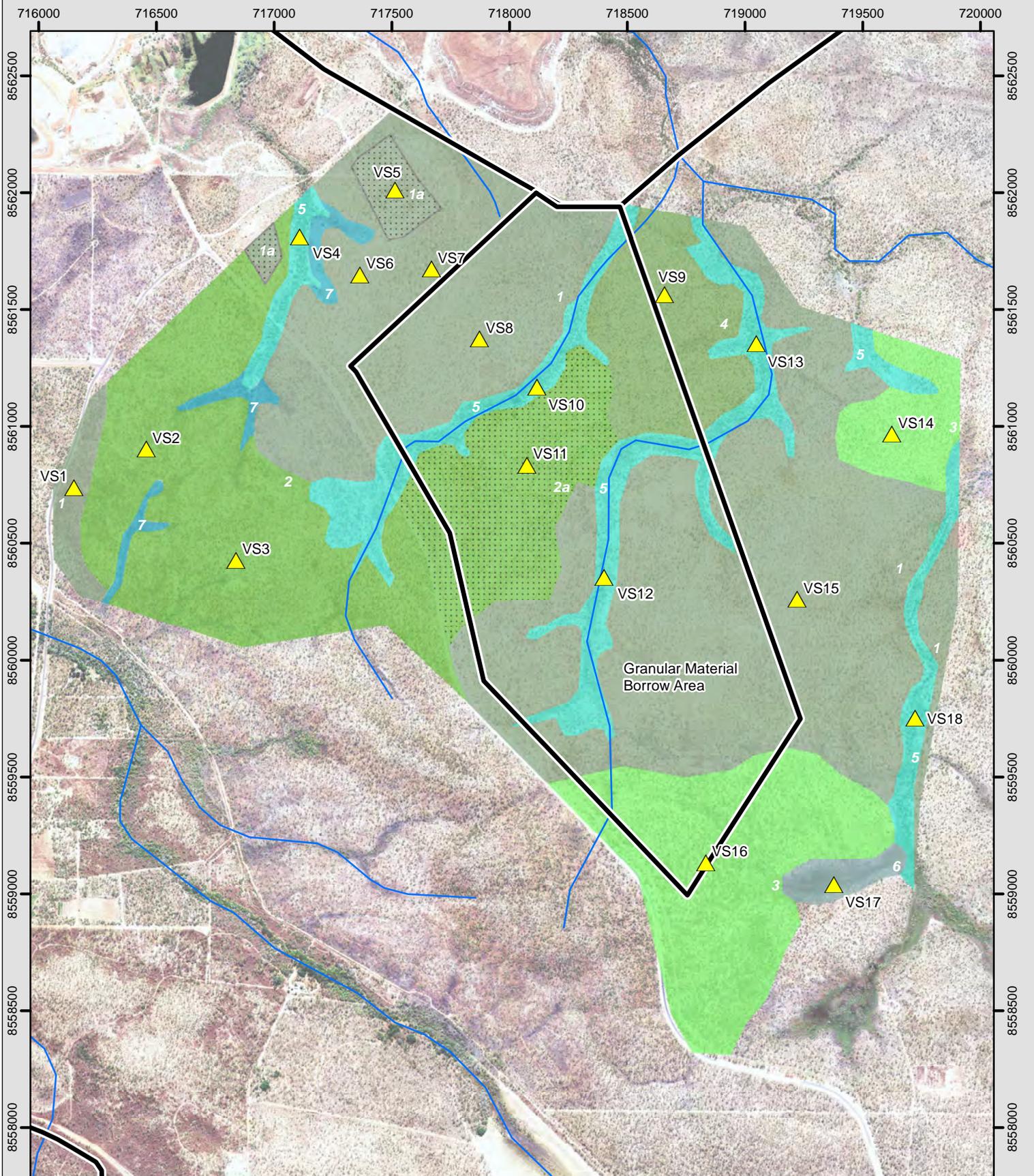
Figure 3-10. Photograph of previously-disturbed Eucalyptus low open woodland (map unit 2a) in the granular material borrow area



Figure 3-11. Photograph of Eucalyptus mid open woodland (map unit 2) in the granular material borrow area

Table 3-2. Vegetation communities in the granular material borrow survey area (EcOz 2019)

Vegetation community		Area
Eucalyptus communities		
1	<i>Eucalyptus tetradonta</i> +/- <i>Eucalyptus miniata</i> , <i>Erythrophleum chlorostachys</i> mid woodland over <i>Livistona humilis</i> , <i>Terminalia ferdinandiana</i> mid open shrubland over <i>Heteropogon triticeus</i> and <i>Sorghum intrans</i> mid open tussock grassland	383.5 ha (45%)
1a	Previously-disturbed area: <i>Buchanania obovata</i> , <i>Acacia difficilis</i> , <i>Terminalia ferdinandiana</i> low open woodland over <i>Acacia oncinocarpa</i> , <i>Livistona humilis</i> , <i>Cycas armstrongii</i> mid sparse shrubland over <i>Eriachne ciliata</i> , <i>Heteropogon triticeus</i> , <i>Sorghum intrans</i> mid open tussock grassland	11.0 ha (1%)
2	<i>Eucalyptus miniata</i> , <i>Erythrophleum chlorostachys</i> mid open woodland over <i>Eucalyptus phoenicea</i> , <i>Terminalia ferdinandiana</i> , <i>Livistona humilis</i> mid open woodland over <i>Chrysopogon latifolius</i> , <i>Sorghum intrans</i> , <i>Sorghum plumosum</i> mid tussock grassland	129.5 ha (15%)
2a	Previously-disturbed area: <i>Eucalyptus phoenicea</i> low open woodland over <i>Livistona humilis</i> , <i>Calytrix exstipulata</i> , <i>Acacia oncinocarpa</i> mid open shrubland over <i>Sorghum plumosum</i> , <i>Eriachne ciliata</i> , <i>Sorghum intrans</i> mid open tussock grassland	60.4 ha (7%)
3	<i>Eucalyptus tetradonta</i> , <i>Eucalyptus miniata</i> mid open forest over <i>Acacia oncinocarpa</i> , <i>Petalostigma pubescens</i> , <i>Xanthostemon paradoxus</i> mid open shrubland over <i>Heteropogon triticeus</i> , <i>Sorghum plumosum</i> , <i>Sorghum intrans</i> mid open tussock grassland	114.2 ha (13%)
4	<i>Corymbia confertiflora</i> , <i>Erythrophleum chlorostachys</i> mid open woodland over <i>Terminalia ferdinandiana</i> , <i>Xanthostemon paradoxus</i> , <i>Livistona humilis</i> mid open shrubland over <i>Eriachne ciliata</i> , <i>Acacia gonocarpa</i> , <i>Heteropogon triticeus</i> mid open tussock grassland	47.2 ha (6%)
Drainage communities		
5	<i>Melaleuca viridiflora</i> , <i>Corymbia polycarpa</i> +/- <i>Lophostemon grandiflorus</i> mid woodland over <i>Lophostemon grandiflorus</i> , <i>Pandanus spiralis</i> , <i>Melaleuca viridiflora</i> mid shrubland over <i>Andropogon gayanus</i> , <i>Sorghum intrans</i> , <i>Eriachne burkittii</i> mid closed tussock grassland	85.6 ha (10%)
6	<i>Pandanus spiralis</i> low isolated trees over <i>Eriachne burkittii</i> , <i>Sorghum intrans</i> mid closed tussock grassland	7.6 ha (1%)
7	<i>Melaleuca nervosa</i> low isolated trees over <i>Livistona humilis</i> low isolated shrubs over <i>Eriachne burkittii</i> , <i>Andropogon gayanus</i> , <i>Pseudopogonatherum contortum</i> mid closed tussock grassland	9.7 ha (1%)



<ul style="list-style-type: none"> Vegetation survey sites Granular Material Borrow <p>Drainage communities</p> <ul style="list-style-type: none"> 5 <i>Melaleuca/Corymbia</i> +/- <i>Lophostemon</i> mid woodland 6 <i>Pandanus</i> low isolated trees 7 <i>Melaleuca</i> low isolated trees 	<p>Woodland communities</p> <ul style="list-style-type: none"> 1 <i>Eucalyptus</i> mid woodland Mixed low open woodland (previously disturbed) 2 <i>Eucalyptus</i> mid open woodland <i>Eucalyptus</i> low open woodland (previously disturbed) 3 <i>Eucalyptus</i> mid open forest 4 <i>Corymbia</i> and <i>Erythrophleum</i> mid open woodland
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0 125 250 500

Metres

MAP INFORMATION

Scale: 1:22,000 @ A4

Projection: GDA 1994 MGA Zone 52

Date Saved: 24-Oct-19

Client: DIPL

Author: N Clark (review: G Ewers)

DATA SOURCE

Topographic data: Geoscience Aust.

Project data: EcOz

Imagery: Shaded relief, Landsat

Figure 3-12. Map of vegetation communities within the granular material borrow area

Low permeability borrow survey area

Four broad vegetation types were identified by EcOz (2019):

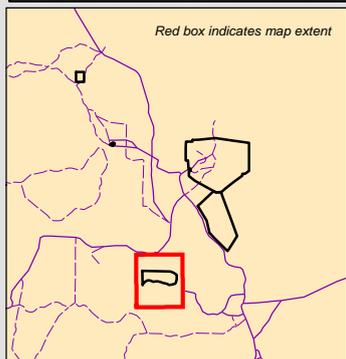
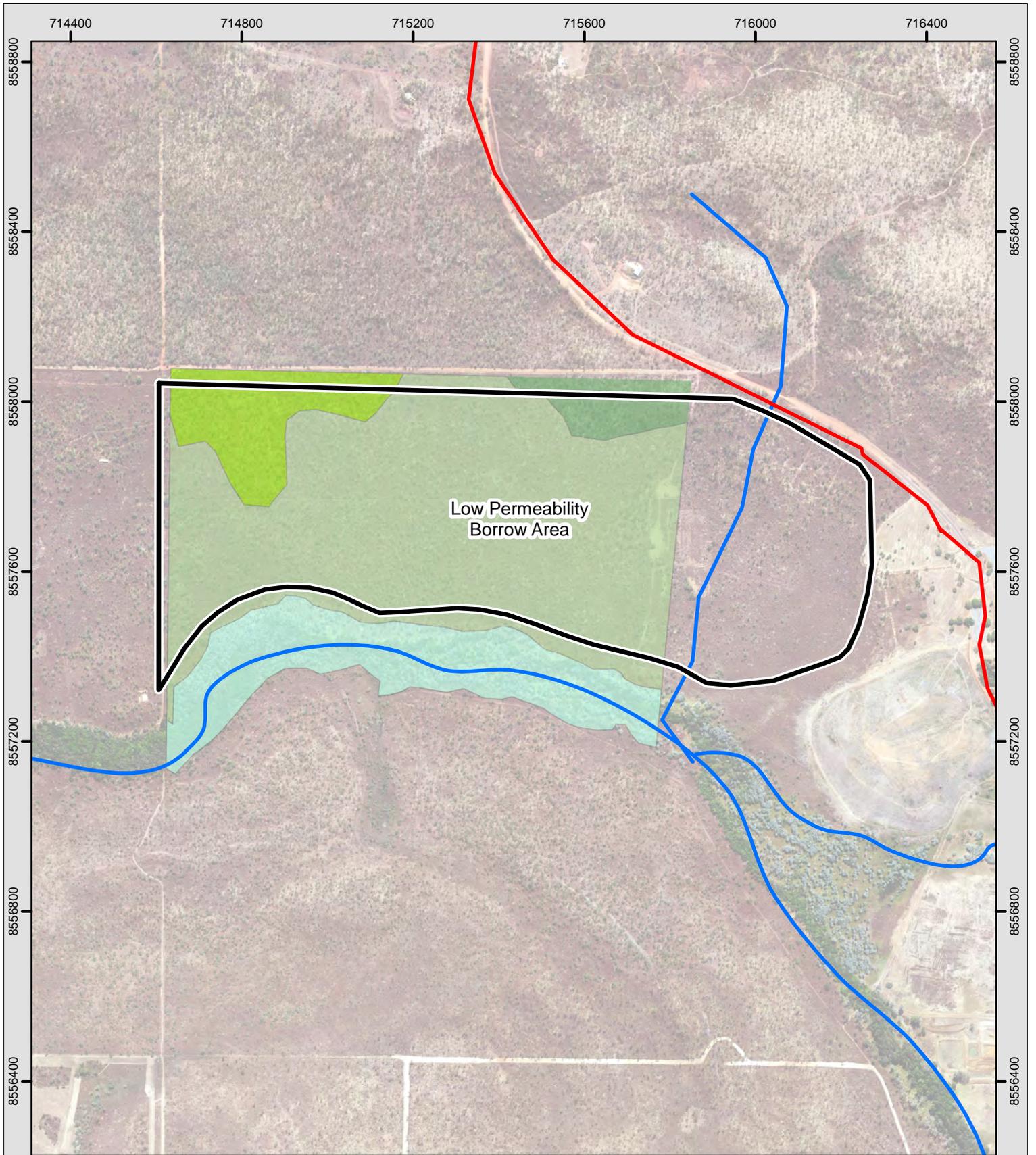
- *Corymbia* species open woodland (60.6 ha)
- *Eucalyptus miniata* woodland (9.0 ha)
- *Eucalyptus tetradonta* woodland (4.3 ha)
- *Melaleuca* species closed forest (18.5 ha).

These are mapped in Figure 3-14, with further details in Section 3 of Appendix E. The environmental weed species Guinea Grass (*Megathyrsus maximus*) is abundant within riparian vegetation (i.e. the *Melaleuca* species closed forest). All the non-riparian vegetation is heavily-infested by Gamba Grass (*Andropogon gayanus*) – see Figure 3-13 for an example.



Figure 3-13. Photograph of the low permeability material borrow area taken from the northern boundary towards the east

Note: The photograph was taken from a height of approximately 3.5 m in order to get above the Gamba Grass.



- Roads
- Watercourses
- Project components

Woodland communities

- Corymbia* sp. open woodland
- E. miniata* woodland
- E. tetradonta* woodland
- Melaleuca* spp. closed forest

MAP INFORMATION

Scale: 1:12,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 24-Oct-19
 Client: DPIR
 Author: NC

DATA SOURCE

Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 3-14. Map of vegetation communities in the low permeability borrow area

3.2.2 Threatened species

Metcalfe (2002) noted that the occurrence of plant species of special conservation significance is unlikely:

*... given the recent history of widespread, frequent fire and extensive disturbance from previous mining over much of the site. Most important, however, is the absence of plant communities of restricted distribution or vegetation types known to contain a high proportion of rare species – sandstone escarpment habitats, wetlands suitable for *Utricularia* spp. for example – as this significantly reduces the likelihood that rare and endangered flora would occur there.*

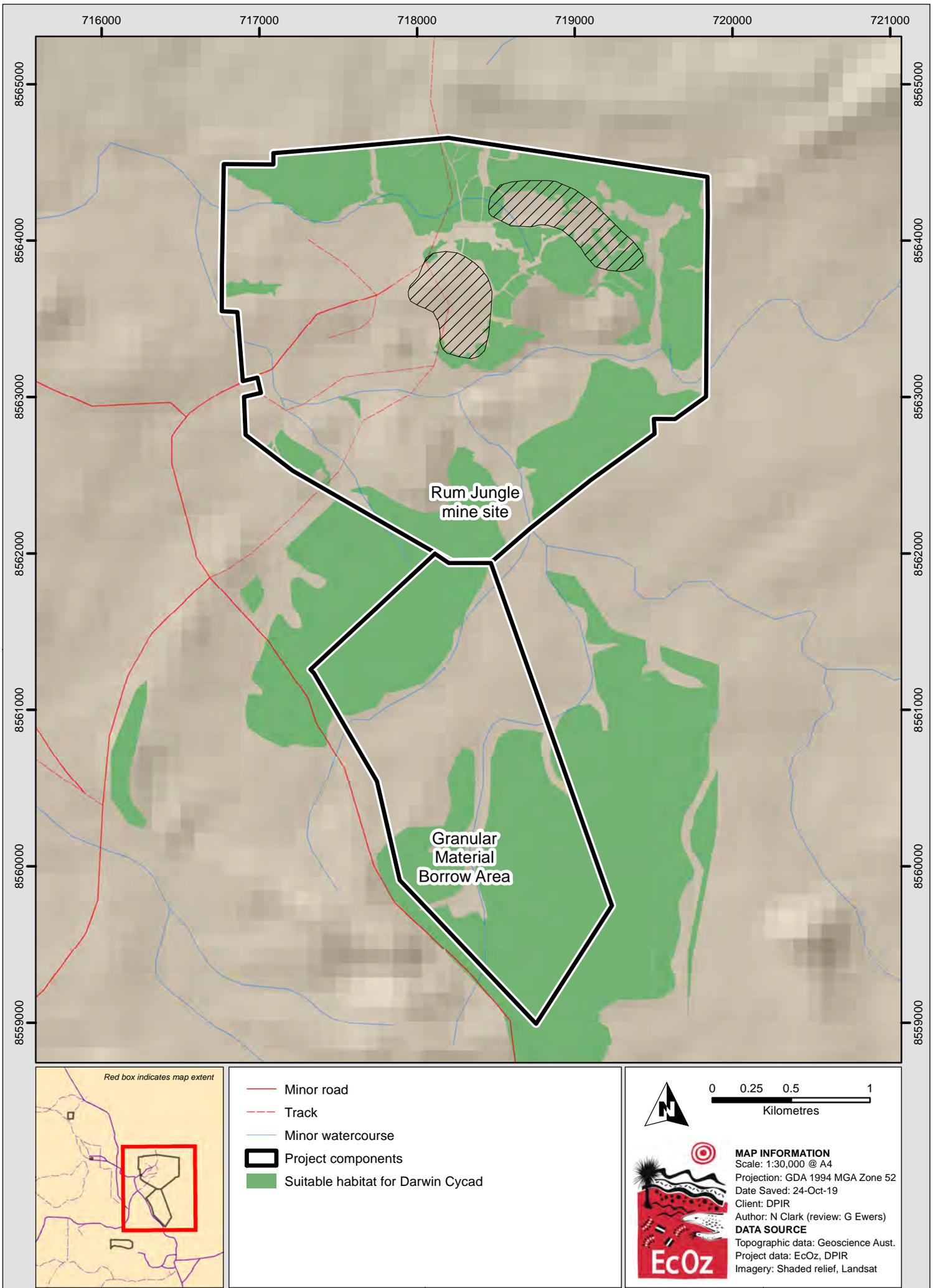
Since that was written, the Darwin Cycad (*Cycas armstrongii*) has been listed as Vulnerable under the *TPWC Act*. This is the only threatened flora species recorded within the project footprint and its surrounds. Moreover, the threatened species 'likelihood of occurrence' assessment undertaken for this report (see Section 5 and 0) concludes that Darwin Cycad is the only threatened flora species with any reasonable likelihood of occurring within the project footprint.

Darwin Cycads have been predominately recorded in the mid and/or lower stratum of mixed *Eucalyptus* species woodland habitats (Metcalfe 2002; Egan 2005; Eco Logical 2014) in more dry upland areas (GHD 2009), but was also recorded in degraded *Acacia auriculiformis* and *Erythrophleum chlorostachys* woodland (URS 2010). GHD (2009) noted that the species was less common in sites showing signs of disturbance. Suitable woodland habitat within the project footprint is mapped at Figure 3-15.

Densities of cycads varied between sites – estimates are listed in Table 3-3. Eco Logical (2014) reported that large differences in the density estimates were likely due to different woodland vegetation communities – there were 429 plants/ha encountered in the *Eucalyptus tetradonta*, *E. miniata* and *E. phoenicea* open woodland, while there were none found in a neighbouring *E. tetradonta* and *E. miniata* woodland. Eco Logical (2014) suggest that is perhaps a consequence of Gamba Grass infestations and the associated high intensity fire events.

Table 3-3. *Cycas armstrongii* density estimates within and proximate to project footprint

Consultant	Location	Density estimate (plants per hectare)
Egan (2005)	Browns Oxide site	75 – 200
Eco Logical (2014)	Rum Jungle site (north)	135
	Rum Jungle site (south)	48
Eco Logical (2015)	North of Rum Jungle	48 – 178
	West of Rum Jungle	130
	Granular material borrow area	178



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17175 - Rum Jungle EIS - ecology\01 Project Files\Report maps\September 2019 V2\Figure 3-15. Cycad habitat.mxd

Figure 3-15. Map of suitable Darwin Cycad habitat within the project footprint

3.2.3 Weeds

Some species of introduced flora are declared to be weeds under the NT *Weeds Management Act* because of the harm they can cause. The Commonwealth Government has also categorised some species as Weeds of National Significance (WoNS). The remaining introduced flora species are referred to as environmental weeds.

The *Draft Natural Resource Management Strategy for the Coomalie Shire* (Price and Baker 2003) identified at least 47 weed species in the wider Coomalie Shire. Revegetation monitoring surveys of the mine site in the mid 1980's detected only localised patches of five weed species; and no Gamba Grass (Ryan 1985).

Metcalf (2002) recorded 31 species within her large survey area (37.5 km²). A search of the NT Government weed records held in NR Maps found that, within a 30 km radius of the mine site there are 13,745 records of approximately 60 species. More than 83 % of those records are of Gamba Grass (discussed further below). Species with more than 30 records are presented in Table 3-4. There are 9 species of declared weeds and 1 species of environmental weeds. Four of the declared weeds are also Weeds of National Significance.

Table 3-4. Most common weed species within a 30 km radius of the Rum Jungle mine site

Common name	Scientific name	Weed of National Significance	Classification*
Declared weeds			
Cabomba	<i>Cabomba caroliniana</i>	X	A, C
Flannel Weed	<i>Sida cordifolia</i>	-	B, C
Gamba Grass	<i>Andropogon gayanus</i>	X	B, C
Hyptis	<i>Hyptis suaveolens</i>	-	B, C
Mimosa	<i>Mimosa pigra</i>	X	B, C
Mission Grass (Perennial)	<i>Cenchrus polystachios</i>	-	B, C
Olive Hymenachne	<i>Hymenachne amplexicaulis</i>	X	B, C
Sicklepod	<i>Senna obtusifolia</i>	-	B, C
Spinyhead Sida	<i>Sida acuta</i>	-	B, C
Environmental weeds			
Mission Grass (Annual)	<i>Cenchrus pedicellatus</i>	-	-

* A – to be eradicated; B – growth and spread to be controlled; C – not to be introduced

Species

In 2003, Price and Baker identified **Gamba Grass** (*Andropogon gayanus*) as 'probably the most serious environmental problem' in the region. The Coomalie Shire lies within the Gamba Grass Class B Zone, which imposes a legal obligation on landholders to contain existing infestations and eradicate any smaller or new infestations. A 2008 survey of the shire detected Gamba Grass was found on 91 % of properties surveyed. Infestations were highest to the west and south-west of Rum Jungle, with the average density of Gamba Grass cover at Rum Jungle between 1 and 10 % (NRETAS 2008). In contrast, the EcOz (2018) survey of Rum Jungle found that 42 % of the Gamba Grass recorded was at >50 % density – see Appendix F.

Gamba Grass is the most widespread weed within the Rum Jungle region – recorded across the extent of the mine site, but at highest densities in the north-west, central and south-west areas (see Figure 3-19). The species also occurs across the extent of the waste rock dump at Mt Fitch (Figure 3-17) and in the vicinity of the waste rock dump at Mt Burton. All the non-riparian vegetation within the low permeability material borrow area is heavily infested by Gamba Grass (see Figure 3-13). In the granular material borrow area, Gamba Grass predominately occurs – sometimes in dense patches – in the riparian areas and drainage lines.

Gamba Grass is able to form very dense thickets, which dramatically alter the structure of native communities and decrease biodiversity (NTG 2018a). It also threatens native vegetation, as it can rapidly grow bigger and taller than native grasses, and creates high fuel loads that promote late and intense fires. Such fires are capable of killing most trees, even fire-tolerant Eucalypts (NTG 2018a). Mature trees that had been killed in fires were observed in woodland in the north-west corner of Rum Jungle (see photograph at Figure 3-16), where Gamba Grass densities are up to or greater than 50 % (see Figure 3-19). Much of the woodland communities in the south-east and central-north border of Rum Jungle have low densities of Gamba Grass (less than 1 to 10 %).

Olive Hymenachne (*Hymenachne amplexicaulis*) is a perennial, robust grass that can grow above or below water (NTG 2018b). It is regarded as one of the worst weeds in Australia due to its propensity to block waterways and affect water quality, in turn threatening fish and reducing habitat availability for waterbirds and other native animals (NTG 2018b). Kraatz and Norrington (2002) noted that no Olive Hymenachne was observed during field surveys. In contrast, EcOz (2018) recorded Olive Hymenachne at high densities along the eastern half of the East Branch as it runs through Rum Jungle. The species was also present in the western half, but at low densities. Hydrobiology (2013) recorded Olive Hymenachne along the East Branch upstream and downstream of the Rum Jungle Mine during site visits.

In 2003, Price and Baker stated that although **Mimosa** (*Mimosa pigra*) was formally recorded in about 90 sites throughout the Coomalie Shire, the species occurred in the headwaters of nearly all creeks and rivers in the region. Metcalfe (2002) found that Mimosa is common in the creek bed downstream of Rum Jungle. EcOz (2018) only found Mimosa at a few sites in the north-west corner of the mine site. There is also Mimosa on the drainage line at the base of the waste rock dump at Mt Fitch.

Grader Grass (*Themeda quadrivalvis*), **Hyptis** (*Hyptis suaveolens*) and both annual and perennial **Mission Grass** (*Cenchrus polystachios* and *Cenchrus pedicellatus*) were recorded at varying – but significant – densities across the central-north and south-west of Rum Jungle. These weeds all grow well in disturbed areas, and are able to outcompete native grasses and alter fire regimes by promoting hotter fires.

Sites

During Rum Jungle monitoring in the late 1990's, Kraatz and Norrington (2002) reported 8 weed species from the **Rum Jungle mine site**. In contrast, the 2018 weed survey by EcOz of the Rum Jungle site recorded 978 weed occurrences of 22 species (see Table 3-5). There are 11 species of declared weeds – all Class B, meaning their growth and spread is to be controlled by landowners – and 11 species of environmental weeds. Four of the declared weeds are also Weeds of National Significance.

Initial introduction of some species is thought to have occurred through importation of contaminated fill material during rehabilitation (Kraatz 1998). Vehicle traffic, wind and animal transport have undoubtedly contributed to the spread of other locally-prevalent weeds. However, whilst many introduced pasture species were deliberately planted during mine site rehabilitation in the mid 1980's, none of these species appear to be extant – see Section 3.2.6.

Although weed control has been undertaken at the mine site since at least 1993, no species have been eradicated – indeed, weeds have proliferated in both distribution and abundance (apart, perhaps, for Mimosa). Gamba Grass is the most widespread weed within the Rum Jungle region – recorded across the extent of the mine site, but at highest densities in the north-west, central and south-west areas (see Figure 3-19).

The **Mt Burton** waste rock dump is almost entirely devoid of vegetation. The adjacent rainforest is also weed-free. Declared weeds recorded in the vicinity of the waste rock dump are Hyptis, Snakeweed, Gamba Grass, Spinyhead Sida and Sicklepod). There are also three environmental weed species (Annual Mission Grass, Red Natal Grass and Calopo).

Mt Fitch is characterised by high densities of Gamba Grass, Sicklepod and Hyptis. There is Perennial Mission Grass and Mimosa on the drainage line at the base of the waste rock dump (see Figure 3-17).

With regards to **riparian zones**, Hydrobiology (2013) observed Olive Hymenachne in the East Branch upstream and downstream of the mine site. EcOz (2018) found that species was prevalent in the section of the East Branch that flows through the mine site. Snakeweed was widespread in the area on moist soils in disturbed areas and along drainage lines. Metcalfe (2002) noted that Mimosa is common in the creek bed downstream of Rum Jungle. Also common in the disturbed terrain surrounding the river banks were Centro (*Centrosema pubescens*), Snakeweed, Sicklepod, Gamba Grass and Hyptis.

The most common weed species in the **granular material borrow area** is Gamba Grass, which was observed in the riparian areas and drainage lines – sometimes in dense patches. There are also some isolated patches of Gamba Grass in woodland, as well as along the tracks in the vicinity of the revegetated borrow areas in the centre of the survey area. Creek lines also contain patches of Hyptis (*Hyptis suaveolens*).

All the non-riparian vegetation within the **low permeability material borrow area** is heavily-infested by Gamba Grass, with Guinea Grass (*Megathyrsus maximus*), an environmental weed species, also abundant.

Table 3-5. Weeds recorded during the 2018 survey of Rum Jungle mine site

Common name	Scientific name	Records
Weeds of National Significance		
Gamba Grass	<i>Andropogon gayanus</i>	484
Grader Grass	<i>Themeda quadrivalvis</i>	34
Mimosa	<i>Mimosa pigra</i>	6
Olive Hymenachne	<i>Hymenachne amplexicaulis</i>	42
Declared weeds		
Mission Grass (Perennial)	<i>Cenchrus polystachios</i>	32
Hyptis	<i>Hyptis suaveolens</i>	63
Sicklepod	<i>Senna obtusifolia</i>	9
Spinyhead Sida	<i>Sida acuta</i>	16
Flannel Weed	<i>Sida cordifolia</i>	48
Paddy's Lucerne	<i>Sida rhombifolia</i>	1
Snakeweed	<i>Stachytarpheta sp.</i>	3
Environmental weeds		
Mission Grass (Annual)	<i>Cenchrus pedicellatus</i>	39
Calopo	<i>Calopogonium mucunoides</i>	39
Coffee Bush	<i>Leucaena leucocephala</i>	3
Guinea Grass	<i>Panicum maximum</i>	7
Para Grass	<i>Urochloa mutica</i>	14
Rat's Tail Grass	<i>Sporobolus sp.</i>	10
Rattle Pod	<i>Crotalaria sp.</i>	67
Red Natal Grass	<i>Melinis repens</i>	17
Rosella	<i>Hibiscus sabdariffa</i>	2
Stylo	<i>Stylosanthes sp.</i>	34
Wild Passionfruit	<i>Passiflora foetida</i>	8



Figure 3-16. Photograph of burnt trees surrounded by Gamba Grass (located outside western border of mine site)

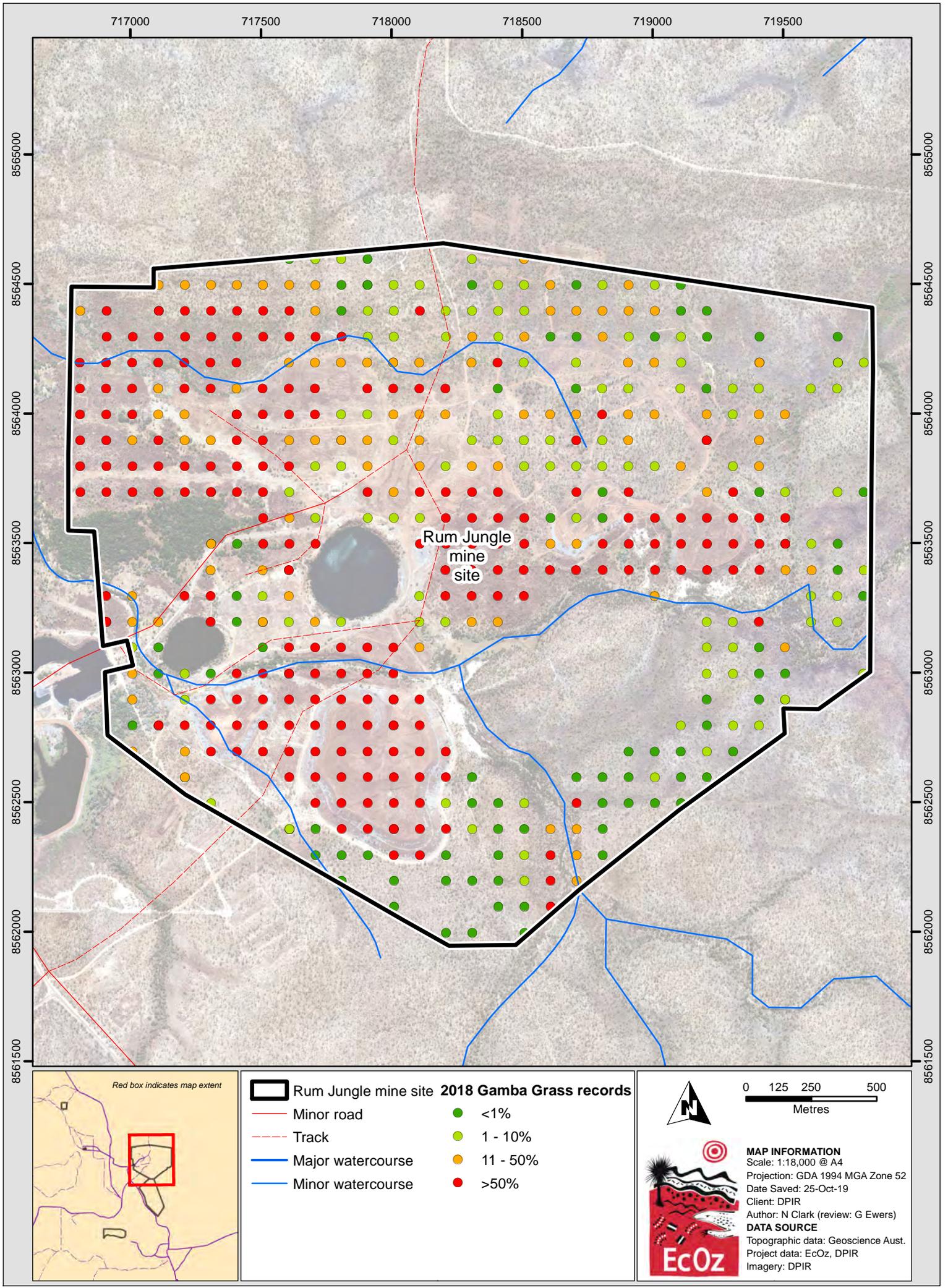
These trees likely died from intense Gamba Grass-fuelled fires that they are unable to tolerate



Figure 3-17. Photograph of high density infestation of Gamba Grass, Perennial Mission Grass and Mimosa at Mt Fitch



Figure 3-18. Photograph of the high density infestation of Gamba Grass at the low permeability material borrow area



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\IEZ17175 - Rum Jungle EIS - ecology\01 Project Files\Report maps\September 2019 V2\Figure 3-19. Gamba Grass extent.mxd

Figure 3-19. Map of the extent of Gamba Grass infestations at Rum Jungle mine site (EcOz 2018)

3.2.4 Threatened Ecological Communities

The [EPBC Protected Matters Search Tool](#) report did not identify any Threatened Ecological Communities that may occur within the project footprint (see Appendix B).

3.2.5 Significant vegetation

Significant vegetation types are those considered significant under the NT *Land Clearing Guidelines* (DENR 2019). These vegetation types are unique to the NT and/or have inherently high biodiversity values. The following occur within the project footprint:

- Riparian vegetation
- Vine forests (wet and dry)
- Vegetation containing large trees with hollows suitable for fauna.

Riparian vegetation

Riparian vegetation is 'a distinct forest community occurring on the banks of rivers or streams that directly influences the adjacent water body' (DENR 2018). Riparian vegetation within the region (including the project footprint) was included in terrestrial vegetation surveys discussed in 3.1. In addition, Hydrobiology surveyed riparian vegetation along the Finnis River in 2013, and Eco Logical conducted assessments of riparian corridors within mine site in 2014. Hydrobiology recorded canopy and woody understory species at 13 fluvial sites, ranging from ~18 km upstream (in the East Branch) to ~30 km downstream of the mine site. Eco Logical surveyed six transects along East Branch (and branching creeks), the diversion channel and Fitch Creek, recording plant cover, regeneration, erosion and weeds, according to the *Tropical Rapid Appraisal of Riparian Condition Version 1 (for use in tropical savannas)* (Dixon et al. 2006).

There is riparian vegetation of varying quality and extent throughout the project footprint. Metcalfe (2002) provides the best assessment of riparian vegetation within the project footprint, noting that:

- The riparian community was the most diverse vegetation type within the survey area (a 37.5 km² area centred on the Browns Oxide mine site).
- The banks of the West Branch of the Finnis River are heavily vegetated by large trees to 20 m with a typically mid-dense, varied understorey layer from 4 to 8 m high. The river levees are prime habitat for native Bamboo (*Bambusa arnhemica*). Other dominant riparian tree species include *Syzygium armstrongii*, *Ficus racemosa*, *Maranthes corymbosa* and *Buchanania arborescens*. Common mid-stratum species include *Diospyros calycantha*, *Canthium schultzei*, *Elaeocarpus arnhemicus*, *Barringtonia acutangula* and young Bamboo. An indicative photograph is presented in Figure 3-20.
- The riparian corridor of the East Branch of the Finnis Branch typically merges rapidly with surrounding Eucalypt woodland areas – having little or no surrounding floodplain areas. Vegetation fringing the river typically includes a narrow band of Black Wattle (*Acacia auriculiformis*) with Paperbarks (*Melaleuca cajuputi* and *Melaleuca leucadendra*), *Terminalia carpentariae* and *Corymbia polycarpa*. Common mid-stratum species include *Pandanus spiralis*, *Barringtonia acutangula* and the occasional Weeping Tea Tree (*Leptospermum longifolium*). An indicative photograph is presented in Figure 3-21.
- Weeds are common in the disturbed terrain surrounding the river banks (see Section 3.2.3).



Figure 3-20. Photograph of West Branch riparian vegetation (near confluence)



Figure 3-21. Photograph of East Branch riparian vegetation (downstream of the mine site)

The Rum Jungle site contains 69 ha of different riparian vegetation (see, e.g. Figure 3-22) – comprising 4 ha of riparian grassland; 5 ha of *Acacia auriculiformis* woodland to open forest, 9 ha of riparian corridor (i.e. in the vicinity of creeks and channels), and 51 ha of paperbark (*Melaleuca sp.*) woodland to open/closed forest. Eco Logical (2014) note that the *Acacia auriculiformis* woodland to closed forest has the same dominant species and stand structures as that of the *Acacia auriculiformis* vine forest described in further below, but that the associated species are very different and are more commonly associated with wetter habitats. Within the riparian corridor, the understorey is very diverse, but with many weeds transported by the creek/channel present (primarily Gamba Grass and Olive Hymenachne). The quality of riparian vegetation varies significantly, as shown in the contrast between the two photographs in Figure 3-22.

Mt Burton is situated a tributary of the West Branch which is lined by significant areas of dense riparian vegetation. Riparian vegetation is also present along minor drainage lines in the granular material borrow area were classified by EcOz (2019) as *Melaleuca viridiflora*, *Corymbia polycarpa* +/- *Lophostemon grandiflorus* mid woodland over *Lophostemon grandiflorus*, *Pandanus spiralis*, *Melaleuca viridiflora* shrubland and tussock grassland. This is mapped as 'vegetation community 5' in Figure 3-12. Meneling Creek is bordered by *Melaleuca* species closed forest with the introduced Guinea Grass (*Megathyrsus maximus*) as the dominant ground layer – as mapped in Figure 3-14.



Figure 3-22. Photographs of riparian vegetation community in the centre of Rum Jungle



Figure 3-23. Photographs of riparian vegetation (top) and an aerial view (drone image) of drainage line (bottom) in the granular material borrow area.

Habitat quality

The Finniss River has been subject to contamination from the Rum Jungle Mine for more than sixty years. The assessment of Hydrobiology (2013) is that within the main Finniss River:

The riparian vegetation assemblage was recovering well from the severe dieback resulting from the Old Tailings Dam failure and other unregulated pollution events during and immediately following the period of active mining. Mature White Paperbark trees (Melaleuca leucadendra) were present and abundant in the main branch of the Finniss River both upstream and

downstream of its confluence with the East Branch. Other species that might be considered vulnerable to heavy metal toxicity such as *Leichhardt Trees* (*Nauclea orientalis*), *Freshwater Mangroves* (*Barringtonia acutangula*), *River Pandanus* (*Pandanus aquaticus*) and *Billabong Trees* (*Carallia brachiata*) were also universally abundant.

Metcalf (2002) stated that although riparian vegetation on the East Branch showed obvious signs of degradation, it supported a reasonable density and diversity of riparian species. Hydrobiology (2013) disagree, stating that:

*The East Branch stood in stark contrast with the main branch of the [Finniss] river. Only the paperbark (*Melaleuca viridiflora*) and Black Wattle (*Acacia auriculiformis*) were recorded as present and abundant on the Rum Jungle mine site and in the immediate downstream riparian zone.*

Care is needed in interpretation of these observations, as the East Branch is clearly intermittent in its flow regime whereas the main Finniss River is perennial or near-perennial. Nevertheless, it is likely that the higher concentrations of heavy metals and other contaminants in the system have limited or are limiting recolonisation by riparian species common to other seasonal braided streams in the western Top End.

Hydrobiology (2013) noted that a meaningful assessment of the environmental values of riparian vegetation is hampered due to the lack of baseline data of naturally-occurring flora assemblages in the Finniss River catchment.

Of the six transects within Rum Jungle that were assessed by Eco Logical (2014), only two contained good quality riparian vegetation; three were considered moderate and one poor. Habitat quality was good along Fitch Creek (in the southern area of mine site) and to the east of the diversion channel (south-east of the intermediate pit); however, riparian vegetation to the west of the diversion channel was considered poor (see Figure 23 of Eco Logical (2014)). Eco Logical found that the primary drivers of poorer quality riparian habitat were largely cover of weeds (see below), organic litter derived from weeds, few tree size classes, and reduced abundance of logs. Also noted were threats to riparian habitat – namely, adjacent tree clearing (from mining or rehabilitation activities that result in minimal regeneration), fire (frequent or late Dry season fires can limit the successful recruitment of riparian trees), feral pigs (which can spread weeds, uproot seedlings, cause erosion and trample groundcover) and channel modification (also from mining or rehabilitation activities). These pressures combine to limit natural recruitment of riparian trees, compromise bank stability, and reduce resilience to fire and feral animals (Eco Logical 2014).

Vine forest

Various types of rainforest and vine forest occurs in the NT over a broad range of landforms throughout the region of summer (i.e. monsoonal) rainfall – essentially north of 18°S (Russell-Smith 1991). Although only covering 0.2 % of the NT, these vegetation types contain 13 % of flora species, making them highly diverse and significant vegetation communities. The total rainforest estate in the NT is divided into 15,000 patches (ranging between 1 ha and 4,000 ha, with a median size of 3.6 ha) that are scattered within a vast expanse of mostly Eucalypt-dominated savanna.

There are two broad types of rainforest and vine forest – wet (evergreen) and dry. Both occur within the project footprint – see Figure 3-27.

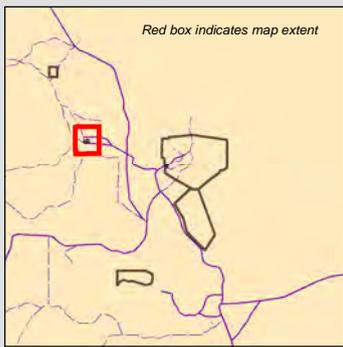
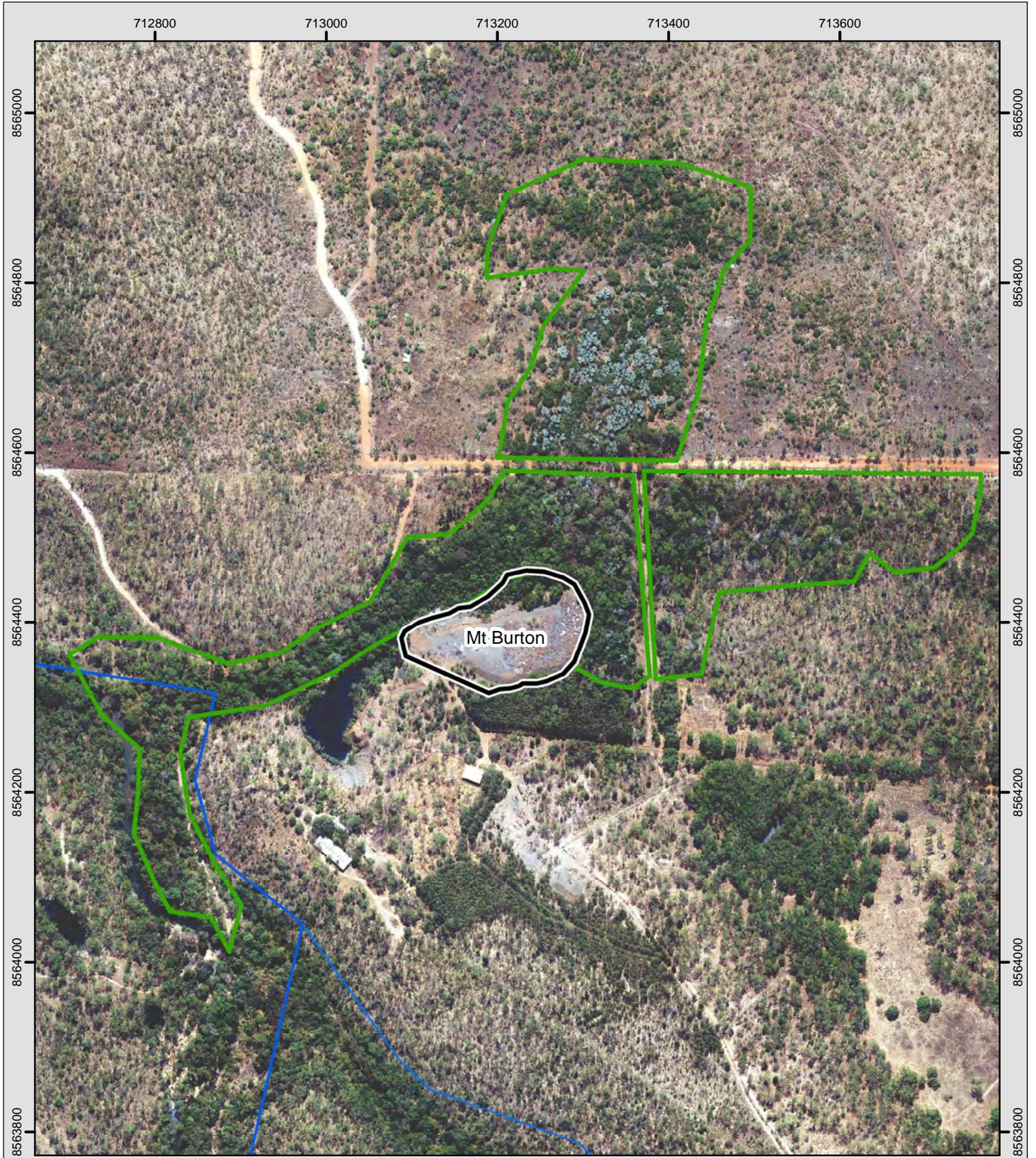
Wet rainforest

Usually associated with permanent water such as springs (Russell-Smith 1991), wet rainforest habitats support a floristically-distinctive community in which evergreen trees typically form a closed canopy forest up to 20 m high (Metcalf 2002). Tree species are characteristic of areas with perennially high soil moisture and include *Sterculia holtzei*, *Myristica insipida*, *Calophyllum sil*, *C. soulattri*, *Terminalia microcarpa*, *Syzygium minutiflorum*, *S. nervosum*, *Carpentaria acuminata* and *Microsorium grossum*. Other canopy species include *Maranthes corymbosa*, *Ficus racemosa*, *Acacia auriculiformis* and *Gmelina schlechteri*.

There is a single occurrence of wet rainforest – described as *wet monsoon vine forest* by Metcalfe (2002) and *closed monsoon vine forest* by GHD (2009) – within the project footprint. This is at Mt Burton, which is bordered to the north and east by approximately 20 ha of wet rainforest associated with a permanent spring – the extent is shown in the map at Figure 3-28, with an example photograph at Figure 3-24.



Figure 3-24. Photograph of the rainforest adjacent to Mt Burton



- Major watercourse
- Minor watercourse
- Project components
- Rainforest boundary

0 50 100 200
Metres

MAP INFORMATION
 Scale: 1:6,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 03-Oct-19
 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 3-25. Map of rainforest adjacent to Mt Burton

Dry vine forest

With vegetation broadly similar to that of wet rainforests – and a large number of species in common – dry rainforests have many deciduous components and occur in drier habitats.

Dry vine forest occurs within the Rum Jungle site in the form of what Metcalfe (2002) calls *Acacia auriculiformis* (Black Wattle) communities – see photograph at Figure 3-26. The dominance of Black Wattle – a rainforest coloniser species – is symptomatic of degraded or regenerating vine forest habitats. Other upper stratum species in this vegetation community include Ironwood (*Erythrophleum chlorostachys*) and *Terminalia microcarpa*. Large Banyan Figs (*Ficus virens*) and Milkwood trees (*Alstonia actinophylla*) may be key species in the re-establishment of vine-forest vegetation.

According to Metcalfe (2002):

These forests typically occur in areas with slightly lower soil moisture than evergreen vine-forests and include parts of the survey area where jungles appear to be recovering from the impacts of disturbance (e.g. clearing, fire, mining etc.). Vegetation structure reflects the lack of perennial water supply with open forest and woodland structural formations more common than closed canopy forests.

Eco Logical (2014) mapped a 16 ha patch of the vegetation type in the centre of the eastern border (see Figure 3-4), with a number of smaller degraded remnant patches nearby. The species richness (43 plant species) was relatively low in comparison to similar *Acacia auriculiformis* vine forests surveyed in the region – Metcalfe (2002) recorded 89 species.

Eco Logical (2014) note that aerial photos from 1977, 1981 and 1990 indicate that dense vegetation communities – possibly vine forests – were once more widespread in this area. Several areas that were dense vegetation on historic aerial photographs were found in the Eco Logical survey to support many large dead trees, with occasional large mature trees and a dense understorey of invasive weeds such as Gamba Grass. In addition to land clearing for the development of the Browns Oxide mine, the decrease was most likely due to weed invasion, with the higher fuel loads created by weeds increasing the frequency and intensity of fires, killing fire-sensitive vine forest species and preventing vine forest regeneration.

There are also some patches (each <1 ha) of dry vine forest immediately north of the Mt Fitch pit – extent is shown in the map at Figure 3-28.

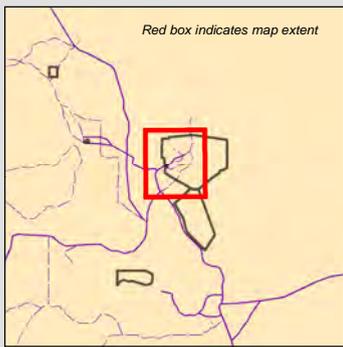
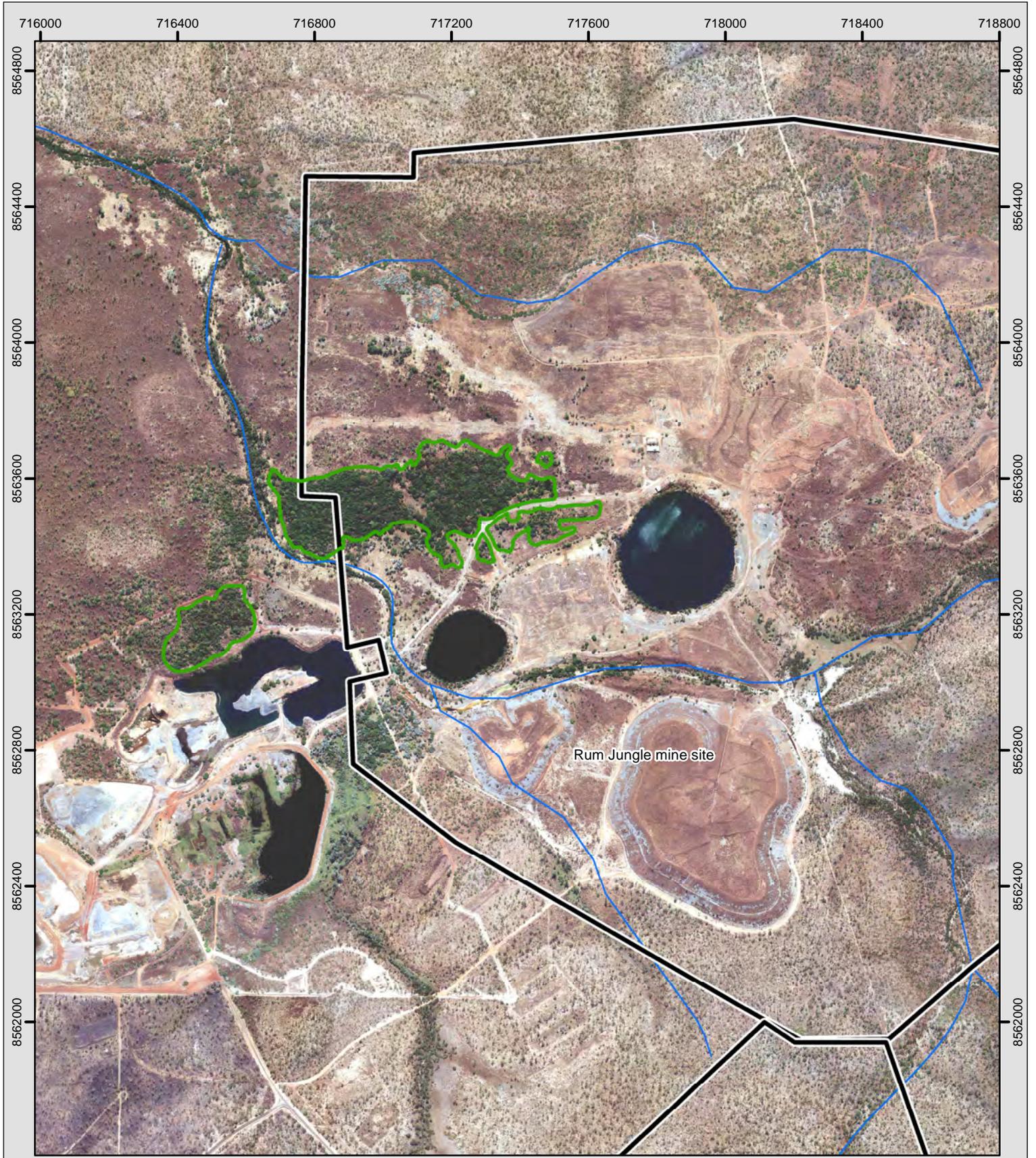


Figure 3-26. Photograph of vine thicket community in the west of mine site

Large hollow-bearing trees

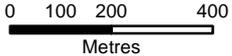
Tree hollows provide valuable habitat for a range of native fauna. In the NT, a *Eucalypt* forest that has either five or more *Eucalypt* stems growing greater than 50 cm in diameter at breast height (dbh) per hectare, and/or 30 or more *Eucalypt* stems greater than 40 cm dbh per ha is considered to be of high value for biodiversity (DENR 2019).

Eco Logical (2014) classified the amount of tree hollows (plus other shelter in fallen wood) within the woodland vegetation groups of Rum Jungle as 'good to excellent', depending on the fire history and maturity of the habitat. Vegetation unit 10 (*Eucalyptus tetradonta* / *Eucalyptus miniata* / *Erythrophleum chlorostachys* woodland to open forest), was described as the tallest and densest *Eucalypt* woodland community (Eco Logical 2014), therefore likely to have the highest rate of tree hollows – see Figure 3-4. This vegetation community occurs in the centre and north of the mine site. In the granular material borrow area, trees with dbh greater than 50 cm were largely limited to occurring along drainage lines outside of the borrow pit boundaries. The *Eucalyptus* woodland communities may contain some hollow-bearing trees, but these are occasional.



-  Dry vine forest boundary
-  Project components
-  Major watercourse
-  Minor watercourse





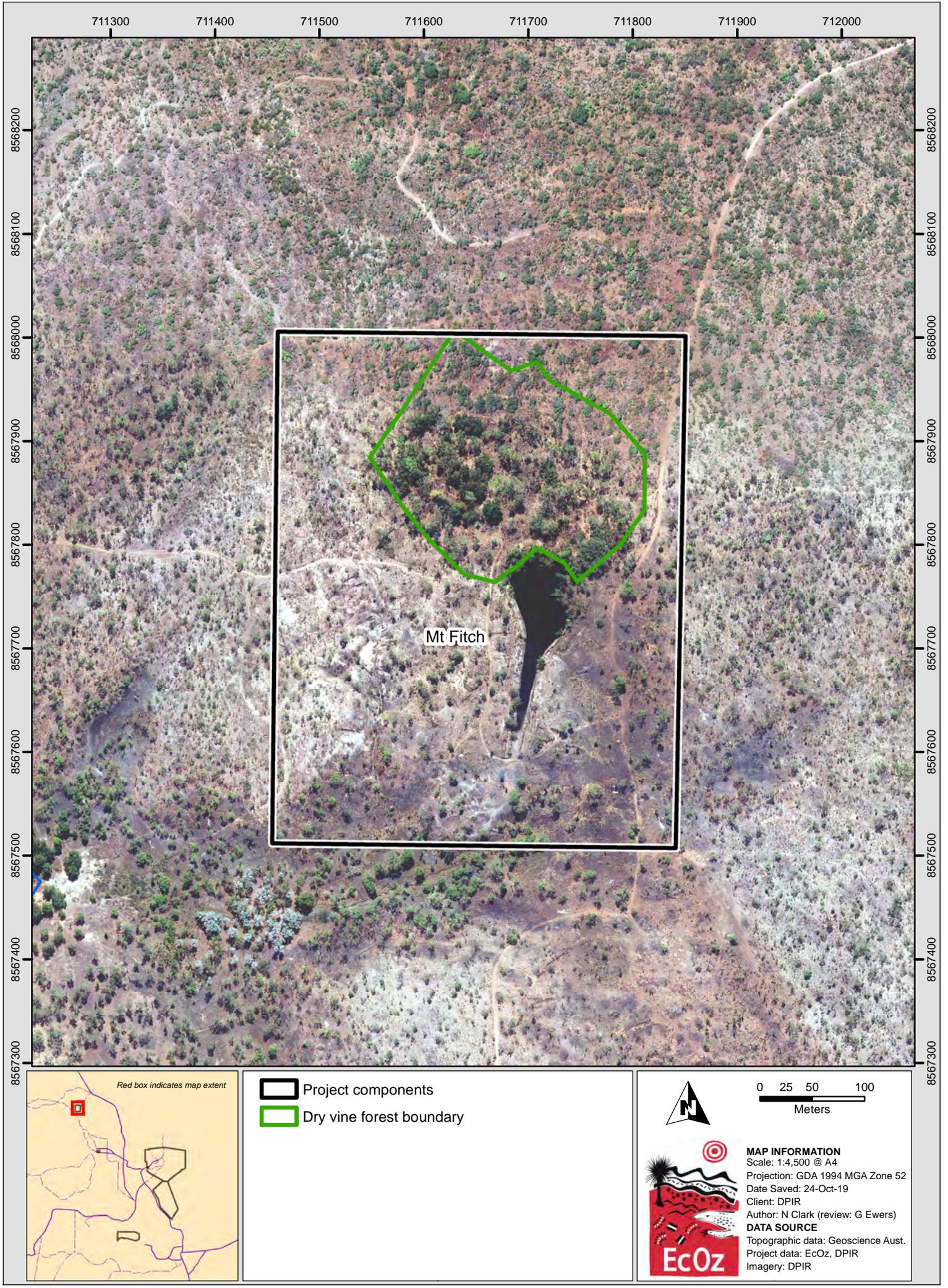
Metres



MAP INFORMATION
 Scale: 1:15,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 24-Oct-19
 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: DPIR

Figure 3-27. Map of vine forest within the Rum Jungle mine site



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17175 - Rum Jungle EIS - ecology\01 Project Files\Report maps\September 2019 V2\Figure 3-24. Mt Fitch vine forest.mxd

Figure 3-28. Map of vine forest within Mt Fitch

3.2.6 Groundwater-dependent ecosystems

Groundwater-dependent ecosystems (GDE's) refer to 'natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services' (Richardson et al. 2011). Based on definitions from Eamus et al. (2006), the [Atlas of Groundwater Dependent Ecosystems](#) maps three types of GDE's – *subterranean*, *aquatic* (i.e. ecosystems dependant on surface expression of groundwater) and *terrestrial* (i.e. ecosystems which accesses sub-surface groundwater to meet some or all of its water requirements).

Subterranean GDE's have not been mapped for the NT, but there is no surface evidence of any cave systems within the project footprint. The Atlas presents the Main Pit, Intermediate Pit and West Branch of the Finnis River as being the only aquatic GDE's in the vicinity of the project footprint. The Atlas identifies the riparian vegetation and the vine forest within the project footprint as terrestrial GDE's – see Section 3.2.5.

3.3 Previous revegetation at the mine site

The rehabilitation works that were undertaken on the Rum Jungle site between 1982 and 1986 included active revegetation of the newly-created landforms, as well as of borrow areas both onsite and offsite. The immediate goal was to rapidly establish a vegetative cover in order to stabilise the landforms from erosion. To this end, seeds of thirteen different introduced pasture species were sown (Ryan 1985). On some sloped areas, bituminous hay mulching was also undertaken, as was seeding of eleven species of native trees and shrubs.

The most recent vegetation survey of the Rum Jungle site (Eco Logical 2014) indicates that none of the species used above are extant, having been displaced by weeds, particularly Gamba Grass. Eco Logical (2014) noted that some revegetated areas – such as the top of the waste rock dumps and the old tailings dam area – were dominated or co-dominated by native grasses such as *Heteropogon contortus* and *Bothriochloa bladhii*. These native grasses were not recommended for use in the initial revegetation, implying that the native grasses must have naturally replaced the non-native pasture grasses and legumes at some stage.

4 FAUNA

This section describes the fauna surveys that have been previously undertaken for this project, as well as for adjacent projects.

4.1 Surveys

The project footprint and surrounds have been surveyed in anticipation of this project, as well as for the Browns Oxide project and, more recently, Yarram Iron Ore project. An inventory of past surveys can be found in Appendix C. This information is summarised in Table 4-1, with locations of survey sites presented in the map at Figure 4-1.

4.1.1 Region

EMS (2005) surveyed for aquatic and terrestrial fauna during the Dry season in 2002 and Wet season in 2005 to inform the Browns Oxide project. This included survey sites located within the Rum Jungle mine site. It is unknown who led the survey; however, Paul Barden, Shauntelle Hermon and Sonia Tidemann were the report authors, and Barbara Triggs undertook the scat and hair analysis.

Also for the Browns Oxide project, GHD (2009) surveyed for fauna relevant to a broad project development area at four mineral tenements in the Batchelor region, which included the mine site. Surveys were conducted during the Dry season in 2007 and the Wet season in 2008. It is unknown who led the survey, although records from it in the NT Fauna Atlas are attributed to Bill Freeland.

As part of the Yarram project, Low Ecological Services (2012) undertook a Wet season fauna survey in 2012. The survey was undertaken by Bill Low, Nicola Hanrahan and Dennis Matthews.

These surveys followed – or were in similar design to – the *Environmental Assessment Guidelines for the Northern Territory: Terrestrial Fauna Survey* (NRETAS 2011), which focus on faunal community assessments within particular samples of major vegetation communities of the survey area.

4.1.2 Project footprint

General biodiversity

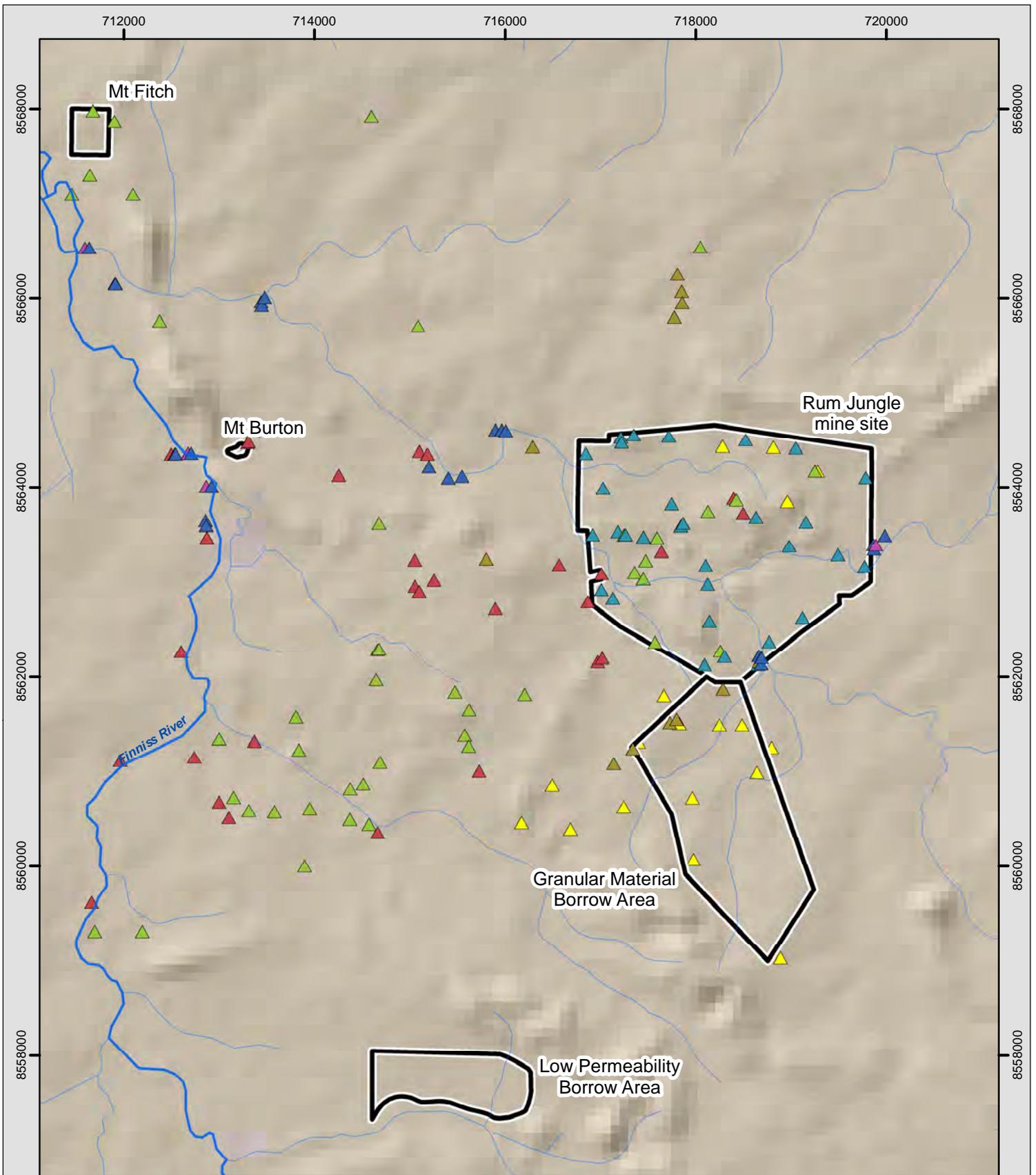
Eco Logical (2015) extensively surveyed for fauna across the Rum Jungle mine site in the Wet and Dry season of 2014 (see Figure 4-1). Also covered were potential extraction areas to the north, west and south of mine site. The surveys were undertaken by Katrina Cousins, Belinda Failes, Ranid May and Sarah Smith.

Other fauna surveys that have included sites within this project's footprint are detailed in Table 4-1 and mapped in Figure 4-1. GHD (2009) had four fauna sites within the mine site, and two immediately adjacent to the disturbance footprint at Mt Fitch. The terrestrial surveys by EcOz (2014a and 2014b) had sites adjacent to both Mt Fitch and Mt Burton, and immediately upstream from the mine site. EMS (2005) had five sites within Rum Jungle; however, these were used to target specific groups – active searches for reptiles (three sites) and birds (one site), and a harp net for bats (one site).

The low permeability material borrow area was not included in the EcOz (2019) fauna survey. From discussions between EcOz and the Executive Director of the Flora and Fauna Division of DENR, Dr Alaric Fisher, it was agreed that the high abundance and density of Gamba Grass across the low permeability material borrow area meant it was inherently unlikely to support threatened species. In those discussions, it was also agreed that targeted threatened species surveys were more appropriate within the granular material borrow area. These are discussed in more detail later in this section.

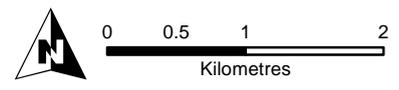
Table 4-1. Summary of fauna surveys conducted partly or fully within the project footprint

Component	Purpose	Surveyor	When	Survey methods
Rum Jungle and granular material borrow area	Targeted species (Partridge Pigeon, Black-footed Tree-rat, Fawn Antechinus and Northern Quoll)	EcOz	May-June 2019	<ul style="list-style-type: none"> • Camera survey (Reconyx and KeepGuard) (18 sites)
Rum Jungle	General biodiversity - terrestrial fauna	Eco Logical	February and June 2014	<ul style="list-style-type: none"> • Fauna trapping (Elliott, cage, pitfall and funnel traps) (7 sites) • Bird census (7 sites) • Camera survey (Reconyx) (9 transects) • Bat survey (SM2BAT+) (2 sites) • Nocturnal spotlighting (7 transects) • Masked Owl playbacks (2 sites)
Rum Jungle and Mt Burton	General biodiversity - terrestrial fauna	EMS	June 2002 and March 2005	<ul style="list-style-type: none"> • Terrestrial fauna trapping (Elliott, cage and pitfall traps, Anabat detectors, harp nets and hair funnels) (9 sites) • Reptile survey (active searches) (12 additional sites) • Bird survey (3 additional sites) • Bat survey (1 additional site)
Rum Jungle and Mt Fitch	General biodiversity - terrestrial fauna	GHD	November 2007 and April 2008	<ul style="list-style-type: none"> • Fauna trapping (Elliott, cage, pitfall and funnel traps, hair funnels and harp nets) (4 sites) • Bird census (4 sites) • Nocturnal playbacks for owls and nightjars
Finniss River (East and West branches)	General biodiversity - terrestrial fauna	EcOz for Hydrobiology	March and September 2014	<ul style="list-style-type: none"> • Fauna trapping (Elliott, cage, pitfall and funnel traps) (8 sites) • Bird survey (8 sites) • Bat survey (4 sites) • Active searches (8 sites) • Camera survey (Fauna Tech/Keep Guard) (8 sites)



- Major watercourse
- Minor watercourse
- Project components

- Surveys**
- ▲ EMS (2004)
 - ▲ GHD (2009)
 - ▲ EcOz (2014)
 - ▲ Eco Logical (2014)
 - ▲ Eco Logical (2015)
 - ▲ EcOz (2015)
 - ▲ EcOz (2019)



MAP INFORMATION
 Scale: 1:55,000 @ A4
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 24-Oct-19
 Client: DPIR
 Author: N Clark (review: G Ewers)

DATA SOURCE
 Topographic data: Geoscience Aust.
 Project data: EcOz, DPIR
 Imagery: Shaded relief, Landsat

Figure 4-1. Map of all fauna survey sites within the region

Targeted

Targeted surveys for threatened species have only become expected in recent years (previously, general biodiversity surveys to detect presence/absence were more common). Using the standard survey methods referred to in Section 4.1.2, threatened species have been recorded. In the past decade, the following targeted surveys have been undertaken to inform this project:

- In 2019, EcOz conducted an extensive camera survey targeting four threatened species (**Partridge Pigeon, Black-footed Tree-rat, Fawn Antechinus and Northern Quoll**) in the north-west of Rum Jungle mine site and across the granular material borrow area (Figure 4-1). The survey was led by EcOz ecologists, Glen Ewers and Jenny Lewis. Survey methodology was based on the draft *Camera Trapping Standing Operating Procedure for the Top End Long-Term Monitoring Program* developed by Flora and Fauna Division of the NT Department of the Environment and Natural Resources. A survey design based around a three-camera array was negotiated with the Flora and Fauna Division. The survey report is presented in Appendix E.
- In 2016, the Mining Compliance Division (MCD) of DPIR undertook a **Partridge Pigeon** survey in line with the Commonwealth guidelines recommended for the detection of this species (DEWHA 2010). The survey effort was 12 hours per day over 4 days (6 hours per day per person), which resulted in 57 km of combined transects. The Partridge Pigeon is not considered overly cryptic as it flushes readily when approached (DEWHA 2010), and so survey methods involved a combination of transect and flushing surveys across suitable woodland habitat in the central northern part of the Rum Jungle mine site. The survey was conducted by Dane Trembath and Chris Brady, both of whom have extensive experience in terrestrial fauna surveys in tropical Northern Australia.
- Call playbacks have been used to target **Masked Owl (northern subspecies)** during several fauna surveys discussed in Section 4.1.2 (GHD 2009, EcOz 2014b and Eco Logical 2015). Call playback surveys are recommended for detection of this cryptic species, and are most effective in the lead-up to the breeding season (approximately March to October) (DEWHA 2010). The Commonwealth survey guidelines for Masked Owl (northern subspecies) considers an eight-hour broadcast survey over four days as adequate for the detection of the species (DEWHA 2010). GHD (2009) surveyed for Masked Owls at each fauna site, with two minutes of broadcasting the species' call followed by three minutes of listening. EcOz (2014b) surveyed using broadcasting opportunistically in suitable habitat, but the exact number of sites and length of broadcasts are unknown. Eco Logical (2014) followed the more detailed methodology described by Ward (2010). This entails a five-minute broadcast while listening and observing for silhouettes of birds flying into the area, and then another five minutes of broadcasting in conjunction with spotlighting. However, this survey was only undertaken on only two nights (one in the Wet season and one in the Dry season); Ward (2010) recommends that surveys occur across multiple nights, since resident owls may be out of hearing range on any one given night.
- As part of the 2015 surveys for Hydrobiology (described above), a bat survey was undertaken by EcOz targeting the threatened **Bare-rumped Sheath-tailed Bat** (*Saccolaimus saccolaimus*). A previous survey had recorded a call possibly made by this species (EcOz 2014a). In the same location where this previous call was recorded, two high-frequency Anabat detectors were deployed for three nights, and recordings were sent for identification to a bat expert, Dr Kyle Armstrong (Specialised Zoological).

4.2 Results

A summary of results from the general surveys described in Section 4.1.2 can be found in Appendix C. This section highlights general trends, and presents records of threatened and pest species.

4.2.1 General biodiversity

The total number of species recorded in each general survey are presented in Table 4-2. Eco Logical (2014) reported that the fauna assemblage recorded during their 2014 survey (122 native and 4 introduced species) was characteristic of that expected of a north Australian savanna habitat, and was consistent with the species identified during a more intense survey in nearby Litchfield National Park. EMS (2005) recorded that *Eucalyptus miniata* and *E. tetradonta* open forest/woodland habitat had the highest species richness in the 2002 Dry season survey, and *Eucalypt* open woodland on rocky rises and riparian vegetation habitat both supported the highest species diversity in the 2005 Wet season survey.

Although the results of each survey cannot be directly compared (due to the significant differences between survey methods, timing, effort and site locations), there is an apparent decline in the number of species recorded over time. EMS first surveyed in 2002 and 2005, and recorded the highest number of all fauna groups in the area. Many species, including the threatened Floodplain Monitor (*Varanus panoptes*), have not been recorded in the region again since those surveys. In 2014, Eco Logical recorded only around 50 % of the mammal species present during EMS survey, and approximately 60 % of both reptile and bird species. These declines coincide with the arrival of the toxic Cane Toad in late 2004 / early 2005, weed proliferation, and the increase in mining activities in the area (particularly the establishment of the Browns Oxide Mine).

Table 4-2. Number of species recorded during regional fauna surveys encompassing the project footprint

	EMS (2005)	GHD (2009)	LES (2012)	Eco Logical (2014)
Reptiles	32	24	3	19
Amphibians	17	12	0	12
Birds	120	99	39	77
Mammals	28	19	10	14

4.2.2 Threatened species

Threatened species records from both standard and target surveys are listed in Table 4-3 and shown in Figure 4-2. Similarly to general fauna observations discussed in Section 4.2.1, there have been records of fewer threatened species in recent surveys. Despite having been previously recorded in the project footprint, certain threatened species may not still be extant in the region. In the past two decades, much of the project footprint and surrounds have been altered to varying degrees in terms of habitat availability and quality – be it from additional land clearing, proliferation of weeds and/or invasion of the Cane Toad. The EMS (2005) survey report notes that Cane Toads arrived in the local area in the weeks or months prior to March 2005 (when the field work was undertaken), and it was surmised that the effects of this invasion on native fauna would soon be apparent.

The only threatened species records from within the mine site were of Partridge Pigeon by DPIR in 2016, Fawn Antechinus (*Antechinus bellus*) and Northern Quoll (*Dasyurus hallucatus*) by GHD in 2008, and Black-footed Tree-rat (*Mesembriomys gouldii gouldii*) by EcOz in 2019. The latter species was also recorded in the same survey within the granular material borrow area.

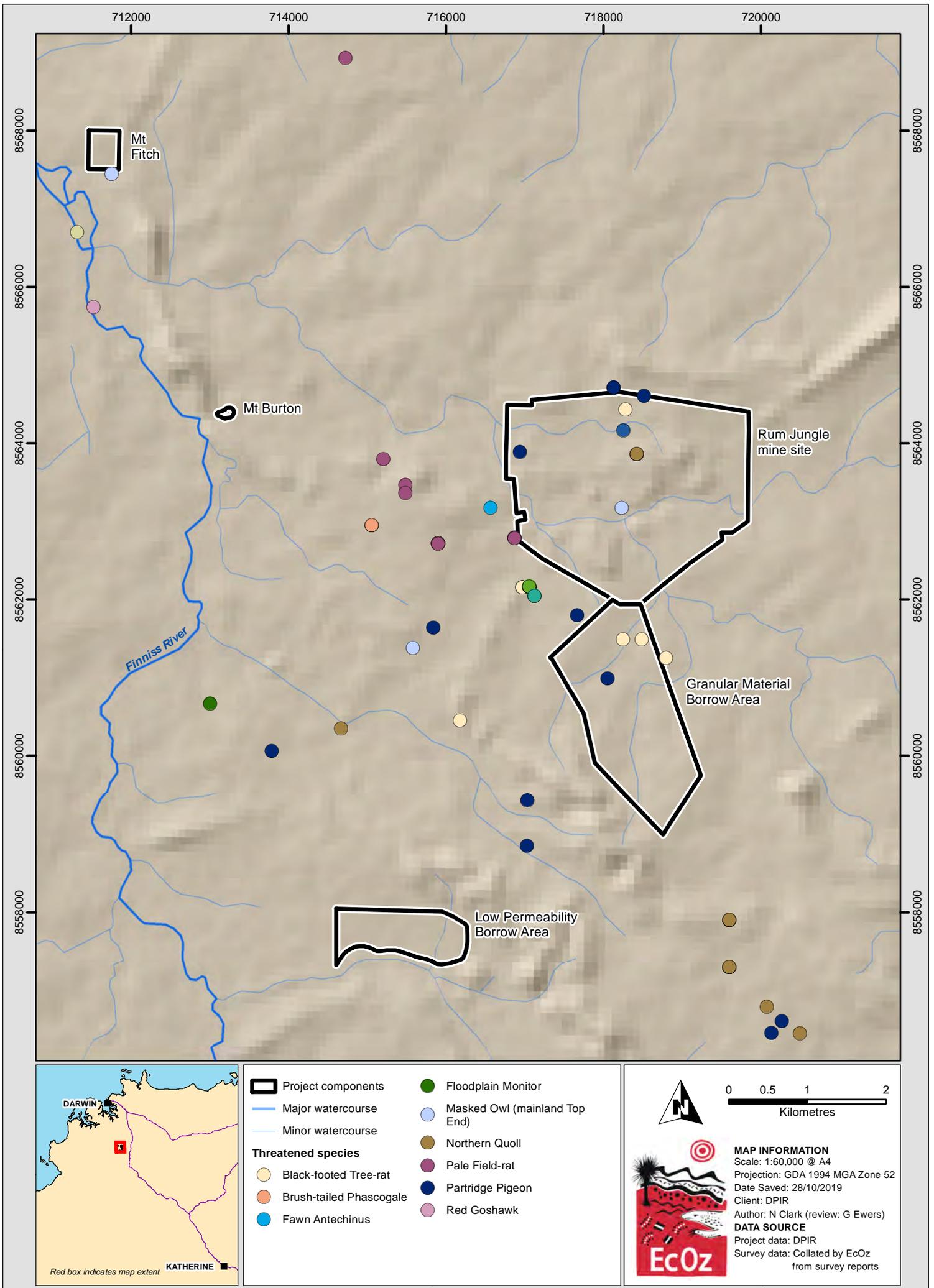
Since the arrival of Cane Toads to the area, both Mertens' and Mitchell's Water Monitors (*Varanus mertensi* and *Varanus mitchelli*) have been recorded along the Finnis River; however, Mertens' has consistently been recorded with greater abundance. EcOz (2015) detected Mertens' at every single survey site, suggesting that the water and habitat quality at the time was suitable for the species throughout the Finnis River and East Branch. Mitchell's Water Monitors were observed only once during surveys by both EcOz (2015) and EMS (2005). Mertens' Water Monitors have been recorded numerous times along the Finnis River, including the East Branch downstream from the mine site (EMS 2005; Eco Logical 2014; EcOz 2014, 2014a, 2015) – see Figure 4-2 for locations. The species was also recorded in 2015 on the East Branch of the Finnis River on the eastern side of the mine site and there are 2014 records immediately to the south of the mine site. All the records that far upstream, however, are during the wet season. It is possible that as the dry season encroaches and water levels lower, the species moves downstream. Additionally, a Mertens' Water Monitor was recorded at Mt Fitch by EcOz (2015). Mitchell's Water Monitor was recorded upstream from Mt Burton in Rum Jungle Creek in 2002 (EMS), adjacent to Mt Burton in 2015 (EcOz) and considerably downstream from the project footprint in 2014 (EcOz) – see Figure 4-2. There are no records of this species in the East Branch of the Finnis River.

Despite multiple targeted bat surveys, the Bare-rumped Sheath-tail Bat (*Saccolaimus saccolaimus*) has not been detected in the region. In EcOz (2014b), it is considered possible that the species was recorded using acoustic detectors at a site on the main Finnis River downstream of where the two branches converge. However, that report stresses that only three of the four criteria for unambiguous identification of the species were met. A follow-up survey by EcOz (2015) recorded unambiguous calls of the closely-related Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*).

Table 4-3. List of threatened terrestrial species recorded in the project footprint (highlighted) and the surrounding region

Species	Year	Location	Surveyor	Notes
Partridge Pigeon	2014	North of Rum Jungle	Eco Logical	-
	2005	East of Rum Jungle	EMS	At a number of sites within the Browns Oxide site (which has since been disturbed)
	2007	South-west of Rum Jungle	GHD	-
	2008	South-west of Rum Jungle	GHD	-
	2015	North-west of Rum Jungle	EcOz	-
	2016	Rum Jungle	MCD	Record of call only
	2019	Granular material borrow area	EcOz	-
Red Goshawk	2002, 2005	West of Rum Jungle	EMS	Browns Oxide site (which has since been disturbed)
Masked Owl	2008	South-west of Rum Jungle, Rum Jungle & Mt Fitch	GHD	Identification based on call recognition
Black-footed Tree-rat	2019	Rum Jungle & granular material borrow area	EcOz	-
	2002	West of Rum Jungle	EMS	Browns Oxide site (which has since been disturbed)
Northern Brush-tailed Phascogale	2002	West of Rum Jungle	EMS	Browns Oxide site (which has since been disturbed)
Fawn Antechinus	2002, 2005	West of Rum Jungle	EMS	Browns Oxide site (which has since been disturbed)

Species	Year	Location	Surveyor	Notes
	2007, 2008	Rum Jungle	GHD	-
Northern Quoll	2002, 2005	Browns Oxide	EMS	Browns Oxide site (which has since been disturbed)
	2007, 2008	Rum Jungle	GHD	-
Pale Field-rat	2002	West of Rum Jungle	EMS	Browns Oxide site (which has since been disturbed). Record of burrow system only
	2005	West of Rum Jungle	EMS	-
	2012	West of Rum Jungle	LES	Proposed Yarram Iron Ore project site
Floodplain Monitor	2002	West of Rum Jungle	EMS	Browns Oxide site which has since been disturbed
Mertens' Water Monitor	2002	West of Rum Jungle	EMS	Browns Oxide site which has since been disturbed
	2014	South of Rum Jungle	Eco Logical	-
	2014, 2015	Finniss River (East and West Branch) and Mt Fitch	EcOz	Including upstream (Wet season only) and downstream of the mine site
Mitchell's Water Monitor	2002	West of Rum Jungle	EMS	On a watercourse between Rum Jungle Creek South and the mine site
	2014, 2015	Finniss River (West Branch)	EcOz	Mostly far downstream, but one record upstream from Mt Burton



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17175 - Rum Jungle EIS - ecology\01 Project Files\Report maps\September 2019 V2\Figure 4-2. Threatened fauna records.mxd

Figure 4-2. Map of historic threatened species records in the vicinity of the project footprint

4.2.3 Pest animals

Price and Baker (2003) noted that the distribution of feral animals across the Coomalie Shire was very poorly known, and that the control of Feral Pigs and Feral Cats should be given priority.

The introduced fauna species listed in Table 4-4 are widespread and abundant within the bioregion, and hence are known or likely to occur within the project footprint. Cane Toads, Feral Cats and Feral Pigs are each listed as a Key Threatening Process under the *EPBC Act*.

Table 4-4. Pest animals that are known, or likely, to occur within the project footprint

Common name	Scientific name	Impacts
Feral Cattle*	<i>Bos taurus</i>	Physical damage to the environment – especially riparian habitats – leading to erosion.
Swamp Buffalo*	<i>Bubalus bubalus</i>	
Donkey	<i>Equus asinus</i>	
Horse	<i>Equus caballus</i>	
Wild Dog	<i>Canis lupus</i>	Prey on many species of native animals.
Feral Cat*	<i>Felis catus</i>	
Pig*	<i>Sus scrofa</i>	Physical damage to wetlands.
House Mouse	<i>Mus domesticus</i>	Not currently considered a great threat to biodiversity. May impact upon native vegetation via seed predation.
Asian House Gecko*	<i>Hemidactylus frenatus</i>	Not currently considered a great threat to biodiversity. May out-compete native species of gecko.
Black Rat*	<i>Rattus rattus</i>	Prey on native bird eggs, and may impact upon native vegetation via seed predation.
Cane Toad*	<i>Rhinella marina</i>	Known to cause population reductions in a range of predatory species (due to poisoning by ingestion).

* Species has been recorded within the project footprint.

5 THREATENED SPECIES

The information requested in the EIS ToR identified certain threatened species that required investigation and assessment. In addition, to determine which other threatened species have the potential to occur in the project footprint, an analysis of bioregional flora and fauna records was undertaken.

The purpose of this section is to provide an assessment of the likelihood of occurrence within the project footprint of Northern Territory and/or nationally-listed threatened species.

5.1 Categories

The International Union for the Conservation of Nature (IUCN) nominates a set of criteria used to identify species at risk of extinction. These criteria are used to define categories of risk – see Figure 5-1 – which are used by the Northern Territory Government to determine which threatened species are listed under the *TPWC Act*, and by the Commonwealth Government to determine which threatened species are listed under the *EPBC Act*. This report focusses on species that are listed as Vulnerable, Endangered or Critically Endangered under the *TPWC Act*, the *EPBC Act* or both.

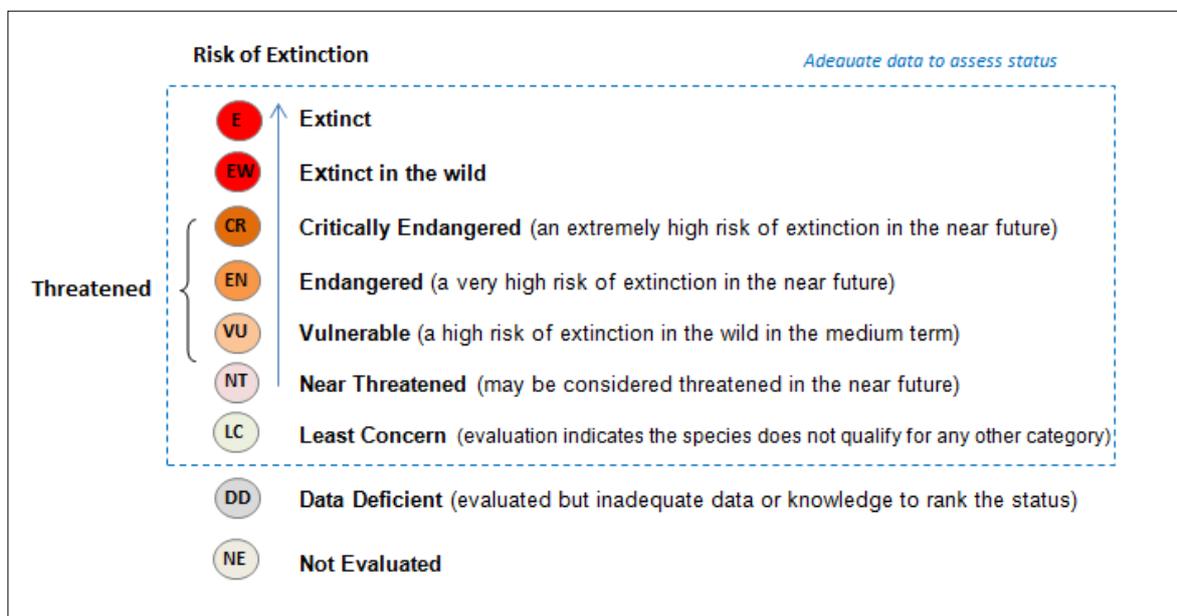


Figure 5-1. The IUCN red list categories of risk for species

5.2 Likelihood of occurrence

As detailed in Section 4.2.2, seven threatened terrestrial species have been recorded within the project footprint:

- Darwin Cycad
- Partridge Pigeon
- Mertens' Water Monitor
- Mitchell's Water Monitor
- Black-footed Tree-rat
- Northern Quoll
- Fawn Antechinus

These records are shown in Figure 4-2.

A 'likelihood of occurrence' assessment for threatened species was undertaken based on all the information available regarding the current state of the environment within the project footprint. The assessment considered the habitats present, historic regional records of threatened species, new threatening processes, any changes in the conservation status of species, and changes in surrounding habitat availability and quality.

As detailed in 0, a list of 59 threatened species that have the potential to occur in the terrestrial ecosystems within the Pine Creek bioregion was generated from desktop databases. For each of these species, the likelihood of it occurring within the project footprint was then assessed based on any desktop and field information relating to habitat requirements, distribution, and the number and dates of proximate records (including those from past surveys listed in earlier sections of this report). Likelihood ratings were defined as follows:

- a) HIGH – it is expected that this species lives within the project footprint because there is core habitat and recent proximate records.
- b) MEDIUM – this species may live within the project footprint because there is suitable habitat; however, there is evidence that lowers its likelihood of occurrence (known range contraction of the species in the region, no recent records with the search area, substantial loss of habitat within the project footprint since previous records, species is naturally-rare or occurs at a low density etc.).
- c) LOW – this species may occur, as a vagrant, within the project footprint; however, there is only marginally-suitable habitat.
- d) NONE – there is strong evidence (no suitable habitat and/or the species is considered likely to be regionally-extinct) that this species will not occur within the project footprint.

Those species that have a high or medium likelihood of occurrence are listed in Table 5-1. These species have a reasonable chance of occurring within the project footprint and so require consideration within the EIS. All other species can be excluded from further assessment because they are unlikely to occur within the project footprint. This process is not a risk assessment as it does not consider project operations and potential impacts (this will be covered in the EIS).

A meeting was held with the Flora and Fauna Division of the Department of Environment and Natural Resources (DENR) on the 1 August 2019 to ensure that these results aligned with the concerns of the department.

Table 5-1. Threatened species 'likelihood of occurrence' assessment (medium and high likelihood species only)

Likelihood	Scientific name	Common name	Class	Status	
				NT	Cth
HIGH	<i>Cycas armstrongii</i>	Darwin Cycad	Plant	VU	-
	<i>Geophaps smithii smithii</i>	Partridge Pigeon (eastern subspecies)	Bird	VU	VU
	<i>Mesembriomys gouldii gouldii</i>	Black-footed Tree-rat (Kimberley and mainland NT subspecies)	Mammal	VU	EN
	<i>Varanus mitchelli</i>	Mitchell's Water Monitor	Reptile	VU	-
	<i>Varanus mertensi</i>	Mertens' Water Monitor		VU	-
MEDIUM	<i>Tyto novaehollandiae kimberli</i>	Masked Owl (mainland Top End subspecies)	Bird	VU	VU
	<i>Erythrotriorchis radiatus</i>	Red Goshawk	Bird	VU	VU

EN = Endangered, VU = Vulnerable.

Notably, Table 5-1 does not contain some species for which there are proximate historic records. This is because environmental conditions have changed in such a way that the likelihood of these species being extant in the project footprint has been significantly reduced:

- **Fawn Antechinus** has been recorded four times within the Rum Jungle site – twice in 2008 in *Corymbia bella* open woodland in the central-north of the site, and twice in 2007 in *Eucalyptus* woodland in the centre-north of the mine site (GHD 2009) – as well as several times to the west of the Browns Oxide site (pre-development) (EMS 2005). The more recent small mammal surveys by Eco Logical (2014) and EcOz (2019) failed to record the species, despite having survey sites in the same habitat types proximate to the previous records. The limits of its range are poorly known, but it is suggested that there has been a range contraction as recent surveys have failed to locate any individuals across central and east Arnhem Land (referenced in Woinarski et al. 2014), where it was historically known to occur.
- The **Northern Quoll** was recorded within the Browns Oxide site in 2002 and 2005 prior to its development (EMS 2005) – the latter year being approximately when Cane Toads first arrived in the region. The species was also recorded within the mine site in 2007 and 2008 (GHD 2009); however, it has not been recorded since. This species now has a very low likelihood of persisting within the project footprint. The mortality of Northern Quolls due to Cane Toad ingestion has been very high wherever these two species co-occur, and there are few post-Cane Toad records of Northern Quoll anywhere. More recent small mammal surveys across the extent of the mine site (Eco Logical 2014) and in remnant vegetation that will be disturbed within the project footprint (EcOz 2019) did not record the species.
- The **Pale Field-rat** was recorded twice in the Browns Oxide Project prior to development (EMS 2005) and numerous times within the Yarram site (Low Ecological Services 2012). Low Ecological Services found that the species occurred in the tall *Mnesithea rottboellioides* grasslands and to a lesser extent, in the monsoon-vine thickets within the centre of the Yarram site, most likely due to its proximity to the grasslands. EMS trapped the species in *Melaleuca* woodland, and recorded characteristic burrow systems throughout *Eucalyptus miniata*, *E. tetradonta* and *Erythrophleum chlorostachys* open forest. The recent small mammal surveys mentioned above did not record the species.
- **Northern Brush-tailed Phascogale** was recorded in 2002 when spotlighting within the Browns Oxide site (pre-development) (EMS 2005). Although this species probably occurs naturally in low densities, it has only been recorded in Kakadu, Coburg Peninsula and the Tiwi Islands throughout the last 10 years, despite many extensive general wildlife surveys across broad regions during that time

(Woinarski et al. 2014). There has likely been a significant recent decline in range and/or population size (Woinarski et al. 2014). The recent small mammal surveys mentioned above did not record the species.

- There are nine historic records for **Gouldian Finch** all assigned to a waypoint in the south-east corner of the Browns Oxide site (just to the south-west of the mine site). These range from 1897 to 1995, and each of them has within its metadata the note: *Gay Crowley / Riikka Hokkanen clean-up of Gouldian Records 2009*. When Gay Crowley was contacted by the author of this report she could not recall the provenance of these records. It is suspected that these are regional records that were, at some stage, clumped together and given a generalised geo-reference of latitude -13°, longitude 130°. Despite being a conspicuous species, none of the surveys discussed in Section 4.1 recorded Gouldian Finch and there is no breeding habitat (wooded hills of Snappy / Salmon Gums) for this species present within the project footprint. It is possible that this species occurs, from time to time, within the project footprint, but there is a low likelihood that it is resident.
- **Floodplain Monitor** was recorded by EMS in 2002 at a drainage area along Rum Jungle Creek (immediately west of Browns Oxide project area), but has not been observed in the region since. This species has undergone extensive declines due to Cane Toad ingestion, and there are few records of the monitor persisting where the two species co-occur (Doody et al. 2009). The Floodplain Monitor now has a very low likelihood of persisting within the project footprint.

6 REFERENCES

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Appendix A THREATENED SPECIES 'LIKELIHOOD OF OCCURRENCE' ASSESSMENT

To determine which threatened species have potential to occur within the project footprint, analysis of regional flora and fauna records – informed by the results of the Commonwealth and NT threatened species search tools (described below) – was undertaken. For each of these species, the likelihood that the species occurs within the project footprint was then assessed based on habitat requirements, distribution, and the number and dates of proximate records. The purpose of such an assessment was to identify which species have a reasonable chance of occurring within the project footprint and so require consideration within the EIS.

For this project, the *project footprint* is considered to comprise:

- The area of land that will be disturbed by land-clearing.
- The riparian environment of the East Branch of the Finnis River downstream of the former Rum Jungle mine site to the junction with the Finnis River proper.
- The riparian environment of the West Branch of the Finnis River downstream of the Mt Burton site to the junction with the Finnis River proper.

The following procedure was used to undertake the likelihood of occurrence assessment for each relevant threatened species:

1. Identify all threatened flora and fauna records for the Pine Creek bioregion using the latest NT Flora and Fauna Atlas database (last updated in August 2019).
2. Use the Protected Matters Search Tool to determine species listed as threatened under the *EPBC Act* (undertaken August 2019). A buffer of 100 km around the project footprint was applied. Species not recorded from the bioregion were excluded.
3. Combine the results of steps 1 and 2 to generate a list of threatened species that may occur within the bioregion intersected by the project footprint.
4. Collate the following details for each of those species – conservation status (NT and Commonwealth), habitat requirements, distribution, and number of records within the search area (from the NT Fauna and Flora Atlas dataset).
5. Using habitat information from previous survey reports, analyse the likelihood that each species will occur in the project footprint by applying the following likelihood classifications (to determine habitat suitability within project footprint):
 - a) HIGH – it is expected that this species lives within the project footprint because there is core habitat and recent proximate records.
 - b) MEDIUM – this species may live within the project footprint because there is suitable habitat; however, there is evidence that lowers its likelihood of occurrence (known range contraction of the species in the region, no recent records with the search area, substantial loss of habitat within the project footprint since previous records, species is naturally-rare or occurs at a low density etc.).
 - c) LOW – this species may occur, as a vagrant, within the project footprint; however, there is only marginally-suitable habitat.
 - d) NONE – there is strong evidence (no suitable habitat and/or the species is considered likely to be regionally-extinct) that this species will not occur within the project footprint.

The results are documented below.

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
BIRDS				
White-throated Grasswren <i>Amytornis woodwardi</i>	VU	VU	Habitat: Confined to hummock grasslands, sometimes with open shrubland or woodland overstorey, mixed among dense boulder fields or sandstone pavements (Schodde 1982; Noske 1992) and escarpment drainage lines. Distribution: NT only – patchily distributed from Nitmiluk National Park to western Arnhem Land (Noske 1992).	NONE <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
			Noske, R. (1992). The status and ecology of the white-throated grass-wren <i>Amytornis woodwardi</i> . <i>Emu</i> , Vol. 92, pp. 39-51. Schodde, R. (1982). <i>The fairy-wrens - A monograph of the Maluridae</i> . Landsdowne Editions, Melbourne.	
Yellow Chat (Alligator River subspecies) <i>Epthianura crocea tunneyi</i>	EN	EN	Habitat: Floodplain depressions and channels, concentrating around wetter areas at the end of the dry season (Armstrong 2004). Distribution: Top End of the NT, where restricted to a small number of sites in the floodplains from the Adelaide River to the East Alligator River (Woinarski & Armstrong 2006).	NONE <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
			Armstrong, M. (2004). <i>The yellow chat Epthianura crocea tunneyi in Kakadu National Park</i> . Report to Parks Australia (North), NT Department of Infrastructure Planning and Environment, Darwin. Woinarski, J. and Armstrong, M. (2006). <i>Threatened Species of the Northern Territory - Yellow Chat (Alligator River subspecies) - Epthianura crocea tunneyi</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0019/206344/yellow-chat.PDF [Accessed 1 May 2018]. Schodde, R. and Mason, I.J. (1999). <i>The Directory of Australian Birds: Passerines</i> . CSIRO Publishing, Melbourne.	
Red Goshawk <i>Erythrotriorchis radiatus</i>	VU	VU	Habitat: Prefers tall, open Eucalypt forest and riparian areas. Nests in large trees, frequently the tallest and most massive in a tall stand, nest trees are invariably within 1 km of permanent water (Debus & Czechura 1988; Aumann & Baker-Gabb 1991). Distribution: Sparsely distributed across much of the northern Australia, from the Kimberley in WA to south-eastern Qld. Within this range, generally occurs in taller forests characteristic of higher rainfall areas, but there are some isolated records from central Australia (Woinarski 2006).	HIGH <ul style="list-style-type: none"> • Suitable foraging habitat within the project footprint. • Suitable nesting habitat only along Finnis River branches. • Recorded during previous surveys.
			Aumann, T. & Baker-Gabb, D. (1991). <i>A Management Plan for the Red Goshawk</i> . RAOU Report 75, Royal Australasian Ornithologists Union, Melbourne. Debus, S. & Czechura, G. (1988). Field identification of the Red Goshawk <i>Erythrotriorchis radiates</i> . <i>Australian Bird Watcher</i> , Vol. 12, pp. 154-159. Woinarski, J. (2006). <i>Threatened Species of the Northern Territory - Red Goshawk - Erythrotriorchis radiates</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0018/206352/red-goshawk.pdf [Accessed 1 May 2018].	

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Gouldian Finch <i>Erythrura gouldiae</i>	EN	VU	<p>Habitat: Prefers annual and perennial grasses (especially <i>Sorghum</i>), a nearby source of surface water and – in the breeding season – unburnt, hollow-bearing Eucalyptus trees (especially <i>E. tintinnans</i>, <i>E. brevifolia</i> and <i>E. leucophloia</i>) (Tidemann 1996; O'Malley 2006).</p> <p>Distribution: Sparsely across northern Australia from the Kimberley to north-central Qld (Dostine 1998; Franklin et al. 1999; Barrett et al. 2003; Franklin et al. 2005). In the NT, most known breeding populations occur in the Top End. Non-breeding birds disperse widely (Garnett et al. 2011), greatly increasing the possible range of this species.</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable foraging habitat within the project footprint. No breeding habitat present. • Not recorded during previous surveys (despite being a conspicuous species). • Nine proximate records (ranging from 1897 to 1995) all assigned to a waypoint in the south-east corner of the Browns Oxide site. Each record has within its metadata the note: <i>Gay Crowley / Riikka Hokkanen clean-up of Gouldian Records 2009</i>. When contacted, Gay Crowley could not recall the provenance of these records. It is suspected that these records were, at some stage, clumped together and given a localised geo-reference of -13°, 130°.
<p>Barrett, G., Silcocks, A., Barry, S., Cunningham, R. & Poulter, R. (2003). <i>The New Atlas of Australian Birds</i>. Royal Australian Ornithologists Union, Melbourne, Victoria.</p> <p>Dostine, P. (1998). <i>Gouldian Finch Recovery Plan Erythrura gouldiae</i>. Gouldian Finch Recovery Team and Parks & Wildlife Commission NT, Darwin.</p> <p>Franklin, D.C., Burbidge, A.H. & Dostine, P.L. (1999). The harvest of wild birds for aviculture: an historical perspective on finch trapping in the Kimberley with special emphasis on the Gouldian Finch. <i>Australian Zoologist</i>, Vol. 31, pp. 92-109.</p> <p>Franklin, D.C., Whitehead, P.J., Pardon, G., Matthews, J., McMahon, P. & McIntyre, D. (2005). Geographic patterns and correlates of the decline of granivorous birds in northern Australia. <i>Wildlife Research</i>, Vol. 32, pp. 399-408.</p> <p>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). <i>The Action Plan for Australian Birds 2010</i>. CSIRO Publishing, Collingwood, Australia.</p> <p>O'Malley, C. (2006). <i>National Recovery Plan for the Gouldian Finch (Erythrura gouldiae)</i>. WWF-Australia, Sydney and Parks and Wildlife NT, Department of Natural Resources, Environment and the Arts, NT Government, Palmerston.</p> <p>Tidemann, S.C. (1996). Causes of the decline of the Gouldian Finch <i>Erythrura gouldiae</i>. <i>Biological Conservation International</i>, Vol. 6, pp. 49-61.</p>				
Grey Falcon <i>Falco hypoleucos</i>	-	VU	<p>Habitat: Occurs in areas of lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm (Ward 2012).</p> <p>Distribution: Sparsely distributed through much of the arid and semi-arid areas of Australia but is recorded in all Australian mainland states and territories. In the NT, the majority of records are from the southern half, but there are records all the way up to Darwin (Ward 2012).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records. • Outside core distribution. Species is highly mobile and could occur as a vagrant.
<p>Ward, S. (2012). <i>Threatened Species of the Northern Territory - Grey Falcon - Falco hypoleucos</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0020/206354/grey-falcon.pdf [Accessed 1 May 2018].</p>				

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Crested Shrike-tit (northern subspecies) <i>Falcunculus frontatus whitei</i>	VU	-	<p>Habitat: Recorded in eight different woodland types in northern Australia, mainly those dominated by <i>Eucalyptus miniata</i>, <i>E. tetradonta</i> or <i>E. bleeseri</i> (Robinson & Woinarski 1992).</p> <p>Distribution: North-western Australia from the Kimberley in WA, across the Top End of the NT to Borroloola (TSSC 2016). In the NT, recorded in very low densities in many isolated sub-populations (Garnett & Crowley 2000) between north-east Arnhem land and semi-arid Victoria River District. Scarcity of records suggests that populations are at very low density (Woinarski 2004). Not known to have disappeared from any area where recorded historically (TSSC 2016).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records. • Outside core distribution.
<p>Garnett, S.T. & Crowley, G.M. (2000). <i>The Action Plan for Australian Birds 2000</i>. Environment Australia and Birds Australia, Canberra, ACT.</p> <p>Robinson, D. and Woinarski, J.C.Z. (1992). 'A review of records of the Northern Shrike-tit <i>Falcunculus frontatus whitei</i> in north-western Australia'. <i>South Australian Ornithologist</i>, Vol. 31, pp. 111-117.</p> <p>Threatened Species Scientific Committee (2016). <i>Approved Conservation Advice for Falcunculus frontatus whitei - crested shrike-tit (northern)</i>. Canberra: Department of the Environment. In effect under the EPBC Act from 02-May-2016. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/26013-conservation-advice-05052016.pdf [Accessed 1 May 2018].</p> <p>Woinarski, J.C.Z. (2004). <i>National multi-species Recovery Plan for the Partridge Pigeon [eastern subspecies] Geophaps smithii smithii; crested shrike-tit [northern (sub)-species] Falcunculus (frontatus) whitei; masked owl [north Australian mainland subspecies] Tyto novaehollandiae kimberli; and masked owl [Tiwi Islands subspecies] Tyto novaehollandiae melvillensis, 2004-2008</i>. NT Department of Infrastructure Planning and Environment, Darwin.</p>				
Partridge Pigeon (eastern subspecies) <i>Geophaps smithii smithii</i>	VU	VU	<p>Habitat: Occurs in open forests and woodlands with an understorey of grasses (Woinarski 2006). Prefers woodland dominated by <i>Eucalyptus tetradonta</i> and <i>E. miniata</i> (Braithwaite 1985; Garnett et al. 2011; Higgins & Davies 1996).</p> <p>Distribution: Historically, across the Top End (from Kununurra in WA to Borroloola in the NT). Since early 20th century a severe range contraction from the western, eastern and southern parts of the former distribution (Higgins & Davies 1996; Woinarski et al. 2007). Currently, distribution is limited to sub-coastal NT from Yinberrie Hill in the south, Litchfield NP in the west and (western) Arnhem Land in the east (Garnett et al. 2011).</p>	<p>KNOWN</p> <ul style="list-style-type: none"> • Recorded during recent survey.
<p>Braithwaite, R.W. (1985). <i>The Kakadu fauna survey: an ecological survey of Kakadu National Park</i>. Australian National Parks & Wildlife Service, Canberra.</p> <p>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). <i>The Action Plan for Australian Birds 2010</i>. Birds Australia, CSIRO Publishing, Melbourne.</p> <p>Higgins, P.J. and Davies S.J.J.F. (eds) (1996). <i>Handbook of Australian, New Zealand and Antarctic Birds. Volume Three: Snipe to Pigeons</i>. Oxford University Press. Melbourne, Victoria.</p> <p>Woinarski, J.C.Z. (2006). <i>Threatened Species of the Northern Territory - Partridge Pigeon (eastern subspecies) - Geophaps smithii</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0003/206355/partridge-pigeon.pdf [Accessed 1 May 2018].</p> <p>Woinarski, J., Pavey, C., Kerrigan, R., Cowie, I. and Ward, S. (Eds) (2007). <i>Lost from Our Landscape: Threatened Species of the Northern Territory</i>. Northern Territory Government, Darwin.</p>				

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Painted Honeyeater <i>Grantiella picta</i>	VU	VU	<p>Habitat: Acacia and Eucalyptus-dominated woodlands and open forest, preferring habitats with more mature trees that host more mistletoe. Breeding times and seasonal movements (south to north) likely governed by the fruiting of mistletoe (Garnett et al. 2011).</p> <p>Distribution: Across eastern and northern parts of the country – but nowhere very numerous (Ward 2012). Many birds move after breeding to semi-arid regions such as north-eastern SA, central and western Qld, and central NT (TSSC 2015). Few NT records – most from the Barkly Tablelands – but no evidence of a breeding population in the NT, and the records are likely irregular visitors from south-eastern Australia (Ward 2012).</p>	<p>LOW</p> <ul style="list-style-type: none"> • No nesting habitat within the project footprint. • Suitable foraging habitat only within the project footprint. • Not recorded within the project footprint during previous surveys.
<p>Garnett, S.T., Szabo, J.K. and Dutton, G. (2011). <i>The Action Plan for Australian Birds 2010</i>. CSIRO Publishing, Collingwood, Australia.</p> <p>Threatened Species Scientific Committee (TSSC) (2015). <i>Approved Conservation Advice for Grantiella picta (Painted Honeyeater)</i>. Canberra: Department of the Environment. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/470-conservation-advice.pdf [Accessed 1 May 2018].</p> <p>Ward, S. (2012). <i>Threatened Species of the Northern Territory – Painted Honeyeater - Grantiella picta</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0009/373554/painted-honeyeater.pdf [Accessed 1 May 2018].</p>				
Masked Owl (northern subspecies) <i>Tyto novaehollandiae kimberli</i>	VU	VU	<p>Habitat: Mainly in <i>Eucalyptus</i> tall open forests (especially those dominated by <i>Eucalyptus miniata</i> and <i>E. tetradonta</i>), but also roosts in monsoon rainforests and forages in more open vegetation types, including grasslands (Woinarski & Ward 2012).</p> <p>Distribution: Poorly known, with few records from across a broad range in northern Australia. In the NT, records from the Top End, Kakadu, Coburg Peninsula (majority of records) and south-west Gulf country (Woinarski & Ward 2012).</p>	<p>MEDIUM</p> <ul style="list-style-type: none"> • No nesting habitat within the project footprint. • Suitable foraging habitat only within the project footprint. • Not recorded within the project footprint during previous surveys. • Recent proximate records.
<p>Woinarski, J.C.Z. and Ward, S. (2012). <i>Threatened Species of the Northern Territory - Masked Owl (north Australian mainland subspecies) - Tyto novaehollandiae kimberli</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/word_doc/0008/373553/masked-owl-mainland-top-end.docx [Accessed 1 May 2018].</p>				
Migratory shorebirds Red Knot Great Knot Bar-tailed Godwit (2 subspecies) Eastern Curlew Greater Sand Plover Lesser Sand Plover Curlew Sandpiper	-	VU	<p>Habitat: Coastal and estuarine with tidal mudflats. May roost during high tide on nearby beaches. May also be found at near-coastal swamps and lakes (apart from Red and Great Knot). Curlew sandpiper is less frequently found at inland freshwater wetlands.</p> <p>Distribution: Mostly widespread around the northern Australian coast, less common in the south, with few inland records. Eastern Curlew is uncommon across Australia while Asian Dowitcher is rare. Every year these species breed in the northern hemisphere in the summer, and migrate to Australia for the southern hemisphere summer. Some birds remain in Australia during the winter.</p> <p>[Information above summarised from Chatto (2003), DoE (2015) and Garnett et al. (2011)].</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint.

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>Chatto, R. (2003). <i>The distribution and status of shorebirds around the coast and coastal wetlands of the Northern Territory</i>. Technical Report 73, Parks and Wildlife Commission of the Northern Territory, Darwin. [online] Available at: https://dtc.nt.gov.au/_data/assets/pdf_file/0008/279917/2003_shorebirds_rpt76.pdf [Accessed 1 May 2018].</p> <p>Department of the Environment (2015). EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species. Commonwealth of Australia, Canberra, ACT. [online] Available at: http://www.environment.gov.au/epbc/publications/shorebirds-guidelines [Accessed 1 May 2018].</p> <p>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). <i>The Action Plan for Australian Birds 2010</i>. CSIRO Publishing. Collingwood, Australia.</p>	
<p>Australian Painted Snipe <i>Rostratula (benghalensis) australis</i></p>	EN	VU	<p>Habitat: Fringes of permanent and temporary wetlands, swamps and inundated grasslands (Taylor et al. 2013).</p> <p>Distribution: Nomadic and scattered across Australia with no predictable occurrence (Rogers 2001), but could occur at any wetland or inundated grassland across its distribution, including nearly all of the NT and Qld (Garnett et al. 2011).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No proximate records. • Nomadic and scattered across Australia, with no predictable occurrence.
			<p>Garnett, S.T., Szabo, J.K. and Dutson, G. (2011). <i>The Action Plan for Australian Birds 2010</i>. CSIRO Publishing. Collingwood, Australia.</p> <p>Rogers, D. (2001). Painted Snipe. <i>Wingspan</i>, Vol. 11 (No. 4), pp. 6-7.</p> <p>Taylor, R., Chatto, R. and Woinarski, J.C.Z. (2013). <i>Threatened Species of the Northern Territory - Australian painted snipe - Rostratula australis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0018/206361/australian-painted-snipe.pdf [Accessed 1 May 2018].</p>	
MAMMALS (TERRESTRIAL)				
<p>Fawn Antechinus <i>Antechinus bellus</i></p>	VU	EN	<p>Habitat: Mostly in open forests and woodlands dominated by <i>Eucalyptus miniata</i> and/or <i>E. tetradonta</i>, particularly where these forests have a relatively dense shrubby understorey (Friend 1985; Friend & Taylor 1985). Declines in areas with frequent intense fires (Corbett et al. 2003) but not necessarily common in areas where fire has been excluded for long periods (>20 years) (Woinarski et al. 2004).</p> <p>Distribution: Restricted to the Top End of the NT (Watson & Calaby 2008), with one record from Melville Island. Recent surveys have failed to record it across central and eastern Arnhem Land (TSSC 2015).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Recorded within the project footprint during previous surveys (most recently 2008), but not in recent surveys despite targeted efforts. • Species has recently undergone an extensive decline in range, and may be locally extinct.
			<p>Corbett L. K., Andersen, A.N. and Muller, W.J. (2003). Terrestrial vertebrates. In: Andersen, A.N., Cook, G.D. and Williams, R.J. (eds.). <i>Fire in tropical savannas: the Kapalga experiment</i>. Springer-Verlag, New York: pp. 126–152.</p> <p>Friend, G.R. and Taylor, J.A. (1985). Habitat preferences of small mammals in tropical open-forest of the Northern Territory. <i>Australian Journal of Ecology</i>, Vol. 10, pp. 173–185.</p> <p>Friend, G.R. (1985). Ecological studies of a population of <i>Antechinus bellus</i> (Marsupialia: Dasyuridae) in tropical Australia. <i>Australian Wildlife Research</i>, Vol. 12 (No. 2), pp. 151-162.</p> <p>Threatened Species Scientific Committee (2015). <i>Approved Conservation Advice for Antechinus bellus – Fawn Antechinus</i>. Canberra: Department of the Environment. In effect under the EPBC Act from 03-Dec-2015. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/344-conservation-advice-2015123.pdf [Accessed 1 May 2018].</p> <p>Watson, M.L. and Calaby, J.H. (2008). Fawn Antechinus: <i>Antechinus bellus</i>. In: Van Dyck, S. and Strahan, R. (eds.). <i>The Mammals of Australia: 3rd Edition</i>. Reed New Holland, Sydney.</p> <p>Woinarski, J.C.Z., Risler, J. and Kean, L. (2004). The response of vegetation and vertebrate fauna to 23 years of fire exclusion in a tropical Eucalyptus open forest, Northern Territory, Australia. <i>Austral Ecology</i>, Vol. 29, pp. 156–176.</p>	

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Brush-tailed Rabbit-Rat <i>Conilurus penicillatus</i>	VU	EN	<p>Habitat: Largely restricted to mixed <i>Eucalypt</i> open forest and woodland, or on dunes with <i>Casuarina</i> – seeming to prefer habitats that are not burnt annually, that have an understorey of predominantly perennial grasses and a sparse-to-moderate middle storey (Firth et al. 2006; Firth 2007; Kemper & Firth 2008).</p> <p>Distribution: Formerly widespread across northern Australia, but has declined extensively from Qld and lower rainfall areas of the Kimberley in WA and the Top End in the NT. No recent records from much of the historically recorded NT range between near the mouth of Victoria River (in the west) and Sir Edward Pellew island group (in east). Most recently known from Cobourg Peninsula, Tiwi Islands, Groote Eylandt and a small area within Kakadu National Park (Woinarski & Hill 2012).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No proximate records. • Species has recently undergone an extensive decline in range, and may be locally extinct.
			<p>Firth, R.S.C. (2007). <i>Ecology and conservation status of the brush-tailed rabbit-rat Conilurus penicillatus</i>. PhD thesis, Charles Darwin University, Darwin, Northern Territory.</p> <p>Firth, R.S.C., Woinarski, J.C.Z. and Noske, R.A. (2006). Home range and den characteristics of the brush-tailed rabbit-rat <i>Conilurus penicillatus</i> in the monsoonal tropics of the Northern Territory, Australia. <i>Wildlife Research</i>, Vol. 33, pp. 397-408.</p> <p>Kemper, C.M. and Firth, R.S.C. (2008). Brush-tailed Rabbit-rat. In: Van Dyck, S. and Strahan, R. (eds). <i>The Mammals of Australia</i>. Reed New Holland, Chatswood, NSW.</p> <p>Woinarski, J.C.Z. and Hill, B. (2012). <i>Threatened Species of the Northern Territory - Brush-tailed rabbit-rat, Brush-tailed tree-rat - Conilurus penicillatus</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0016/205504/brush-tailed-rabbit-rat.pdf [Accessed 1 May 2018].</p>	
Northern Quoll <i>Dasyurus hallucatus</i>	EN	CR	<p>Habitat: Wide range of habitats – especially coastal <i>Eucalypt</i> tall open forests – but since Cane Toads the most suitable habitats are rocky areas (Van Dam et al. 2002). Prime habitat in the NT consists of rocky sandstone escarpments (Braithwaite & Griffiths 1994).</p> <p>Distribution: Historically occurred from Borroloola in the south-east as far west as the NT/WA border (Woinarski et al. 2007). Dramatic range contraction associated with Cane Toad invasion. Now occurs across northern Australia in five regional populations – including the Top End in the NT.</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Recorded within the project footprint during previous surveys (pre Cane Toads). • Species has undergone dramatic declines since Cane Toad arrival, and may be locally extinct.
			<p>Braithwaite, R.W. and Griffiths, A.D. (1994). Demographic variation and range contraction in the Northern Quoll, <i>Dasyurus hallucatus</i> (Marsupialia: Dasyuridae). <i>Wildlife Research</i>, Vol. 21, pp. 203-218.</p> <p>Van Dam, R.A., Walden, D.J. and Begg, G.W. (2002). <i>A preliminary risk assessment of cane toads in Kakadu National Park</i>. Supervising Scientist Report 164, Darwin, Northern Territory.</p> <p>Woinarski, J.C.Z., Rankmore, B.R., Fisher, A. and Milne, D. (2007). <i>The natural occurrence of northern quolls Dasyurus hallucatus on islands of the Northern Territory: assessment of refuges from the threat posed by cane toads Bufo marinus</i>. Report to Natural Heritage Trust.</p>	
Arnhem Leaf-nosed Bat <i>Hipposideros inornatus</i>	EN	VU	<p>Habitat: Caves or abandoned mine sites in cool draughty areas, close to water (Churchill 1998; Corbett & Richards 2002). Reported as foraging in riparian areas and in Eucalypt tall open forests (Woinarski & Milne 2015).</p> <p>Distribution: Restricted to the NT and only known to occur on the western Arnhem Land sandstone massif (Deaf Adder Gorge and upper South Alligator River area) and from one site – Tolmer Falls – in Litchfield National Park (McKean & Hertog 1979) where population appears to be disappearing (Woinarski & Milne 2015).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable foraging habitat within the project footprint. • No roosting habitat within the project footprint. • No proximate records. • Restricted range – the project footprint is outside this species' extent of occurrence.

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>Churchill, S. (1998). <i>Australian Bats</i>. Reed New Holland, Sydney.</p> <p>Corbett, L. and Richards, G. (2002). <i>Bat survey: Gunlom land trust area</i>. Report to Parks Australia North, EWL Sciences, Darwin.</p> <p>McKean, J.L. and Hertog, A.L. (1979). Extension of range in the horseshoe bat. <i>Northern Territory Naturalist</i>, Vol. 1, p. 5.</p> <p>Woinarski, D. and Milne, D. (2015). <i>Threatened Species of the Northern Territory – Arnhem Leaf-nosed Bat – Hipposideros inornata</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0018/205524/arnhem-leaf-nosed-bat.pdf [Accessed 1 May 2018].</p>	
Northern Leaf-nosed Bat <i>Hipposideros stenotis</i>	-	VU	<p>Habitat: Prefers rocky outcrops. Often found in shallow caves, boulder piles and old mine sites. Forages in a wide range of habitats including monsoon vine thickets, woodlands and open grasslands (Milne 2012).</p> <p>Distribution: In the NT – recorded in few locations, often associated with large sandstone escarpments. Recorded throughout parts of the Kimberley, WA and in north-western Mt Isa, Qld (Woinarski et al. 2014).</p>	<p>NONE</p> <ul style="list-style-type: none"> • Potentially-suitable foraging habitat within the project footprint; no roosting habitat within the project footprint. • No proximate records – the project footprint is outside this species' extent of occurrence.
			<p>Milne, D. (2012). <i>Threatened Species of the Northern Territory - Northern Leaf-nosed Bat - Hipposideros stenotis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0016/205513/northern-leafnosed-bat.pdf [Accessed 1 May 2018].</p> <p>Woinarski, J., Burbidge, A. & Harrison, P. (2014). <i>The Action Plan for Australian Mammals 2012</i>. CSIRO Publishing, pp. 501-503.</p>	
Golden Bandicoot <i>Isodon auratus (auratus)</i>	-	EN	<p>Habitat: Mainly in heathland and shrubland on sandstone sheets, avoiding vegetation with greater tree cover (Palmer et al. 2012; Southgate et al. 1996).</p> <p>Distribution: Formerly across most of northern, central and western Australia (across a broad range of habitats), but now only recorded population on mainland Australia is within the Kimberley. Within the NT, confined to the offshore islands of Arnhem Land. The only records from mainland NT are from the north-east corner of Arnhem Land between 1950 and 1980 (Palmer et al. 2012). Now extinct on the mainland except in a few locations in the north-west Kimberley (TSSC 2015).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Extinct on mainland NT.
			<p>Palmer, C., Woinarski, J. and Hill, B. (2012). <i>Threatened Species of the Northern Territory - Golden Bandicoot - Isodon auratus</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0017/205505/golden-bandicoot.pdf [Accessed 1 May 2018].</p> <p>Southgate, R., Palmer, C., Adams, C., Masters, M., Triggs, B. and Woinarski, J. (1996). Population and habitat characteristics of the Golden Bandicoot (<i>Isodon auratus</i>) on Marchinbar Island, Northern Territory. <i>Wildlife Research</i>, Vol. 23, pp. 647-664.</p> <p>Threatened Species Scientific Committee (TSSC) (2015). <i>Approved Conservation Advice for Isodon auratus auratus (golden bandicoot (mainland))</i>. Canberra: Department of the Environment. [online] Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/66665-conservation-advice-01102015.pdf [Accessed 1 May 2018].</p>	
Ghost Bat <i>Macroderma gigas</i>	VU	-	<p>Habitat: Ranging from the arid Pilbara (WA) to tropical savanna woodlands and north Qld rainforests (TSSC 2016). Permanent roost sites are generally deep natural caves or disused mines (TSSC 2016).</p> <p>Distribution: Geographically-disjunct colonies occur in the Pilbara and Kimberley in WA, NT north of approximately 17° latitude (including Elcho Island and Groote Eylandt), the Gulf of Carpentaria, eastern Qld from Cape York to near Rockhampton, and western Qld (including Riversleigh and Camooweal districts) (TSSC 2016). Distribution likely influenced by the availability of suitable caves and mines for roost sites (Ward & Milne 2016). Only 14 breeding sites known (Worthington Wilmer 2012). In arid Australia, including southern NT until the early 1960's (Ward & Milne 2016).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable foraging habitat within the project footprint • No roosting or breeding habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No proximate records.

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>Milne, D. and Ward, S. (2016). <i>Threatened Species of the Northern Territory – Ghost Bat - Macroderma gigas</i>. Northern Territory Department of Environment and Natural Resource. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0010/376138/ghost-bat.pdf [Accessed 1 May 2018].</p> <p>Threatened Species Scientific Committee (2016). <i>Approved Conservation Advice for Macroderma gigas (ghost bat)</i>. Canberra: Department of the Environment. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/174-conservation-advice-05052016.pdf [Accessed 1 May 2018].</p> <p>Worthington Wilmer, J. (2012). Ghost Bat <i>Macroderma gigas</i>. In: Curtis et al. (eds.). <i>Queensland's Threatened Animals</i>. CSIRO, Canberra: pp. 382-383.</p>	
<p>Black-footed Tree-rat (Kimberley and mainland NT subspecies) <i>Mesembriomys gouldii gouldii</i></p>	EN	VU	<p>Habitat: In the NT, found in tropical woodlands and open forests in coastal areas. Shelters in tree hollows and Pandanus stands during the day (Hill 2012).</p> <p>Distribution: Occurs in the Top End of the NT, the Kimberley in WA and Cape York Peninsula south to Townsville in Qld (Hill 2012). Has remained relatively abundant in the Darwin rural area (Price et al. 2005).</p>	<p>KNOWN</p> <ul style="list-style-type: none"> Recorded during recent surveys in Rum Jungle mine site and the granular material borrow area
			<p>Hill, B. (2012). <i>Threatened Species of the Northern Territory- Black-footed Tree-rat - Mesembriomys gouldii</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0018/205515/black-footed-tree-rat.pdf [Accessed 1 May 2018].</p> <p>Price, O., Rankmore, B., Milne, D.J., Brock, C., Tynan, C., Kean, L. and Roger, L. (2005). Regional patterns of mammal abundance and their relationships to landscape variables in eucalypt woodlands near Darwin, northern Australia. <i>Wildlife Research</i>, Vol. 32, pp. 435-446.</p>	
<p>Golden-backed Tree-rat <i>Mesembriomys macrurus</i></p>	-	CR	<p>Habitat: In the NT, little known of the ecology apart that all three records were from riverine vegetation. In the Kimberley, known to occur in open Eucalypt forests with tussock grass understorey, rainforest patches, sandstone screes, beaches, and black soil plains (Woinarski et al. 2012).</p> <p>Distribution: Historically, known to have occurred in three localities in the NT (Parker 1973) with no new records in the last 30 years. In 1993, reportedly spotted in Kakadu National Park; however, further surveys of suitable habitats in the NT failed to locate the species (Lee 1995). Now only known to occur in some areas of the north-western Kimberley and associated offshore islands (Palmer et al. 2003).</p>	<p>NONE</p> <ul style="list-style-type: none"> Potentially-suitable habitat within the project footprint. Extinct on mainland NT. No proximate records. Has not been recorded from NT in 30 years.
			<p>Lee, A.K. (1995). <i>The Action Plan for Australian Rodents</i>. Australian Nature Conservation Agency, Endangered Species Program, Canberra.</p> <p>Palmer, C., Taylor, R. & Burbidge, A. (2003). <i>Recovery plan for the Golden Bandicoot <i>Isodon auratus</i> and golden-backed tree-rat <i>Mesembriomys macrurus</i> 2004-2009</i>. Northern Territory Department of Infrastructure Planning and Environment, Darwin.</p> <p>Parker, S.A. (1973). An annotated checklist of the native land mammals of the Northern Territory. <i>Records of the South Australian Museum</i>, Vol. 16, pp. 1-57.</p> <p>Woinarski, J.C.Z., Palmer, C. & Hill, B. (2012). <i>Threatened Species of the Northern Territory - Golden-backed tree-rat - Mesembriomys macrurus</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0006/205476/golden-backed-tree-rat.pdf [Accessed 1 May 2018].</p>	
<p>Nabarlek (Top End subspecies) <i>Petrogale concinna canescens</i></p>	EN	VU	<p>Habitat: Isolated and rocky areas consisting of both sandstone and granite escarpments (Churchill 1997; Telfer et al. 2008). Shelters in caves and crevices during the day (Churchill 1997) and may move from these to forage in adjacent flat areas (Sanson et al. 1985).</p> <p>Distribution: Restricted to the Top End of the NT in scattered populations from sandstone cliffs bordering the Arafura Swamp (Arnhem Land) in the east, to the Daly River catchment in the west (Ward & Woinarski 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> No suitable habitat within the project footprint.

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>Churchill, S. (1997). Habitat use, distribution and conservation status of the Nabarlek, <i>Petrogale concinna</i>, and sympatric rock-dwelling mammals, in the Northern Territory. <i>Australian Mammalogy</i>, Vol. 19, pp. 297-308.</p> <p>Sanson, G.D., Nelson, J. and Fell, P. (1985). Ecology of <i>Peradorcas concinna</i> in Arnhem Land in a wet and a dry season. <i>Proceedings of the Ecological Society of Australia</i>, Vol. 13, pp. 65-72.</p> <p>Telfer, W.R., Griffiths, A.D. and Bowman, D.M.J.S. (2008). The habitat requirements of four sympatric rock-dwelling macropods of the Australian monsoon tropics. <i>Austral Ecology</i>, Vol. 33, pp. 1033-1044.</p> <p>Ward, S. and Woinarski, J. (2012). <i>Threatened Species of the Northern Territory - Nabarlek - Petrogale concinna</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0017/205523/nabarlek.pdf [Accessed 1 May 2018].</p>	
Black-footed Rock Wallaby <i>Petrogale lateralis</i>	VU	-	<p>Habitat: Upland rocky areas with associated steep slopes (Pavey 2006). Heavily weathered outcrops, caves, cliffs and rock piles provide suitable habitat as daytime shelter (Woinarski et.al. 2014).</p> <p>Distribution: In the NT, mostly found in the MacDonnell Ranges, but also occurs throughout the arid southern end of the NT (Pavey 2006) and may be found in the Davenport and Murchison Ranges.</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
			<p>Pavey, C. (2006). <i>Threatened Species of the Northern Territory - Black-footed Rock-Wallaby - Petrogale lateralis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0003/376122/black-footed-rock-wallaby.pdf [Accessed 1 May 2018].</p> <p>Woinarski, J., Burbidge, A. and Harrison, P. (2014). <i>The Action Plan for Australian Mammals 2012</i>. CSIRO Publishing: pp. 403-405.</p>	
Northern Brush-tailed Phascogale <i>Phascogale pirata</i>	VU	EN	<p>Habitat: No detailed studies, but ecology is probably similar to that reported for temperate relatives (Rhind 1998). Most records are from tall open forests dominated by <i>Eucalyptus miniata</i> and <i>E. tetradonta</i> (Woinarski et al. 2014).</p> <p>Distribution: Very few records exists, reported in West Island, east Arnhem Land, Coburg Peninsula, Kakadu, Litchfield and the Tiwi Islands. Only recorded once in Kakadu, Coburg Peninsula and the Tiwi Islands throughout the last 10 years (Woinarski et al. 2014).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Recorded within the project footprint during previous surveys (pre Cane Toads). • Species has undergone dramatic declines since Cane Toad arrival, and may be locally extinct.
			<p>Rhind, S.G. (1998). <i>Ecology of the brushtailed phascogale in jarrah forest of south-western Australia</i>. PhD thesis, Murdoch University, Perth, Western Australia.</p> <p>Woinarski, J., Burbidge, A. and Harrison, P. (2014). <i>The Action Plan for Australian Mammals 2012</i>. CSIRO Publishing: pp. 125-127.</p>	
Pale Field-rat <i>Rattus tunneyi</i>	-	VU	<p>Habitat: Historically occurred in a wide range of habitats, but now primarily in dense vegetation along creeks (Aplin et al. 2008).</p> <p>Distribution: Higher rainfall areas of northern Australia, extending from Kimberley in WA to south-eastern Qld, including the Top End of the NT (Braithwaite & Griffiths 1996).</p>	<p>MEDIUM</p> <ul style="list-style-type: none"> • Potentially-suitable habitat within the project footprint. • Recorded during previous surveys. • Recent proximate records (but in habitat that does not occur within the project footprint).
			<p>Aplin, K., Braithwaite, R. and Baverstock, P. (2008). Pale Field-rat: <i>Rattus tunneyi</i>. In: Van Dyck, S. and Strahan, R. (eds.). <i>The Mammals of Australia (3rd Edition)</i>. Reed New Holland, Sydney, NSW.</p> <p>Braithwaite, R. and Griffiths, A. (1996). The paradox of <i>Rattus tunneyi</i>: endangerment of a native pest. <i>Wildlife Research</i>, Vol. 23, pp. 1-21.</p>	

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Arnhem Rock-rat <i>Zyomys maini</i>	VU	VU	<p>Habitat: Rugged sandstone environments, typically where there are many caves, crevices or boulders. Occupies environments in association with monsoonal rainforest, typically those areas which are floristically-rich and provide the fleshy fruits and seeds that form its principal food item (Begg et al. 1980).</p> <p>Distribution: Endemic to the sandstone massif of western Arnhem Land in the NT (Woinarski 2004). Commonly found throughout parts of Kakadu National Park and Warddeken Indigenous protected area (Woinarski et al. 2014).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
<p>Begg, R.J. and Dunlop, C.R. (1980). Security eating, and diet in the large rock-rat, <i>Zyomys woodwardi</i> (Rodentia: Muridae). <i>Australian Wildlife Research</i>, Vol. 7, pp. 63-70.</p> <p>Woinarski, J., Burbidge, A. & Harrison, P. (2014). <i>The Action Plan for Australian Mammals 2012</i>. CSIRO Publishing: pp. 652-654.</p> <p>Woinarski, J.C.Z. (2004). <i>Threatened plants and animals in Kakadu National Park: a review and recommendations for management</i>. Darwin, Northern Territory DIPE.</p>				
REPTILES (TERRESTRIAL)				
Plains Death Adder <i>Acanthophis hawkei</i>	VU	VU	<p>Habitat: Floodplains and cracking soil plains (Webb et al. 2002).</p> <p>Distribution: Habitat mapping suggests the potential geographic range extends from western Qld, across the north of the NT to north-eastern WA. Fragmented populations occur in the Mitchell Grass Downs of western Qld, the Barkly Tablelands on the NT/Qld border and east of Darwin in the NT (TSSC 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint.
<p>Webb, J.K., Christian, K.A. & Fisher, P. (2002). Fast growth and early maturation in a viviparous sit-and-wait predator, the northern death adder (<i>Acanthophis praelongus</i>) from tropical Australia. <i>Journal of Herpetology</i>, Vol. 36, no. 3, pp. 505-509.</p> <p>Threatened Species Scientific Committee (2015). <i>Approved Conservation Advice – Acanthophis hawkei – Plains Death Adder</i>. Canberra: Department of the Environment. [online] Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/83821-conservation-advice.pdf [Accessed 1 May 2018].</p>				
Arnhem Land Skink <i>Bellatorias obiri</i>	EN	EN	<p>Habitat: Prefers sandstone outcrops, typically with extensive fissures and cave systems (Sadlier 1990).</p> <p>Distribution: Restricted to the Western Arnhem Land plateau and outliers (e.g. Jabiluka), where it is patchily distributed (Armstrong & Dudley 2004).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
<p>Armstrong, M. and Dudley, A. (2004). <i>The Arnhem Land Egernia obiri in Kakadu National Park</i>. Report to Parks Australia North, NT Department of Infrastructure Planning and Environment, Darwin.</p> <p>Sadlier, R.A. (1990). A new species of scincid lizard from western Arnhem Land, Northern Territory. <i>The Beagle</i>, Vol. 7, pp. 29-33.</p>				
Yellow-snouted Gecko <i>Lucasium occultum</i>	EN	VU	<p>Habitat: Prefers areas with well-developed leaf litter and grasses (King et al. 1982; Johansen 2006) in open forests dominated by <i>Eucalyptus miniata</i> and <i>E. tetradonta</i>. Commonly found in sandy red-loam substrates. Has been recorded in areas consisting of moderate to sparse Gamba grass (Beggs et al. 2012).</p> <p>Distribution: Endemic to the NT with known populations from north-west of Kakadu National Park and the Wildman Reserve (King et al. 1982).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			<p>Beggs, K., Armstrong, M., Woinarski, J. and Ward, S. (2012). <i>Threatened Species of the Northern Territory - Yellow-Snouted Gecko - Lucasium occultum</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0007/206458/yellow-snouted-gecko.pdf [Accessed 23 May2017].</p> <p>Johansen, T. (2006). <i>The yellow-snouted gecko (Diplodactylus occultus), a little known endemic species of northern Australia</i>. Report to NT Department of Natural Resources Environment and the Arts.</p> <p>King, M., Braithwaite, R.W. and Wombey, J.C. (1982). A new species of Diplodactylus (Reptilia: Gekkonidae) from the Alligator Rivers region - Northern Territory. <i>Transactions of the Royal Society of South Australia</i>, Vol. 106, pp. 15-18.</p>	
Oenpelli Python <i>Morelia oenpelliensis</i>	-	VU	<p>Habitat: Shelters in cracks, caves and crevices of rugged broken sandstone escarpments and gorges; or in large shady trees. Within this environment, reported from monsoon rainforest patches, riparian areas, woodlands, open heathlands and bare rock pavements (Woinarski & Ward 2012).</p> <p>Distribution: Restricted to the sandstone massif of Western Arnhem Land in the NT. Reported in the upper catchments of the Cadell also in the South & East Alligator River systems (Woinarski & Ward 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
			<p>Woinarski, J. and Ward, S. (2012). <i>Threatened Species of the Northern Territory - Oenpelli Python - Morelia oenpelliensis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0008/206459/oenpelli-python.pdf [Accessed 1 May 2018].</p>	
Mertens' Water Monitor <i>Varanus mertensi</i>	-	VU	<p>Habitat: Semi-aquatic, occupying edges of watercourses and lagoons, but seldom seen far from water (Christian 2004).</p> <p>Distribution: Across far northern Australia from the western Cape York Peninsula in Qld to the Kimberley in WA (Christian 2004). Widespread in the NT, occupying all of the Top End river systems (Ward et al. 2006).</p>	<p>HIGH</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Recorded within the project footprint during previous surveys. • Recent proximate records.
			<p>Christian, K. (2004). <i>Varanus mertensi</i>. In: Pianka et al. (eds.). <i>Varanoid lizards of the world</i>. Indiana University Press, Bloomington, Indianapolis.</p> <p>Ward, S., Woinarski, J., Griffiths, T. and McKay, L. (2006). <i>Threatened Species of the Northern Territory - Mertens Water Monitor - Varanus mertensi</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0018/206460/mertens-water-monitor.pdf [Accessed 1 May 2018].</p>	
Mitchell's Water Monitor <i>Varanus mitchelli</i>	-	VU	<p>Habitat: Semi-aquatic and arboreal, inhabiting margins of watercourses, swamps and lagoons (Ward 2012).</p> <p>Distribution: Top End of the NT and Kimberley in WA (Schultz & Doody 2004). In the NT, recorded in most catchments flowing into the Timor Sea, Arafura Sea and the Gulf of Carpentaria (Ward 2012).</p>	<p>HIGH</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Recorded within the project footprint during previous surveys. • Recent proximate records.
			<p>Doody, J.S., Green, B., Rhind, D., Castellano, C., Sims, R. and Robinson, T. (2009). Population-level declines in Australian predators caused by an invasive species. <i>Animal Conservation</i>, Vol. 12, pp. 46-53.</p> <p>Schultz, T. and Doody, S. (2004). <i>Varanus mitchelli</i>. In: Pianka et al. (eds.). <i>Varanoid lizards of the world</i>. Indiana University Press, Bloomington, Indianapolis.</p> <p>Ward, S. (2012). <i>Threatened Species of the Northern Territory - Mitchell's Water Monitor - Varanus mitchelli</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0019/206461/mitchells-water-monitor.pdf [Accessed 1 May 2018].</p>	

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Floodplain Monitor <i>Varanus panoptes</i>	-	VU	Habitat: Broad range of habitats from coastal beaches to savanna woodlands (Christian 2004). Also common throughout floodplains grasslands and a variety of native woodlands (Ward et al. 2012). Distribution: Across northern Australia from the Kimberley in WA to Cape York Peninsula, and southwards through most of Qld. In the NT, recorded across most of the Top End and the Gulf Region (Christian 2004). Experienced significant declines due to cane toad poisoning (Doody et al. 2009).	LOW <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • Species has undergone dramatic declines since Cane Toad arrival, and may be locally extinct.
			Christian, K. (2004). <i>Varanus panoptes</i> . In: Pianka et al. (eds). <i>Varanoid lizards of the world</i> . Indiana University Press, Bloomington, Indianapolis. Doody, J.S., Green, B., Rhind, D., Castellano, C., Sims, R. and Robinson, T. (2009). Population-level declines in Australian predators caused by an invasive species. <i>Animal Conservation</i> , Vol. 12, pp. 46-53. Ward, S., Woinarski, J., Griffiths, T. & McKay, L. (2012). <i>Threatened Species of the Northern Territory - Yellow Spotted Monitor, Northern Sand Goanna, Floodplain Monitor - Varanus panoptes</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0006/206466/floodplain-monitor.pdf [Accessed 1 May 2018].	
AMPHIBIANS				
Howard Springs Toadlet <i>Uperoleia daviesae</i>	-	VU	Habitat: Very little is known; however, appears to be confined to sandsheet heathland. Suitable habitat consists of short vegetation and sandy substrates which become inundated during the wet season (Ward et al. 2012). Distribution: Endemic to the NT. Confined to sandsheet heathlands in the Howard and Elizabeth River catchments (Ward et al. 2012).	NONE <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
			Ward, S., Young, S. and Hill, B. (2012). <i>Threatened Species of the Northern Territory - Howard River Toadlet – Uperoleia daviesae</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0003/205527/howard-river-toadlet.PDF [Accessed 1 May 2018].	
FISH				
Northern River Shark <i>Glyphis garricki</i>	EN	EN	Habitat: Little is known of the ecology, probably restricted to shallow, brackish reaches of large rivers (Ward & Larson 2012). Distribution: In Australia, there are few records, including in the NT from the Adelaide, East and South Alligator River systems. Also known from the Kimberley coast and King Sound in WA (Thorburn & Morgan 2004; Compagno et al. 2008).	LOW <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No records for the Finnis River.
			Compagno, L.J.V., White, W.T. and Last, P.R. (2008). <i>Glyphis garricki</i> sp. nov., a new species of river shark (Carcharhiniformes: Carcharhinidae) from northern Australia and Papua New Guinea, with a redescription of <i>Glyphis</i> (Müller & Henle, 1839). In: Last et al. (eds.). <i>Descriptions of New Australian Chondrichthyans</i> . CSIRO Marine and Atmospheric Research Paper, 022: pp. 203-226. Thorburn, D.C. and Morgan, D.L. (2004). The northern river shark, <i>Glyphis</i> sp. C (Carcharhinidae) discovered in Western Australia. <i>Zootaxa</i> , Vol. 685, pp. 1-8. Ward, S. and Larson, H. (2012). <i>Threatened Species of the Northern Territory – Northern River Shark - Glyphis garricki</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0005/206384/northern-river-shark.pdf [Accessed 1 May 2018].	

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Spear-tooth Shark <i>Glyphis glyphis</i>	CR	VU	<p>Habitat: Tropical fresh water and marine environments (Bradshaw et al. 2008). May be restricted to low salinity environments such as freshwater or brackish areas of rivers (DoE 2017).</p> <p>Distribution: Papua New Guinea and Northern Australia. Considered to be very rare in Australia as few specimens have been collected (Cavanagh et al. 2003). Three distinct geographical locations in the NT and northern Qld (DoE 2017). In the NT, recorded in the Alligator River region across to Adelaide River, and the Bizant River (Ward and Larson 2012).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No records for the Finniss River.
			<p>Bradshaw, C.J.A., Fitzpatrick, B.M., Steinberg, C.C., Brook, B.W. and Meekan, M.G. (2008). Decline in whale shark size and abundance at Ningaloo Reef over the past decade: the world's largest fish is getting smaller. <i>Biological Conservation</i>, Vol. 141, pp. 1894–1905.</p> <p>Cavanagh, R., Kyne, P., Fowler, S., Musick, J. and Bennett, M. (eds.) (2003). <i>The Conservation Status of Australian Chondrichthyans</i>. Report of the IUCN Shark Specialist Group Australia and Oceania Red List Workshop. The University of Queensland, School of Biomedical Sciences, Brisbane, Australia.</p> <p>Department of the Environment (2017). <i>Glyphis - Spear-tooth Shark</i>. Species Profile and Threats Database, Department of the Environment, Canberra. [online] Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82453 [Accessed 1 May 2018].</p> <p>Ward, S. and Larson, H. (2012). <i>Threatened Species of the Northern Territory - Spear-tooth Shark - Glyphis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0009/206388/spear-tooth-shark.pdf [Accessed 1 May 2018].</p>	
Lorentz Grunter <i>Pingalla lorentzi</i>	-	VU	<p>Habitat: Small and large pools with rock and sand substrates, usually in open unshaded sections of streams and in water temperatures between 25°C and 30°C (Allen et al. 2002).</p> <p>Distribution: Rare in Australia, more widespread in PNG. In the NT only known from the Finniss River near Rum Jungle (Stirrat et al. 2006).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Recorded only once (in 1992) in upper reaches of Finniss River (East Branch), despite many more recent surveys.
			<p>Allen, G.R., Midgley, S.H. and Allen, M. (2002). <i>Field Guide to Freshwater Fishes of Australia</i>. Western Australian Museum, Perth.</p> <p>Stirrat, S., Woinarski, J.C.Z. and Larson, H. (2006). <i>Threatened Species of the Northern Territory – Lorentz Grunter - Pingalla lorentzi</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0020/206390/lorentz-grunter.pdf [Accessed 26 April 2017].</p>	
Dwarf Sawfish <i>Pristis clavata</i>	VU	VU	<p>Habitat: Tropical marine and estuarine habitats, entering estuarine or fresh waters to breed during the wet season and moving into marine waters following the wet season (Peverell 2005).</p> <p>Distribution: Indonesia, South-East Asia and northern Australia (Cavanagh et al. 2003). In the NT, known to occur around Darwin (including Buffalo Creek and Rapid Creek), in Kakadu National Park (Alligator River), and Keep River and Victoria River (Thorburn et al. 2003).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No records for the Finniss River.
			<p>Cavanagh, R., Kyne, P., Fowler, S., Musick, J. and Bennett, M. (eds.) (2003). <i>The Conservation Status of Australian Chondrichthyans</i>. Report of the IUCN Shark Specialist Group Australia and Oceania Red List Workshop. The University of Queensland, School of Biomedical Sciences, Brisbane, Australia.</p> <p>Peverell, S.C. (2005). Distribution of sawfishes (Pristidae) in the Queensland Gulf of Carpentaria, Australia, with notes on their ecology. <i>Environmental Biology of Fishes</i>, Vol. 73, pp. 391-402.</p> <p>Thorburn, D.C., Peverell, S., Stevens, S., Last, J.D. and Rowland, A.J. (2003). <i>Status of freshwater and estuarine elasmobranchs in Northern Australia</i>. Report to Natural Heritage Trust, Canberra.</p>	

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
Freshwater or Largetooth Sawfish <i>Pristis pristis</i>	VU	VU	<p>Habitat: Tropical marine and estuarine habitats, entering estuarine or fresh waters to breed during the wet season and moving into marine waters following the wet season (Peverell 2005).</p> <p>Distribution: Circumtropical, with distinct populations in the eastern Atlantic, western Atlantic, eastern Pacific and Indo-West Pacific – including northern Australia (TSSC 2014). In the NT, reported in Adelaide, Victoria, Daly, East and South Alligator, Goomadeer, Roper, McArthur, Wearyan and Robinson Rivers (TSSC 2014).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No records for the Finniss River.
			<p>Peverell, S.C. (2005). Distribution of sawfishes (Pristidae) in the Queensland Gulf of Carpentaria, Australia, with notes on their ecology. <i>Environmental Biology of Fishes</i>, Vol. 73, pp. 391-402.</p> <p>Threatened Species Scientific Committee (2014). <i>Approved Conservation Advice - Pristis (largetooth sawfish)</i>. Canberra: Department of the Environment. In effect under the EPBC Act from 11-April-2014. [online] Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/60756-conservation-advice.pdf [Accessed 1 May 2018].</p>	
Green Sawfish <i>Pristis zijsron</i>	VU	VU	<p>Habitat: Tropical waters including marine inshore waters, estuaries, lagoons and freshwater. However, the majority of records are from marine or estuarine waters (Thorburn et al. 2003). Enters estuarine or fresh waters to breed during the wet season and moves back into marine waters following the wet season (Peverell 2005).</p> <p>Distribution: Northern Australia, South-East Asia and the Indian Ocean (Cavenagh et al. 2003). Most frequently encountered of the sawfish species in Australian waters (Last & Stevens 1994). Most commonly known from the Gulf of Carpentaria (Stevens et al. 2005). In the NT specimens have only been collected from Buffalo Creek in Darwin (Stirrat et al. 2006).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Suitable habitat within the project footprint. • Not recorded within the project footprint during previous surveys. • No records for the Finniss River.
			<p>Cavanagh, R., Kyne, P., Fowler, S., Musick, J. and Bennett, M. (eds.) (2003). <i>The Conservation Status of Australian Chondrichthyans</i>. Report of the IUCN Shark Specialist Group Australia and Oceania Red List Workshop. The University of Queensland, School of Biomedical Sciences, Brisbane, Australia.</p> <p>Last, P.R. and Stevens, J.D. (1994). <i>Sharks and Rays of Australia</i>. CSIRO, Melbourne.</p> <p>Peverell, S.C. (2005). Distribution of sawfishes (Pristidae) in the Queensland Gulf of Carpentaria, Australia, with notes on their ecology. <i>Environmental Biology of Fishes</i>, Vol. 73, pp. 391-402</p> <p>Stirrat, S., Larson, H. and Woinarski, J. (2006). <i>Threatened Species of the Northern Territory - Green Sawfish - Pristis zijsron</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0006/206394/green-sawfish.pdf [Accessed 1 May 2018].</p> <p>Thorburn, D.C., Peverell, S., Stevens, S., Last, J.D. and Rowland, A.J. (2003). <i>Status of freshwater and estuarine elasmobranchs in Northern Australia</i>. Report to Natural Heritage Trust, Canberra.</p>	
FLORA				
a shrub <i>Acacia praetermissa</i>	VU	VU	<p>Habitat: Upper to lower slopes with various aspects in stony, skeletal or sandy soils on sandstone or laterite substrates. Several sites are on the slopes of a tertiary plateau remnant; others are on ridge slopes (Cowie & Kerrigan 2012).</p> <p>Distribution: Endemic to the NT, collected from two roadside localities along 25 km of the Stuart Highway; near Emerald Springs and Hayes Creek (Dunlop et al. 1995). Some targeted searches have been conducted and considerable survey has been conducted in the wider region, suggesting that existing records reflect this species' restricted distribution and abundance (Cowie & Kerrigan 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
			<p>Cowie, I. and Kerrigan, R. (2012). <i>Threatened Species of the Northern Territory - Acacia praetermissa</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0018/208404/acacia-praetermissa.pdf [Accessed 1 May 2018].</p> <p>Dunlop, CR., Leach, GJ. and Cowie, ID. (1995). <i>Flora of the Darwin Region</i>. Vol 2. Conservation Commission of the Northern Territory, Darwin.</p>	

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
a shrub <i>Clausena excavata</i>	CR	CR	<p>Habitat: Collected from two small monsoonal vine thickets situated on limestone (karst) geology. One population was found in outcropping limestone and the other on the border of a sink hole (Westaway & Cowie 2012).</p> <p>Distribution: Thought to be endemic to the NT – highly restricted and known only from a small area on Tipperary Station, 5 km north-west of Mt Burrell in the Daly Basin bioregion (Westaway & Cowie 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> Project area is outside the species range (Outcropping limestone on Tipperary Station, NT.)
<p>Westaway, J. and Cowie, I. (2012). Threatened Species of the Northern Territory - Clausena sp. Tipperary. Northern Territory Department of Environment and Natural Resources. https://nt.gov.au/__data/assets/pdf_file/0004/208426/clausena-tipperary.pdf [Accessed 1 May 2018].</p>				
a herb² <i>Cleome insolata</i>	-	VU	<p>Habitat: Inundated sedge land growing on silty loam with coverage of laterite gravels in close proximity to a river catchment (Short 2010).</p> <p>Distribution: Endemic to the NT, known from a population located near Humpty Doo and three populations in Lloyd Creek in the Darwin rural area (Westaway & Cowie 2012; EcOz records). A species specific survey has not been carried out (Westaway & Cowie 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> Highly restricted range which is outside the project area.
<p>Short, P.S. (2010). New species of Cleome L. (Cleomaceae) from the Northern Territory, Australia. The Beagle, Records of the Museum and Art Galleries of the Northern Territory, 2010, Vol. 26, pp. 1–12. [online] Available at: https://dnc.nt.gov.au/__data/assets/pdf_file/0011/254954/Short.pdf [Accessed 28 April 2017].</p> <p>Westaway, J. and Cowie, I. (2012). Threatened Species of the Northern Territory - Cleome insolata. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/__data/assets/pdf_file/0006/208428/cleome-insolata.pdf [Accessed 28 April 2017].</p>				
Darwin Cycad <i>Cycas armstrongii</i>	-	VU	<p>Habitat: Open grassy woodland where adequate drainage appears to be a limiting factor (Kerrigan et al. 2006). Prime habitat has deep loamy soil (Liddle 2009).</p> <p>Distribution: Restricted to the Top End of the NT – from Gunn Point to Hayes Creek, west to within 50km of the coastline and east to the Wildman River catchment (Kerrigan et al. 2006). Also on the Tiwi Islands and Cobourg Peninsula.</p>	<p>HIGH</p> <ul style="list-style-type: none"> Suitable habitat within the project footprint Recorded during recent surveys.
<p>Kerrigan, R., Cowie, I. and Liddle, D. (2006). <i>Threatened Species of the Northern Territory - Cycas armstrongii</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/__data/assets/pdf_file/0017/208430/cycas-armstrongii.pdf [Accessed 1 May 2018].</p> <p>Liddle, D.T. (2009). Management Program for Cycads in the Northern Territory of Australia 2009-2014. Northern Territory Department of Natural Resources, Environment, the Arts and Sport, Darwin. [online] Available at: http://www.territorystories.nt.gov.au/jspui/bitstream/10070/265358/1/Management%20program%20for%20cycads%20in%20the%20Northern%20Territory%20of%20Australia%202009%20to%202014.pdf [Accessed 1 May 2018].</p>				
a ground orchid <i>Dienia montana</i>	-	VU	<p>Habitat: Wet (spring-fed) rainforest (Kerrigan et al. 2013).</p> <p>Distribution: Northern Qld, and one population in the NT, near Munmarlary in Kakadu National Park. A targeted search in 2003 failed to record any plants at this locality (Kerrigan et al. 2013).</p>	<p>NONE</p> <ul style="list-style-type: none"> No monsoon rainforest or littoral rainforest habitat within the project area. Highly restricted range No records near the project area.

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
			Kerrigan, R., Cowie, I. and Ward S. (2013). Threatened Species of the Northern Territory - <i>Dienia montana</i> . Northern Territory Department of Environment and Natural Resources. https://nt.gov.au/_data/assets/pdf_file/0007/208474/dienia-montana-malaxis-latifolia.pdf [Accessed 1 May 2018].	
a sedge <i>Eleocharis retroflexa</i>	VU	-	<p>Habitat: Margins of seasonal swamps and watercourses with <i>Melaleuca</i>, <i>Eucalyptus</i> and <i>Corymbia</i> species and grasses (Cowie & Kerrigan 2006).</p> <p>Distribution: Northern Qld near Cairns and in the NT in Nitmiluk National Park near Katherine (TSSC 2008).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records.
	<p>Cowie, I. and Kerrigan, R. (2006). <i>Threatened Species of the Northern Territory - Eleocharis retroflexa</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0010/376264/eleocharis-retroflexa.pdf [Accessed 1 May 2018].</p> <p>Threatened Species Scientific Committee (2008). Commonwealth Conservation Advice on <i>Eleocharis retroflexa</i>. Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/23672-conservation-advice.pdf [Accessed 1 May 2018].</p>			
a herb <i>Goodenia quadrifida</i>	VU	-	<p>Habitat: Ecology not well known; however, one population recorded growing in grassland, whilst another grows on the upper parts of estuarine floodplains on poorly drained soils (Cowie & Kerrigan 2006).</p> <p>Distribution: Endemic to the Top End of the NT. Known from the Murrumbidgee Crossing area on the Adelaide River and Hardies Creek (Cowie & Kerrigan 2006).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records.
	<p>Cowie, I. and Kerrigan, R. (2006). <i>Threatened Species of the Northern Territory - Goodenia quadrifida</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0006/376269/goodenia-quadrifida.pdf [Accessed 1 May 2018].</p>			
a shrub <i>Helicteres macrothrix</i>	EN	EN	<p>Habitat: Woodland dominated by <i>Eucalyptus tectifica</i>, <i>E. tetradonta</i> and <i>E. miniata</i> on sandy loam and rocky siltstone slopes or granitic rocks (Cowie et al. 2012). Absent from the laterite country predominant in the region (DoE 2017).</p> <p>Distribution: Restricted to the Top End of the NT where only three populations known – Mt Bunday, Batchelor/Glenluckie Creek and Lake Bennett (DoE 2017). While it is possible that extensive targeted searches may uncover additional subpopulations, there is a high degree of confidence in the broader distributional data (Cowie et al. 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
	<p>Cowie, I., Kerrigan, R. and Stuckey, B. (2012). <i>Threatened species of the Northern Territory - Helicteres Sp. Glenluckie Creek</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0005/208445/helicteres-macrothrix.pdf [Accessed 1 May 2018].</p> <p>Department of the Environment (2017). <i>Helicteres macrothrix</i>. Species Profile and Threats Database, Department of the Environment, Australian Government, Canberra. [online] Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=86586 [Accessed 1 May 2018].</p>			
a sub-shrub <i>Hibbertia tricornis</i>	-	VU	<p>Habitat: Sandy scree among sandstone escarpments (Westaway & Cowie 2012).</p> <p>Distribution: Known only from one location at Mt Brockman on the central western escarpment on the Arnhem land plateau. This population is located within the Kakadu National Park south of Jabiru (Westaway & Cowie 2012). High level of general survey in the area suggests that substantial increases are unlikely (Westaway & Cowie 2012).</p>	<p>NONE</p> <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
	<p>Westaway, J. and Cowie, I. (2012). <i>Threatened Species of the Northern Territory - Hibbertia tricornis</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0019/208450/hibbertia-tricornis.pdf [Accessed 1 May 2018].</p>			

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
a shrub <i>Hibiscus brennanii</i>	VU	VU	Habitat: Sandstone cliffs, in gullies and on broken sandstone (Kerrigan & Cowie 2006). Distribution: Endemic to the NT, with restricted population in the Mt Brockman area to the west of Arnhem Land (Kerrigan & Cowie 2006). Considered adequately surveyed (Kerrigan & Cowie 2006).	NONE <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
Kerrigan, R. and Cowie, I. (2006). <i>Threatened Species of the Northern Territory - Hibiscus brennanii</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0003/208452/hibiscus-brennanii.pdf [Accessed 1 May 2018].				
a shrub <i>Jacksonia divisa</i>	-	VU	Habitat: Associated with shrubland on sandy kaolinite clay on ledges around the escarpment of a tertiary plateau (Cowie & Westaway 2012). Distribution: Endemic to the NT; found on the edges of a gorge on the eroding western margin of the Murrumbidgee Plateau at Bloomfield Springs in southern Kakadu National Park (Cowie & Westaway 2012). An intensive survey of adjoining Nitmiluk National Park in 1999- 2001 failed to find additional subpopulations (Cowie & Westaway 2012).	NONE <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' extent of occurrence.
Cowie, I. and Westaway, J. (2012). <i>Threatened Species of the Northern Territory - Jacksonia divisa</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0011/208469/jacksonia-divisa.pdf [Accessed 1 May 2018].				
<i>Lithomyrtus linariifolia</i>	-	VU	Habitat: Associated with heaths or eucalypt woodlands on sandstone, in sandy skeletal soils amongst sandstone boulders and outcrops (Kerrigan & Cowie 2006). Distribution: Endemic to the NT, with only known populations in 14 localities in Kakadu National Park and Arnhem Land. (Kerrigan & Cowie 2006). Considered adequately surveyed (Kerrigan & Cowie 2006).	NONE <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • The project footprint is outside this species' area of occurrence.
Kerrigan, R. and Cowie, I. (2006). <i>Threatened Species of the Northern Territory - Lithomyrtus linariifolia</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0006/208491/schoutenia-ovata.pdf [Accessed 3 September 2019].				
a shrub / tree <i>Schoutenia ovata</i>	-	EN	Habitat: Monsoonal vine thicket on both granite and limestone outcrops. Predominant on south-facing slopes within the Mt Bunday region (Cowie & Kerrigan 2012). Distribution: Occurs in three disjunct populations in the NT – two located at Mt Bunday and Mt Goyder and one near Tipperary Station (Liddle et al. 1994). The general habitat has been sufficiently well sampled across the Top End to indicate that its apparently highly restricted distribution in the NT is true (Cowie & Kerrigan 2012).	NONE <ul style="list-style-type: none"> • No suitable habitat within the project footprint. • Restricted range – the project footprint is outside this species' area of occurrence.
Cowie, I. and Kerrigan, R. (2012). <i>Threatened Species of the Northern Territory - Schoutenia ovata</i> . Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0006/208491/schoutenia-ovata.pdf [Accessed 1 May 2018]. Liddle, D.T., Russell-Smith, J., Brock, J., Leach, G.J. and Connors, G.T. (1994). <i>Atlas of the vascular rainforest plants of the Northern Territory</i> . Flora of Australia Supplementary Series No. 3, ABRIS, Canberra.				

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
a herb^{1,2} <i>Typhonium praetermissum</i>	EN	EN	<p>Habitat: Seasonally-saturated sandy substrate in nutrient-deficient grass/sedge land (Kerrigan & Cowie 2006).</p> <p>Distribution: Endemic to the NT, with the only known population from the edge of the Howard River floodplain (Kerrigan & Cowie 2006). Targeted survey for this species in the Howard River Floodplain as part of a biodiversity assessment survey (Cowie 2002) did not relocate or uncover any additional populations of this species. Considered adequately surveyed, based on the strong survey effort in the area and the high profile of this genus amongst collectors. While more populations may exist, the paucity of collections of this species is considered to accurately reflect its very restricted distribution and abundance (Kerrigan & Cowie 2006).</p>	<p>NONE</p> <ul style="list-style-type: none"> • Only known population on the Howard River floodplain which is well away from project area.
<p>Cowie, I. D. (2002). Preliminary report on a survey of Utricularia (Lentibulariaceae) in the Howard River – Shoal Bay area. NT Department of Infrastructure Planning and Environment, Darwin.</p> <p>Kerrigan, R. and Cowie, I. (2006). Threatened species of the Northern Territory - <i>Typhonium taylori</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0019/208504/typhonium-taylori.pdf [Accessed 2 May 2017].</p>				
Trigger plant <i>Stylidium ensatum</i>	EN	EN	<p>Habitat: Margins of drainage areas in damp heavy clay or peaty soil (Cowie & Westaway 2012).</p> <p>Distribution: Known from three localities in Darwin – Shoal Bay, Girraween Rd, Hayes Creek. Other historical collections recorded; however, the exact locality for these collections is unknown. Not collected since 1974 (Cowie & Westaway 2012). No additional subpopulations have been located despite several flora and biodiversity surveys in the Darwin region over the last ten years (but no systematic survey of potentially suitable habitat at an appropriate time of year). Substantial areas of potentially-suitable habitat south from Darwin towards Hayes Creek that are relatively poorly surveyed and it is likely that additional sub-populations exist (Cowie & Westaway 2012).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records.
<p>Cowie, I. and Westaway, J. (2012). <i>Threatened species of the Northern Territory - Stylidium ensatum</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0009/208494/stylidium-ensatum.pdf [Accessed 1 May 2018].</p>				
a bladderwort <i>Utricularia dunstaniae</i>	-	VU	<p>Habitat: Wet sand, often in shallow water, in paperbark (<i>Melaleuca nervosa</i>) woodland or Feather-flower (<i>Verticordia</i>) shrub land. Occurs in slightly wetter micro-habitats than other sympatric <i>Utricularia</i> species, frequently where water is percolating from the ground (Kerrigan & Cowie 2012).</p> <p>Distribution: Endemic to Australia, known from WA and the NT – where known from nine locations. Locations near Darwin are Noonamah, Howard Springs and the Howard River floodplain. Other sub-populations on the Cobourg Peninsula, near Murgarella and near Finnis River (Kerrigan & Cowie 2012). As apparently suitable habitat within the extent of occurrence remains unsurveyed, it is likely that additional, undiscovered subpopulations exist (Kerrigan & Cowie 2012).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records. Finnis River records are more than 40 km downstream from the mine site.
<p>Kerrigan, R. and Cowie, I. (2012). <i>Threatened Species of the Northern Territory - Utricularia dunstaniae</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0020/208505/utrularia-dunstaniae.pdf [Accessed 1 May 2018].</p>				

Name	Status		Summary	Likelihood of occurrence
	Cth	NT		
a bladderwort <i>Utricularia singeriana</i>	-	VU	<p>Habitat: Margins of wet sandy flats and swamps with short grasses and sedges (Kerrigan & Cowie 2012).</p> <p>Distribution: Endemic to the NT with known populations from five locations between Darwin and Katherine – the nearest Darwin being Finn Rd in Weddell. Other sites are the Edith River area, near the Finnis River, and the Marrawal Plateau east of Pine Creek. Port Darwin population (early 1900's record) no longer in existence (Kerrigan & Cowie 2012). As much apparently suitable habitat within the extent of occurrence remains unsurveyed, it is likely that additional undiscovered sub-populations exist (Kerrigan & Cowie 2012).</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records. Finnis River records are more than 40 km downstream from the mine site.
<p>Kerrigan, R. and Cowie, I. (2012). <i>Threatened Species of the Northern Territory - Utricularia singeriana</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0003/208506/utricularia-singeriana.pdf [Accessed 1 May 2018].</p>				
Ground Orchid <i>Zeuxine oblonga</i>	-	VU	<p>Habitat: Grows in clusters in dark and moist situations on the rainforests floor or in wet peaty areas near streams (Jones 1988).</p> <p>Distribution: Qld, NSW and in the NT, where known from five widely-spaced locations south and south-west of Darwin, from Keep River near the WA border to south-west of Adelaide River (Liddle et al. 1994). Not collected since 1992, despite efforts to relocate the Keep River population in 2000 and 2001 (Kerrigan & Cowie 2006). There is a negative collection bias associated with this species due to its ephemeral nature.</p>	<p>LOW</p> <ul style="list-style-type: none"> • Potentially-suitable habitat within the project footprint. • Not recorded during previous surveys. • No proximate records.
<p>Jones, D.L. (1988). <i>Native Orchids of Australia</i>. Reed, Sydney.</p> <p>Kerrigan, R. and Cowie, I. (2006). <i>Threatened Species of the Northern Territory – Zeuxine oblonga</i>. Northern Territory Department of Environment and Natural Resources. [online] Available at: https://nt.gov.au/_data/assets/pdf_file/0008/208691/zeuxine-oblonga.pdf [Accessed 1 May 2018].</p> <p>Liddle, D.T., Russell-Smith, J., Brock, J., Leach, G.J. and Connors, G.T. (1994). Atlas of the vascular rainforest plants of the Northern Territory. <i>Flora of Australia Supplementary Series No. 3</i>, Australian Biological Resources Study, Canberra.</p>				

Appendix B EPBC PROTECTED MATTERS SEARCH TOOL REPORT



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 30/08/19 15:55:07

[Summary](#)

[Details](#)

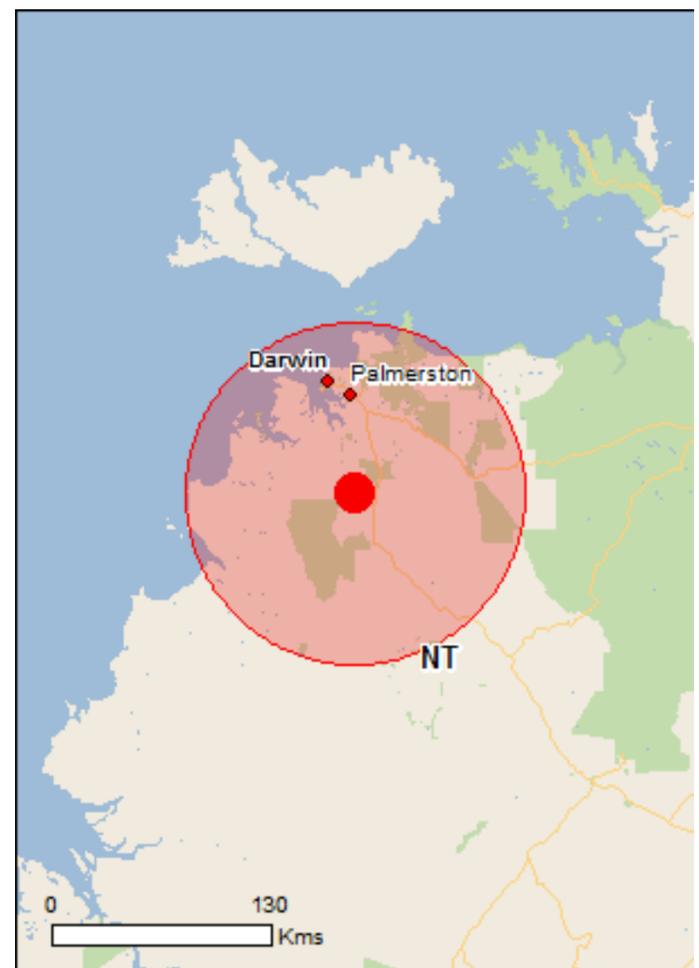
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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[Coordinates](#)

[Buffer: 100.0Km](#)



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	50
Listed Migratory Species:	69

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	38
Commonwealth Heritage Places:	9
Listed Marine Species:	110
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	1
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	30
Regional Forest Agreements:	None
Invasive Species:	34
Nationally Important Wetlands:	9
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties [\[Resource Information \]](#)

Name	State	Status
Kakadu National Park	NT	Declared property

National Heritage Properties [\[Resource Information \]](#)

Name	State	Status
Natural		
Kakadu National Park	NT	Listed place

Wetlands of International Importance (Ramsar) [\[Resource Information \]](#)

Name	Proximity
Kakadu national park	Within Ramsar site

Commonwealth Marine Area [\[Resource Information \]](#)

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name

EEZ and Territorial Sea

Marine Regions [\[Resource Information \]](#)

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name

[North](#)

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Epthianura crocea tunneyi Alligator Rivers Yellow Chat, Yellow Chat (Alligator Rivers) [67089]	Endangered	Species or species habitat known to occur within area
Erythrorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species

Name	Status	Type of Presence
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	habitat known to occur within area Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Hipposideros inornatus Arnhem Leaf-nosed Bat [86675]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat known to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheath-tail Bat [66889]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat known to occur within area
Plants		
Acacia praetermissa a shrub [14840]	Vulnerable	Species or species habitat likely to occur within area
Atalaya brevialata [86125]	Critically Endangered	Species or species habitat known to occur within area
Clausena excavata [68631]	Critically Endangered	Species or species habitat known to occur within area
Goodenia quadrifida [56035]	Vulnerable	Species or species habitat known to occur within area
Helicteres macrothrix [86586]	Endangered	Species or species habitat known to occur within area
Stylidium ensatum a triggerplant [86366]	Endangered	Species or species habitat known to occur within area
Typhonium taylori a herb [65904]	Endangered	Species or species habitat likely to occur within area
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Lucasium occultum Yellow-snouted Gecko, Yellow-snouted Ground Gecko [82993]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Breeding known to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area

Migratory Marine Species

Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area

Name	Threatened	Type of Presence
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name

Commonwealth Land -
 Commonwealth Land - Australian Customs Service
 Commonwealth Land - Australian Government Solicitor
 Commonwealth Land - Department of Administrative Services
 Commonwealth Land - Department of Community Services & Health
 Commonwealth Land - Department of Immigration Local Government & Ethnic Affairs
 Commonwealth Land - Department of Transport & Regional Development
 Commonwealth Land - Deputy Crown Solicitor
 Commonwealth Land - Director of Property Services Defence Estate
 Commonwealth Land - Kakadu National Park
 Commonwealth Land - National Transmission Agency
 Defence - AUSTRALIAN ARMY BAND - DARWIN
 Defence - BERRIMAH ONE
 Defence - DARWIN - AP10 RADAR SITE - LEE POINT
 Defence - DARWIN - AP3 RECEIVING STATION - LEE POINT
 Defence - DARWIN - TRANSMITTING STATION '11 MILE'
 Defence - DARWIN RELOCATIONS CENTRE
 Defence - DARWIN RIVER GRAVEL QUARRY
 Defence - DEFENCE FORCE CAREERS REFERENCE CENTRE
 Defence - ELIZABETH DOWNS STATION RADAR SITE
 Defence - Esanda Builidng
 Defence - HMAS COONAWARRA (Berrimah)
 Defence - HUMPTY DOO TRANSMITTING STATION
 Defence - KANGAROO FLATS TRAINING AREA
 Defence - KOWANDI NORTH COMMUNICATION STATION
 Defence - KOWANDI SOUTH REPEATING STATION
 Defence - LARRAKEYAH BARRACKS
 Defence - LEANYER BOMBING RANGE
 Defence - MT BUNDY TRAINING AREA
 Defence - MT GOODWIN RADAR SITE
 Defence - Patrol Boat Base (DARWIN NAVAL BASE)
 Defence - QUAIL ISLAND BOMBING RANGE
 Defence - RAAF BASE DARWIN
 Defence - ROBERTSON BARRACKS (Waler Barracks)
 Defence - SHOAL BAY RECEIVING STATION
 Defence - STOKES HILL OIL FUEL INSTALLATION
 Defence - WINNELLIE ONE
 Defence - WINNELLIE TWO

Commonwealth Heritage Places

[\[Resource Information \]](#)

Name	State	Status
Natural		
Mount Bunday Military Training Area	NT	Listed place
Historic		
Adelaide River War Cemetery	NT	Listed place
Larrakeyah Barracks Headquarters Building	NT	Listed place
Larrakeyah Barracks Precinct	NT	Listed place
Larrakeyah Barracks Sergeants Mess	NT	Listed place
RAAF Base Commanding Officers Residence	NT	Listed place
RAAF Base Precinct	NT	Listed place
RAAF Base Tropical Housing Type 2	NT	Listed place
RAAF Base Tropical Housing Type 3	NT	Listed place

Listed Marine Species

[\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		habitat may occur within area Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur

Name	Threatened	Type of Presence within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribbioned Pipehorse, Ribbioned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [[Resource Information](#)]

Name	Status	Type of Presence
Mammals		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur

Name	Status	Type of Presence within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Commonwealth ReservesTerrestrial [Resource Information]

Name	State	Type
Kakadu	NT	National Park (Commonwealth)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Adelaide River Foreshore	NT
Black Jungle / Lambells Lagoon Conservation Reserve	NT
Blackmore River	NT
Buffalo Creek Management Area	NT
Casuarina	NT
Channel Island	NT
Channel Point	NT
Charles Darwin	NT
Daly River (Mt Nancar)	NT
Djukbinj	NT
Douglas River / Daly River Esplanade Conservation Area	NT
Fish River	NT
Fogg Dam	NT
George Brown Darwin	NT
Harrison Dam Conservation Area	NT
Holmes Jungle	NT
Howard Springs	NT
Howard Springs	NT
Indian Island	NT
Knuckey Lagoons	NT
Leaning Tree Lagoon	NT
Litchfield	NT
Manton Dam Recreation Area	NT
Mary River	NT
Melacca Swamp	NT
Shoal Bay	NT
Territory Wildlife Park / Berry Springs Nature Park	NT
Tjuwaliyn (Douglas) Hot Springs Park	NT
Tree Point Conservation Area	NT
Vernon Islands	NT

Invasive Species

[[Resource Information](#)]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species

Name	Status	Type of Presence
<i>Annona glabra</i> Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		habitat likely to occur within area
<i>Brachiaria mutica</i> Para Grass [5879]		Species or species habitat may occur within area
<i>Cabomba caroliniana</i> Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
<i>Cenchrus ciliaris</i> Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
<i>Dolichandra unguis-cati</i> Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat may occur within area
<i>Eichhornia crassipes</i> Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
<i>Hymenachne amplexicaulis</i> Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
<i>Jatropha gossypifolia</i> Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
<i>Lantana camara</i> Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
<i>Mimosa pigra</i> Mimosa, Giant Mimosa, Giant Sensitive Plant, Thorny Sensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		Species or species habitat likely to occur within area
<i>Parkinsonia aculeata</i> Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
<i>Pennisetum polystachyon</i> Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat likely to occur within area
<i>Sagittaria platyphylla</i> Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
<i>Salvinia molesta</i> Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
<i>Vachellia nilotica</i> Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat may occur within area
Reptiles		
<i>Hemidactylus frenatus</i> Asian House Gecko [1708]		Species or species habitat likely to occur within area
<i>Lepidodactylus lugubris</i> Mourning Gecko [1712]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat known to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Adelaide River Floodplain System	NT
Daly River Middle Reaches	NT
Daly-Reynolds Floodplain-Estuary System	NT
Finniss Floodplain and Fog Bay Systems	NT
Kakadu National Park	NT
Mary Floodplain System	NT
Mount Bunday Training Area - Mary River Floodplain	NT
Port Darwin	NT
Shoal Bay - Micket Creek	NT

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-12.9876 131.011

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix C SUMMARY OF PAST SURVEYS

Site	Project	Survey target	Surveyor	When	Survey methods	Threatened species recorded
Rum Jungle	Rum Jungle rehabilitation	Partridge Pigeon	Mining Compliance Division ¹	March 2016	<ul style="list-style-type: none"> • Transects within new waste rock dump perimeter 	<ul style="list-style-type: none"> • Partridge Pigeon (calls only)
		Flora	Eco Logical ²	February and June 2014	<ul style="list-style-type: none"> • Vegetation community and condition mapping (15 detailed, 175 rapid sites) • Riparian corridor assessments (6 sites) • Cycad survey (2 transects) 	<ul style="list-style-type: none"> • Darwin Cycad
		Fauna			<ul style="list-style-type: none"> • Fauna trapping (7 sites) • Camera survey (9 transects) • Bat survey (2 sites) • Nocturnal spotlighting (7 transects) • Masked Owl playbacks (2 sites) 	<ul style="list-style-type: none"> • Partridge Pigeon • Mertens' Water Monitor
		Weeds	EcOz ³	April 2018	<ul style="list-style-type: none"> • Entire site surveyed at 100 m scale 	-
			Wild Man Land Management ⁴	April 2011 and November – December 2012	<ul style="list-style-type: none"> • Extent of Rum Jungle site surveyed 	-
Rum Jungle and granular material borrow area		Partridge Pigeon, Black-footed Tree-rat, Fawn Antechinus and Northern Quoll	EcOz	May-June 2019	<ul style="list-style-type: none"> • Camera survey (18 sites) 	<ul style="list-style-type: none"> • Black-footed Tree-rat • Partridge Pigeon

¹ Mining Compliance Division (2016). Partridge Pigeon survey of the proposed waste rock dump at the former Rum Jungle Mine. Prepared for Department of Mines and Energy.

² Eco Logical (2014). Flora and fauna surveys of the former Rum Jungle mine site. Prepared for Northern Territory Department of Mines and Energy (Q12-0518).

³ EcOz (2018). Weed Management Plan – Former Rum Jungle Mine Site. Prepared for Department of Primary Industry and Resources.

⁴ Wild Man Land Management (WMLM) (2011). Rum Jungle Mine site 5 Year Weed Management Plan. Prepared for Northern Territory Government.

Site	Project	Survey target	Surveyor	When	Survey methods	Threatened species recorded
Gravel and low permeability material borrow areas		Flora	EcOz	May 2019	<ul style="list-style-type: none"> • Vegetation survey (19 sites in gravel area; 4 check sites in clay) • Vegetation survey (via drone imagery; clay area only) 	<ul style="list-style-type: none"> • Darwin Cycad
Rum Jungle, Browns Oxide and Finniss River	Browns Oxide Project	Fauna	Ecological Management Services ⁵	June 2002 and March 2005	<ul style="list-style-type: none"> • Terrestrial fauna survey (9 sites) • Aquatic fauna survey (9 sites) • Reptile survey (12 additional sites) • Bird survey (3 additional sites) 	<ul style="list-style-type: none"> • Northern Quoll • Red Goshawk • Partridge Pigeon • Pale Field-rat • Fawn Antechinus • Brush-tailed Phascogale • Black-footed Tree-rat
Rum Jungle (Sulfides), Mt Fitch, Area 55, TSF2	Project Development Area	Flora	GHD ⁶	November 2007 and April 2008	• Flora survey (28 sites, 17 additional sites surveyed for vegetation structure)	• Darwin Cycad
		Fauna			• Fauna trapping (4 sites)	<ul style="list-style-type: none"> • Masked Owl (call only) • Partridge Pigeon
Region (Finniss River)	Former Rum Jungle mine	Water monitors and bats ⁷	EcOz	April and May 2015	<ul style="list-style-type: none"> • Active searches • Camera survey (8 sites) • Bat survey (1 site) 	<ul style="list-style-type: none"> • Mertens' Water Monitor • Mitchell's Water Monitor • Partridge Pigeon
		Aquatic fauna (turtles, monitors and crocodiles) ⁸		May 2014	<ul style="list-style-type: none"> • Active searches (8 sites) • Turtle trapping (8 sites) • Nocturnal spotlight survey (8 sites) 	<ul style="list-style-type: none"> • Mertens' Water Monitor • Mitchell's Water Monitor

⁵ Ecological Management Services Pty Ltd. (EMS) (2005). Browns Oxide Project - Fauna report. Prepared for Enesar Consulting Pty Ltd and Compass Resources NL.

⁶ GHD (2009). Report for Flora and Fauna Characterisations: Project Development Area. Prepared for Coffey Natural Systems Pty Ltd.

⁷ EcOz (2015). Threatened monitor lizard and bat survey of the Finniss River. Prepared for Hydrobiology.

⁸ EcOz (2014a). Aquatic reptile survey of the Finniss River. Prepared for Hydrobiology.

Site	Project	Survey target	Surveyor	When	Survey methods	Threatened species recorded
		Terrestrial fauna ⁹		March and September 2014	<ul style="list-style-type: none"> • Fauna trapping (8 sites) • Bird survey (8 sites) • Bat survey (4 sites) • Active searches (8 sites) • Camera survey (8 sites) 	<ul style="list-style-type: none"> • Mertens' Water Monitor • Mitchell's Water Monitor
Yarram	Yarram Prospect	Flora	Low Ecological Services ¹⁰	February 2012	• Flora survey (5 sites)	• Darwin Cycad
		Fauna			<ul style="list-style-type: none"> • Fauna survey (4 sites) • Camera survey (2 sites) • Bird survey (4 sites) • Bat survey (4 sites) 	<ul style="list-style-type: none"> • Pale Field-rat • Darwin Cycad
Browns Oxide	Browns Mining Project	Flora	URS ¹¹	April 2010	• Flora survey (12 sites)	• Darwin Cycad
	Browns Oxide Project	Flora	Kristin Metcalfe ¹²	May – August 2002	• Flora survey (12 sites)	• Darwin Cycad

⁹ EcOz (2014b). Finnis River terrestrial fauna survey. Prepared for Hydrobiology.

¹⁰ Low Ecological Services (2012). Yarram Prospect (ERL125, ERL146 and MLN1163): Landscape, Flora and Fauna Survey, February 2012. Prepared for Territory Iron.

¹¹ URS (2010). Browns Mining Project – Flora Survey 2010. Prepared for HNC (Australia) Resources Pty Ltd.

¹² Metcalfe, K. (2002). Flora assessment study for environmental impact statement – Browns polymetallic project, Batchelor, NT. Report prepared for Compass Resources NL and NSP Environmental Consultants Pty Ltd.

Appendix D ECO LOGICAL - FLORA AND FAUNA SURVEYS OF THE FORMER RUM JUNGLE MINE SITE REPORT

Main report:

https://dpir.nt.gov.au/_data/assets/pdf_file/0007/261268/Rum20Jungle20flora20and20fauna20survey.pdf

Appendices:

https://dpir.nt.gov.au/_data/assets/pdf_file/0004/261265/Rum20Jungle20flora20and20fauna20survey2020-20Appendices.pdf

**Appendix E SUPPLEMENTARY ECOLOGY SURVEY REPORT FOR
THE RUM JUNGLE EIS**