Appendix A

Paru Road Terrestrial Biodiversity Survey

Terrestrial Biodiversity Threatened Species Survey Report

Paru Road Upgrade - NT Portion 1644, Melville Island

Terrestrial Biodiversity Threatened Species Survey Report

Paru Road Upgrade - NT Portion 1644, Melville Island

Client: Department of Infrastructure Planning and Logistics

ABN: 84 085 734 992

Prepared by

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Quality Information

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Prepared by William Riddell and David van den Hoek

Reviewed by Abe Francis, Alana Court

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
1	07/04/2020	Interim Draft Report (Desktop)	Abe Francis	
2	26/02/2021	Draft Report	Alana Court	
3	22/04/2021	Addressing DIPL comments	Alana Court	

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Executive Summary

The Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) proposes to upgrade Paru Road within NT Portion 1644 by realigning the current road in a number of locations. AECOM Australia Pty Ltd (AECOM) has been commissioned by DIPL to undertake a terrestrial biodiversity assessment of the areas of NT Portion 1644 that may be disturbed due to realignments of the road and gravel extraction. To facilitate the road upgrade gravel will be extracted from two nominated locations. The project area covers a total of 383.8 ha, comprising two proposed gravel pits and four proposed road realignments of Paru Road, located in the south-west of Melville Island. The road realignment works will smooth bends along Paru Road.

An upper estimate of 74.7 ha of vegetation is required for clearing, comprising approximately 60.3 ha for five proposed gravel pits, and 14.4 ha within the Paru Road realignments. It should be noted that the majority of vegetation to be cleared along Paru Road is likely to be of poorer habitat value as it would be subject to disturbance and edge effects at Paru Road. This is likely to result in modified vegetation structure and reduced fauna presence due to traffic disturbance.

The aims of the terrestrial biodiversity assessment comprise the following:

- to describe the existing environment of the project areas
- to describe potential impacts of the development to threatened species
- provide mitigation measures to minimise impacts; and
- to identify relevant legislative requirements including the Environment Protection Biodiversity Conservation (EPBC) Act 1999, the Territory Parks and Wildlife Conservation (TPWC) Act 2006 and Environmental Assessment Act 1982.

Desktop assessments have identified 19 threatened flora species and 17 threatened fauna species as potentially occurring within the project area.

Terrestrial biodiversity surveys were conducted within the project area during 15 to 22 January 2021. These surveys were designed to determine threatened species that occur within the project area and the significance of potential impacts from the project.

Nine vegetation communities were mapped within the project area. The majority of the project area (81.5%) has been mapped as 1a - *Corymbia nesophila, Eucalyptus tetrodonta, E. miniata* open forest on undulating rises.

A total of 198 *Typhonium jonesii* and 481 *Typhonium mirabile* were recorded during surveys within the project area. This included a high-density *Typhonium mirabile* patch within the Gravel Pit 1 road alignment that consisted of 304 plants.

Significant populations of *Typhonium jonesii* and *T. mirabile* were identified during the threatened flora surveys. The likelihood of the project having a significant impact to *Typhonium spp.* is outlined below:

- South Road Alignment:
  - Low likelihood of significant impact to *Typhonium jonesii* or *Typhonium mirabile*
- Gravel Pit 1 Road Alignment
  - Low likelihood of significant impact to *Typhonium jonesii*
  - High likelihood of significant impact to *Typhonium mirabile*
- Creek Road Alignments
  - Option 1:
    - Low likelihood of significant impact to *Typhonium jonesii* or *Typhonium mirabile*
  - Option 2:
    - Low likelihood of significant impact to *Typhonium jonesii* or *Typhonium mirabile*

  - Option 3:
    - High likelihood of significant impact to *Typhonium jonesii*
    - Low Likelihood of significant impact to *Typhonium mirabile*
- North Road Alignment:
  - Low likelihood of significant impact to *Typhonium jonesii* or *Typhonium mirabile*
- Gravel Pit 2:
  - Low likelihood of significant impact to *Typhonium jonesii* or *Typhonium mirabile.*

Gravel pit locations have been recommended within both Gravel Pit 1 and Gravel Pit 2 with consideration of the following:

- *Typhonium spp.* records
- Slope model (0 - 4% slope)
- Native vegetation buffers:
  - 50 m buffer around low value wetlands
  - 100 m buffer around moderate value sensitive vegetation patches and wetlands
  - 250 m buffer around high value sensitive vegetation patches.

Five areas have been identified for gravel extraction. A total of 24 *Typhonium jonesii* and 20 *T. mirabile* are proposed to be impacted by these gravel pit locations. This equates to approximately 3.6% of the known *Typhonium jonesii* population and 2.9% of the known *T. mirabile* population. These areas have a low likelihood of significant impacts to *Typhonium spp*.

During the fauna survey the following threatened fauna species were recorded within the project area:

- Red Goshawk (*Erythrotriorchis radiatus*) (potential nest)
- Partridge pigeon (*Geophaps smithii smithii*)
- Masked Owl (*Tyto novaehollandiae melvillensis*)
- Black-footed Tree-rat (*Mesembriomys gouldii*)
- Pale Field-rat (*Rattus tunneyi*)
- Butler's Dunnart (*Sminthopsis butleri*)
- Mertens' Water Monitor (*Varanus mertensi*).

Following an analysis of desktop records, field survey results within the project footprint it has been determined that the project is unlikely to have a significant impact to threatened species. In accordance with *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA, 2013) the project does not require a referral under the EPBC Act.

The recommended gravel pit location within Gravel Pit 1 (GP1-1) is close to where a potential Red Goshawk nest was detected during the January 2021 surveys. AECOM recommends an 80 m buffer be applied to this nest to minimise disturbance to the species. The nest should be monitored during the project to determine whether it is an active Red Goshawk nest and whether the project may be impacting breeding.

AECOM recommends the following mitigation measures be implemented for the project:

- Minimise the removal of:
  - 3a - Riparian vegetation (Creek Road Alignment)
  - large (diameter >30 cm) *Eucalyptus miniata, E. tetrodonta* and *Corymbia nesophila* trees that contain large hollows
  - Areas with high shrub density.

- Implement erosion and sediment controls at the Creek Road alignment; and
- Implement weed hygiene methods to prevent the introduction of weeds to the project area.

1.0 Introduction

1.1 Project description

The Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) proposes to upgrade Paru Road within NT Portion 1644 by realigning the current road in a number of locations. AECOM Australia Pty Ltd has been commissioned by DIPL to undertake a terrestrial biodiversity assessment of the areas of NT Portion 1644 that may be disturbed due to realignment of the road and gravel extraction. To facilitate the road upgrade gravel will be extracted from two nominated locations. The project area covers a total of 383.8 ha, comprising two proposed gravel pit project areas and four proposed road realignments near Paru road, located in the south-west of Melville Island. The road realignment works will smooth three bends along Paru Road.

The project includes two gravel pit project areas, where gravel pits and access tracks will be located. The Gravel Pit 1 project area comprises 229.9 ha and is located on the southern side, and the Gravel Pit 2 project area comprises 120.7 ha and is located on the northern side of the project area. The Northern Road alignment comprises 11.0 ha, the Creek Road alignment is 14.8 ha and the Southern Road alignment is 7.3 ha (see Figure 1).

Clearing within the five allocated gravel pits will be limited to 1 ha at a time. The maximum footprint of the project will be 74.7 ha (refer Section 5.1). This is a conservative estimate as a portion of the 60.2 ha identified as suitable for gravel extraction is likely to be required.

The aims of the terrestrial biodiversity assessment comprise the following:

- to describe the existing environment of the project areas
- to describe potential impacts of the development to threatened species
- provide mitigation measures to minimise impacts; and
- to identify relevant legislative requirements including the Environment Protection Biodiversity Conservation (EPBC) Act 1999, the Territory Parks and Wildlife Conservation (TPWC) Act 2006 and Environmental Assessment Act 1982.

Field surveys were conducted during 15 to 22 January 2021. The fauna surveys team conducted work for seven days and six nights, whilst the flora survey team conducted work for eight days.

1.2 Project location

The Tiwi Islands comprises two islands, Melville and Bathurst islands, located approximately 80 km north of Darwin in the Timor Sea.

The project areas occur along and adjacent to Paru road, located in the south-west of Melville Island (Figure 1). The southern end of the road terminates at the Paru barge landing, which provides access to a barge service for locals that travel between Melville and Bathurst Islands. Paru Outstation is located along the southern end of the road.

The project to upgrade Paru Road will comprise the following project areas:

- Development of two gravel extraction pits (refer Figure 1):
  - Gravel Pit 1 (229.92 ha)
  - Gravel Pit 2 (120.73 ha)
- Realignment of Paru Road in four locations (refer Figure 1):
  - Road Realignment Chainage 5,300m to 6,300m (11.02 ha) (Refereed to henceforth as the North Road Alignment).
  - Road Realignment Chainage 7,800m to 9,000m (14.85 ha) (Creek Road Alignment)
  - Chainage 9,900 m to 11,000 m within the Gravel Pit 1 area

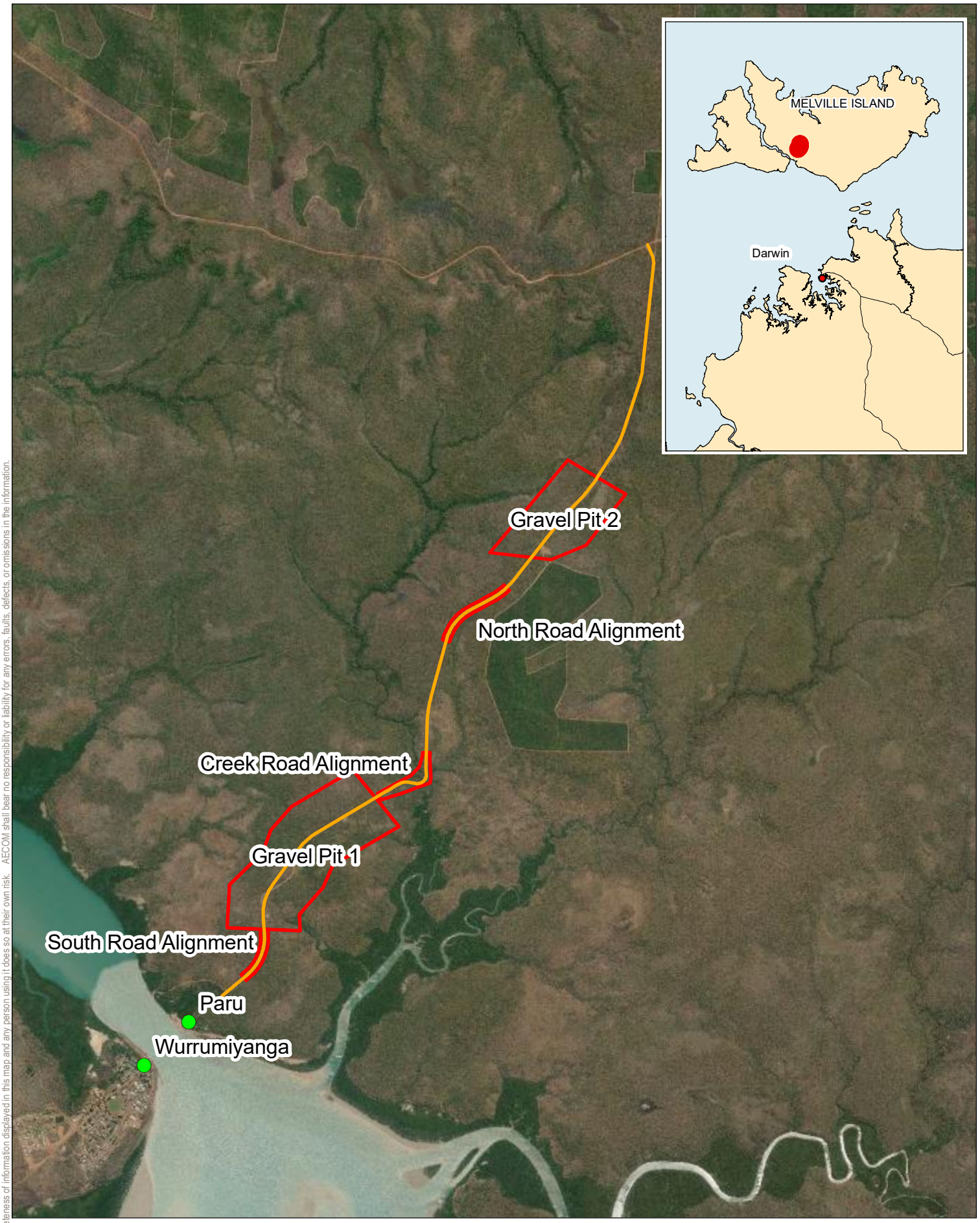
- Road Realignment Chainage 11,200m to 12,000m (7.28 ha) (South Road Alignment)

The project areas comprise a total of 383.80 ha.

1.3 Objectives of this report

The objectives of this terrestrial biodiversity assessment report are to:

- describe the results of the terrestrial biodiversity surveys, focusing on threatened species
- describe the vegetation, flora, terrestrial fauna and habitat, including threatened species, within the project areas
- assess the likely impacts of clearing on terrestrial biodiversity, particularly regarding threatened species, and the significance of the impacts
- identify potential constraints to the proposed development
- recommend practical mitigation strategies to address such constraints and minimise identified impacts
- recommend gravel extraction locations within the gravel pit project areas that are unlikely to result in significant impacts to threatened species.



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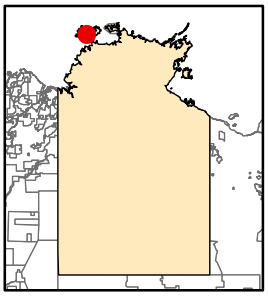
- Tiwi Communities
- Paru Road Proposed Alignment
- Project Area



Location of the project area and project area components

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Figure 1

A4 size

2.0 Desktop description of physical and biological environment

2.1 Climate

Rainfall on the Tiwi Islands is strongly seasonal, falling mainly during the wet season which usually occurs between November to April. Very little rain occurs during the dry season. The Tiwi Islands records the highest rainfall in the Northern Territory, with average annual rainfall ranging between 1,572.9 mm at Point Fawcett, located in the south-west of Bathurst Island and 1,989.3 mm at Pirlangimpi, located in the north-west of Melville Island. The high rainfall is attributed to the early onset of thunderstorm activity across the centre of Melville Island, which occurs a month earlier than other coastal regions of the NT (PWCNT, 1998). Temperatures remain relatively constant throughout the year, with a mean maximum temperature of 33.7 °C in October and a mean minimum temperature of 19.1 °C in August recorded at Pirlangimpi (BOM, 2020).

2.2 Landform

Bathurst and Melville Island comprise low relief undulating lateritic rises, dissected rises and low plateaux, to around 100m above sea level. Where gullies dissect the plateaux, intersected aquifers form permanent springs. Extensive deposits of material eroded from old tertiary surface surround the plateau surfaces (PWCNT, 1998).

2.3 Soil

Soils on the Tiwi Islands are typically deeply weathered and have undergone laterisation. Soils situated nearby to the project area are dominated by deep, well-drained sandy and loamy red massive earths (red Kandosols). Loamy soils are generally located on the flatter central plateaux surface area and are surrounded down slope by sandier soils within broad low-lying drainage areas. Plateaux margins and ridges contain massive red earths with varying levels of ironstone gravels and skeletal soils (PWCNT, 1998). The project areas collectively contain the range of soils described above.

2.4 Flora and vegetation

Vegetation varies across the Tiwi Islands and is strongly influenced by landform, hydrology and soil type. It includes forests, woodlands, Acacia shrublands, grasslands, freshwater swamps, samphire and mangrove communities.

Eucalypt open forests and woodlands are the dominant vegetation types and are found on the low-lying dissected plateaux and undulating rises which are the dominant landforms. Dominant species include *Eucalyptus tetrodonta, E. miniata* and *Corymbia nesophila*. On Melville Island, areas within this vegetation type have been cleared and developed into timber plantations which are largely dominated by *Acacia mangium*. Drier plateaux side slopes often support mixed *Callitris intratropica / Eucalypt spp.* open forests.

Poorly drained clay sites support mixed Bloodwood communities of *Corymbia confertiflora, C. oligantha* and *C. latifolia.* Seepage zones below rocky slopes often comprise dry monsoonal vine forests, while wet monsoon forests are associated with springs and permanent streams. *Melaleuca spp.* open forests are also associated with these areas.

Drainage flats and wet clay pans support *Melaleuca spp.* low open forests and low open woodlands with grassland and sedgeland communities along the edges of these drainage features. Sparsely wooded plains comprising grasslands, acacia and grevillea shrublands and mixed low open woodlands also occur on the Tiwi Islands. Mangrove communities are found on the coastal mud flats, estuaries and tidal waterways (PWCNT, 1998).

2.4.1 Vegetation communities of the project area

A desktop vegetation assessment was undertaken to identify likely habitat types and associated threatened species within the project area. Four broad vegetation types were mapped comprising:

- Monsoon vine forest

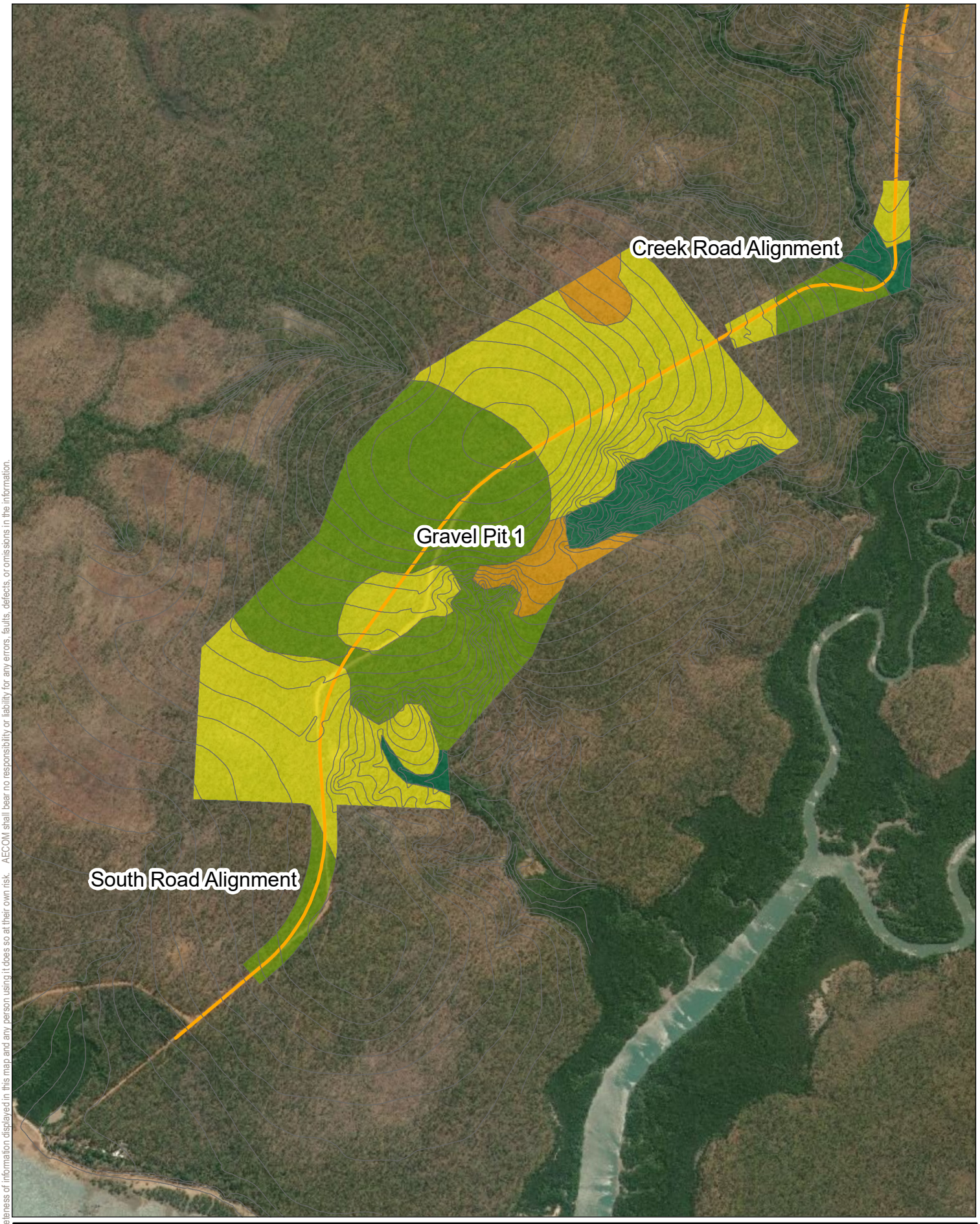
- Eucalypt open forest
- Mixed Eucalypt / Corymbia spp. woodland
- Sparsely wooded plain.

Eucalyptus open forests display a dense canopy layer and are generally located higher up in the landscape within areas of well-draining soils. In lower more moderately drained areas where canopy cover is reduced, vegetation generally transitions into mixed *Eucalyptus* / *Corymbia* spp. woodland. In several places within the project area, vegetation transitions further into sparsely wooded plains within drainage areas and monsoon vine forests situated along creek lines and within seepage gullies. Monsoon vine forests are a spatially restricted vegetation type within the broader landscape and provide important habitat for a relatively large number of species, including threatened species such as *Garcinia warrenii* and *Mitrella tiwiensis*. As such, monsoon vine forests are a sensitive vegetation type under the Northern Territory Land Clearing Guidelines. Drainage areas are also considered to be of conservation value as they act as sediment traps within the landscape (DENR, 2020) and also represent important habitat for several species.

Eucalypt open forest and *Eucalyptus* / *Corymbia* spp. woodland dominate the project areas. Smaller patches of monsoon forest and sparsely wooded plains occur throughout the project area. Table 1 below outlines a desktop assessment of each vegetation type within the project area. Desktop vegetation maps have been produced for both the southern and northern project areas (see Figure 2 and Figure 3).

Table 1 Desktop assessment of each vegetation type within the project area

Vegetation type	Project area	Area ha	Total area (ha)
Eucalyptus open forest	Gravel Pit 1	81.5	129.9 (34%)
	Gravel Pit 2	36.1	
	South Road Alignment	6.1	
	Creek Road Alignment	6.2	
Mixed *Eucalyptus* / *Corymbia* spp. woodland	Gravel Pit 1	120	210.8 (55.2%)
	Gravel Pit 2	73.7	
	South Road Alignment	1.1	
	Creek Road Alignment	5	
	North Road Alignment	11	
Sparsely wooded plain	Gravel Pit 1	12.4	21.2 (5.5%)
	Gravel Pit 2	8.8	
Monsoon forest	Gravel Pit 1	15.8	20 (5.3%)
	Gravel Pit 2	0.7	
	Creek Road Alignment	3.5	
Total			**381.9**



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2m Contours
Paru Road Proposed Alignment

Vegetation Type

Monsoon Vine Forest
Eucalypt Open Forest
Mixed Eucalypt/Corymbia spp. Woodland
Sparsely Wooded Plain
Gravel Pit

Desktop vegetation map of the southern project area

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Figure 2

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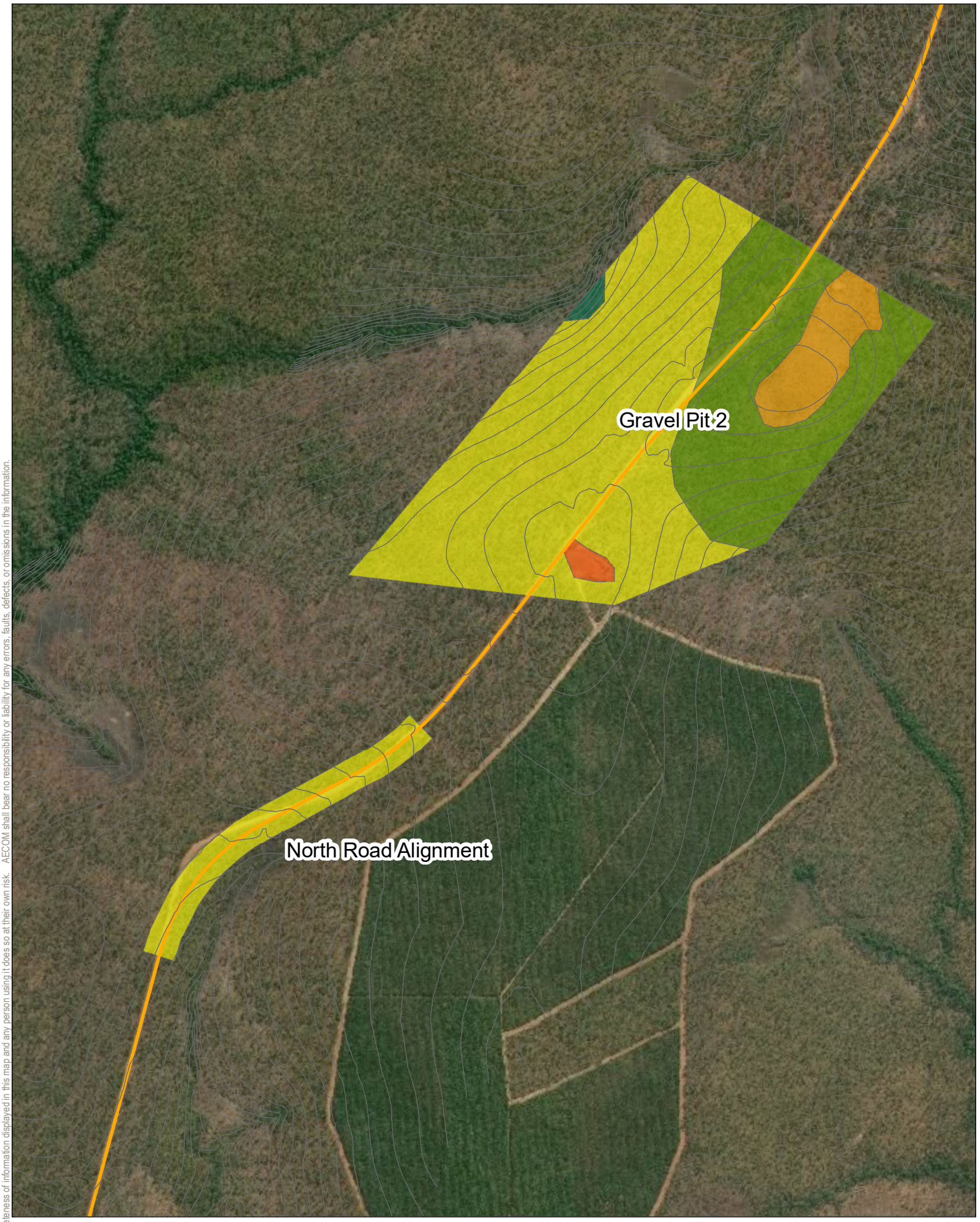

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2m Contours
Paru Road Proposed Alignment

Vegetation Type

Monsoon Vine Forest
Eucalypt Open Forest
Mixed Eucalypt/Corymbia spp. Woodland
Sparsely Wooded Plain
Gravel Pit

Desktop vegetation map of the northern project area

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Figure 3

A4 size

2.5 Threatened flora

A total of 19 flora species, six of which are endemic to the Tiwi Islands, were identified as potentially occurring within the project area. These species and their habitat requirements are outlined in Table 2.

Records of three threatened species occur within and nearby to the project area, including:

- *Cycas armstrongii* – Vulnerable (TPWC Act) – within the South Road Alignment and Gravel Pit 2
- *Typhonium jonesii* - Endangered (EPBC Act) and (TPWC Act) – within the South Road Alignment, Creek Road Alignment, Gravel Pit 1, and Gravel Pit 2
- *Typhonium mirabile* – Endangered (EPBC Act) and (TPWC Act) – nearby to the Creek Road Alignment.

All three plants occur within *Eucalypt* open forests and woodlands on varying topography and soil types. *Typhonium jonesii* occurs on rocky or lateritic hills (Kerrigan & Cowie, 2006). This habitat also supports *Cycas armstrongii* which mainly occurs on well drained lateritic soils overtopped by *Eucalyptus tetrodonta* and *E. miniata* (Kerrigan *et al*., 2006). These areas of well drained lateritic soils also support *Typhonium mirabile*, which is also known to occur on sandy soils overtopped by eucalypt woodland (Kerrigan *et al*. 2007). The range of Eucalypt habitats described above covers most of the project area, with vegetation mapping identifying Eucalyptus open forest (34%) and Mixed *Eucalyptus* / *Corymbia spp*. woodland (55.2%) being the dominate vegetation type (see Section 2.4.1). Habitat modelling has also been undertaken by the Northern Territory Herbarium for both *Typhonium jonesii* and *T. mirabile* to identify areas of suitable habitat according to vegetation structure lithology and topography. Areas having a probability of occurrence greater than or equal to 0.5 have been modelled as high likelihood, with moderate likelihood ranging between 0.49 and 0.25 probability of occurrence (DENR 2018). The location of threatened flora records and *Typhonium spp*. habitat likelihood modelling within the project area are shown in Figure 4.

Patches of monsoon rainforest, drainage flats and riparian creek lines occur within Gravel Pit 1, Gravel Pit 2 and the Creek Road Alignment. Table 2 provides the potential habitat for several threatened flora species within the project area.

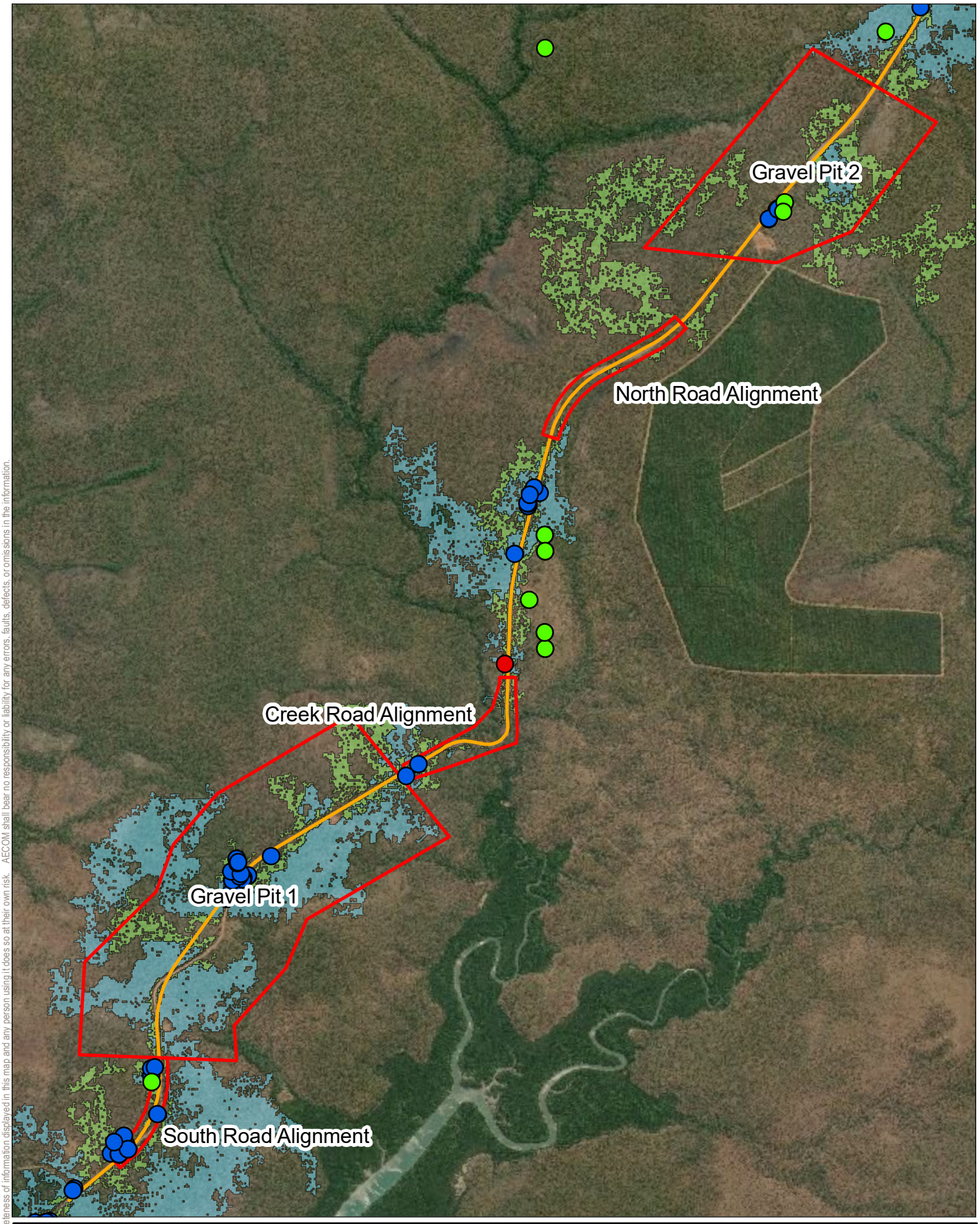
Table 2 Threatened flora species occurring on the Tiwi Islands

Family	Scientific Name	Listing – EPBC & TPWC	Endemic	Habitat	Habitat within project area
ANNONACEAE	*Mitrella tiwiensis*	Vulnerable – EPBC & TPWC	Yes	Monsoon vine forest	Yes • Gravel Pit 1 • Gravel Pit 2 • Creek Road Alignment
	Xylopia monosperma	Vulnerable – EPBC & TPWC	Yes	Wet rainforest	No
APOCYNACEAE	*Hoya australis subsp. oramicola*	Vulnerable – EPBC & TPWC	Yes	Coastal monsoon vine forest	No
ARACEAE	*Typhonium jonesii*	Endangered – EPBC & TPWC	Yes	Rocky or lateritic hills with *Eucalyptus tetrodonta* & *E. miniata*	Yes • South Road Alignment • North Road Alignment • Creek Road Alignment • Gravel Pit 1 • Gravel Pit 2

Family	Scientific Name	Listing – EPBC & TPWC	Endemic	Habitat	Habitat within project area
	Typhonium mirabile	Endangered – EPBC & TPWC	Yes	*Eucalyptus* woodlands on lateritic & sandy soils	Yes • South Road Alignment • North Road Alignment • Creek Road Alignment • Gravel Pit 1 • Gravel Pit 2
BURMANNIACEAE	*Burmannia sp. Bathurst Island*	Endangered – EPBC & TPWC	Yes	Spring fed rainforest	No
CLUSIACEAE	*Garcinia warrenii*	Endangered – TPWC	No	Rainforests and watercourses	Yes • Creek Road Alignment
CYCADACEAE	*Cycas armstrongii*	Vulnerable – TPWC	No	Well drained *Eucalyptus* woodland	• South Road Alignment • North Road Alignment • Creek Road Alignment • Gravel Pit 1 • Gravel Pit 2
CYPERACEAE	*Mapania macrocephala*	Vulnerable – TPWC	No	Spring fed rainforest	No
ELAEOCARPACEAE	*Elaeocarpus miegei*	Critically Endangered – TPWC	No	Wet rainforest	No
HYMENOPHYLLACEAE	*Abrodictyum obscurum*	Endangered – TPWC	No	Waterfall splash zone	No
LAURACEAE	*Endiandra limnophila*	Vulnerable – TPWC	No	Rainforest	No
ORCHIDACEAE	*Calochilus caeruleus*	Vulnerable – TPWC	No	Swamps and seasonally inundated flats	No
	Luisia corrugata	Vulnerable – TPWC	No	Monsoon forest margins	Yes • Gravel Pit 1 • Gravel Pit 2 • Creek Road Alignment
	Thrixspermum congestum	Vulnerable – TPWC	No	Rainforest and mangroves	No
PANDANACEAE	*Freycinetia excelsa*	Vulnerable – TPWC	No	Wet rainforest	No

Family	Scientific Name	Listing – EPBC & TPWC	Endemic	Habitat	Habitat within project area
	Freycinetia percostata	Vulnerable – TPWC	No	Wet rainforest Bathurst Island	No
RUBIACEAE	*Tarennoidea wallichii*	Endangered – TPWC	No	Monsoon forest	Yes • Gravel Pit 1 • Gravel Pit 2 • Creek Road Alignment
SANTALACEAE	*Dendromyza reinwardtiana*	Vulnerable – TPWC	No	Wet rainforest	No

A summary of threatened flora information, including ecology and threats to species, is included in Appendix E.



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- *Cycas armstrongii* records
- *Typhonium jonesii* records
- *Typhonium mirabile* records
- Paru Road Proposed Alignment
- Moderate likelihood *Typhonium spp.* habitat
- High likelihood *Typhonium spp.* habitat
- Project Area

Threatened flora species records and *Typhonium spp.* habitat modelling within and nearby to the project area

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Figure 4

2.6 Threatened fauna

Several threatened and endemic fauna species occur on the Tiwi Islands. The desktop assessment identified 17 threatened fauna species as potentially occurring within the project area. These comprised five birds, seven mammals, three reptiles and two invertebrates. The species and their habitat are outlined in Table 3.

Of the threatened species described in Table 3, Masked Owl has been recorded within Gravel Pit 1 and south of the North Road Alignment, and Cognate Land Snail and Mertens' Water monitor records occur within the Creek Road Alignment. One Black-footed Tree-rat record also occurs between the North Road and Creek Road Alignments. Several more threatened species occur in Eucalypt tall open forest and woodland dominated by *Eucalyptus miniata* and *E. tetrodonta*. This habitat is widespread throughout the Tiwi Islands and occurs within the project area. These species may therefore occur within the project area, as the lack of records probably reflects a lack of effort.

Records of threatened fauna species within 1 km of the project area are shown in Figure 5.

Records of four threatened species occur within and nearby to the project area:

- Masked Owl (Tiwi) – within the project area (gravel pit)
- Mertens' Water Monitor – within the project area (road alignment)
- Cognate Land Snail – within the project area (road alignment)
- Black-footed Tree-rat – nearby to the project area

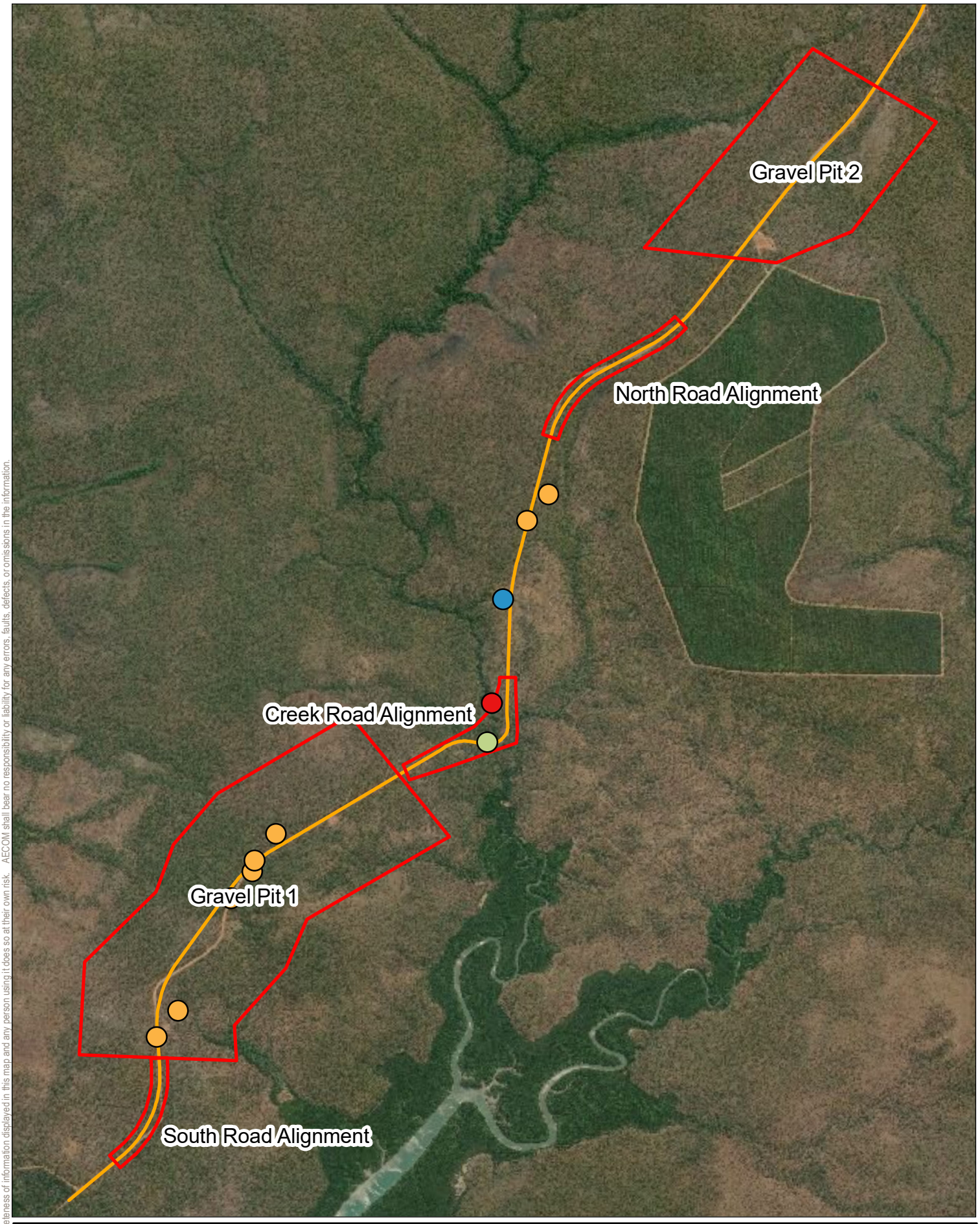
Table 3 Threatened fauna species on the Tiwi Islands

Scientific Name	Common name	Listing - EPBC & TPWC	Endemic	Habitat
Birds				
Erythrotriorchis radiates	Red Goshawk	Vulnerable – EPBC & TPWC	No	Tall open eucalypt forest and riparian areas
Falco hypoleucos	Grey Falcon	Vulnerable – TPWC	No	Timbered lowland plains on inland drainage systems in arid and semi-arid environments
Geophaps smithii smithii	Partridge Pigeon (Eastern)	Vulnerable – EPBC & TPWC	No	Lowland eucalypt open forests and woodlands with grassy understorey
Mirafra javanica melvillensis	Horsfield's Bushlark (Tiwi)	Critically Endangered - EPBC	Yes	Treeless plains dominated by Acacia open shrubland with perennial Sorghum understorey
Tyto novaehollandiae melvillensis	Masked Owl (Tiwi)	Vulnerable – EPBC & TPWC	Yes	Tall open forests dominated by *Eucalyptus miniata* and *E. tetrodonta*
Mammals				
Antechinus bellus	Fawn Antechinus	Endangered – EPBC Vulnerable - TPWC	No	Forests and woodlands dominated by *Eucalyptus miniata* and *E. tetrodonta*
Conilurus penicillatus	Brush-tailed Rabbit-rat	Endangered - EPBC Vulnerable - TPWC	No	Eucalypt tall open forest and woodland dominated by *Eucalyptus miniata* and *E. tetrodonta*

Scientific Name	Common name	Listing - EPBC & TPWC	Endemic	Habitat
Mesembriomys gouldii melvillensis	Black Footed Tree-rat	Endangered - EPBC Vulnerable – TPWC	No	Lowland open forests and woodlands dominated by *Eucalyptus miniata* and *E. tetrodonta*, with a dense shrubby understorey
Phascogale pirata	Northern Brush-tailed Phascogale	Endangered - EPBC Vulnerable - TPWC	No	Tall open forests dominated by *Eucalyptus miniata* and *E. tetrodonta*
Rattus tunneyi	Pale Field-rat	Vulnerable – TPWC	No	Dense vegetation along creeks
Sminthopsis butleri	Butler's Dunnart	Vulnerable – EPBC & TPWC	No	Eucalypt open forest and woodland dominated by *Eucalyptus miniata*, *E. tetrodonta* and *Corymbia nesophila*
Xeromys myoides	False Water-rat	Vulnerable – EPBC	No	Coastal habitats such as mangrove forests, coastal lagoons, swamps and sedged lakes close to lagoons
Reptiles				
Acanthophis hawkei	Plains Death Adder	Vulnerable – EPBC & TPWC	No*	Treeless cracking-soil plains
Varanus mertensi	Mertens' Water Monitor	Vulnerable - TPWC	No	Occurs close to water
Varanus panoptes	Yellow-spotted Monitor	Vulnerable - TPWC	No	Variety of habitats including coastal beaches, floodplains, grasslands and woodlands
Invertebrates				
Amphidromus cognatus	Cognate Land Snail	Vulnerable - TPWC	No	Monsoon rainforest
Attacus wardi	Atlas Moth	Vulnerable - TPWC	No	Large patches of monsoon forest

* Possibly undescribed species or subspecies

A summary of threatened fauna information, including ecology and threats to species, is included in Appendix E.



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Kilometres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
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- Black-footed Tree-rat
- Cognate Land Snail
- Masked Owl (Tiwi)
- Mertens' Water Monitor
- Paru Road Proposed Alignment
- Project Area

Threatened fauna records within 1 km of the project area

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Figure 5

Filename: P:\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Final Report Maps Jan 2021\Figure 5 Threatened fauna records within 1km of project.mxd

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2.7 Migratory fauna

Desktop assessments of the project area has identified five Migratory listed fauna species that potentially occur within the project area, comprising four birds and one reptile. These species are listed below in Table 4.

Table 4 Migratory species

Common Name	Scientific name	Listing
Fork-tailed Swift	*Apus pacificus*	Migratory Marine Bird
Estuarine Crocodile	*Crocodylus porosus*	Migratory Marine Species
Oriental Cuckoo	*Cuculus optatus*	Migratory Terrestrial Species
Barn Swallow	*Hirundo rustica*	
Oriental Reed-warbler	*Acrocephalus orientalis*	Migratory Wetland Species