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Terrestrial Biodiversity Surveys Melville Island

Department of Infrastructure, Planning and Logistics

23-Apr-2021

Environmental Impact Assessment

Paru Road Upgrade - NT Portion 1644, Melville Island

Environmental Impact Assessment

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

Document Environmental Impact Assessment

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Prepared by William Riddell

Reviewed by Abe Francis, Alana Court

Revision History

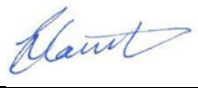
Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
1	26-Feb-2021	Draft Paru Road EIA	Alana Court Associate Director - Environment	
2	23-Apr-2021	Addressing DIPL comments	Alana Court Associate Director - Environment	

Table of Contents

Executive Summary

This Environmental Impact Assessment (EIA) has been prepared by AECOM Pty Ltd (AECOM) on behalf of the proponent, the Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) as formal notification of a proposal to undertake construction works to upgrade Paru Road on Melville Island.

A 2012 project development report undertaken by the former Department of Infrastructure concluded that the existing Tiwi Island road network has deteriorated and is currently inadequate for community purposes. The existing gravel road surface and associated drainage features were determined as being in poor condition and subject to ongoing deterioration during each wet season (DTF, 2014).

In recent years, road usage on Melville Island has grown rapidly due to a growth of industrial activities including the establishment of timber plantations and mines. This increased usage has led to a deterioration in the road network and created safety concerns for road users.

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. 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 locations for proposed gravel pits and three proposed road realignments along Paru Road, located in the south-west of Melville Island. The road realignment works will smooth four bends along Paru Road.

The project footprint occurs along and adjacent to Paru Road, located in the south-west of Melville Island (Figure 1). The project includes five locations identified as suitable for gravel extraction within two gravel pit project areas, and four road realignments:

- Gravel Pit 1 area:
  - GP1-1 (6.6 ha)
  - GP1-2 (9.9 ha)
  - GP1-3 (6.5 ha)
- Gravel Pit 2 area:
  - GP2-1 (34.0 ha)
  - GP2-2 (3.3 ha)
- Road realignments:
  - Chainage 11,200 m to 12,000 m in south of project area (7.3 ha) (henceforth referred to as the southern road alignment)
  - Chainage 9,900 m to 11,000 m within the Gravel Pit 1 area
  - Chainage 7,800 m to 9,000 m in the centre of project area (14.8 ha) (creek road alignment)
  - Chainage 5,300 m to 6,300 m in the north of the project area (11.0 ha) (northern road alignment).

The maximum clearing footprint of the project is 74.7 ha.

The objectives of this EIA are to:

- provide formal notification to the Northern Territory Environment Protection Authority (NT EPA) of the proponent's intention to undertake construction works at NT Portion 1644 on Paru Road, Melville Island.
- demonstrate that road upgrade works on Paru Road will not have an unacceptable impact on the environment, now or into the future.
- identify and characterise the environmental impacts that may arise due to construction works to upgrade Paru Road and determine whether these impacts have potential to be significant, in

accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, Commonwealth) and the *Environment Protection Act 2019* (EP Act, NT).

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

A terrestrial biodiversity survey report has assessed potential impacts to threatened species and made project design recommendations to minimise impacts. This assessment found that the project is unlikely to have a significant impact, according to *Significance Impact Guidelines 1.1 - Matters of National Environmental Significance* (DEWHA, 2013). The project therefore does not require referral under the EPBC Act.

An environmental risk assessment was undertaken to assess potential environmental impacts arising with road construction works on Paru Road. The risk assessment identified 31 risk aspects relating to the project that require the implementation of mitigation methods.

Mitigation measures are described in this EIS and addressed in a construction environment management plan (CEMP) that will be applied during the project.

Rehabilitation of the project site is recommended once construction works have been completed. The proposed rehabilitation approach is assisted natural regeneration in areas cleared for gravel pits and natural regeneration for the road realignments.

1.0 Introduction

1.1 Scope

This Environmental Impact Assessment (EIA) has been prepared by AECOM Pty Ltd (AECOM) on behalf of the proponent, the Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) as formal notification of a proposal to undertake construction works to upgrade Paru Road on Melville Island.

1.2 Project Background

A 2012 project development report undertaken by the former Department of Infrastructure concluded that the existing Tiwi Island road network has deteriorated and is currently inadequate for community purposes. The existing gravel road surface and associated drainage features were determined as being in poor condition and subject to ongoing deterioration during each wet season (DTF, 2014).

In recent years road usage on Melville Island has grown rapidly due to a growth of industrial activities including the establishment of timber plantations and mines. This increased usage has led to a deterioration in the road network and created safety concerns for road users such as:

- reduced efficiency and resultant increase in travel time in transporting people by road between communities
- a lack of all-weather access between major communities, schools and facilities
- an increase in safety issues and near misses associated with deteriorating road surfaces coupled with increased large vehicle movements
- marked deterioration in the provision of reliable resources to service the widely spaced commercial activities such as tourism, aquaculture, mining and forestry
- a growing transport task associated with continued development of new plantation areas requiring access for fertilising, spraying and environmental care as well as the prevention and lighting of fires in the commercial forest areas.

1.2.1 Benefits of the Project

The benefits of upgrade works to Paru Road include:

- provision of safe and efficient roadways facilitating movement of people between communities, for work, business, cultural, and educational and training purposes
- improved access between the major communities to facilitate the efficient use of available essential services such as medical, educational, police and food stores
- improved access to the Tiwi College at Pickertaramoor
- improved road safety
- reduction in vehicle maintenance and replacement cost factors for commercial activities such as tourism, aquaculture, mining and forestry
- providing better access to widely-spaced commercial activities such as tourism, aquaculture, mining and forestry
- providing better access for residents to employment opportunities and for visitors to tourist sites; and facilitating continued and future new development.

The Paru Road upgrade is part of a larger project to improve roads on Melville Island.

1.3 Proponent

The proponent for the project is the Northern Territory Department of Infrastructure, Planning and Logistics (DIPL). The contact details for DIPL are as follows:

Richard Underhill and Josefa Tchong

Department of Infrastructure, Planning and Logistics

Northern Territory Government

Level 2, Highway House, Palmerston Circuit, Palmerston

PO Box 61, Palmerston, NT 0831

Phone: 08 8999 4512

1.4 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 footprint occurs along and adjacent to Paru Road, located in the south-west of Melville Island, starting approximately 3 km south of the Threeways intersection extending to approximately 900 m north of Paru Outstation (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.

1.5 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. 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 near Paru Road, located in the south-west of Melville Island. The road realignment works will smooth four bends along Paru Road.

The project includes two gravel pit project areas, within which five areas suitable for gravel extraction have been identified:

- Gravel Pit 1 area:
  - GP1-1 (6.6 ha)
  - GP1-2 (9.9 ha)
  - GP1-3 (6.5 ha)
- Gravel pit 2 area:
  - GP2-1 (34.0 ha)
  - GP2-2 (3.3 ha)

The maximum area that will be cleared for gravel pits for the project is 60.3 ha. However, a smaller area is likely to be required to facilitate the road upgrade. The project will adhere to DIPL's *Standard Specification for Environmental Management* for materials extraction within gravel pits, specifically Section 19.1:

- Gravel pits should not exceed 1 ha
- Extraction areas are to be progressively rehabilitated so that one gravel pit is rehabilitated before another one is established

The project includes the following four road realignments:

- Chainage 11,200 m to 12,000 m in south of project area (2.4 ha to be cleared) (henceforth referred to as the southern road alignment)
- Chainage 9,900 m to 11,000 m within the Gravel Pit 1 area
- Chainage 7,800 m to 9,000 m in the centre of project area (4.2 ha) (creek road alignment)

- Chainage 5,300 m to 6,300 m in the north of the project area (3.0 ha) (northern road alignment)

The maximum clearing footprint of the project will be 74.7 ha.

1.5.1 Roadworks

Roadworks will include the following:

- clearing and grubbing
- earthworks in cut and fill
- pavement works
- drainage works including multiple transverse drainage structures along the road, and a new bridge/major culvert at the creek.
- sealing with two coat seal
- line marking
- installation of signage
- installation of guardrails.

1.5.2 Plant and equipment

Plant and equipment that will be used include:

- backhoe
- graders
- excavators
- water carts
- rollers
- dump trucks
- road trains
- crane
- bitumen spray truck.

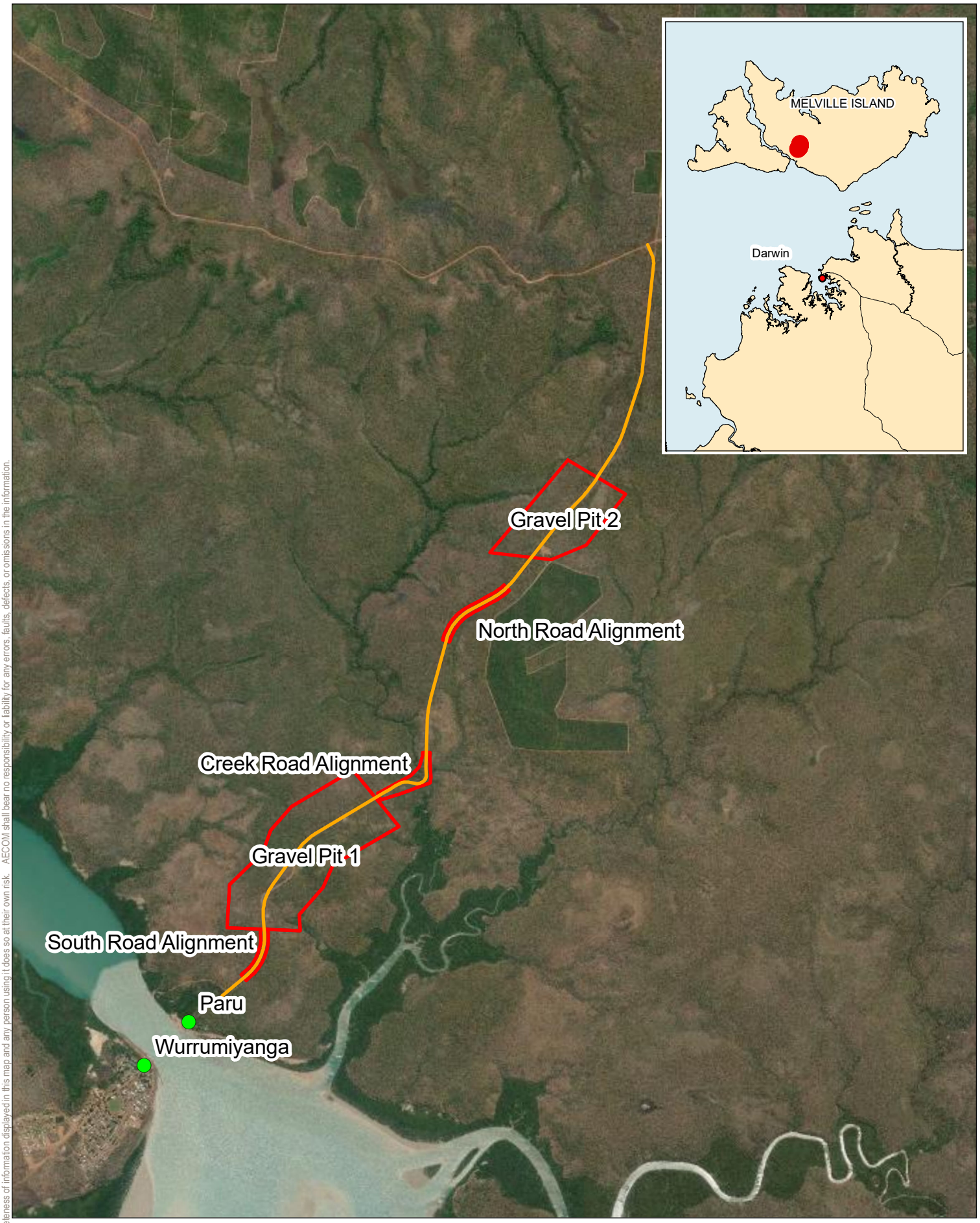
1.5.3 Timing

Road construction works are anticipated to be undertaken during the 2021 and 2022 dry seasons (April to October). Works will be programmed so that sections of road are constructed and sealed before the wet season commences.

1.6 Objectives of this Report

The objectives of this EIA are to:

- provide formal notification to the Northern Territory Environment Protection Authority (NT EPA) of the proponent's intention to undertake construction works at NT Portion 1644 on Paru Road, Melville Island.
- demonstrate that road upgrade works on Paru Road will not have an unacceptable impact on the environment, now or into the future.
- identify and characterise the environmental impacts that may arise due to construction works to upgrade Paru Road and determine whether these impacts have potential to be significant, in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, Commonwealth) and the *Environment Protection Act 2019* (EP Act, NT).



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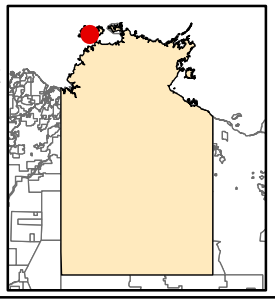
DATUM GDA 1994, PROJECTION MGA ZONE 52

0 0.5 1 2 3
Kilometres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
AECOM Australia and Esri do no warrent the accuracy or completeness of information in this publication and any person relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

- Tiwi Communities
- Paru Road Proposed Alignment
- Project Area



Location of the project area and project area components

PROJECT ID	60571058
CREATED BY	david.vandenhoek
LAST MODIFIED	22-Feb-2021
VERSION	1

Figure 1

A4 size

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2.0 Legislative Context and Licensing Requirements

2.1 Environment Protection Act 2019 (Northern Territory)

This report has been developed in accordance with the *Environment Protection Act 2019* (EP Act) and *Environmental Impact Assessment and Environmental Approval in the Northern Territory - Environmental impact assessment guidance Version 1.0* (NT EPA, 2020).

Under the EP Act, if a proposed action has the potential for significant impact on the environment it is to be planned, assessed and carried out in a manner that takes account of the following:

- the principles of ecologically sustainable development
- the environmental decision-making hierarchy
- the waste management hierarchy
- ecosystem-based management
- the impacts of a changing climate.

Under the EP Act, a proposed action that has the potential to have a significant impact on the environment must be referred to the NT EPA for assessment. A proposed action or strategic proposal that undergoes environmental impact assessment by the NT EPA must have an environmental approval granted by the Minister for Environment and Natural Resources before it can proceed in the NT.

2.2 Northern Territory Legislation Context

Other Northern Territory legislation, approvals and licensing requirements relevant to the project include:

- *Heritage Act 2016*
- *Northern Territory Aboriginal Sacred Sites Act 2013*
- *Territory Parks and Wildlife Conservation Act 2019*
- *Soil Conservation and Land Utilization Act 2016*
- *Waste Management and Pollution Control Act 2020*
- *Water Act 2020*
- *Weeds Management Act 2013*
- Aboriginal Areas Protection Authority (AAPA) certificate, which provides legal indemnities for works carried out in accordance with Certificate conditions (AAPA certificate C2020/087) has been authorised for this project).
- Northern Territory Land Clearing Guidelines (DENR, 2019).

2.3 Commonwealth Environmental legislation Context

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Australia's national environmental law and ensures that 'nationally significant' animals, plants, habitats and heritage places are identified, and any potential negative impacts to them are considered, before changes in land use or new developments are approved.

Governments and developers must seek Commonwealth approval in addition to state and territory or local government approvals if their plans have potential to significantly impact on matters of national significance.

Other Commonwealth legislation relevant to the project includes:

- *Native Title Act 2017*

- *Australian Heritage Council Act 2019*
- *Hazardous Waste (Regulation of Exports and Imports) Act 2017*

3.0 Site Description and Environmental Setting

3.1 Physical Environment

3.1.1 Climate

The Tiwi Islands experiences a dry monsoonal climate, characterised by a hot and humid wet season and a dry and hot dry season. The wet season occurs from October to April, while the dry season occurs from May to September. Winds are mostly north-westerly in the wet season, and south-easterly in the dry season. January is the wettest month with mean monthly rainfall of 412.6 mm recorded at Pirlangimpi Airport, whilst June is the driest month with a mean monthly rainfall of 2.6 mm. The average annual rainfall is 1989.3 mm, with more than 95% of rainfall occurring during the wet season. October is the hottest month with a mean maximum temperature of 33.7 C°. The coolest month is July when the mean minimum temperature drops to 18.5 C° (BoM, 2020).

The Tiwi Islands experience higher rainfall than the tropical mainland. One of the reasons is the cumulonimbus clouds, or thunderclouds, that consistently forms during the afternoon from October to March each year. This weather system is known as Hector, which is considered one of the world's most consistently large thunderstorms, reaching heights of approximately 20 km. The system brings significant early wet season rainfall and results in a longer wet season on the islands compared to the Australian mainland (Tiwi land Council, 2020).

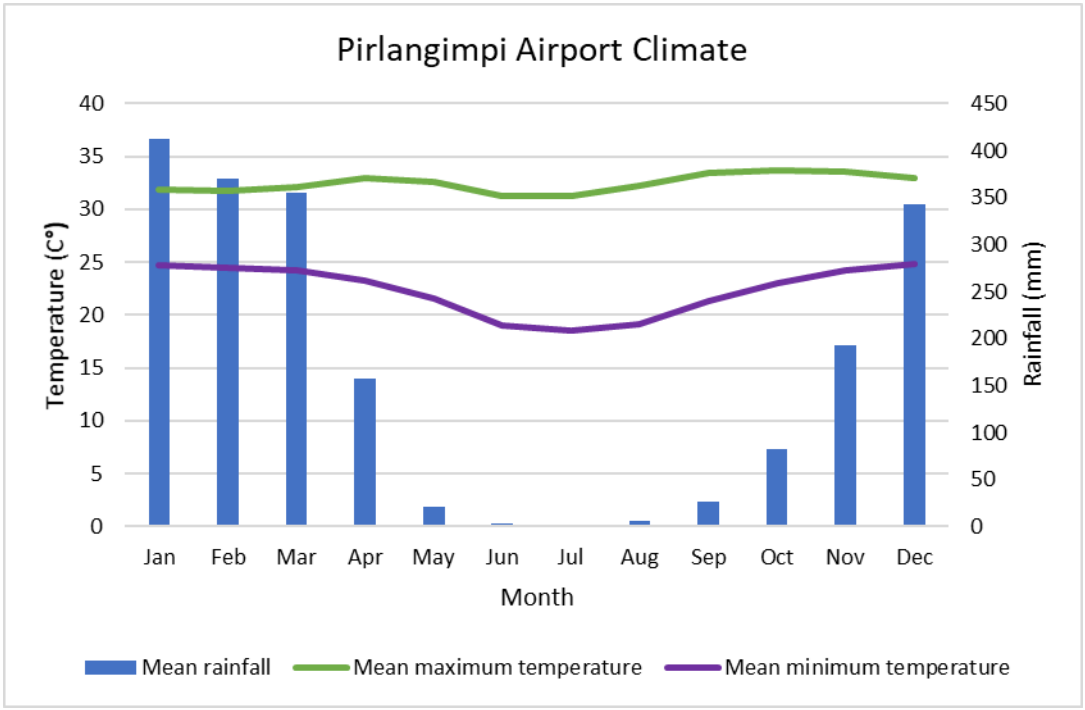

Figure 2 Climate data at Pirlangimpi Airport

3.1.2 Geology

The Tiwi Islands are of low relief with undulating laterite rises, dissected rises and low plateaux up to 100 m above sea level. Basement rocks underlying the islands have been produced by deformation, intrusion and metamorphism of Lower Proterozoic sediments (PWCNT, 1998).

The regional stratigraphy of the Tiwi islands consists of Quaternary aged alluvium, Tertiary aged Van Diemen Sandstone and the underlying Cretaceous aged Mookinu and Wangurlu Mudstone (Hollingsworth, 2003).

The Van Diemen Sandstone is a fine to medium grained quartzose sandstone of fluvial and partly littoral origin. The sandstone covers most of Melville Island and varies in thickness from approximately 20 to 30 m thick in areas of gently undulating terrain to a maximum of 80 m on high ridges along the southern part of the island. The Van Diemen sandstone lies unconformably over the Mookinu

Mudstone, which consists of grey, carbonaceous mudstone consisting of fine to very fine sandstone with interbeds of grey carbonaceous mudstone and siltstone. Underlying this layer is a sticky to firm, grey claystone known as the Wangurlu Mudstone (Hollingsworth, 2003).

3.1.3 Soils

Land unit mapping to a scale of 1:25,000 has been conducted immediately east and north-east of the project area (Wells & van Cuylenburg, 1978). This land unit mapping would provide an indication of the vegetation communities and soil types that likely occur within the project area. Soils mapped in the area include:

- **Kandosols** - these soils occur within *Eucalyptus miniata* and *Eucalyptus tetrodonta* open forests and woodlands that occur on plateaux, rises and low hills.
- **Rudosols** – these soils occur within *Corymbia nesophila* and *Eucalyptus tetrodonta* open forests on sideslopes.
- **Hydrosols** - soils that occur within drainage areas such as *Eulalia mackinlayi* grasslands, *Grevillea pteridifolia* open scrub and tall closed monsoon forests.

Kandosol soils are the predominant soil within the project area. These soils are very deep, massive in structure, acidic with a texture grading from sandy loam to sandy clay loam subsoil down the profile (DLRM, 2015).

Hydrosol soils are the second most common soils type within the project area. Hydrosols are defined as seasonally or permanently wet soils. Within the project area these soils would be most likely to occur within the creek road alignment, close to the permanent creek. These soils are often mottled, indicating oxidising and reducing conditions (DLRM, 2015).

3.1.4 Hydrology

Groundwater

Two main regional aquifer systems occur on the Tiwi Islands, one of which occurs below the project area. The shallow and unconfined aquifer that occurs below the project area consists of Van Diemen sandstone and overlying laterite and alluvium. The Van Diemen Sandstone is described as a brown, tan, purple and white friable medium to coarse-grained quartz sandstone with a clayey matrix. This shallow aquifer has been named the Van Diemen Sandstone in previous hydrological investigations. The maximum thickness of the Van Diemen Sandstone is approximately 70 metres, and has higher production where thickness is greater than 20 m (Haig *et al*., 2003).

A second deeper confined aquifer occurs within the Moonkinu Member of the Bathurst Island Formation on the Tiwi islands. This aquifer does not occur underneath the project area.

The Van Diemen Sandstone aquifer is recharged by direct infiltration during localised rainfall events during the wet season. The aquifer requires several rainfall events before the aquifer becomes saturated and affects the water table.

Water in the shallow and deep aquifers across the Tiwi Islands are within the *Water Quality and Monitoring Guidelines as outlined in the Australian and New Zealand Guidelines for Fresh Water Quality* (ANZECC, 2002), with the exception of pH. The Tiwi Islands aquifers consist of sandstone with layers of silt and clay. The sand and clay layers do not react with the groundwater, therefore the water within the sandstone aquifers is similar in composition to the rainfall that recharges the aquifer. The water sourced from borefields for domestic water supply is considered to be of very high quality (Haig *et al*., 2003).

Surface Water

The rivers and streams scattered throughout the Tiwi Islands experience highest flows during the wet season when flow is dominated by rainfall runoff. In general surface water chemistry is similar to the groundwater from which it is sourced (Haig *et al*., 2003).

A major non-perennial stream intersects the creek road realignment, while a minor non-perennial stream occurs in the north road alignment.

3.1.5 Fire

Fire is an intrinsic part of the Australian environment and has shaped the evolution of most natural ecosystems within it, however since European settlement, fire regimes have changed leading to corresponding changes in vegetation structure, composition and flammability.

In 2018 Tiwi Resources Pty Ltd, with endorsement from the Tiwi land Council, entered an agreement with the Indigenous Land Corporation to fund fire management on the Tiwi Islands in exchange for carbon credits. This agreement has been funded by Inpex Operations Australia Pty Ltd and provides funding to the Tiwi Rangers.

Fire mapping on the Northern Australia and Rangelands Fire Information website indicates that woodlands on either side of Paru Road has been burnt regularly since 2010, with the area burnt 5-9 times from 2010 to 2019 (NAFI, 2020). This is consistent with fire maps produced by Tiwi resources indicating that most of the project area was burnt during 2018 and 2019 (Tiwi Land Council, 2018, 2019).

3.2 Terrestrial Environment

3.2.1 Vegetation Communities

Vegetation communities were mapped within the project area as part of the Terrestrial Biodiversity Survey (Appendix A).

The majority of the project area (81.5%) has been mapped as 1a - *Corymbia nesophila, Eucalyptus tetrodonta, E. miniata* open forest on undulating rises. Areas of mixed forest (2b and 2c) were also recorded on slopes and rises in the southern project area, making up a total of approximately 6% of the project area. Small areas of 2a - Monsoon vine forest in gully (0.5%) and 3a – Riparian vegetation in creek line (1.1%) were recorded, with the majority of the 3a located with the Creek Road alignment. The remaining 10.6% of the project area was mapped as either upland perched drainages or broad lowland drainage slopes and flats (4a – 4d).

3.2.2 Threatened Flora

A desktop assessment undertaken for the Terrestrial Biodiversity Survey (Appendix A) identified eight threatened flora specie as potentially occurring within the project area:

- *Mitrella tiwiensis* (Vulnerable – EPBC & TPWC)
- *Typhonium jonesii* (Endangered – EPBC & TPWC)
- *Typhonium mirabile* (Endangered – EPBC & TPWC)
- *Garcinia warrenii* (Endangered - TPWC)
- *Cycas armstrongii* (Vulnerable - TPWC)
- *Luisia corrugata* (Vulnerable - TPWC)
- *Tarennoidea wallichii* (Endangered – TPWC).

Field Survey

Threatened flora surveys recorded a total of 198 *Typhonium jonesii* and 481 *T. mirabile* within the project area. This included a high-density patch of 304 plants of *Typhonium mirabile* within Gravel Pit 1. This sub-population is considered to be conservation significant.

A summary of results from the Terrestrial Biodiversity Survey is provided in Appendix A.

3.2.3 Weeds

The increase in traffic from the mainland in recent years has resulted in an increase in the introduction of weeds and weed seed (Tiwi Land Council, 2021). Weeds on the Tiwi islands include Perennial Mission grass (*Pennisetum polystachion*) and Gamba Grass (*Andropogon gayanus*). These exotic grasses pose a threat by out-competing native grasses, causing changes in nutrient flows, soil conditions and increasing fuel loads (Liddle *et al*, 2008). Mimosa (*Mimosa pigra*) and Lantana

(*Lantana camara*), which are Weeds of National Significance, have been detected in two small isolated areas on the Tiwi islands and efforts are being undertaken to eradicate them.

Large plantations of the non-native *Acacia mangium* occur across Melville Island. Wildings have spread from these plantations into both open forest and rainforest communities (Liddle *et al*, 2008).

3.2.4 Native Fauna

Database searches indicate that Melville Island supports a diverse array of fauna. Several fauna surveys have been conducted on the island over the years, both by the NT Government and by forestry operators. Database searches of the project area (ALA and NR Maps) provide records for 194 species of bird, 71 species of reptile, 30 species of mammals and 18 species of amphibians.

A total of 20 threatened species listed under either the EPBC Act or TPWC Act may potentially occur in the area. These include five birds, seven mammals, three reptiles and two invertebrates. The assessment on the likelihood of species occurrence based on the availability of suitable habitat within the project area was conducted as part of the Terrestrial Biodiversity Survey Report (Appendix A). The following species were identified as 'possibly' occurring in the project area and are known to occur in the wider landscape of Melville Island:

- Red Goshawk *Erythrotriorchis radiatus* (Vulnerable EPBC & TPWC)
- Partridge Pigeon (eastern subspecies) *Geophaps smithii smithii* (Vulnerable EPBC & TPWC)
- Masked Owl (Tiwi subspecies) *Tyto novaehollandiae melvillensis* (Vulnerable EPBC & TPWC)
- Brush-tailed Rabbit-rat *Conilurus penicillatus* (Endangered EPBC, Vulnerable TPWC)
- Black-footed Tree-rat *Mesembriomys gouldii (*Endangered EPBC, Vulnerable TPWC)
- Pale Field-rat *Rattus tunneyi* (Vulnerable TPWC Act)
- Butler's Dunnart *Sminthopsis butleri* (Vulnerable EPBC & TPWC)
- Mertens' Water Monitor *Varanus mertensi* (Vulnerable TPWC Act)
- Yellow-spotted Monitor *Varanus panoptes* (Vulnerable TPWC Act)
- Cognate Land Snail *Amphidromus cognatus* (Vulnerable TPWC Act)

The following fauna listed as Migratory under the EPBC Act have been identified as possibly occurring within the project area:

- Fork-tailed swift *Apus pacificus* (Migratory Marine)
- Estuarine Crocodile Crocodylus porosus (Migratory Marine)
- Oriental Cuckoo *Cuculus optatus* (Migratory Terrestrial)
- Barn Swallow *Hirundo rustica* (Migratory Terrestrial)
- Oriental Reed-warbler *Acrocephalus orientalis* (Migratory Wetland)

Field survey

A terrestrial biodiversity survey was undertaken within the project area at Paru Road during 17-22 January 2021. The terrestrial fauna survey comprised a diversity of survey methods including the set-up of six quadrat sites (50 m x 50 m) with Elliot, pitfall, cage and funnel traps, motion-activated cameras with bait-stations, call playback, acoustic recording with song-meters and active searches.

A total of 31 species of bird, seven mammals, seven reptiles and two amphibians were recorded during the survey.

Six threatened species were recorded during the field survey including:

- Partridge Pigeon, in two locations in Gravel Pit 1, in two locations within the Creek Road alignment and in one location at the south of Gravel Pit 2
- Masked Owl, including one bird in Gravel Pit 1 and one in Gravel Pit 2

- Black-footed Tree-rat, including five individuals within Gravel Pit 1, two within the Creek Road alignment and three within Gravel pit 2
- Pale Field-rat, comprising one individual within the Creek Road alignment and one within Gravel Pit 1
- Butler's Dunnart, including an individual within Gravel Pit 1, one within the Creek Road alignment and one within Gravel Pit 2
- Mertens' Water Monitor, including one individual recorded incidentally close to a creek within the Creek Road alignment.

A potential Red Goshawk nest was identified within Gravel Pit 1, approximately 80 m from Paru Road. The survey was undertaken outside of the Red Goshawk breeding season (June to December) therefore it could not be determined with certainty whether the nest belongs to the species.

No Migratory species were identified during the field survey.

A description of methods and results from the terrestrial biodiversity survey are provided in Appendix A.

3.2.5 Feral Animals

Feral animals and pest species on Melville Island include:

- Feral cats (*Felis catus*)
- Water Buffalo (*Bubalus bubalis*)
- Horse (*Equus caballus*)
- Pig (*Sus scrofa*).

During the January 2021 survey one Water Buffalo was sighted in the south-west section of the Gravel Pit 2 area. This was the only feral animal sighted within the project area during the survey.

3.2.6 Biting Insects

The project area occurs close to coastal mangroves, estuarine creeks and monsoon rainforests that provide suitable habitat to a variety of biting insects such as midges and mosquitoes.

Previous biting insect investigation undertaken on Melville Island at Andranangoo Creek and Lethbridge Bay provide an indication of biting insects that may occur within the project area (Warchot & Whelan, 2007). Biting insects recorded during this investigation include:

- *Aedes normanensis*
- *Aedes notoscriptus*
- *Aedes vigilax*
- *Anopheles bancroftii*
- *Anopheles farauti*
- *Anopheles hilli*
- *Coquillettidia xanthogaster*
- *Culex annulirostris*
- *Culex sitiens*
- *Culicoides ornatus*
- *Culicoides bundyensis*
- *Culicoides narrabeenensis*
- *Culicoides marksi*

- *Culicoides austropalpalis*
- *Lasiohelia* sp.
- *Mansonia uniformis*
- *Verrallina funereal.*

Of these species Northern Salt Marsh Mosquito (*Aedes vigilax*) and the Common Banded Mosquito (*Culex annulirostris*) are known vectors of Ross River virus and Barmah Forest virus, while the latter is also a vector of the potentially fatal Murray Valley encephalitis virus.

Other mosquito species that are potential disease vectors or pest mosquitoes include Receptacle Mosquito (*Aedes notoscriptus*), the Golden Mosquito (*Coquillettidia xanthogaster*), the Brackish Water Mosquito (*Verrallina funereal*) and the Salt Water Culex Mosquito (*Culex sitiens*).

The mangrove biting midge *Culicoides ornatus* is considered the most significant human pest biting midge species around the NT coast and is also the most common biting midge pest (Whelan, 2003).

Many mosquitoes feed just after sunset while others are more active at other times such as late in the night, in the late afternoon, or the early morning. Biting midges are most active in the evening and early morning (Whelan, 2004).

3.3 Matters of National Environmental significance

Desktop assessments have indicated that the only Matters of National Environmental Significance (MNES) that occur within the project area are listed threatened and Migratory species (Table 1). Impacts to these species have been assessed in the Terrestrial Biodiversity Survey Report (Appendix A). This assessment determined that significant impacts to MNES or habitat critical to the survival of MNES species due to the project are unlikely.

A referral under the EPBC Act will be submitted.

Table 1 MNES within the project area

MNES	Number
World heritage properties	None
National heritage places	None
Wetlands of international importance	None
Great Barrier reef marine park	None
Commonwealth marine area	None
Listed threatened ecological communities	None
Listed threatened species	9
Listed migratory species	5

3.4 Social and Cultural Environment

3.4.1 Native Title

The Tiwi Land Council was established in August 1978 under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Commonwealth). This was the first legislation in Australia to establish a land claim process by which traditional owners could claim land. The Tiwi Islands Land Council was established to represent the interests of traditional owners in access and use processes, and also has responsibilities under the *Native Title Act 1993* and the *Pastoral Land Act 1992*.

3.4.2 Cultural Heritage and Sacred Sites

The Tiwi Islands comprises Melville and Bathurst Island and is home to the Indigenous Tiwi people. The Tiwi People are believed to have occupied the islands since the last ice age, when the islands

were separated from the mainland approximately 11,000 years ago. Through years of isolation the Tiwi have developed a unique language and culture (Tiwi Land Council, 2020).

An Aboriginal Areas Protection Authority (AAPA) certificate was provided to DIPL on 8 December 2020 (RA2020/93, Appendix B). The AAPA Certificate identified the following cultural heritage along Paru Road:

- One sacred site (5074-58) comprising an intertidal mangrove area within the Aspley Strait, south of Paru outstation
- A sacred burial area (5074-45) that includes ceremonial poles and human remains occurs, approximately 250 m north-east from the boat ramp
- A sacred burial area (5074-44) that includes ceremonial poles and human remains occurs within Paru outstation
- A sacred burial area (5074-46) that includes ceremonial poles and human remains occurs to the south-east of the Southern Road alignment
- A burial site occurs approximately 1.2 km west of Gravel Pit 1 footprint.

All of the sacred sites identified in the AAPA certificate occur outside of the project footprint, with the exception of a Restricted Works Area (RWA) associated with a sacred burial area (5074-46) that intersects a small portion (approximately 0.6 ha) of the southern road alignment.

3.4.3 Socio Economic Summary

The Tiwi Islands cover 8,320 km^2 and has a population of approximately 2,741 (ABS, 2020). The largest communities are Pirlangimpi and Milikapiti on Melville Island, and Wurrumiyanga (formerly Nguiu).

Analysis of the 2016 Australian Bureau of Statistics (ABS) census indicate that the Tiwi Islands has high unemployment, low levels of income and a very low score on the Index of Relative Socio-Economic Advantage/Disadvantage. The unemployment rate was 23.7% in 2016 compared to 6.9% across Australia. The main employing industry on the islands is Education and training, which accounts for an estimated 24.8% of all jobs (ABS, 2020).

More than 90% of the population of the Tiwi islands are Indigenous (ABS, 2020).

3.4.4 Traffic

The estimated traffic volume for Paru Road is 50 – 60 vehicles per day, which may halve during the wet season, depending on road condition (Tiwi Land Council, pers comm). Traffic on Paru Road consists of the following vehicle types:

- Passenger vehicles (approximately 40-50 per day)
- 5-tonne buses (8-12 per day)
- 10 tonne trucks (4-8 per week)
- 8 tonne grader (once per fortnight)

A new car ferry that can carry two vehicles at a time has been constructed that can transport vehicles between Bathurst and Melville islands. It is anticipated that the operation of this ferry will lead to increased traffic volumes on Paru Road (Tiwi Land Council, pers comm).

3.4.5 Noise

The closest urban living area to the project is Paru outstation, which is approximately 850 m from the southern road alignment. Wurrumiyanga on Bathurst island is the closest community, lying across the Aspley Strait approximately 2 km to the south-east of the project area. On Melville Island the communities of Pirlangimpi and Milikapiti are approximately 44 km and 33 km from the project area respectively.

Noise is not anticipated to be a significant problem to Tiwi Islands residents during the project. This is due to the fact that construction activities will be restricted to daylight hours (6 am to 6 pm).

4.0 Environmental Risk Assessment

4.1 Methodology

A formal assessment of the risk of potential environmental and safety impacts and issues was carried out based upon a standard risk management approach.

This process involved was two-fold

1. Identifying the latent risk of the activities associated with the road construction activities along Paru Road prior to allocating risk mitigation management and monitoring strategies involved the following stages:
    - Identification of the key activities and considerations.
    - Ascertaining the potential hazards associated with these activities including the potential impacts associated with them.
    - Determination of the environmental, engineering, cost and reputational aspects associated with the hazard.
    - Assigning a consequence severity rating.
    - Assigning a likelihood/frequency rating.
    - Determining the resultant level of risk for each potential impact.
2. Once each hazard aspect was rated, the residual risk rating was determined by:
    - Evaluating the current known body of information available to inform the management and mitigation of the identified hazard.
    - Generating management mitigation and monitoring measures to incorporate into the management planning.
    - Assigning a consequence severity rating.
    - Assigning a likelihood/frequency rating.
    - Determining the residual level of risk for each potential impact.

The management practices identified are designed to keep risks as low as reasonably practicable (ALARP).

The Impact Consequence Severity Rating Matrix is shown in the Risk Treatment Criteria in Table 2 and Table 3, and the final Qualitative Risk Analysis Matrix based on likelihood and severity in Table 4.

Table 2 Environmental and safety impact consequence severity rating matrix

Consequences	Category				
	Safety	**Environment and community**	**Cost**	**Stakeholder perception**	**Law, regulation and civil action**
5 Severe	One or more fatalities or illness or total permanent disability to a large exposed group	Major and long-term damage extending beyond the project area. Extensive loss of community livelihood.	>$50M	Multiple stakeholder groups mobilising and encouraging others to take action as reflected in media channels with significant reach and influence	Criminal charges against director, senior executive or senior manager not involving jail or loss of right to manage the company. Prolonged major litigation – exposure to significant damages. Suspension/ restriction to operate asset.
4 Massive	Injury or illness to one or more persons, resulting in permanent partial disability	Major and long-term damage within the project area; or Significant but reversible damage extending beyond the project area. Significant impacts to community cost of living, business viability or social wellbeing.	>$5M - $50M AUD	More than one stakeholder groups opinion or view influencing other stakeholders, reported through media channels with some reach and influence	Criminal charges against any employee (not described above) Major litigation – exposure to damages.
3 Major	Serious injury or illness to one or more persons resulting in hospitalisation and lost time	Significant damage confined to the project area. Moderate impacts to community cost of living, business viability or social wellbeing.	>$100K - $5M AUD	More than one stakeholder group offering an opinion or view, reported through media channels with some reach and influence	Non-compliance with conditions of licence to operate an asset or to conduct an activity. Litigation – exposure to damages.
2 Moderate	Injury or illness resulting in medical treatment and first aid injuries and lost time	Minor short-term damage confined to the project area. Small scale impacts to community cost of living, business viability or social wellbeing.	>$5K - $100K AUD	A single stakeholder group drawing attention to an incident, issue or approach, conveyed through media channels with potential reach and influence.	Moderate non-compliance with external mandatory obligations or breach of contractual or other legal obligations.
1 Minor	Minor illness or injury requiring first aid	Minor environmental or community impact – readily dealt with.	Up to $5K	A person or organisation within stakeholder group signalling an interest in an incident, event or approach, using channels with limited reach or influence.	Minor non-compliance with external mandatory obligations or breach of contractual or other legal obligations.

Table 3 Qualitative measures of likelihood/frequency

Likelihood of occurrence (in any given year)		
5	Highly likely	Has a >90% chance of occurring if the risk is not mitigated.
4	Likely	Has a 60-90% chance of occurring if the risk is not mitigated.
3	Possible	Has a 40-60% chance of occurring if the risk is not mitigated.
2	Unlikely	Has a 10-40% chance of occurring if the risk is not mitigated.
1	Rare/Remote	May occur in exceptional circumstances, i.e. less than 10% chance of occurring if risk is not mitigated.

Table 4 Qualitative risk analysis matrix - level of risk based on likelihood/severity

		Likelihood				
		5. Almost Certain	**4 Likely**	**3 Possible/ Occasionally**	**2 Unlikely**	**1 Rare/Remote**
Consequence	**5 Severe**	Extreme	Extreme	High	High	Medium
	4 Massive	Extreme	High	High	Medium	Low
	3 Major	High	High	Medium	Medium	Low
	2 Moderate	High	Medium	Medium	Low	Low
	1 Minor	Medium	Low	Low	Low	Low

Risk level	**Risk treatment criteria**
Low	Some mitigation may be required - no detailed assessment of factors and aspects required but addressed in EMP as routine controls
Moderate	Substantial mitigation required - assessment required of factors and aspects
High	Major mitigation (including offsets) may be required - assessment required of factors and aspects
High	Potentially unacceptable, modification of proposal required
Extreme	Some mitigation may be required - no detailed assessment of factors and aspects required but addressed in EMP as routine controls

4.2 Risk Assessment Summary

The assessment of potential impacts and management aims to avoid (if possible) and minimise environmental impacts arising with road construction works on Paru Road. Environmental risks associated with the project have been identified through a thorough impact and risk assessment process. The purpose of the analysis was to identify potential impacts, assess the associated risk of these impacts and develop measures for preventing or mitigating impacts that reduce the risks.

A risk register is provided in Appendix C which presents the outcome of the risk assessment process. A summary of the impact causing activities and their relative likelihood of occurrence are summarised in Table 5. The inherent risk assessment results are based on the proposed construction activities and the timescale over which they will be undertaken.

Table 5 Risk assessment summary

	Number of Risks				Total
Activity	**Low**	**Medium**	**High**	**Extreme**	
Number of risks for project prior to mitigation measures (inherent)	15	16	0	0	31
Number of risks for project including mitigation measures (residual).	31	0	0	0	

5.0 Potential Environmental Impacts and Management Measures

This section identifies the potential environmental and social impacts associated with the project as presented in Section 3.0 of this EIA.

This assessment has been based on a desktop assessment of several published studies that have been undertaken on the Tiwi islands. This desktop information is supplemented by the results of the biodiversity assessment carried out in the project area in January 2021.

A project specific Construction Environment Management Plan (CEMP) framework has been developed for Paru Road construction work (Appendix D).

5.1 Erosion and Sediment Control

Project construction activities, including land clearing and earthworks, create erosion and sedimentation. The potential impacts related to erosion and sedimentation are:

- loss of soil and land stability
- damage to existing road infrastructure
- dust generation
- increased sedimentation of waterways and associated impacts to water quality and aquatic health

To manage construction impacts an Erosion and Sediment Control Plan (ESCP) will be prepared for the project. The ESCP will aim to:

- Address key soil and water management issues, including legislative requirements.
- Determine the “Type” of erosion and sediment control to be implemented during the project and post-project.
- Where practical identify, eliminate and reduce hazards and associated risks inherent in specific work activities, which if untreated could lead to a diminished product or create the potential for an accident, dangerous occurrence or environmental incident.

An ESCP framework has been developed for the project (Appendix E).

5.2 Spill Prevention and Response

Spills can range from large scale, which can trigger an emergency response plan, to small scale spills and leaks that can be readily dealt with by on-site personnel. Spills can be classified according to the following criteria:

- Tier 1: Spills that can be contained within the regulated activity area and can be cleaned up by site personnel without involvement of external organisations.
- Tier 2: Spills that cannot be totally contained within the regulated activity area and/or may require the involvement of external organisations.
- Tier 3: Severe spill that cannot be contained by the operator and requires substantial additional resources to manage the spill.

The potential impacts associated with hazardous spills include:

- Groundwater:

  Oil and hydrocarbon spills have the potential to leach into aquifers and pollute the groundwater. Pollution of aquifers by fuels, oils and hydraulic fluids is associated with low dissolved oxygen concentration, increased biological oxygen demand, increased water temperature, presence of organic impurities and increased acidity of groundwater (Ugwoha & Omenogor, 2017). The quantity of oils and hydrocarbons is unlikely to result in an impact on groundwater resources on the permit area.

- Surface water:

  Spills have the potential to migrate to local surface waters, such as the creek that runs through one of the road alignments. This can deleteriously effect surface water quality and the ecological values of the receiving habitat.

- Soil:

  Impacts of hazardous spills to soil includes salinization and consequent degrading of soil textures and deep erosion, and stress or death to surrounding vegetation.

The objectives of spill management include:

- prevent the spill/ leakage of hazardous liquids, including fuel, oils and wastewater, into the environment
- facilitate the rapid and effective response to any spills of hazardous liquids
- facilitate the effective remediation or removal and safe disposal of contaminated soil to prevent ongoing environmental impacts.

A spill prevention and response plan has been included within the CEMP framework.

5.3 Surface Water

The project area will produce site run-off, with associated potential for impact on water quality in nearby creeks. A key design objective for the project is to manage the quality of water discharged during construction, to avoid adverse effects on the values in the area of influence.

Potential impacts to surface water runoff quality from the project are:

- interruption to, or reduction of, natural drainage flows
- increased suspended sediment loads in surface waters during construction
- contamination from leaks and spills of fuels, lubricants, solvents or other products.

The management of potential impacts to surface water are covered by the prevention and response plan and waste management actions within the CEMP framework, as well as the ESCP framework.

5.4 Weed Management

Grassy weeds present the highest risk for weed spread and potential environmental damage across Melville Island. Grassy weeds of particular concern are Mission Grass (*Cenchrus polystachios*), Guinea Grass (*Panicum maximum syn. Urochloa maxima*) and Gamba Grass (*Andropogon gayanus*). Increased development and traffic across the Islands has led to increased spread of grassy weeds on Melville Island, including along roadsides and within plantations.

The movement of vehicles, machinery and other materials to, from and within the project area may result in weeds being imported or spread.

The potential impacts of weeds being spread or introduced include:

- loss or degradation of native vegetation communities and native fauna habitat
- increased flammability and fire risk.

Weed management will include sourcing as much plant and machinery as is available locally on the Tiwi islands. Any machinery that is to be imported from the mainland will require a thorough inspection and cleaning to ensure that it is free of mud and plant material prior to entering Melville Island.

A pre-construction weed survey should be undertaken to provide a baseline of the extent of weed infestations within the project area and determine the level of weed risk for the project. If an outbreak of a declared weed occurs during the project weed treatment is to be undertaken as soon as possible to control and eradicate the infestation.

The aim of weed management for the project will be to prevent any introduction and spread of declared weeds resulting from construction activities.

Weed management actions have been addressed within the CEMP framework.

5.5 Bushfire

Fire mapping on the Northern Australia and Rangelands Fire Information website indicates that the project area has been burnt regularly since 2010 (NAFI, 2020). Fire management, including controlled burns, is regularly undertaken by Tiwi ranger groups on Melville Island.

The risk of bushfires causing damage to the natural environment was determined to be a Medium risk prior to the implementation of mitigation methods.

Increased incident and intensity of bushfires can lead to vegetation degradation and habitat modification. Fire can travel over large areas therefore its impact can occur outside of the project site.

The potential impacts from bushfires include:

- loss of life and property
- death of fauna and loss of fauna habitat
- increased erosion risk
- damage to or loss of culturally significant sites
- damage to or loss of public infrastructure, private infrastructure and equipment or community lands.

The focus of bushfire management will be to mitigate the risk of fire resulting from project operations as well as mitigating the risk of bushfires ignited from elsewhere on Melville Island impacting the project. This can be achieved by implementing appropriate storage of fuel and other flammable and combustible liquids, having adequate firefighting equipment on site and liaising with the Tiwi Land Council and rangers about planned burns in the vicinity of the project.

Bushfire management actions have been addressed within the CEMP framework.

5.6 Waste Management

A variety of wastes are likely to be generated during the project, including

- putrescible and municipal waste
- recyclables (glass and cans)
- cardboard packaging materials
- scrap metals
- used fuel drums and oil containers
- timber pallets
- vehicle tyres
- oil drained from machinery, oily rags, filters.

The anticipated waste characteristics associated with the project are outlined in Table 6.

Table 6 Waste characteristics

Waste	Characteristics	Management
Domestic waste – municipal, putrescible and recyclable	Potentially hazardous to non-hazardous	Designated collection bins with transport off-site by licensed contractor

Waste	Characteristics	Management
Wastes associated with construction activities (fuel, oil, batteries etc.)	Hazardous to non-hazardous	Collection and storage on-site, and transport off-site by licensed contractor

The potential impacts of poor waste management associated with the project are:

- pollution of aquifers through spillage of waste pollutants
- pollution of surface waters through release of waste pollutants
- contamination of soil through inappropriate waste management
- attracting pest species due to inappropriate organic waste management

All waste material introduced to site will be removed from the lease area and disposed. All sample bags, waste materials and contaminants will be removed from site and disposed of in an appropriate manner, following the completion of road construction works.

A waste register will be developed and maintained to track the disposal of various waste streams.

Waste management actions have been addressed within the CEMP framework.

5.7 Flora and Fauna

The project will result in the removal of a maximum of 74.7 ha of native vegetation. This loss of native vegetation will not have a significant impact on woodland ecosystems on a regional scale.

Following and an analysis of desktop records, field survey results and 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).

Potential impacts to flora and fauna associated with project activities include:

- disturbance to environmentally sensitive flora species
- loss or endangerment of threatened flora and fauna species
- loss or reduction of habitat and native vegetation extent vehicle collision with fauna – fauna mortality.

Environmentally significant and sensitive vegetation occurs within the Creek Road alignment, where monsoon rainforest and riparian habitat occurs. These patches of vegetation are likely to be of lower quality due to their location adjacent to the road and subsequent disturbance. There is no option to completely avoid this vegetation, as realignment of this section of road is an essential part of the project. The removal of riparian vegetation therefore must be minimised as practicable

Other sensitive vegetation likely to occur within the project area includes habitat that qualifies as old growth forest. The criteria by which such stands of vegetation are identified in *Eucalyptus miniata* and *E. tetrodonta* communities is defined as a minimum of five or more stems greater than 50 cm diameter at breast height (DBH) per hectare and/or 30 or more stems greater than 40 cm DBH per hectare (DLRM, 2019). The protection of old growth forest will mitigate potential impacts to the threatened species such as Masked Owl (*Tyto novaehollandiae melvillensis*) and Red Goshawk (*Erythrotriorchis radiatus*).

Other vegetation types that should be protected include areas with high shrub density that comprise suitable habitat for threatened small and medium sized mammals such as Brush-tailed Rabbit-rat and Black-footed Tree-rat. Shrubs can be defined as vegetation between 0.2 m and 1.3 m in height (Davies *et al.*, 2017).

Risks to native fauna can also be minimised by restricting vehicle movements to daylight hours, particularly due to the prevalence of nocturnal fauna on the Tiwi Islands, including several threatened species.

Flora and fauna management actions have been included within the CEMP framework.

5.8 Feral Animal and Pest Species

Feral animals threaten populations of native wildlife in two main ways: direct predation (e.g. cats, dogs) or competition for limited resources (e.g. water buffalo, pigs). Feral species are more likely to penetrate areas of habitat that have been disturbed. Hence, habitats that have been disturbed or are suffering the impacts of edge effects will often be associated with a population of feral species.

Feral pigs pose a significant threat to the listed plants that occur on the island, while pigs and buffalo can impact the recruitment of rainforest plant species (Liddle *et al*., 2008).

The presence of feral cats on Melville Island has been implicated in the decline of threatened mammal species on Melville Island, specifically Brush-tailed Rabbit-rat (Davies *et al*., 2016).

The potential impacts of feral animals and pest species include:

- impacts to native fauna through predation or competition.
- damage to vegetation, habitat, and creeks through feral animal activity.
- introduction of diseases associated with feral and pest species may impact upon habitat quality, vegetation and native fauna.
- health and safety risks, such as Water Buffalo congregating near roads.

The objective for feral animal and other pest species management is to prevent their introduction or spread. This can be achieved by cleaning up and managing waste to prevent the attraction of feral and pest fauna to the project area.

Feral animal and pest species management actions have been included within the CEMP framework.

5.9 Biting Insects

The project area occurs close to coastal mangroves, estuarine creeks and monsoon rainforests that provide suitable habitat to a variety of biting insects such as midges and mosquitoes. If rainfall occurs during construction potential exists for water to pool on receptacles associated with the project and facilitate the breeding of biting insects.

Biting insects pose potential health risks, both as pest insects and as vectors of diseases such Ross River virus, Barmah Forest virus, Murray Valley encephalitis virus and Kunjin virus.

The risk of construction activities associated with the project facilitating the breeding of biting insects is low. Despite this, biting insects can impact personnel working on the project and measures can be taken to minimise impacts.

Periodic inspections, particularly after rainfall events, should be conducted to ensure mosquito breeding in artificial receptacles is prevented. Any receptacles that hold water should be tipped upside down, stored under cover away from rain, appropriately disposed of at a well-maintained waste disposal facility, or treated with a residual insecticide until it no longer poses a potential mosquito breeding issue.

The following personal protection can be applied by project personnel to minimise impacts from biting insects:

- wear thick clothing or tightly woven material
- wear lightly coloured, long sleeved shirts and full-length trousers
- apply insect repellents to the skin and clothing
- stay in accommodation that has insect screening

Biting insect management actions have been included within the CEMP framework.

5.10 Air Quality

Construction activities associated with the project, such as earthworks, vegetation clearing, and vehicle movements will have the potential to affect air quality within and surrounding the project area.

The key issue during the project will be dust. Paru Road is unsealed and dust is generated as a result of vehicle movements upon these roads during the dry season. The clearing of vegetation and earthworks will expose additional areas of bare earth, while soil stockpiles present an additional dust source.

Impacts of dust emission include:

- nuisance and amenity impacts to adjacent areas
- effects on surrounding vegetation from dust deposition
- inhibition to driver visibility within the project area

The Project would not be expected to cause a significant increase in carbon monoxide (CO), nitrogen oxides (NOx) and sulphur dioxide (SO2).

Potential air quality impacts during the project can be mitigated by maintaining vehicles and equipment in good condition. Visual inspections of dust impacts can be monitored and a water truck can be used to manage dust emissions.

Air quality management actions have been included within the CEMP framework.

5.11 Greenhouse Gases

The main greenhouse gas (GHG) that is likely to be produced during the project will be carbon dioxide (CO2), produced by the combustion of fuels during construction. Other GHG impacts from the project include the clearing of vegetation and the resulting loss of carbon sink capacity.

Impacts from the project include:

- increasing levels of greenhouse gases, primarily CO2
- removal of carbon sink associated with removal of vegetation

Due to the small scale of the project impacts from greenhouse gases will be minor. Vegetation cleared for gravel extraction will be progressively rehabilitated and over time will replace the loss.

Management of Greenhouse gasses is addressed within the air quality management actions within the CEMP framework.

5.12 Noise and Vibration Management

Noise generating activities from the project include:

- occupational health and safety issues due to long-term exposure to noise sources through use of mechanical equipment
- nuisance noise impacts on surrounding communities or project workers through use of mechanical equipment
- disrupting or altering fauna feeding, breeding or other activities through noise and vibration from use of mechanical equipment.

No sensitive receptors occur in proximity to the project. The project is located within a sparsely populated area, with the closest populated area being Paru outstation. The closest community is Wurrumiyanga on Bathurst Island, while Milikapiti and Pirlangimpi on Melville Island are approximately 30 km and 40 km from the project area respectively.

Construction activities are anticipated to occur between the hours of 6 am and 6 pm. Routine construction related noise associated with the machinery and vehicle movements are not anticipated to cause any significant noise nuisance given the long distance to between populated areas and the project site.

Noise and vibration management actions have been included within the CEMP framework.

5.13 Traffic

Construction activities will result in an increase in traffic along Paru Road, though these increases will be minor.

Potential impacts of the project relating to traffic include:

- safety issues due to vehicle traffic traversing Paru Road in proximity to construction works
- longer waiting times for traffic during construction works, including portable traffic lights where vehicles are required to stop, and reduced speed limits

Access to Paru Road will be maintained throughout construction and conflicts between construction traffic and local traffic should be monitored. A traffic management plan will include details for safe traffic movement through the work site, procedures for notification to other road users and specific communication requirements.

Vehicle access to construction sites will be designed to ensure the flow of traffic along Paru Road is not impeded.

5.14 Cultural Heritage

Potential impacts related to cultural heritage are:

- Damage to or loss of culturally significant artefacts, areas or species.
- Inappropriate access to sacred sites or culturally significant places.

An Aboriginal Areas Protection Authority (AAPA) certificate was provided to DIPL on 8 December 2020 (RA2020/93, Appendix B). The certificate identified four sacred sites in the vicinity of the project area, including a RWA associated with a sacred burial area (5074-46) that intersects a small portion (approximately 0.6 ha) of the southern road alignment. RWAs will be flagged to ensure that no works occur within the boundaries.

Advice provided by the Heritage Branch (NT Government) indicates that no archaeological sites occur within the project area and no heritage surveys are required.

Prior to the commencement of construction activities, all construction staff are to be inducted on the conditions of the AAPA certificate. A work program must also be provided to the Tiwi Land Council that includes site-specific environmental and cultural issues.

The majority of the project area consists of Eucalypt woodland immediately adjacent to Paru Road. The risk of encountering any Aboriginal archaeological items or places is considered to be low given the proximity to a disturbed area.

Cultural heritage actions are included within the CEMP framework. This includes an unexpected finds protocol.

5.15 Social Impacts

Paru Road is the only access road to the barge on Melville Island that travels across the Aspley Strait to Bathurst Island. It is the first road used by people commuting from Bathurst Island to Melville Island, and the last road used by people on Melville Island travelling to Bathurst Island.

As discussed in Section 1.2 the upgrade of Paru Road is part of a larger project to improve roads on Melville Island. Upgrade works to Melville Island roads have a variety of benefits including better access across the island for residents and commercial activities and improved safety.

The Tiwi people have a long record of pursuing economic development. This has led to several different industries being created on the islands, including forestry, aquaculture, mining and tourism. Upgrade works to Paru Road are expected to provide better access for commercial activities and reduce vehicle maintenance and replacement costs.

Stakeholders for the Paru Road upgrade include:

- Tiwi Island people that use the road as access to move between Bathurst and Melville Islands
- Tiwi Island community services including:
  - Tiwi Land Council who exert authority over development and commercial activities on the Tiwi Islands
  - Tiwi Island Regional Council who are responsible for managing main road between communities on Bathurst and Melville Island
  - Police, fire and emergency services
- Commercial businesses that use the road, including
  - Tiwi Plantations - Manages the *Acacia mangium* plantations on Melville Island for export of woodchip to Asian markets
  - Plantation Management Partners that provides the staff and technical skills to plant, grow, harvest, chip and market trees for Tiwi Plantations
  - Tiwi Enterprises - A registered 'Not for Profit' company that aims to develop economic opportunities, provide services and create jobs for Tiwi Islanders

Potential negative social impacts from the project include:

- Safety issues arising from commuters driving on Paru Road in proximity to construction work
- Safety issue arising from increased traffic occurring on Paru Road during construction
- Disruption to regular commute due to safety measures implemented along Paru Road during construction works, such as speed reductions, portable traffic signals and detours.

Other potential impacts assessed in the risk assessment, such as noise and vibration impacts and damage to culturally significant artefacts are considered to be low risk.

The construction contractor responsible for implementing Paru Road upgrade works should address potential social impacts of the project through the development of a Code of Conduct. This document should be implemented as part of site inductions for all personnel. The Code of Conduct will include:

- Background on the Tiwi people, their culture and customs
- Measures to maintain good relationships with local Tiwi people
- Outline appropriate behaviours outside of work hours.

6.0 Site Rehabilitation

The proposed rehabilitation approach is assisted natural regeneration in areas cleared for gravel pits and natural regeneration for the road realignments.

6.1 Progressive natural regeneration

Where clearing is required, topsoil and cleared vegetation will be stockpiled to be respread following the works. The topsoil will contain a natural seedbank. Spreading of waste vegetative matter over disturbed areas provides micro-habitats and slows run-off during rainfall events, thus enhancing infiltration. This is proposed to be implemented progressively following the realignment of each of the three sections of road.

6.2 Assisted natural regeneration

Assisted natural regeneration combines natural regeneration with soil preparation and weed control. If monitoring demonstrates that natural regeneration is unsuccessful, additional soil preparation (importing topsoil) combined with reseeding using local provenance seed shall be carried out.

Areas with a hardened or compacted soil surface, such as heavily used roads and camp sites, must be either ripped or pitted (using a raised tyne) to break up the hardened surface, increase infiltration of water and provide a roughened surface where windblown seeds, rainwater and topsoil can accumulate. Pitting is best used on gentle slopes and ripping is best used on more sloping land, parallel to the contours. The depth of ripping depends on the degree of compaction and the soil type; heavily compacted sites or clay soils will need ripping to at least 50 cm depth. Ripping will be carried out on dry soil, rather than moist soil.

7.0 References

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