GROOTE EYLANDT MINING COMPANY (GEMCO)

SOUTHERN LEASE STAGE 2 EXPLORATION PROGRAM

NOTICE OF INTENT May 2020

Volume 2







Hansen Bailey
ENVIRONMENTAL CONSULTANTS

SOUTH32

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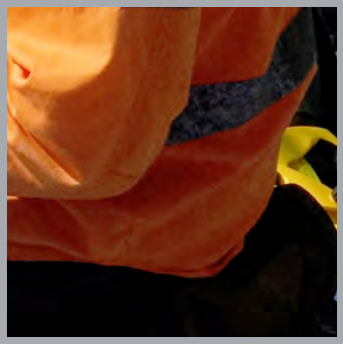
Baseline Terrestrial Ecology









Southern Lease - Stage 2 Exploration Program

Baseline Terrestrial Ecology Report

GEMCO/South32

21 May 2020

Final

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Report No. 20003RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Approved by:	**Katrina Wolf**
Position:	Principal
Signed:	
Date:	21 May, 2020

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Glossary

Term / Abbreviation	Definition
ALC	Anindilyakwa Land Council
CAMBA	China–Australia Migratory Bird Agreement
DAWE	Federal Department of Agriculture, Water and the Environment
DENR	Northern Territory Department of Environment and Natural Resources
Eastern Leases	Mineral Leases (ML) 31219 and 31220; formerly Exploration Licences in Retention (ELR) 28161 and 28162
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GEMCO	Groote Eylandt Mining Company Pty Ltd
GIS	Geographic Information System
GPS	Global Positioning System
IR camera	Infra-red camera
JAMBA	Japan–Australia Migratory Bird Agreement
LiDAR	Light Detection and Ranging
littoral	Refers to environments that are within proximity of the sea or the sea shore (e.g. "littoral rainforests" or "littoral zone")
Locality	Area within 20 km radius of the centre of the Study Area
mesic	Refers to moderate – high moisture environments (such as rainforests) and the plants that are associated with such environments (e.g. "mesic vegetation" or "mesic plants")
microhabitat	Refers to very small, specialised habitats, such as a clump of grass or a space between rocks
MNES	'Matters of National Environmental Significance' that are listed by the EPBC Act
NR Maps	Northern Territory Natural Resource Maps search facility
NT	Northern Territory
NVIS	National Vegetation Information Systems. The NVIS is a comprehensive data system that provides information on the extent and distribution of vegetation types in Australian landscapes. It is an ongoing collaborative initiative between the Australian and state and territory governments to manage national vegetation data to help improve vegetation planning and management within Australia.
physiographic	Refers to the features and attributes of the earth's land surface
PMST	Protected Matters Search Tool
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
sp.	Singular of 'species' and used when the species was unable to be identified
spp.	Plural of 'species' and used when referring to a number of species within a genus
Study Area	Exploration Licence (EL2455) shown on **Figure 1**, comprising the entirety of the Southern Lease
TEC	Threatened Ecological Community

Term / Abbreviation	Definition
TPWC Act	Territory Parks and Wildlife Conservation Act
TSMP	Groote Archipelago Threatened Species Management Plan
VMU	Vegetation Map Unit

1. Introduction

Cumberland Ecology was commissioned by the Groote Eylandt Mining Company Pty Ltd (GEMCO) to undertake a baseline terrestrial ecology assessment of GEMCO's Southern Lease Exploration Licence (EL2455) area of Groote Eylandt. This report also makes reference to GEMCO's proposed Stage 2 Exploration Program (the 'exploration program'). The exploration program is proposed to be undertaken within the Southern Lease Exploration Licence. This report utilises the following terms:

- Study Area: represents the Southern Lease Exploration Licence (EL2455) and is shown in **Figure 1**; and
- Stage 2 exploration program area: represents the broad area currently proposed to be explored, and is shown in **Figure 2**.

This report presents the results of the baseline terrestrial ecology assessment undertaken by Cumberland Ecology. The assessment included desktop studies, as well as results from recent ecological surveys undertaken within the Study Area and surrounds.

1.1. Purpose

The baseline terrestrial ecology assessment seeks to gain a comprehensive understanding of the terrestrial ecological values (including vegetation communities, fauna habitat and threatened species) of the Study Area. The purpose of this report is to document the findings of the baseline terrestrial ecology assessment of the Study Area.

Specifically, the objectives of this terrestrial ecology report are to:

- Present the findings of ecological surveys undertaken within the Study Area;
- Identify and map the location of threatened flora and fauna species;
- Assess the likelihood as to whether threatened flora and fauna species could occur within the Study Area, and specifically within the Stage 2 exploration program area;
- Provide baseline ecology information on Matters of National Environmental Significance (MNES) within the Study Area; and
- Describe the presence or likely occurrence of introduced and invasive species (both flora and fauna) in the Study Area.

This report will be used to support an application for regulatory approval for the Southern Lease Stage 2 exploration program. In addition, it fulfils the requirements of GEMCO's Exploration Agreement with the Anindilyakwa Land Council (ALC) to prepare a baseline ecology assessment of the Southern Lease.

1.2. Island and Regional Context

The Study Area is located on Groote Eylandt in the Northern Territory (NT), the third largest island off the Australian mainland. It is part of an archipelago to the east of Arnhem Land that has international significance because of the integrity of its flora and fauna. According to the NT Government (NRETAS 2009), Groote Eylandt and other islands in the archipelago have conservation values including:

- Nationally and internationally significant sites for nesting seabirds and turtles;
- Approximately 900 species of vascular plants and 330 vertebrates; and
- Known occurrences of a suite of threatened species including the nationally listed Northern Hopping-mouse (*Notomys aquilo*), Brush-tailed Rabbit-rat (*Conilurus penicillatus*) and Northern Quoll (*Dasyurus hallucatus*).

The main reason for the conservation significance of the island is thought to be the absence or near absence of key threatening processes that occur on the Australian mainland (NRETAS 2009). Of particular note, many of the feral animals that have impacted native flora and fauna on the mainland are absent from Groote Eylandt. In particular, feral cattle (*Bos taurus*), horses (*Equus caballus*), donkeys (*Equus asinus*), Water Buffalo (*Bubalus bubalis*), the Cane Toad (*Rhinella marina*), Rusa Deer (*Cervus timorensis*), Feral Pig (*Sus scrofa*), and the European Red Fox (*Vulpes vulpes*) are not established on the island.

Groote Eylandt is located in the Groote Sub-region of the Arnhem Coast Bioregion (DSEWPaC 2012). The Arnhem Coast Bioregion comprises a coastal strip extending from just east of the Cobourg Peninsula to just north of the township of Numbulwar in south eastern Arnhem Land, and includes many offshore islands including Groote Eylandt (**Figure 3**). The Arnhem Coast Bioregion has a tropical monsoonal climate with a distinct wet and dry season, and high temperatures throughout the year (DEWHA 2008).

The vegetation within the Arnhem Coast Bioregion is characterised by eucalypt woodlands, monsoon vine forests and coastal communities such as mangroves (DEWHA 2008). Coastal vegetation includes well developed heathlands, mangroves and saline flats, with some floodplain and wetland areas (DLRM 2014). Inland from the coast, the dominant vegetation type is eucalypt tall open forest, typically dominated by *Eucalyptus miniata* (Darwin Woollybutt) and *Eucalyptus tetrodonta* (Darwin Stringybark), with smaller areas of monsoon rainforest and eucalypt woodlands (DLRM 2014). Well-developed coastal dune systems and rugged Cretaceous sandstone areas have been recorded on Groote Eylandt (DLRM 2014).

The whole of Groote Eylandt is Aboriginal land under the Commonwealth *Aboriginal Land Rights (Northern Territory) Act 1976*. Furthermore, the Groote Eylandt Archipelago has been declared an Indigenous Protected Area; an area of Indigenous-owned land or sea where Traditional Owners have entered into an agreement with the Federal Government to promote biodiversity and cultural resource conservation (DotEE 2019r).

The bioregion is located entirely within Aboriginal land (DEWHA 2008). Commercial land uses within the bioregion include bauxite and manganese mining, as well as tourism (DEWHA 2008). No national parks occur within the bioregion (DLRM 2014).

1.3. Description of the Study Area

The Study Area includes the catchments of the Emerald, Yanbakwa, Amagula, Innokumanja and Mayimokumanja Rivers, and Salt Creek (**Figure 2**). It is characterised by areas of flat to undulating sand plains surrounded by low hills of outcropping quartzitic rock to the east, and the coastline to the west and south.

The vegetation and habitats within the Study Area are relatively pristine and are strongly influenced by topography and drainage. Eucalypt open forests and woodlands dominate the well-drained areas with

Melaleuca-dominated vegetation occurring in swampy and riparian areas, and coastal vegetation and tidal flats occurring at locations in proximity to the coastline. Fire also plays a very significant role in determining vegetation composition in the open forest and woodland habitats, with a large proportion of the Study Area regularly burnt by the Traditional Owners. Overall the vegetation is in a very good condition and is characterised by a high species and structural diversity, although the structure of the understorey and the condition of the ground layer has been modified by a regime of frequent fires. The Study Area provides a range of habitats for fauna species and is contiguous with native vegetation in other areas of Groote Eylandt.

Within the Study Area there are some areas of disturbance, including exploration activities that took place in 2016 and 2019 in the north western portion of the Study Area. These activities were localised to the south of the Emerald River and to the west of the Amagula River. Other forms of anthropogenic disturbance include the Emerald River Road and the Wurrumenbumanja outstation (see **Figure 2**). A small number of access tracks occur, predominantly within the western half of the Study Area.

2. Regulatory Framework

2.1. Commonwealth Legislation

2.1.1. Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's principal piece of environmental legislation and is administered by the Federal Department of Agriculture, Water and the Environment (DAWE). It is designed to protect national environmental assets, known as MNES, which include threatened species of flora and fauna, endangered ecological communities, migratory species as well as other protected matters. Among other things, it defines the categories of threat for threatened flora and fauna, identifies key threatening processes and provides for the preparation of recovery plans for threatened flora, fauna and communities.

Approval is required under the EPBC Act for any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES (including nationally threatened ecological communities (TECs) and species, and listed migratory species).

2.1.2. International Treaty Obligations on Migratory Species

Australia is signatory to several agreements relating to migratory species. Migratory species listed under the following agreements and conventions are protected in Australia by being listed as MNES (Migratory Controlling Provision) under the EPBC Act:

- China–Australia Migratory Bird Agreement (CAMBA);
- Japan–Australia Migratory Bird Agreement (JAMBA);
- Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA); and
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

The CAMBA and JAMBA agreements list terrestrial, water and shorebird species which migrate between Australia and the respective countries. In both cases, the majority of listed species are shorebirds (DotE 2014a).

Both agreements require the parties to protect migratory birds by:

- Limiting the circumstances under which migratory birds are taken or traded;
- Protecting and conserving important habitats;
- Exchanging information; and
- Building cooperative relationships.

The JAMBA agreement also includes provisions for cooperation on the conservation of threatened birds. Australian government and non-government representatives meet every two years with Japanese and Chinese counterparts to review progress in implementing the agreements and to explore new initiatives to conserve migratory birds (DotE 2014a).

The ROKAMBA formalises Australia's relationship with the Republic of Korea in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (DotE 2014a).

In addition to these bilateral agreements, Australia is also a signatory of the Bonn Convention. This convention aims to conserve terrestrial, aquatic and avian migratory species throughout their range (CMS 2015).

2.2. Northern Territory Legislation and Guidelines

2.2.1. Territory Parks and Wildlife Conservation Act 1976

The *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act) is the primary piece of legislation for managing the protection and conservation of biodiversity, and the sustainable use of wild populations (of predominantly terrestrial species) in the Northern Territory. The Act is administered by the NT Department of Tourism, Sport and Culture and the Department of Environment and Natural Resources (DENR) is responsible for Part IV, Divisions 1-5.

The TPWC Act makes provision for the study, protection, conservation and sustainable utilisation of wildlife throughout the NT. This legislation covers the classification and management of wildlife; classification and control of feral animals; permits for taking wildlife and entering land; designation and management of protected areas, including joint management with Traditional Owners; and private sanctuaries.

The management of wildlife under the TPWC Act is to be carried out in accordance with the Principles of Management (Section 31 of the TPWC Act), which promote:

(a) the survival of wildlife in its natural habitat;

(b) the conservation of biological diversity within the Territory;

(c) the management of identified areas of habitat, vegetation, ecosystem or landscape to ensure the survival of populations of wildlife within those areas;

(d) the control or prohibition of:

(i) the introduction or release of prohibited entrants into the Territory; and

(ii) any other act, omission or thing that adversely affects, or will or is likely to adversely affect, the capacity of wildlife to sustain its natural processes; and

(e) the sustainable use of wildlife and its habitat.

Under the TPWC Act, threatened flora and fauna species in the NT are classified under the following conservation categories:

- Extinct;
- Extinct in the Wild;
- Critically Endangered;

- Endangered;
- Vulnerable;
- Near Threatened;
- Least Concern;
- Data Deficient; and
- Not Evaluated.

These categories and associated assessment criteria are aligned with the classification system and criteria developed by the International Union for the Conservation of Nature for determining the conservation status of species.

Under the TPWC Act, species are considered as 'threatened' wildlife if they are classified as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable and are assigned protected wildlife status. The categories utilised under the TPWC Act are independent of the listing of wildlife under the EPBC Act as they relate only to their occurrence within the NT.

2.2.2. Weeds Management Act 2001

The *Weeds Management Act 2001* (WM Act) makes provision for the control and eradication of declared weeds in the NT. The Act is administered by the DENR.

Weeds that have been identified to have an impact on the NT's economic, environment, cultural and social values are declared under the WM Act. A weed may be declared as:

- Class A: To be eradicated;
- Class B: Growth and spread to be controlled; and
- Class C: Not to be introduced to the NT.

2.2.3. Land Clearing Guidelines 2019

The NT *Land Clearing Guidelines* (DENR 2019) play a role in guiding good land development practice in the NT by establishing standards for native vegetation clearing. The guidelines recognise that decisions to clear native vegetation are significant because clearing will lead to at least some change in landscape function. The guidelines seek to manage clearing in a way that promotes the greatest possible net benefit from the use of land which has been cleared of native vegetation.

The purpose of the guidelines is to provide:

- Recommendations regarding best practice clearing of native vegetation;
- A standardised suite of environmental parameters requiring consideration; and
- Advice to consent authorities.

The guidelines aim to provide greater clarity and certainty around the acceptability of clearing applications to ensure consistent and transparent decision making. This is achieved by setting out matters for consideration in assessing applications and through applying the principles of natural justice to the process.

The guidelines are administered by the DENR. The guidelines are recognised formally under the NT *Planning Act 1999* and referenced in the NT Planning Scheme.

Mining and exploration activities are controlled by the NT *Mining Management Act 2001* rather than the *Planning Act* and mining/exploration activities are subject to a separate environmental approval process under the NT *Mining Management Act 2001*. Mining applications are not, therefore, required to formally consider the *Land Clearing Guidelines* (DENR 2019). Nevertheless, there are sections of the guidelines that provide useful information regarding the assessment of sensitive or significant vegetation types.

3. Methodology

This section describes the methodology adopted for the baseline terrestrial ecology assessment. Investigations for the assessment entailed a literature review and database assessment followed by review of previous fieldwork undertaken within the Study Area and for nearby areas of Groote Eylandt. The methods used for each component are explained in more detail below.

3.1. Desktop Assessment

3.1.1. Database Analysis

A database analysis was conducted through consultation of the DAWE EPBC Protected Matters Search Tool (PMST) (DAWE 2020f) and the NT Natural Resource Maps (NR Maps) search facility (DNRM 2020). The EPBC PMST generated a list of potentially occurring MNES listed species under the EPBC Act within a 20 km radius of the centre of the Study Area (i.e. the locality), which fully encompassed the Study Area (see **Appendix A**). The NR Maps search facility was used to generate records of flora and fauna, (including threatened species), known to occur across Groote Eylandt. This information was used for the purposes of confirming the previous records of each species within the locality. The abundance, distribution and age of records within the locality provided supplementary information to assess the likelihood of those threatened species to occur within the Study Area.

A map of threatened ecological communities in the NT (DSEWPaC 2013) was also consulted to determine the potential presence of threatened ecological communities within the Study Area.

3.1.2. Literature Review

Available literature on the ecology of Groote Eylandt was reviewed, including available government data and in-house reports made available from GEMCO. Numerous ecological studies have been conducted within and in proximity to the Study Area, including several recent detailed flora and fauna investigations. Key documents reviewed for this terrestrial ecology report included:

- Cumberland Ecology (2019c): Southern Lease Project – Baseline Terrestrial Ecology Report;
- Cumberland Ecology (2019b): GEMCO/South32 Southern Lease Small Mammal Research Project – Report;
- Anindilyakwa Land & Sea Rangers (2019): Northern Hopping Mouse Surveys: Final Report to Territory NRM July 2019;
- Heiniger and Gillespie (2017): Survey of Threatened Mammal and Feral Cat Surveys on Groote Eylandt. Unpublished Report to the Anindilyakwa Land Council;
- Cumberland Ecology (2016): Southern Lease Project – Baseline Terrestrial Ecology Report;
- Cumberland Ecology (2015): Eastern Leases Project – Terrestrial Ecology Assessment Report;
- URS Australia Pty Ltd (2012): Flora and Fauna Surveys of Western Groote Eylandt;
- G. Webb Pty Limited (1992): Flora and Fauna Surveys on the Western Side of Groote Eylandt, N.T. (1991-92);

- Brocklehurst and Cowie (1992): Flora Survey of the GEMCO Mining Lease on the Western Side of Groote Eylandt, Northern Territory; and
- Langkamp et al. (1981): Ecological gradients in forest communities on Groote Eylandt, Northern Territory, Australia.

Of these documents, Cumberland Ecology (2016, 2019b) includes detailed field surveys undertaken within the Southern Lease which forms the basis of the ecological data presented within this report. These studies are discussed in further detail in ***Section 3.1.3***. The other key datasets drawn upon within this assessment are from Cumberland Ecology (2019c), Anindilyakwa Land & Sea Rangers (2019), Heiniger and Gillespie (2017), Cumberland Ecology (2015), URS Australia Pty Ltd (2012) and Webb (1992). With the exception of Anindilyakwa Land & Sea Rangers (2019) and Heiniger and Gillespie (2017) which covers multiple locations on Groote Eylandt, the location of the study areas of the key datasets are shown in **Figure 4**.

Numerous other reports were consulted during the preparation of this baseline terrestrial ecology report including those presenting the results of targeted surveys (Ward 2006b, a, 2007b, a, Firth 2008, Smith 2009b, Rankmore 2011), pre-clearing/exploration surveys (Coffey Environments 2010, EMS 2013, 2014, Hansen Bailey 2016), impact assessment reports (EMS 2008, LES 2013), general reporting of species groups on Groote Eylandt (Davies and Tyler 1986, Noske and Brennan 2002) and remote sensing of vegetation (Crase and Hempel 2005). A summary of the suite of previous survey reports utilised within this assessment is provided in **Appendix B**.

A detailed review of threatened species information provided within the Threatened Species Information Sheets published by the NT Government and the Species Profiles and Threats Database published by DAWE was also undertaken as part of this assessment.

Information within the reviewed literature was utilised in determining the likelihood of threatened species to occur within the Study Area.

3.1.3. Recent Targeted Studies within the Southern Lease

Two recent studies by Cumberland Ecology (2016, 2019b) included terrestrial flora and fauna field surveys targeted to the terrestrial biodiversity values within the Southern Lease. The field surveys undertaken by each of these studies is summarised below.

3.1.3.1. Cumberland Ecology (2016)

Cumberland Ecology undertook a baseline terrestrial ecology assessment of the western part of the Southern Lease area of Groote Eylandt in 2016 (**Figure 4**). The field survey was undertaken in May 2016, and comprised both a terrestrial flora survey and terrestrial fauna survey. The field surveys were designed to comply with relevant NT and Commonwealth guidelines. Survey design was also informed by studies by Cumberland Ecology (2015), URS Australia Pty Ltd (2012) and Webb (1992) of the areas located to the north and north-east of the Study Area.

The terrestrial flora survey included:

- Vegetation mapping, undertaken in the following stages:

- Development of a preliminary vegetation map based on a desktop review of available datasets and studies, using aerial photograph interpretation techniques and GIS software;
- Collection of detailed site data during field surveys to validate the preliminary mapping and to inform final mapping outputs, including 21 primary plots and 766 track notes; and
- Review and refinement of the preliminary vegetation map based on field datasets.

- Threatened flora searches.

Vegetation communities were classified in accordance with the vegetation communities that were described in Webb (1992). Webb classified the vegetation communities he studied on Groote Eylandt into 28 "Map Units". These map units were based on the floristic and structural characteristics of the dominant vegetation type within each community. Map units that were not previously described by Webb (1992) were classified to Level III of the National Vegetation Information Systems (NVIS) framework.

The terrestrial fauna survey included:

- Trapping at four fauna survey sites within a 50 x 50 m quadrat for a period of three nights, with each site including 20 Elliott traps, four cage traps, four pitfall traps and associated drift fencing, and four funnel traps. Elliot traps were utilised to target small to medium sized mammals, cage traps were utilised to capture medium-large sized mammals, and pitfall traps and funnel traps were utilised to capture reptiles and frogs;
- Bird census at four fauna survey sites within a 100 x 100 m quadrat, including eight diurnal bird counts and two nocturnal bird counts. Nocturnal bird counts included spotlighting, as well as the use of call playback for the Masked Owl (northern) (*Tyto novaehollandiae kimberli*). An additional two locations were surveyed for the Masked Owl (northern) (*Tyto novaehollandiae kimberli*) using spotlighting and call playback;
- Active searches at four fauna survey sites within a 50 x 50 m quadrat, including three searches during the day and two searches at night using spotlights. Active searches targeted reptiles, amphibians and mammals;
- Ultrasonic call detection surveys for microchiropteran bats (microbats) undertaken at four fauna survey sites and two additional locations for a period of one to three nights;
- Harp trapping for microbats at three locations for a period of two to three nights;
- Spotlighting along major tracks from a slow-moving vehicle targeting birds, mammals and reptiles;
- Motion-sensor cameras at four short-term locations (five nights) and 10 long-term locations (approximately two months). Cameras targeted small, trap shy ground-dwelling fauna;
- Incidental observations throughout the study area; and
- Habitat assessments at four fauna survey sites within a 100 x 100 m quadrat.

The location of the study area utilised by Cumberland Ecology (2016) is shown in **Figure 4**.

3.1.3.2. Cumberland Ecology (2019)

Cumberland Ecology undertook a small mammal research project within the Southern Lease and surrounds in 2017 and 2018. The small mammal research project was undertaken to address the requirements of the *GEMCO Southern Lease Exploration Area Threatened Mammal Risk Assessment Plan* (Gillespie and Heiniger 2017). The small mammal research project was designed to obtain additional information on two threatened species, the Northern Hopping-mouse (*Notomys aquilo*) and the Brush-tailed Rabbit-rat (*Conilurus penicillatus*) to provide a more detailed understanding of the occurrence and habitat preferences of these species within the Southern Lease exploration tenement and surrounds. The design of the study also enabled collection of information on habitat types and a suite of other fauna species.

The small mammal research project included field surveys undertaken at 152 sampling sites, the locations of which were determined based on stratification units. Stratification units were determined by habitat types and time since fire. Habitat types were nominated by DENR based on an initial draft island-wide vegetation map that was prepared by DENR in 2017. Time since fire was determined from data downloaded from the North Australia and Rangelands Fire Information website in July 2017 (Darwin Centre for Bushfire Research 2017).

Seventy-six (76) sites were surveyed between August and November 2017 and the remaining 76 sites were surveyed between May and August 2018. Field surveys included the following at each of the 152 sampling sites:

- Four motion-sensor cameras and bait stations, including two unfenced cameras and bait stations, and two fenced (drift fence) cameras and bait stations, with cameras left to record for a minimum of four weeks (28 days);
- A 50 x 50 m habitat assessment quadrat centred at the sampling site, which included the collection of the following data:
    - Representative site photographs;
    - General vegetation description;
    - Evidence of fire prior to site establishment;
    - Circumferences of trees;
    - Length and circumferences of logs;
    - Ground cover, grass layer, shrub/woody vegetation and mid-storey vegetation; and
    - Soil information at each camera.
- Four 20 x 20 m Northern Hopping-mouse burrow search quadrats located adjacent to each camera, which included collection of the following data where spoil heaps were recorded:
    - Measurement of maximum spoil heap width was recorded, a Global Positioning System (GPS) unit reading taken, and the spoil heap photographed;

- Where spoil heaps had a maximum width greater than 50 cm, searches were undertaken within 5 m of the spoil heap for the presence of pop holes; and
- Where pop holes were detected, a measurement of the width of the hole was recorded, a GPS reading taken, and the hole photographed.

The location of the study area utilised by Cumberland Ecology (2019b) is shown in **Figure 4**.

An extensive amount of data analysis was undertaken following field surveys, including review of camera images and collation of field survey data. As the Northern Hopping-mouse (*Notomys aquilo*) and the Brush-tailed Rabbit-rat (*Conilurus penicillatus*) were not recorded within the study area utilised by the small mammal research project, no occupancy modelling was undertaken for these threatened species.

3.1.4. Aerial Photography and LiDAR

The most recent available aerial photography and Light Detection and Ranging (LiDAR) of the Study Area and immediate surrounds (flown by GEMCO in September 2017) was utilised for this assessment. The aerial photography and LiDAR (i.e. accurate topographic data) was used by GEMCO to map the extent of white rock. The white rock mapping was then utilised for this assessment. The LiDAR data was also used to assist with delineating catchments and waterways.

3.1.5. Vegetation Mapping

A number of studies undertaken within GEMCO's mining leases, including Cumberland Ecology (2015, 2016), URS Australia Pty Ltd (2012) and Webb (1992), have included vegetation mapping components. Most recently, DENR was commissioned by the ALC to undertake island-wide vegetation mapping of Groote Eylandt.

The suite of vegetation mapping information presented within the earlier studies was utilised by DENR, in conjunction with desktop assessments, additional field surveys and Geographic Information Systems (GIS) software. An initial draft vegetation map was prepared in 2017, and included classification of vegetation into Vegetation Map Units (VMUs).

A suite of information on vegetation within the Southern Lease and surrounds, collected by Cumberland Ecology in 2017 and 2018 for the small mammal research project (2019b), was provided to DENR for incorporation into updated vegetation mapping. GEMCO also provided DENR with the aerial photography and LiDAR data collected in 2017. Incorporation of this additional data, in conjunction with further field data collected by DENR resulted in updated vegetation mapping being prepared in 2018. The vegetation mapping presented within this report is based on the latest available DENR vegetation mapping (i.e. prepared in 2018).

3.1.6. Geological Mapping

Geological mapping of the Study Area was sourced from the NT Department of Mines and Energy (2010) and further verified by GEMCO. This provided an indication of the underlying substrate which was used to inform habitat mapping.

3.1.7. Soil Mapping

Soil mapping of the Study Area was sourced from the National Resource Information Centre Digital Atlas of Australian Soils (Bureau of Rural Sciences 2014). Soils mapping was utilised to correlate vegetation types and habitat preferences of particular flora and fauna, to soil types present within the Study Area.

3.2. Likelihood of Occurrence Assessment

As described in ***Section 3.1.1***, database searches were undertaken to identify threatened species that are known to, or that have the potential to occur within the locality. The likelihood of such species occurring within the Study Area and Stage 2 exploration program area was then assessed based on the results of the field surveys and the species were classified using the criteria presented in **Table 1**. The assessment was based on the species known ranges, number and age of records, and habitat preferences which were evaluated considering site characteristics observed during the field surveys.

Table 1 Criteria to assess potential for threatened species to occur within the study area

Likelihood to Occur	Definition
Present	The species was recorded within the Study Area during recent (2016-2018) terrestrial field surveys.
High	The species was not recorded within the Study Area during recent (2016-2018) terrestrial field surveys, but is known to occur within the surrounding area. Habitat of a similar and suitable quality is known to exist within the Study Area and it is deemed likely that the species will occur.
Moderate	The species was not recorded within the Study Area during recent (2016-2018) terrestrial field surveys, although it is known to occur in the wider region. Habitat was identified for the species within the Study Area during field surveys; however it is marginal, fragmented and/or small in size, or degraded.
Low	The species was not recorded within the Study Area during recent (2016-2018) terrestrial field surveys. The species is unlikely to occur due to a lack of, or limited, habitat within the Study Area, or extremely poor quality habitat within the Study Area, or no or very few recent records of the species occurring in the wider region.

In the case of the Northern Hopping-Mouse and Brush-tailed Rabbit-rat, the potential for the species to occur was based on the results of Cumberland Ecology (2019b), given that this study addressed the specific issue of occurrence of these species in the Study Area. Assessment of the Northern Hopping-mouse also considered the results of Anindilyakwa Land & Sea Rangers (2019), given that this study also targeted this species.

3.3. Fauna Habitat Modelling

Habitat types of the Study Area were developed based on the following:

- 2018 version of DENR's vegetation mapping;
- Observations made during recent (2016-2018) terrestrial surveys of the Study Area; and

- Review of landform and vegetation structure.

The 2018 version of DENR's vegetation mapping provided a good starting point to develop the modelling of fauna habitat within the Study Area. The VMUs identified in the 2018 version of DENR's vegetation mapping were initially assessed to determine their alignment to the habitat types. Areas that were mapped as comprising combined VMUs, were assigned to the habitat type of the dominant VMU. As some VMUs comprised multiple habitat types, each individual polygon of mapped vegetation was assessed against recent available aerial imagery (September 2017), 1 m contour data, geological mapping and mapping of white rock. Where polygons appeared to contain more than one habitat type, it was assigned to the dominant habitat type.

The fauna habitat modelling prepared for this assessment delineates the major types of habitats within the Study Area, many of which are relevant to the threatened species known or potentially occurring within the Study Area. The results of fauna habitat modelling are discussed in **Chapter 6**.

3.4. Limitations

No significant limitations to recent terrestrial surveys and habitat modelling were identified. As noted above, this assessment utilises information collected during recent terrestrial field surveys of the Study Area by Cumberland Ecology (2016, 2019b), as well as relevant findings of numerous surveys conducted over several years and in all seasons in nearby areas with the same or very similar habitats. Moreover, as data has also been collected for the Study Area, this provides a high degree of confidence in the mapping of vegetation communities and broad fauna habitats, as these occur on and have been studied extensively for other adjacent and nearby areas.

3.4.1. Flora

The most recent DENR vegetation mapping used for the Study Area incorporated field data collected by both DENR and Cumberland Ecology (2016, 2019b). Whilst the most recent DENR vegetation mapping is considered to be largely representative of the Study Area, there may be locations where actual vegetation differs to what has been mapped due to:

- The scale of DENR's island-wide mapping (1:50,000) which may not pick-up narrow ecotonal areas or small patches of vegetation communities;
- Differences in vegetation composition which may not be picked-up on aerial imagery for map units that are structurally similar. This is particularly the case for different *Melaleuca* dominated VMUs that differ slightly based on the relative dominance of grasses, sedges or ferns in the ground layer; and
- Some VMUs forming a mosaic of several communities that cannot readily be mapped separately (combination VMUs). An example of this is on coastal sand dunes where grasslands, shrublands and monsoon open woodlands can form a mosaic depending on the degree of coastal exposure (i.e. micro-topography including protected dune swales, exposed dunes and dune crests).

Notwithstanding these potential discrepancies, the most recent vegetation mapping (2018 version) produced by DENR is considered the most accurate mapping available for the Study Area.

Detailed floristic surveys undertaken by Cumberland Ecology (2016) were restricted to the north-western portion of the Study Area. Some floristic information was also collected by Cumberland Ecology (2019b), which was limited to characteristic species and trees. Given the size of the Study Area and extensive range of vegetation communities present, not all flora species present would have been recorded during the surveys. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora.

3.4.2. Fauna

Recent terrestrial fauna surveys by Cumberland Ecology (2016, 2019b), were successful in detecting a wide range of vertebrate fauna, particularly birds, bats and non-flying mammals. The most recent terrestrial surveys by Cumberland Ecology (2019b) included collection of survey data between 2017 and 2018, with survey locations targeted towards a spatial and temporal distribution within a range of habitats. The other recent terrestrial surveys by Cumberland Ecology (2016) were situated in the north western portion of the Study Area (**Figure 4**) at locations where a number of representative habitat types co-occur and are therefore areas of high species diversity.

Data obtained from the fauna surveys are generally considered a "snapshot" in time and illustrate the fauna that were active during the time of the surveys. As the most recent terrestrial surveys by Cumberland Ecology (2019b) included the use of motion-sensor cameras at 152 sites for a minimum of four weeks during the post-wet and pre-wet seasons, the data is considered to represent more than a "snapshot" of terrestrial fauna species. The data produced by the surveys is intended to be indicative of the types of species that could occur and are not an absolute census of all vertebrate fauna species occurring within the Study Area. Due to the design of the Cumberland Ecology (2019b) surveys which targeted terrestrial mammals, the assemblage of terrestrial mammals within the Study Area is considered to be well known.

It is likely that if additional field sampling was undertaken within the Study Area, more species may be identified, in particular frogs, reptiles and birds. This is due to the fact that the small mammal research project, was designed by DENR to focus on small mammals and not other species. For this reason, this assessment has also taken into account the results of previous surveys undertaken within, or in close proximity to the Study Area such as those undertaken for the Eastern Leases Project (Cumberland Ecology 2015).

As well as providing an overall census of the vertebrate fauna recorded within the Study Area, the recent terrestrial survey by Cumberland Ecology (2019b) also targeted several of the threatened species predicted to occur.

3.4.3. Habitat Modelling

The threatened or migratory species for which habitat was modelled have habitat requirements that are either broad, or specific. Some species, such as the Northern Quoll (*Dasyurus hallucatus*) occur within all terrestrial habitats on the island. Others such as Mertens' Water Monitor (*Varanus mertensi*) are much more specific in their preference for habitats, and are known to forage along streams and in riparian vegetation.

The most recent DENR vegetation mapping, in conjunction with field observations, and desktop review, is considered adequate to provide a basis for the habitat types within the Study Area.

4. Results: Overview of Environmental Values

This chapter provides an overview of the environmental values of the Study Area and surrounds, including information on landform, geology, soils, land systems, hydrology and vegetation.

4.1. Geology

Groote Eylandt was formed on a stable basement of Proterozoic quartzite. This basement quartzite forms extensive elevated outcrops in the centre of the island.

A blanket of Cretaceous marine sediments was subsequently deposited over the paleosurface of basement and reworked basement materials in the west of the island. The distribution of the Cretaceous marine sediments is generally confined to the western plains and valleys of the island. The upper Cretaceous sediments contain the manganese ore.

The manganese ore is a sedimentary layer, consisting of manganese strata occurring between clay and sand beds.

Much of the Cretaceous sediment profile (including some of the manganese ore) has been extensively modified by a long period of tropical weathering (or laterisation) during the Tertiary period. This has resulted in the development of thick laterite profiles up to 25 m thick.

The surface geology of the Study Area is shown in **Figure 5**, and includes Quaternary sediments, Tertiary laterite/lateritic clay, Cretaceous sediments and Proterozoic sediment (which represents the geological basement in this area). The surface geology strongly influences vegetation composition across the Study Area, as the geological surface erodes to provide sandy, relatively infertile soils, typically suitable only for native vegetation types, such as Eucalypts, Melaleucas and Cypress.

4.2. Soils

Broad scale soils mapping for the Study Area is shown in **Figure 6**, and **Table 2** provides a summary of the three soil mapping units occurring within the Study Area. The soil mapping indicates that the Study Area is predominatly plains of sandy yellow earths with some gravels. A sandstone plateau with large areas of bare rock outcropping and sandy soils is located toward the central and eastern portions of the Study Area. Coastal soils are located near the western and southern boundaries of the Study Area in proximity to the coastline.

Table 2 Soil units recorded within the Study Area

Unit	Description	Study Area	
		Area (ha)	%
AC15	Plains with some incised streams and some flat valleys and spillways subject to local flooding: chief soils are yellow earthy sands with sandy yellow earths, both may contain some ironstone gravels.	15,006.4	57.6
BA10	Dissected sandstone plateau of high, stony, often steep-sided hills; large areas of bare rock outcrop: chief soils are shallow gritty and stony sands.	9,778.0	37.5

Unit	Description	Study Area	
		Area (ha)	%
B34	Coastal dune systems generally consolidated but with many mobile areas; sometimes with a central core of limestone or ancient coral: chief soils are siliceous sands.	1,278.6	4.9
Total		**26,063**	**100**

4.3. Land Systems

Land systems within the NT have been mapped and described by the NT Department of Land Resource Management (Lynch et al. 2012). Ten land systems are recognised in the Study Area as detailed in **Table 3** and the extent of the land systems is shown in **Figure 7**. The land systems support different types of vegetation, and provide important habitat for a broad range of plant and animal species.

Table 3 Land systems within the Study Area (Lynch et al. 2012)

Landform	Indicated Soil Types	Vegetation
Coastal parabolic dunefields Land System: Bartalumba	Siliceous sands	Tall open shrubland of *Acacia torulosa, Calytrix exstipulata, Bossiaea bossiaeoides* over *Triodia microstachya, Chrysopogon elongatus* and *Sorghum* spp
Beach ridge plains and chenier plains Land System: Blue Mud	Deep siliceous sands and shelly lithosols	Mid high open woodland (*Acacia auriculiformis, Acacia hemignosta, Melaleuca nervosa* and *Casuarina equisetifolia*)
Sandy colluvial footslopes below elevated quartz sandstone plateaux Land System: Bundah	Siliceous sands and shallow sandy skeletal soils	Tall open woodland of *E. tetrodonta, E. miniata, Callitris intratropica, C. polycarpa* over tropical tall grass (*Heteropogon triticeus, Chrysopogon fallax, Sorghum* spp)
Gently undulating sand plains in coastal areas Land System: Dalumbu	Siliceous sands	Low open woodland of *Melaleuca nervosa, C. polycarpa, Acacia auriculiformis, Grevillea pteridifolia* over a mid-dense grass cover (*Triodia microtheca, Sorghum* spp, *Germania grandifolia*)
Level to gently undulating alluvial floodplains of dominantly sandy alluvium Land System: Effington	Uniform gradational and texture contrast sandy soils	Mid-high woodland of *Melaleuca viridiflora, C. polycarpa, Melaleuca nervosa, E. bigalerita, C. latifolia* over *Chrysopogon fallax, Pseudopogonatherum spinescens, Eriachne triseta*
Rugged dissected plateaux on quartz sandstone Land System: Groote	Bare rock and shallow lithosols	Mid-high open woodland of *E. tetrodonta, C. ferruginea, E. miniata, C. bleeseri, E. tectifica* over a sparse to mid-dense grass

Landform	Indicated Soil Types	Vegetation
		cover (*Heteropogon triticeus, Chrysopogon fallax, Sorghum* spp)
Level tidal flats with channels and estuaries and minor dunes Land System: Littoral 1	Saline muds and grey cracking clays	Samphire, sedgeland, or mangrove low closed forest
Gently undulating sandplains Land System: Queue	Deep red earthy sands	Mid-high woodland of *E. tetrodonta, E. miniata, C. bleeseri, Callitris intratropica* over tall tropical grass (*Heteropogon triticeus*, *Chrysopogon fallax*, *Sorghum* spp)
Gently undulating coastal sand plains with parabolic dunes Land System: Umbakumba	Siliceous sands	Tall open shrubland to low open woodland of *Acacia torulosa*
Level to gently undulating plains Land System: Yarrawirrie	Red earths and red siliceous sands	Low open woodland of dwarfed *E. tetrodonta* over *Chrysopogon fallax, Setaria apiculata*, *Schizachyrium fragile*

4.4. Hydrology

The Study Area includes the catchments of the Emerald, Yanbakwa, Amagula, Innokumanja and Mayimokumanja Rivers, and Salt Creek. The major waterways in the Study Area are shown in **Figure 8**.

4.5. Vegetation

The vegetation across the entire Study Area comprises remnant vegetation, and there has been little clearing of vegetation. Overall the vegetation is in very good condition and it is characterised by a high species and structural diversity, although the structure of the understorey and the condition of the ground layer has been modified by a frequent fire regime. Very few weeds occur within the Study Area.

Due to the remnant vegetation status of the entire Study Area, and the absence of broad scale vegetation clearing, habitat connectivity in the landscape is excellent and unbroken throughout. The Study Area provides linkages with remnant vegetation on all sides that can be utilised by fauna species to connect to adjacent areas of habitat. The Study Area provides a range of habitats for fauna species, including watercourses and wetlands, rocky outcrops and extensive areas of woodland.

The Study Area is regularly burnt by the Traditional Owners, which has resulted in a reduction in the amount of woody debris, and is also likely to have affected the species composition and structure of the vegetation. Some species are highly sensitive to changes in fire regime, and it is likely that this may have influenced the suite of species that are present within the Study Area.

4.6. Land Uses

The land within and surrounding the Study Area comprises natural bushland. No farming or agriculture activities are undertaken in the vicinity of the Study Area; however, the vegetation is regularly burnt by the

Traditional Owners. With the exception of access roads/tracks, the 2016 and 2019 exploration areas, and outstations, there are few existing forms of anthropogenic disturbances within the Study Area.

5. Results: Flora

This chapter provides an overview of the flora of the Study Area and surrounds, including information on vegetation communities, general flora species and threatened flora species.

5.1. Vegetation Communities

The vegetation community patterns within the Study Area strongly reflect the geology, soils, topography, and the impacts of frequent fires. Rocky sandstone hills are often sparsely vegetated by woodlands (depending on the depth of soil formed on the sandstone), but also include open forests, shrublands and grasslands. Gently undulating, well-drained sand plains are typically forested. On flatter, low relief areas, forests give way to woodlands, swamps and sedgelands (depending on drainage). *Callitris intratropica* (Northern Cypress Pine) forms thickets in places and are prevalent where the sand plains meet the rocky hillsides. Riparian forests and woodland occur along permanent and seasonal streams and adjacent floodplains including seasonal wetlands. Rainforests and vine thickets occur in areas protected from fires and as such are generally found adjacent to streams, soaks and springs, in protected rocky sites, and in the lee of sand dunes. Coastal vegetation varies in structure depending on the degree of coastal exposure and occurs near the western and southern boundaries of the Study Area in proximity to the coastline, including tidal flats near the western boundary.

The most extensive vegetation communities within the Study Area comprise open woodlands to open forests dominated by *Eucalyptus tetrodonta* (Darwin Stringybark), which occur on both gently undulating sandy and lateritic soils, as well as within rocky sandstone areas. Within sandy and lateritic areas, *Eucalyptus miniata* (Darwin Woollybutt) is locally common in some areas and more rarely *Corymbia polycarpa* (Long-fruited Bloodwood). Alluvial woodlands also include *Corymbia bella* (Ghost Gum), *Corymbia polycarpa* (Long-fruited Bloodwood) and *Eucalyptus bigalerita* (Northern Salmon Gum). *Eucalyptus miniata* (Darwin Woollybutt) also occurs within rocky sandstone areas, along with *Callitris intratropica* (Northern Cypress Pine), *Corymbia polycarpa* (Long-fruited Bloodwood) and *Corymbia kombolgiensis* (Scarp Gum). *Melaleuca*-dominated vegetation occurs within the riparian zones and wetlands within the Study Area, and is often dominated by *Melaleuca viridiflora* (Broad-leaved Paperbark) and/or *Melaleuca cajuputi* (Swamp Tea Tree), with *Pandanus spiralis* (Common Screwpine) being common in the midstorey. Coastal areas within the Study Area comprise a mix of mangroves, shrublands, grasslands, sedgelands, monsoon forest and Melaleuca-dominated dune swales. Monsoon forests also occur inland in sheltered riparian or seepage locations.

Vegetation mapping of the Study Area has been undertaken by DENR (2018 updated mapping), which identified over 100 individual VMUs or combination VMUs. Combination VMUs are represented by areas where two VMUs are intermingled and therefore are unable to readily split into discrete areas. The first VMU listed in a combination VMU represents the dominant VMU. A detailed list of the individual VMUs or combination VMUs occurring within the Study Area is provided in **Appendix C**.

Due to the complexity of vegetation mapped by DENR which has resulted in a high number of VMUs and combination VMUs, the units have been grouped together to form broad vegetation types based on consultation and endorsement from DENR. For combination VMUs, the assigned broad vegetation type is representative of the dominant VMU. **Table 4** summarises the broad vegetation types within the Study Area. The broad vegetation types for the Study Area are shown in **Figure 9**. Detailed vegetation profiles are currently being prepared by DENR and are therefore not included within this report.

Table 4 Broad vegetation types within the Study Area

Broad Vegetation Types	Corresponding VMUs	Study Area		Stage 2 Exploration Program Area	
		Area (ha)	%	Area (ha)	%
1: Mangrove	1	148.2	0.6	-	-
2: Spring closed forest (rainforest)	4, 6, 49	134.3	0.5	-	-
3: Dry closed forests or thickets (rainforest) on sand or sandstone	2, 62	93.9	0.4	-	-
4: Riparian and gully closed forests with mixed canopies (rainforest and Melaleuca spp.)	5, 18	93.1	0.4	-	-
5: Eucalypt open forests of lowlands and deeper sandy soils derived from sandstone or deeply weathered parent rocks (lateritic)	10, 10a, 12, 24, 31	4,881.4	18.7	4.5	11.31
6: Eucalypt open forests on Quaternary sands	31a	416.2	1.6	0.1	0.34
7: Eucalypt open forests and woodlands of sandstone uplands	10b, 11	4,624.5	17.7	12.4	30.89
8: Callitris open forest	15	80.6	0.3	<0.0	0.12
9: Melaleuca open forests on alluvial plains and drainage systems	17, 19	1,012.5	3.9	1.1	2.61
10: Melaleuca swamps	22, 23	110.2	0.4	-	-
11: Eucalypt woodlands and open woodlands of lowlands with sandy soils	40, 40a, 59	2,478.9	9.5	10.9	27.17
12: Eucalypt woodland and open woodlands on shallow soils associated with basement geologies	13, 29b, 40b, 48, 53	3,626.0	13.9	-	-
13: Eucalypt woodlands on alluvial soils	42, 45, 51, 51a, 51c	2,113.7	8.1	8.3	20.73
14: Eucalypt woodland on quaternary sands	50	43.1	0.2	-	-
15: Callitris woodland and open woodland	41	742.3	2.8	-	-
16: Melaleuca woodlands on alluvial soils (wet)	26, 28, 44, 52, 54, 55, 55a, 55b	1,005.8	3.9	0.6	1.40
17: Melaleuca woodlands on sandy soils (dry)	27a, 27b	281.6	1.1	0.1	0.26
18: Melaleuca open woodlands on alluvial soils (wet)	43, 61	781.2	3.0	1.5	3.68

Broad Vegetation Types	Corresponding VMUs	Study Area		Stage 2 Exploration Program Area	
		Area (ha)	%	Area (ha)	%
19: Melaleuca open woodlands on sandy soils (dry)	60	73.9	0.3	-	-
20: Eucalypt low open woodland	46	137.2	0.5	0.6	1.48
21: Shrublands on quaternary sand	72, 73	188.0	0.7	-	-
22: Sandstone shrublands	70	258.1	1.0	-	-
23: Acacia thickets etc. on sand or sandstone	57	180.3	0.7	-	-
24: Tussock grasslands on alluvial soils or relict marine plains	81, 81a	7.4	<0.0	-	-
25: Tussock grasslands on Quaternary sand	82a	8.1	<0.0	-	-
26: Sedge wetlands	80, 81b, 84, 88	59.9	0.2	-	-
28: Hummock grassland on sandstone (or minor basalt)	86	35.5	0.1	-	-
29: Saline tidal flats and shrublands	75, 100	123.1	0.5	-	-
33: Cleared/disturbed/regrowth	202	1.7	<0.0	-	-
34: Water/ocean	500	2.5	<0.0	-	-
36: Eucalypt and/or Melaleuca open forest/vine thicket complex	20, 21, 30	2,310.5	8.9	-	-
Unmapped[1]	-	9.3	<0.0	-	-
Total[2]		**26,063**	**100**	**40**	**100**

1. A few sections of rivers have been unmapped by DENR.

2. In some cases totals may not equal the appropriate total number due to rounding.

5.2. Threatened Ecological Communities

The EPBC Act PMST did not record any TECs as occurring or potentially occurring within a 20 km radius of the centre of the Study Area (see **Appendix A**). The map of EPBC Act listed TECs in the NT (DSEWPaC 2013) does not show the occurrence of any TECs within the Study Area, or Groote Eylandt.

Only one ecological community that occurs in the NT is listed as Endangered under the Commonwealth EPBC Act. This is the *Arnhem Plateau Sandstone Shrubland Complex*, however this TEC does not occur on Groote Eylandt.

Considering the above, it is concluded that no TECs occur in the Study Area. TECs are therefore not considered or assessed further in this report.

There is currently no mechanism for listing TECs under NT legislation. Therefore, the TPWC Act does not contain listings for TECs and are therefore not assessed further in this report.

5.3. Flora Species: Overview

Over 120 plant species were previously recorded within the north western portion of the Study Area by Cumberland Ecology (2016). The data indicated that the floristic assemblage across the north western portion is very similar to the assemblage recorded in the Eastern Leases (Cumberland Ecology 2015) and is well represented by Poaceae (grasses), Fabaceae (acacias and peas), Cyperaceae (sedges) and Myrtaceae (*Eucalyptus spp.* and *Melaleuca spp.*). A list of flora species that have been recorded within the Study Area by Cumberland Ecology (2016) is presented in **Appendix E**.

Given that the Study Area comprises a much larger area of land and a much higher diversity of vegetation types, the number of flora species is likely to be significantly greater.

5.3.1. Declared Weeds

No declared weeds were recorded within the Study Area during recent terrestrial field surveys, or during subsequent pre-clearance surveys. The Study Area has been relatively unaffected by anthropogenic activities. The vegetation within the Study Area is therefore considered to be unaffected by weeds.

The NR Maps database (DNRM 2020) holds a number of records within the existing GEMCO mine, such as *Jatropha gossypiifolia* (Bellyache) and *Themeda quadrivalvis* (Grader Grass) which are highly mobile. Weeds recorded by Cumberland Ecology (2020) outside of the Study Area included *Hyptis suaveolens* (Hyptis), *Stachytarpheta cayennensis* (Snakeweed) and *Sida cordifolia* (Flannel Weed). A number of declared weeds have also previously been recorded within GEMCO's existing mining tenement including *Cenchrus echinatus* (Mossman River Grass), *Cenchrus polystachios* (Mission Grass), *Senna obtusifolia* (Sicklepod) and *Sida acuta* (Spinyhead Sida) (URS Australia Pty Ltd 2012). Weeds that are more common in the existing mining tenements include *Hyptis suaveolens*, *Passiflora foetida* (Stinking Passionflower), *Urochloa mosambicensis* (Sabi Grass) and *Stylosanthes* spp. (the Stylos) (Addison 2013).

5.4. Flora Species: Threatened Species

No threatened flora species were recorded within the Study Area during terrestrial surveys undertaken by Cumberland Ecology (2016, 2019b).

An analysis of ecological databases was conducted for the Study Area and its surrounds, including interrogation of the DAWE EPBC PMST (DAWE 2020f), and NR Maps search facility (DNRM 2020) for threatened flora records. The results of the PMST search is presented in **Appendix A**, and the records held within the NR Maps database are shown on **Figure 10**.

Database records identified the presence of one threatened flora species on Groote Eylandt, namely *Hernandia nymphaeifolia* (Lantern Tree). *Hernandia nymphaeifolia* (Lantern Tree) is listed as Vulnerable under the TPWC Act only. The location of the records of this species held within the NR Maps database across Groote Eylandt are shown on **Figure 10**. There are three records, all of which were found on the north-east coast of Groote Eylandt.

No records of this species occur within the locality, however it has been retained within this assessment as Cumberland Ecology (2019c) identified a moderate likelihood of occurrence within the Study Area. A likelihood of occurrence assessment was undertaken for *Hernandia nymphaeifolia* (Lantern Tree) to determine if it has the potential to occur within the Stage 2 exploration program area. The likelihood of this species occurring was classified using the criteria presented in **Table 1**. The assessment was based on the species known range, number and age of records, and habitat preferences which were evaluated considering site characteristics observed during the field surveys. The full results of this likelihood of occurrence assessment are presented in **Appendix D**. A summary of *Hernandia nymphaeifolia* (Lantern Tree) species and its occurrence within the Study Area is provided below.

Hernandia nymphaeifolia

EPBC Act Status: Not listed

TPWC Act Status: Vulnerable

Species Overview

Hernandia nymphaeifolia (Lantern Tree) is a shrub or tree 5-22 m high (Kerrigan and Cowie 2006). This species is known to occur exclusively in coastal areas, along the seashore in littoral rainforest and in coastal swamps (Kerrigan and Cowie 2006). This species occurs throughout the tropics, however in the NT, it is only known from Groote Eylandt and north-east Arnhem Land (Kerrigan and Cowie 2006).

Presence and Habitat within the Stage 2 exploration program area and Study Area

Hernandia nymphaeifolia (Lantern Tree) was not recorded during recent terrestrial surveys by Cumberland Ecology (2016, 2019b). The NR Maps database holds a number of records of this species occurring on the north-eastern coast of Groote Eylandt, with the last record being from 1988 (see **Figure 10**).

Areas of coastal habitat occur near the western and southern boundaries of the Study Area, which may provide suitable habitat for *Hernandia nymphaeifolia*. This species is therefore considered to have a moderate likelihood of occurrence in this coastal habitat area. However, the remainder of the Study Area, including the Stage 2 exploration program area, does not contain coastal habitat, and is considered unsuitable for this species.

6. Results: Fauna

This chapter provides an overview of the fauna of the Study Area and surrounds, including information on fauna habitats, general fauna species and threatened fauna species.

6.1. Fauna Habitats

The Study Area contains extensive areas of remnant vegetation which provide a range of habitats for fauna species. The matrix of fauna habitats within the Study Area occur within the various vegetation communities, topographical formations and water resources (permanent and ephemeral). The habitat features are numerous and provide potential foraging, shelter and breeding opportunities for a suite of fauna species. Key habitats identified within the Study Area include:

- Closed forest (rainforest) habitats;
- Laterite woodland and forest habitats;
- Sandstone woodland and forest habitats;
- Coastal dune/swale complex habitats;
- Riparian/wetland habitats; and
- Estuarine complex habitats.

The extent of these habitats within the Study Area is summarised in **Table 5** and shown in **Figure 11**. Each of these habitats is discussed below.

Table 5 Fauna habitats within the Study Area

Habitat Type	VMUs[1]	Study Area		Stage 2 Exploration Program Area	
		Area (ha)	%	Area (ha)	%
Closed forest (rainforest) habitats	2, 4, 5, 6	227.0	0.9	-	-
Laterite woodland and forest habitats	10 (part), 10a (part), 10b (part), 11 (part), 12 (part), 13 (part), 15 (part), 27a, 30 (part), 31, 31a (part), 40 (part), 40a, 41 (part), 42 (part), 45 (part), 46, 47, 48 (part), 51, 51a, 51c (part), 53, 59	13,816.2	53.0	35.6	88.51
Sandstone woodland and forest habitats	10 (part), 10a (part), 10b (part), 11 (part), 12 (part), 13 (part), 15 (part), 29b, 40 (part), 40b (part), 41 (part), 42 (part), 45 (part), 48 (part), 49, 51c (part), 70, 86	6,850.3	26.3	-	-
Coastal dune/swale complex habitats	27b (part), 28 (part), 30 (part), 31a (part), 32, 40b (part), 48 (part), 50,	989.6	3.8	-	-

Habitat Type	VMUs[1]	Study Area		Stage 2 Exploration Program Area	
		Area (ha)	%	Area (ha)	%
	55a (part), 57, 60 (part), 61 (part), 62, 72, 73, 82a,				
Riparian/wetland habitats	17, 18, 19, 20, 21, 22, 23, 26, 27b (part), 28 (part), 43, 44, 45 (part), 52, 54, 55, 55a (part), 55b, 60 (part), 61 (part), 84, 500, water	3,849.8	14.8	4.6	11.49
Estuarine complex habitats	1, 75, 80, 81, 81a, 81b, 88, 100	319.0	1.2	-	-
Cleared	202	1.7	<0.0	-	-
Total[2]		**26,054**	**100**	**40**	**100**

1. VMUs comprising more than one habitat type are labelled as '(part)' (see Section 3.3.2).

2. In some cases totals may not equal the total number due to rounding.

6.1.1. Closed Forest (Rainforest) Habitats

True closed forest (rainforest) habitats cover less than 1% of the Study Area (**Table 5**). This habitat type is present at a number of scattered locations within the Study Area, including within coastal and inland areas (**Figure 11**). No areas of closed forest are mapped within the Stage 2 exploration program area.

The relative rarity of rainforest in the Study Area is, to a large extent, due to the prevalence of fires, which regularly impact most of the island. Closed forest (rainforest) habitats occur in restricted unburnt areas, at the coastal fringe and along some inland riparian areas. Some other areas of vegetation within the Study Area contain elements of rainforest in the understorey, however these have not been included in the closed forest (rainforest) habitat type as they do not form closed forests. At coastal locations, closed forest (rainforest) habitats occur in sheltered areas just beyond the coastal dune/swale complex habitats. At inland locations, closed forest (rainforest) habitats occur at sheltered locations in proximity to the larger watercourses where the stream flow is perennial, in spring-fed areas associated with sandstone plateaus, and in areas fed by seepage from adjacent wetlands.

Closed forest includes canopy of *Pouteria sericea* (Wild Prune), *Diospyros maritima* (Sea Ebony), *Aglaia brownii* (Coastal Boodyarra), *Drypetes deplanchei* (Yellow Tulipwood), *Celtis philippensis* (Celtis), *Alstonia actinophylla* (Milkwood), *Canarium australianum* (Mango Bark) and *Melaleuca leucadendra* (Cajeput Tree), some of which form large hollows. As closed forest is associated with moderate to high moisture (or mesic) conditions and reliable water, it is likely to support a different assemblage of fauna to other habitats in the Study Area.

Fauna species recorded during recent terrestrial surveys by Cumberland Ecology (2016, 2019b) within this habitat type included the Northern Brown Bandicoot (*Isoodon macrourus*), Grassland Melomys (*Melomys burtoni*), Agile Wallaby (*Macropus agilis*), Water Rat (*Hydromys chrysogaster*), Orange-footed Scrubfowl

(*Megapodius reinwardt*), Emerald Dove (*Chalcophaps indica*), Sand Goanna (*Varanus gouldii*) and Short-beaked Echidna (*Tachyglossus aculeatus*).

Features of this habitat type are summarised in **Table 6**, and a photograph of the closed forest (rainforest) habitat within the Study Area is shown in **Photograph 1**.

Table 6 Features of close forest (rainforest) habitats within the Study Area

Feature	Comment
Close forest (rainforest) area	Less than 1% of Study Area Does not occur within the Stage 2 exploration program area
Physiographic location	Small pockets protected from fires, coastal areas, riparian areas, spring-fed areas, seepage areas
Soils	High proportion of surface rocks and gravel, with organic material and debris on the rock surface
Water	Associated with permanent water, shallow groundwater, spring-fed locations, seepage areas
Fire	Unburnt
Tree hollows and fallen logs	Large trees with hollows typically present
Key microhabitats	Forest canopy, supporting a diversity of tree and liana types (i.e. long-stemmed woody vines that are rooted in the soil at ground level, and which utilise the trees in order to climb up to the canopy)
Values for wildlife	Sheltered, constant microclimate, diversity of plant food resources, hollow-bearing trees

Photograph 1 Closed forest (rainforest) habitat within the Study Area (August 2017)

6.1.2. Laterite Woodland and Forest Habitats

Laterite woodland and forest habitats cover approximately 53% of the Study Area (**Table 5**). This habitat type dominates the western half of the Study Area and also occurs extensively within the eastern half (**Figure 11**). This habitat type is the dominant habitat type within the Stage 2 exploration program area.

This habitat type is associated with the undulating laterite plains within the Study Area. This habitat type varies structurally between open woodland and open forest. At some locations, which are likely in areas where the water table is close to the surface, the canopy stratum is expressed as a shrub layer of stunted or regenerating trees. Laterite woodland and forest habitats are typically dominated by a canopy of *Eucalyptus tetrodonta,* with *Eucalyptus miniata* being locally common at some locations. *Eucalyptus polycarpa* and *Eucalyptus tectifica* also occur within this habitat type. Areas of this habitat type are frequently burnt by the Traditional Owners.

The extensive areas of laterite woodland and forest habitats provide numerous important habitat features that would be suitable for a suite of fauna species, including a number of the threatened fauna known or predicted to occur within the Stage 2 exploration program area (see ***Section 6.3***). Habitat features within this habitat type include a diversity of grasses for seed-eating species, a shrubby understorey for birds and taller eucalypt trees. Hollow bearing trees of varying sizes are present in these areas, however these features are largely absent from low open woodlands. The tree hollows and stags within the Study Area provide shelter, roosting and nesting habitat for a number of arboreal fauna species, including microbats and gliders, diurnal birds, owls and some reptiles. Terrestrial features such as fallen logs, debris and leaf litter provide shelter for many of the

small to medium sized terrestrial fauna species known from the Study Area (see ***Section 6.2***). However, there is also a paucity of coarse woody debris on the ground due to the frequency of fire.

Fauna species recorded within this habitat type during recent terrestrial surveys by Cumberland Ecology (2016, 2019b) included the Northern Quoll (*Dasyurus hallucatus*), Northern Brown Bandicoot (*Isoodon macrourus*), Delicate Mouse (*Pseudomys delicatulus*), Sand Goanna (*Varanus gouldii*), Gilbert's Dragon (*Lophognathus gilberti*), Frilled Lizard (*Chlamydosaurus kingii*), Torresian Crow (*Corvus orru*) and Australian Owlet-nightjar (*Aegotheles cristatus*). Feral cats (*Felis catus*) were also recorded within this habitat type.

Features of this habitat type are summarised in **Table 7**. An example of laterite woodland and forest habitat within the Study Area is shown in **Photograph 2**.

Table 7 Features of laterite woodland and forest habitats within the Study Area

Feature	Comment
Laterite woodland and forest area	Covers approximately 53% of Study Area Covers approximately 89% of Stage 2 exploration program area
Physiographic location	Gently undulating lateritic plains
Soils	Dark brown to reddish brown loamy sands (open forests) and brownish black loamy sands to whitish/red sands (open woodland). Some areas with gravel present
Water	Well drained, relatively dry habitats. Some areas of low open woodland may be associated with shallow groundwater or seasonal flooding
Fire	Frequently and extensively burnt (annually or biennially)
Tree hollows and fallen logs	Large trees with hollows and fallen logs typically present
Key microhabitats	Woodland or forest canopy, subcanopy, shrub layer and grassy ground stratum well developed
Values for wildlife	- Diverse array of plant food resources, hollow-bearing trees, fallen logs, termite mounds - Some woodland has well developed grass and sedge areas

Photograph 2 Laterite woodland and forest habitat within the Study Area (May 2018)

6.1.3. Sandstone Woodland and Forest Habitats

Sandstone woodland and forest habitats cover approximately 26% of the Study Area (**Table 5**). This habitat type dominates the north eastern half of the Study Area (**Figure 11**). This habitat type is absent from the Stage 2 exploration program area.

This habitat type is associated with the sandstone plateaus and rocky outcropping within the Study Area and is characterised by the presence of numerous rocky outcrops with extensive areas of bare rock. This habitat type is predominantly a woodland and forest structure, with some small areas of shrubland and grassland also present. Sandstone woodland and forest habitats have a mixed canopy and include *Eucalyptus tetrodonta*, *Eucalyptus kombolgiensis*, *Callitris intratropica* and *Corymbia polycarpa*. *Cycas arnhemica* is also common within this habitat type.

These areas provide high quality habitat for mammals and reptiles (shelter habitat in the form of rocky outcrops, rock slabs, cracks, crevices, and caves). Sandstone woodland and rock outcrops are considered to provide high quality habitat for the Northern Quoll (*Dasyurus hallucatus*), in particular for denning and shelter.

Fauna species recorded within this habitat type during recent terrestrial surveys by Cumberland Ecology (2016, 2019b) included the Northern Quoll (*Dasyurus hallucatus*), Northern Brown Bandicoot (*Isoodon macrourus*), Delicate Mouse (*Pseudomys delicatulus*), Short-eared Rock-wallaby (*Petrogale brachyotis*), Common Rock-rat (*Zyzomys argurus*), Common Sheathtail-bat (*Taphozous georgianus*), Olive Python (*Liasis olivaceus*) Short-

beaked Echidna (*Tachyglossus aculeatus*), Black-headed Monitor (*Varanus tristis*) and Australian Owlet-nightjar (*Aegotheles cristatus*). Feral cats (*Felis catus*) were also recorded within this habitat type.

Features of this habitat type are summarised in **Table 8**. An example of the sandstone woodland and forest habitat in the Study Area is shown in **Photograph 3**.

Table 8 Features of sandstone woodland and forest habitats within the Study Area

Feature	Comment
Sandstone woodland and forest area	Covers approximately 26% of Study Area Does not occur within the Stage 2 exploration program area
Physiographic location	Sandstone hills, plateaus and rocky outcropping
Soils	Shallow, if non-existent, gravelly and often rocky clayey sand over quartz sandstone with minor Leptic Rudosols
Water	Water is scarce - though may be present amid deeper rock outcrops
Fire	Relatively unburnt
Tree hollows and fallen logs	Few trees with hollows typically present
Key microhabitats	Various shelters amid rocks including crevices, caves and boulder piles
Values for wildlife	Rocky shelters providing refugia from heat and fire, diversity of plant food resources

Photograph 3 Sandstone woodland and forest habitat within the Study Area (May 2016)

6.1.4. Coastal Dune/Swale Complex Habitats

Coastal dune/swale complex habitats cover approximately 4% of the Study Area (**Table 5**). This habitat type occurs along the southern and south-western boundaries of the Study Area (**Figure 11**). This habitat type is absent from the Stage 2 exploration program area.

This habitat type is associated with the coastal sand plains and is characterised by a dune and swale complex. Whilst this habitat type is associated with the coastline, it extends inland in some areas up to 3.5 km from the coast. This habitat type is variable in structure, with dunes often comprising grassland and shrubland with bare sand, and swales often comprising *Melaleuca* dominated woodland and forest. Grasslands and shrublands included both hummock and perennial grassland, and a shrub layer of *Acacias*, *Melaleucas*, *Grevillea heliosperma* (Rock Grevillea) and *Terminalia carpentariae* (Wild Peach). Woodlands and forests included a mixed canopy of *Melaleuca dealbata* (Blue-leaved Paperbark), *Melaleuca ferruginea* (Paperbark) and *Melaleuca cajuputi* (Cajuput Tree).

These habitats contained limited terrestrial features such as trees with hollows and hollow logs. Some areas contained significant dieback of trees and shrubs. Ground cover is generally sparse, with bare ground common throughout the habitat type.

Fauna species recorded within this habitat type during recent terrestrial surveys by Cumberland Ecology (2019b) included the Delicate Mouse (*Pseudomys delicatulus*), Northern Quoll (*Dasyurus hallucatus*), Northern Brown Bandicoot (*Isoodon macrourus*), Gilbert's Dragon (*Lophognathus gilberti*), Short-beaked Echidna (*Tachyglossus aculeatus*), Torresian Crow (*Corvus orru*) and Pheasant Coucal (*Centropus phasianinus*). Feral cats (*Felis catus*) were also recorded within this habitat type.

Features of this habitat type are summarised in **Table 9**. An example of the woodland form and shrubland form of the coastal dune/swale complex within the Study Area are shown in **Photograph 4** and **Photograph 5**, respectively.

Table 9 Features of coastal dune/swale complex habitats within the Study Area

Feature	Comment
Coastal dune / swale complex area	Covers approximately 4% of Study Area Does not occur within the Stage 2 exploration program area
Physiographic location	Gently undulating coastal sand plains with dunes and swales
Soils	Siliceous sands
Water	Water is generally scarce, although during the wet season will be held in swales
Fire	Relatively unburnt
Tree hollows and fallen logs	Few trees with hollows typically present
Key microhabitats	- Sheltered areas within woodland and forest - Open areas for foraging

Feature	Comment
Values for wildlife	Array of plant food resources

Photograph 4 Coastal dune/swale complex habitat (woodland) within the Study Area (August 2017)

Photograph 5 Coastal dune/swale complex habitat (shrubland) within the Study Area (May 2018)

6.1.5. Riparian/Wetland Habitats

Riparian/wetlands habitats cover approximately 15% of the Study Area (**Table 5**). This habitat type is interspersed throughout the Study Area (**Figure 11**). It occurs at some discrete locations within the Stage 2 exploration program area.

This habitat type is associated with watercourses within the catchments of the Emerald, Yanbakwa, Amagula, Innokumanja and Mayimokumanja Rivers, and Salt Creek. The majority of the riparian habitat within the Study Area is represented by ephemeral watercourses that only flow when sufficient rain has fallen. These flow during the wet season, however all but the deepest pools dry out during the dry season. This habitat type also includes seasonal wetlands within the Study Area, which form in the wet season and dry out over the course of the dry season. Riparian/wetland habitats are typically dominated by *Melaleuca viridiflora* (Broad-leaved Paperbark) and or *Melaleuca cajuputi* (Cajuput Tree), and often includes a dense shrub layer with sedges also common in the ground layer. Areas of this habitat type are occasionally burnt by the Traditional Owners, with wetter areas being less easily burnt.

The riparian/wetland areas provide numerous habitat features that would be suitable for a suite of fauna species. Habitat features within this habitat type include a diversity of grasses for seed-eating species, a shrubby understorey for birds and taller eucalypt trees. Hollow bearing trees of varying sizes are present in the structurally diverse riparian areas. The tree hollows provide shelter, roosting and nesting habitat for a number of fauna species. The riparian areas contain woody debris, standing trees, macrophytes and fringing

vegetation such as reeds and rushes. They are likely to provide suitable habitat for a range of amphibians and waterbirds, including migratory wetland birds. Any freshwater habitats occurring within the Study Area would be restricted mainly to remnant pools isolated by dry river or stream beds. These temporary pools of water would provide a valuable drinking source in hot and dry months. The seasonal wetlands form short-lived seasonal swamps supporting sedges, rushes and grasses.

Fauna species recorded within this habitat type during recent terrestrial surveys by Cumberland Ecology (2016, 2019b) included the Northern Brown Bandicoot (*Isoodon macrourus*), Agile Wallaby (*Macropus agilis*), Grassland Melomys (*Melomys burtoni*), Gilbert's Dragon, Sand Goanna (*Varanus gouldii*), Torresian Crow (*Corvus orru*), Peaceful Dove (*Geopelia striata*) and Buff-banded Rail (*Gallirallus philippensis*).

Features of this habitat type are summarised in **Table 10**. An example of riparian habitat and a seasonal wetland within the Study Area is shown in **Photograph 6** and **Photograph 7**, respectively.

Table 10 Features of riparian/wetland habitats within the Study Area

Feature	Comment
Area	Covers approximately 15% of Study Area Covers approximately 11% of the Stage 2 exploration program area
Physiographic location	Along watercourses and low-lying depressions
Soils	Brownish black to dark black sandy clay loams to silty loams
Water	Associated with permanent or seasonally flowing watercourses, and seasonally wet depressions
Fire	Larger, perennial sections of watercourses provide protection against fires, but most smaller seasonal watercourses support riparian vegetation that is regularly burnt
Tree hollows and fallen logs	Large trees with hollows present along larger watercourses
Key microhabitats	- Watercourses/water - Forest canopy, supporting a diversity of tree and shrub types - Riparian and aquatic plants present
Values for wildlife	Water resources plus a diversity of plant food resources

Photograph 6 Riparian habitat within the Study Area (May 2016)

Photograph 7 Wetland habitat within the Study Area (May 2016)

6.1.6. Estuarine Complex Habitats

Estuarine complex habitat covers approximately 1% of the Study Area (**Table 5**). This habitat type is located near the south-western boundaries of the Study Area (**Figure 11**). No areas of estuarine complex habitat are mapped within the Stage 2 exploration program area.

This habitat type is associated with tidal flats with channels and estuaries. It is variable in structure and includes mangroves, tidal flats, grassland, shrubland and sedgeland. Most of this habitat type is subject to tidal influences. Mangroves within the Study Area form low closed forests, whilst the other forms within this habitat type are sparsely vegetated. These include samphire/chenopod shrublands, closed tussock grassland, and sedgelands of *Eleocharis* and *Cyperus*. The tidal flats within the Study Area contain extensive areas of bare ground interspersed with saltmarsh, with occasional emergent trees or chenopod shrubs.

Features of this habitat type are summarised in **Table 11**, and a photograph of the coastal habitats within the Study Area is shown in **Photograph 8**.

Table 11 Features of estuarine complex habitats within the Study Area

Feature	Comment
Estuarine complex area	Covers approximately 1% of Study Area Does not occur within the Stage 2 exploration program area
Physiographic location	Along the coastal strand, up to high tide levels
Soils	Marine and estuarine sediments and soils
Water	Influenced by tidal movements and associated with the mouth of an unnamed watercourse
Fire	Grassland vegetation likely to be frequently burnt (annually or biennially)
Tree hollows and fallen logs	Limited trees and fallen logs
Key microhabitats	- Dense understorey in mangrove areas - Well developed ground layer in grassland areas - Open areas for foraging (saltmarsh, clay pans)
Values for wildlife	Array of plant food resources

Photograph 8 Estuarine complex habitat within the Study Area (May 2016)

6.2. Fauna Species: Overview

In total, 96 fauna species have been recorded from the Study Area during the recent terrestrial surveys by Cumberland Ecology (2016, 2019b), including 56 birds, 19 mammals and 21 reptiles. A discussion of the faunal diversity recorded from the Study Area is presented below. A complete list of all the fauna species that have been recorded from the Study Area is presented in **Appendix G**. A suite of other fauna species have been recorded in the vicinity of the Study Area by Heiniger and Gillespie (2017), Cumberland Ecology (2015), URS Australia Pty Ltd (2012) and Webb (1992), the results of which are also presented in **Appendix G**.

6.2.1. Amphibians

No amphibians were recorded within the Study Area, which is considered to be related to the absence of water during surveys undertaken at times suitable for detecting amphibians, and limited targeted surveys.

No threatened amphibians listed under the EPBC Act and/or the TPWC Act have been recorded from the Study Area or from database searches and none are considered likely to occur.

6.2.2. Birds

A range of habitat features suitable for birds occurs throughout the Study Area. A total of 56 bird species were recorded within the Study Area during the recent terrestrial surveys. Due to the broad range of habitats present within the Study Area, it is anticipated that bird diversity is much higher than recorded. Targeted bird surveys

were restricted to the north-western portion of the Study Area within laterite woodland and open forest. Species within other habitats were subsequently detected during camera surveys.

The vast majority of bird species were common and widespread, and typical of woodland environments. Dominant families within the Study Area include Meliphagidae (honeyeaters and friarbirds), Columbidae (pigeons and doves), Accipitridae (raptors) and Rhipiduridae (fantails). Commonly recorded species include Torresian Crow (*Corvus orru*), Australian Owlet-nightjar (*Aegotheles cristatus*), Peaceful Dove (*Geopelia striata*), Bar-shouldered Dove (*Geopelia humeralis*), Brown Honeyeater (*Lichmera indistincta*), Rufous Whistler (*Pachycephala rufiventris*), Striated Pardalote (*Pardalotus striatus*), Silver-crowned Friarbird (*Philemon argenticeps*), White-throated Honeyeater (*Melithreptus albogularis*), Pied Butcherbird (*Cracticus nigrogularis*), Rainbow Lorikeet (*Trichoglossus haematodus*) and Northern Fantail (*Rhipidura rufiventris*).

Only one threatened and/or migratory bird was recorded within the Study Area during recent terrestrial surveys, namely the Masked Owl (northern) (*Tyto novaehollandiae kimberli*). Further discussion of this species is provided in ***Section 6.3***.

6.2.3. Mammals

A total of 19 mammal species were recorded during the recent terrestrial field surveys, including 13 terrestrial species, two non-flying arboreal species and four microbats. Of the mammals species recorded, two are exotic species (dingo/dog and cat) (see ***Section 6.2.5***).

The most common and widespread terrestrial mammals observed within the Study Area included the Northern Brown Bandicoot (*Isoodon macrourus*), Delicate Mouse (*Pseudomys delicatulus*), Northern Quoll (*Dasyurus hallucatus*), Agile Wallaby (*Macropus agilis*), Grassland Melomys (*Melomys burtoni*) and Short-beaked Echidna (*Tachyglossus aculeatus*).

The non-flying arboreal mammals recorded within the Study Area during surveys included the Sugar Glider (*Petaurus breviceps*) and Rock Ringtail Possum (*Petropseudes dahli*). Four microbats were recorded including the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Common Sheathtail-bat (*Taphozous georgianus*), Northern Cave Bat (*Vespadelus caurinus*) and Finlayson's Cave Bat (*Vespadelus finlaysoni*). Ultrasonic call detection results indicated the potential for a further three species of microbats; however, these calls could not be positively identified.

Only one threatened mammal was recorded during recent terrestrial surveys within the Study Area, namely the Northern Quoll (*Dasyurus hallucatus*). Further discussion of this species is provided in ***Section 6.3***.

6.2.4. Reptiles

A range of habitat features suitable for reptiles occurs throughout the Study Area. A total of 21 reptile species were recorded within the Study Area during the recent terrestrial surveys. Due to the broad range of habitats present within the Study Area, it is anticipated that reptile diversity is much higher than recorded.

The dominant family within the Study Area was Scincidae (skinks), with other families present including Varanidae (monitors), Agamidae (dragons) and Elapidae (snakes). Commonly recorded reptiles include Gilbert's Dragon (*Lophognathus gilberti*), Sand Goanna (*Varanus gouldii*), Frilled Lizard (*Chlamydosaurus kingii*),

Two-lined Dragon (*Diporiphora bilineata*), Northern Blue-Tongue Lizard (*Tiliqua scincoides intermedia)* and Bar-shouldered Ctenotus (*Ctenotus inornatus*).

No threatened reptile species have been recorded within the Study Area during recent (2016-2018) field surveys. However, one threatened reptile has been recorded within the Study Area during a survey conducted for the Eastern Leases Project in 2014, namely the Mertens' Water Monitor (*Varanus mertensi*). Further discussion of this species is provided in ***Section 6.3***.

6.2.5. Exotic / Feral Species

Groote Eylandt represents a unique faunal refuge in that exotic and feral species such as feral cattle, horses, donkeys, pigs, goats, Water Buffalo, the Cane Toad and Rusa Deer are not established on the island.

Domestic Dogs (*Canis familiaris*) and Dingoes (*Canis lupus*) were frequently recorded within the Southern Lease. A very small number of Feral Cats (*Felis catus*) were recorded during field surveys. This is consistent with Heiniger et al. (2020) that states there is a low density of Feral Cats on Groote Eylandt. One House Gecko (*Hemidactylus frenatus*) was recorded during spotlighting surveys on sandstone outcropping.

6.3. Fauna Species: Threatened Species

An analysis of ecological databases was conducted for the Study Area and its surrounds, including interrogation of the DAWE EPBC PMST (DAWE 2020f) and NR Maps search facility (DNRM 2020) for threatened fauna records. Database records identified the presence of a number of threatened fauna species or habitat within the locality of the Study Area (defined in this report as a 20 km radius from the centre of the Study Area). Results of the database searches within the locality of the study area for terrestrial threatened fauna species listed under the EPBC Act and/or the TPWC Act are summarised in **Table 12**.

As the locality includes some ocean areas, the search yielded numerous marine species including fish, turtles and marine mammals. These are not relevant to an assessment of terrestrial ecology within the Study Area and are not considered further in this report. The full results of the PMST search is presented in **Appendix A**. The threatened fauna records held within the NR Maps database across Groote Eylandt, including the locality, are shown on **Figure 12**.

A number of threatened fauna species have been recorded within the Study Area during recent studies and their locations are shown on **Figure 13**. In some instances, there were multiple sightings of a particular species at a single location, however only one of these records is shown on the figure.

Table 12 Threatened fauna species database records within the locality

Common Name	Scientific Name	Conservation Status[1]		Database Results	
		EPBC Act[2]	TPWC Act	PMST	NR Maps
Birds					
Red Knot	*Calidris canutus*	E, M(w)	V	X	X
Curlew Sandpiper	*Calidris ferruginea*	CE, M(w)	V	X	X
Great Knot	*Calidris tenuirostris*	CE, M(w)	V		X

Common Name	Scientific Name	Conservation Status[1]		Database Results	
		EPBC Act[2]	TPWC Act	PMST	NR Maps
Greater Sand Plover	*Charadrius leschenaultii*	V, M(w)	V		X
Lesser Sand Plover	*Charadrius mongolus*	E, M(w)	V		X
Red Goshawk	*Erythrotriorchis radiatus*	V	V	X	
Gouldian Finch	*Erythrura gouldiae*	E	V	X	
Partridge Pigeon	*Geophaps smithii*	V[3]	V		X
Bar-tailed Godwit	*Limosa lapponica*	V/CE[4], M(w)	V	X	X
Eastern Curlew	*Numenius madagascariensis*	CE, M(w)	V	X	X
Australian Painted Snipe	*Rostratula australis*	E	V	X	
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	V	V		X
Mammals					
Brush-tailed Rabbit-rat	*Conilurus penicillatus*	V	E	X	X
Northern Quoll	*Dasyurus hallucatus*	E	CE	X	X
Ghost Bat	*Macroderma gigas*	V		X	
Northern Hopping-mouse	*Notomys aquilo*	V	V	X	X
Bare-rumped Sheathtail Bat	*Saccolaimus saccolaimus nudicluniatus*	V		X	
Water Mouse	*Xeromys myoides*	V		X	
Reptiles					
Plains Death Adder	*Acanthophis hawkei*	V	V	X	
Mertens' Water Monitor	*Varanus mertensi*		V		X
Yellow-spotted Monitor	*Varanus panoptes*		V		X
Species Restricted to Marine Environment					
Blue Whale	*Balaenoptera musculus*	E, M(m)		X	
Loggerhead Turtle	*Caretta caretta*	E, M(m)	V	X	
Green Turtle	*Chelonia mydas*	V, M(m)		X	X
Leatherback Turtle	*Dermochelys coriacea*	E, M(m)	CE	X	
Hawksbill Turtle	*Eretmochelys imbricata*	V, M(m)	V	X	X
Olive Ridley Turtle	*Lepidochelys olivacea*	E, M(m)	V	X	X
Flatback Turtle	*Natator depressus*	V, M(m)		X	X
Great White Shark	*Carcharodon carcharias*	V, M(m)		X	
Speartooth Shark	*Glyphis glyphis*	CE	V	X	
Dwarf Sawfish	*Pristis clavata*	V, M(m)		X	
Largetooth Sawfish	*Pristis pristis*	V, M(m)		X	

Common Name	Scientific Name	Conservation Status[1]		Database Results	
		EPBC Act[2]	TPWC Act	PMST	NR Maps
Green Sawfish	*Pristis zijsron*	V, M(m)		X	
Whale Shark	*Rhincodon typus*	V, M(m)		X	

1. Conservation Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory [(m) = marine, (t) = terrestrial, (w) = wetland]

2. Subcategories for EPBC Act listing of migratory species follow those within the PMST report

3. Two subspecies of Geophaps smithii are listed under the EPBC Act as Vulnerable (Geophaps smithii blaauwi and Geophaps smithii smithii).

4. Subspecies of Limosa lapponica have different listings under the EPBC Act. Limosa lapponica baueri is listed as Vulnerable and Limosa lapponica menzbieri is listed as Critically Endangered.

A likelihood of occurrence assessment was undertaken for the threatened species listed in **Table 12** (excluding marine species) to determine if they have the potential to occur within the Study Area, and more specifically to occur within the Stage 2 exploration program area. The likelihood of this species occurring was classified using the criteria presented in **Table 1**. The assessment was based on the species known range, number and age of records, and habitat preferences which were evaluated considering site characteristics observed during the field surveys. The full results of this likelihood of occurrence assessment are presented in **Appendix D**. A summary of the threatened species considered and the assessment of likelihood of occurrence is provided in **Table 13**.

Table 13 Summary of the likelihood of occurrence of threatened fauna species

Common Name	Scientific Name	Conservation Status[1]		Likelihood of Occurrence	
		EPBC Act[2]	TPWC Act	Study Area	Stage 2 Exploration Program Area
Birds					
Red Knot	*Calidris canutus*	E, M(w)	V	Low	Low
Curlew Sandpiper	*Calidris ferruginea*	CE, M(w)	V	Low	Low
Great Knot	*Calidris tenuirostris*	CE, M(w)	V	Low	Low
Greater Sand Plover	*Charadrius leschenaultii*	V, M(w)	V	Low	Low
Lesser Sand Plover	*Charadrius mongolus*	E, M(w)	V	Low	Low
Red Goshawk	*Erythrotriorchis radiatus*	V	V	Low	Low
Gouldian Finch	*Erythrura gouldiae*	E	V	Low	Low
Partridge Pigeon	*Geophaps smithii*	V[3]	V	Low	Low
Bar-tailed Godwit	*Limosa lapponica*	V/CE[4], M(w)	V	Low	Low
Eastern Curlew	*Numenius madagascariensis*	CE, M(w)	V	Low	Low
Australian Painted Snipe	*Rostratula australis*	E	V	Low	Low

Common Name	Scientific Name	Conservation Status[1]		Likelihood of Occurrence	
		EPBC Act[2]	TPWC Act	Study Area	Stage 2 Exploration Program Area
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	V	V	Present	Present
Mammals					
Brush-tailed Rabbit-rat	*Conilurus penicillatus*	V	E	Low	Low
Northern Quoll	*Dasyurus hallucatus*	E	CE	Present	Present
Ghost Bat	*Macroderma gigas*	V		High	High
Northern Hopping-mouse	*Notomys aquilo*	V	V	Low[5]	Low
Pale Field Rat	*Rattus tunneyi*		V	Low	Low
Bare-rumped Sheathtail Bat	*Saccolaimus saccolaimus nudicluniatus*	V		Low	Low
Water Mouse	*Xeromys myoides*	V		Low	Low
Reptiles					
Plains Death Adder	*Acanthophis hawkei*	V	V	Low	Low
Mertens' Water Monitor	*Varanus mertensi*		V	Present	High
Yellow-spotted Monitor	*Varanus panoptes*		V	High	High

1. EPBC Act Status / TPWC Act Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory [(m) = marine, (t) = terrestrial, (w) = wetland]

2. Subcategories for EPBC Act listing of migratory species follow those within the PMST report

3. Two subspecies of Geophaps smithii are listed under the EPBC Act as Vulnerable (Geophaps smithii blaauwi and Geophaps smithii smithii).

4. Subspecies of Limosa lapponica have different listings under the EPBC Act. Limosa lapponica baueri is listed as Vulnerable and Limosa lapponica menzbieri is listed as Critically Endangered.

5. Five records of the species from the NR Maps database exist within the Study Area; however these records are associated with the presence of spoil heaps, which are not a reliable determinate for the presence of the Northern Hopping-mouse (Coffey Environments Pty Ltd 2010, Diete et al. 2015a). The likelihood of occurrence has been determined based on the findings of the small mammal research project undertaken within the Study Area and surrounds by Cumberland Ecology (2019b).

The following sections provide details of the threatened fauna species that have been recorded within the Study Area during recent surveys, or which are considered to have a moderate or high likelihood to occur within the Study Area.

6.3.1. EPBC Act Species (Threatened)

Two threatened fauna species listed under the EPBC Act, namely the Masked Owl (northern) (*Tyto novaehollandiae kimberli*) and Northern Quoll (*Dasyurus hallucatus*), are known to occur within the Study Area. In addition, the Ghost Bat was considered to have a high likelihood of occurring in the Study Area. Details on these species, their occurrence, and habitat preferences within the Study Area and Stage 2 exploration program area are provided below.

An additional two EPBC Act listed threatened fauna species, namely the Brush-tailed Rabbit-rat (*Conilurus penicillatus*) and Northern Hopping-mouse (*Notomys aquilo*) are considered further despite being assessed as having a low potential for occurrence. Recent surveys within the Study Area by Cumberland Ecology (2019b) targeted these two species and neither species were recorded despite the presence of suitable habitat. However, it is acknowledged that these species may be present in areas of the Southern Lease that were not surveyed as part of this work. As such, and due to the significance of these species on Groote Eylandt, details of these species and the results of the targeted surveys have been included.

A number of other threatened species are considered to have a moderate potential to occur within the estuarine complex habitat located near the south-western boundaries of the Study Area, or on isolated permanent wetland areas on the southern boundary of the Study Area (see **Figure 11**). As the habitats for these species represent a small proportion of the habitat within the Study Area, and do not occur within the Stage 2 exploration program area, these species have not been described in detail below. Summary descriptions of these species are, however, provided in **Appendix D**.

Masked Owl (northern)

EPBC Act Status: Vulnerable

TPWC Act Status: Vulnerable

Species Overview

The Masked Owl (northern) has been recorded from riparian forest, rainforest, open forest, Melaleuca swamps and the edges of mangroves, as well as along the margins of sugar cane fields (DAWE 2020m). The species occurs mainly in tall eucalypt open forests (especially those dominated by *Eucalyptus miniata* (Darwin Woollybutt) and *E. tetrodonta* (Darwin Stringybark) and also forages in more open vegetation types, including grasslands (Woinarski and Ward 2012a). Roosting habitat occurs in dense foliage, including within monsoon rainforests, however it more typically roosts and nests in tree hollows (Woinarski and Ward 2012a). Critical habitat for this species is not defined due to a lack of records, however this species is considered to be dependent on tree hollows (Woinarski 2004b). Mammals that are up to the size of possums form the primary component of the diet of this species (Higgins 1999). The distribution of the Masked Owl (northern) is imperfectly known, with remarkably few records across its broad range (Woinarski 2004b). The Masked Owl (northern) has been impacted by broad-scale changes to the environment of northern Australia caused by altered fire regimes, grazing by livestock and feral animals, and the invasion of native woodlands by exotic plants, particularly introduced pasture grasses (DAWE 2020m).

EPBC Act Plans

Conservation Advice

Approved Conservation Advice for the Masked Owl (northern) has been prepared, which identifies conservation and management actions, survey and monitoring priorities and information and research priorities. Identified threats to the Masked Owl (northern) include broad-scale changes to the environment caused by altered fire regimes, grazing by livestock and feral animals, and the invasion of native woodlands by exotic plants (Threatened Species Scientific Committee 2015b).

Recovery Plan

There is no current Recovery Plan for the Masked Owl (northern); however, the DAWE Species Profile and Threats Database acknowledge that a recovery plan is required. A National Multi-species Recovery Plan had previously been in place for several bird species, including the Masked Owl (Northern) (Woinarski 2004b); however DAWE has advised that this plan has ceased to be in effect from 1 October 2015 (DAWE 2020m).

Threat Abatement Plan

A Threat Abatement Plan is in place for the Masked Owl (northern) for the threat of five listed grasses.

Referral Guideline

There is no Referral Guideline for the Masked Owl (northern).

Groote Archipelago Threatened Species Management Plan

The Groote Archipelago Threatened Species Management Plan (TSMP) has been developed with support from the NT Government and the Australian Government (DENR and ALC 2019). The plan identifies key actions to reduce threats and support conditions for threatened species recovery, and it includes the Masked Owl (northern). The goal for the Masked Owl (northern) is to acquire a baseline for the population and evaluate its status within two years. Very high and high risk threats identified for the species includes major habitat loss/alteration, weed invasion and inappropriate fire regimes.

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Masked Owl (northern) was recorded from one location within the Study Area by Cumberland Ecology (2016), using call playback and spotlighting (**Figure 13**). This species was recorded flying over laterite woodland and forest in response to call playback. This location is in close proximity to the Stage 2 exploration program area. This species has also been recorded at numerous locations in the Eastern Leases, which is to the north of the Study Area, by Cumberland Ecology (2015) and EMS (2013), and at one location to the west of the Study Area by Cumberland Ecology (2019b). A photograph of a Masked Owl (northern) recorded within the Eastern Leases is shown in **Photograph 9**.

The majority of the fauna habitat types occurring in the Study Area (as listed in **Table 5**) have the potential to provide habitat resources for this species. This includes:

- Closed forest (rainforest) habitats;
- Laterite woodland and forest habitats;
- Sandstone woodland and forest habitats;
- Coastal dune/swale complex habitats; and
- Riparian/wetland habitats.

Key foraging habitat resources are present and consist of a high density of potential prey species such as small- to medium-sized ground-dwelling mammals, including the Delicate Mouse (*Pseudomys delicatulus*), Northern Brown Bandicoot (*Isoodon macrourus*) and Northern Quoll (*Dasyurus hallucatus*), as well as habitats containing the Sugar Glider (*Petaurus breviceps*). Such foraging habitats are widespread in the Study Area. Roosting and nesting habitat in the Study Area is confined to the denser closed forest (rainforest) habitats containing large emergent trees with hollows, and in other areas containing hollow-bearing trees with medium- to large-sized hollows such as laterite woodland and forest habitats, sandstone woodland and forest habitats, coastal dune/swale habitats and riparian/wetland habitats. The species is not likely to roost or nest in parts of the Study Area which contain shrubland habitat or grassland habitat due to the lack of dense canopy and large hollow-bearing trees. The Masked Owl (northern) may, however, forage within the woodland/shrubland habitats. Within the Stage 2 exploration area, roosting and nesting habitat is likely to be confined to laterite woodland and forest habitats, and riparian/wetland habitats, containing hollow-bearing trees. Pre-clearing assessments undertaken by EMS (2013, 2014) within the nearby Eastern Leases have recorded the highest density of hollows within *Eucalyptus tetrodonta* (Darwin Stringybark), *Eucalyptus miniata* (Darwin Woollybutt) and stags. Hollows assessed as suitable for the Masked Owl (northern) within the Eastern Leases were typically located in the main trunk of these trees, with other locations recorded in large branches (EMS 2014). Pre-clearance surveys undertaken by Cumberland Ecology within the Study Area in 2016 and 2019 recorded suitable hollows for the Masked Owl (northern) at a number of locations, most commonly within *Eucalyptus tetrodonta* (Darwin Stringybark), including a small number within the Study Area.

Photograph 9 Masked Owl photographed in open forest in the Eastern Leases

Northern Quoll

EPBC Act Status: Endangered

TPWC Act Status: Critically Endangered

Species Overview

The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (DAWE 2020e). Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats with high structural diversity used for foraging and dispersal (DAWE 2020e). Rocky areas are considered as prime habitat for the Northern Quoll (Hill and Ward 2010). Den sites include rocky outcrops and crevices, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings (Hill and Ward 2010, DAWE 2020e). During the non-breeding season, home ranges are about 35 ha, but this increases to about 100 ha for males in the breeding season (Woinarski and Ward 2012a). They are opportunistic omnivores that feed on a broad range of items, including beetles, grasshoppers, spiders, scorpions, centipedes, fruit and nectar, switching dietary resources according to season and availability (Hill and Ward 2010, DAWE 2020e). The current distribution is discontinuous across northern Australia, with core populations in rocky and/or high rainfall areas (Hill and Ward 2010), however there has been a decline across much of this range (Woinarski and Ward 2012a). It is known from a number of offshore islands, including Groote Eylandt (Hill and Ward 2010).

Key threats to the Northern Quoll include lethal toxic ingestion caused by Cane Toads, removal, degradation and fragmentation of habitat, inappropriate fire regimes, weeds and feral predators (DAWE 2020e).

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Northern Quoll.

Recovery Plan

A National Recovery Plan for the Northern Quoll has been prepared (Hill and Ward 2010). The plan lists a series of objectives and actions to manage existing populations of the species, including the protection of quoll populations on offshore islands from invasion and establishment of cane toads, cats and other potential predators.

Threat Abatement Plan

Threat Abatement Plans are in place for the Northern Quoll for the threat of Cane Toads, Feral Cats, and five listed grasses.

Referral Guideline

A Referral Guideline exists for the Northern Quoll which outlines likely habitats critical to the survival of the Northern Quoll and populations important for its long term survival (DotE 2016).

Groote Archipelago Threatened Species Management Plan

The TSMP has been developed with support from the NT Government and the Australian Government (DENR and ALC 2019). The plan identifies key actions to reduce threats and support conditions for threatened species recovery, and it includes the Northern Quoll. The goal for the Northern Quoll is to maintain a stable population at 2017 densities or occupancies across the current range. Very high and high risk threats identified for the species includes poisoning by cane toads, weed invasion and inappropriate fire regimes.

Presence and Habitat within the Stage 2 exploration program area and Study Area

Northern Quolls were recorded within the Study Area at 86 locations by Cumberland Ecology (2019b) during camera surveys, three locations by Cumberland Ecology (2016) during Elliott trapping and cage trapping, and nine locations by Cumberland Ecology (2016) during camera surveys. It was also recorded at a further 15 locations by Heiniger and Gillespie (2017). The locations of these records are shown on **Figure 13**. A number of these records occur within the Stage 2 exploration program area. A photograph of a Northern Quoll photographed during camera surveys is shown in **Photograph 10**.

The Northern Quoll has also been recorded within mine rehabilitation areas of the existing GEMCO mine (Cumberland Ecology 2015). The Northern Quoll has been recorded numerous times within and in close proximity to the Eastern Leases (Webb 1992, Ward 2006b, Firth 2008, Smith 2009b, URS Australia Pty Ltd 2012, Cumberland Ecology 2015). Records of this species within the Study Area are also held in the NR Maps

database (as shown in **Figure 12**). Smith (2009b) noted that the Northern Quoll appears to be widely distributed across Groote Eylandt.

Due to the range of habitat this species is known to occur in, the majority of the habitat types listed in **Table 5** (which are found within the Study Area) are considered to be able to provide potential suitable habitat for this species for foraging and breeding. This includes:

- Closed forest (rainforest) habitats;
- Laterite woodland and forest habitats;
- Sandstone woodland and forest habitats;
- Coastal dune/swale complex habitats; and
- Riparian/wetland habitats.

Key areas of habitat are located in proximity to rocky habitats in vegetation with high structural diversity, especially sandstone woodland and rock outcrop habitat. Other habitat types such as closed forest (rainforest), laterite woodland and forest and riparian/wetland habitats also provide den habitat in the form of tree hollows, hollow logs and termite mounds, in addition to suitable habitat for prey species such as other small mammals, frogs, reptiles and invertebrates.

Photograph 10 Northern Quoll captured during camera surveys within the Study Area (July 2018)

Ghost Bat

EPBC Act Status: Vulnerable

TPWC Act Status: Not listed

Species Overview

The Ghost Bat occupies habitats ranging from the arid habitats to tropical savanna woodlands and rainforests (Threatened Species Scientific Committee 2016b). During the daytime they roost in caves, rock crevices and old mines (Threatened Species Scientific Committee 2016b). Roost sites used permanently are generally deep natural caves or disused mines with a relatively stable temperature of 23°−28°C and a moderate to high relative humidity of 50−100 percent (Threatened Species Scientific Committee 2016b). Colonies can disperse up to 150 km from permanent roosting sites during the non-breeding season in the cooler months, with caves, rock shelters, overhangs, vertical cracks and mines providing day roost habitat (Hourigan 2011). Most breeding sites appear to require multiple entranced caves (Threatened Species Scientific Committee 2016b). Individuals aggregate in maternity roosts during spring and summer (Hourigan 2011). The Ghost Bat perches in vegetation to ambush passing prey (either on the ground or in the air), and it also gleans surfaces such as the ground while in flight (Threatened Species Scientific Committee 2016b). It feeds on small mammals including other bats, birds, reptiles, frogs and large insects (Threatened Species Scientific Committee 2016b). The current distribution is discontinuous, with geographically disjunct colonies occurring in the Pilbara, Kimberley, northern portion of the NT (including Groote Eylandt), the Gulf of Carpentaria, coastal and near coastal eastern Queensland from Cape York to near Rockhampton, and western Queensland (Threatened Species Scientific Committee 2016b). A photograph of a Ghost Bat is shown in **Photograph 11**.

EPBC Act Plans

Conservation Advice

Approved Conservation Advice for the Ghost Bat has been prepared, which identifies threats and conservation actions for the species. Conservation actions include management actions, survey and monitoring priorities and information and research priorities. The key threat to the Ghost Bat is habitat loss and degradation due to mining activities (Threatened Species Scientific Committee 2016b).

Recovery Plan

There is no Recovery Plan available for the Ghost Bat; however, the DAWE Species Profile and Threats Database and Approved Conservation Advice recommends that a recovery plan is prepared.

Threat Abatement Plan

A Threat Abatement Plan is in place for the Ghost Bat for the threat of the European Red Fox.

Referral Guideline

There is no Referral Guideline for the Ghost Bat.

Groote Archipelago Threatened Species Management Plan

The TSMP has been developed with support from the NT Government and the Australian Government (DENR and ALC 2019). The plan identifies key actions to reduce threats and support conditions for threatened species recovery, and it includes the Ghost Bat. The goal for the Ghost Bat is to improve viability of populations on Groote Eylandt in five years. One very high risk threat identified for the species includes poisoning by cane toads. A number of other threats have been identified, including predation by feral cats.

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Ghost Bat was not recorded within the Study Area during recent terrestrial surveys. The Ghost Bat has been previously recorded within dry eucalypt forest within the existing GEMCO mine (URS Australia Pty Ltd 2012), within open woodland in proximity to the existing GEMCO mine (Diete et al. 2015b) and in coastal grass and shrub habitat in the south west peninsular of the island (Diete et al. 2015b). The NR Maps database has records of this species in the central and northern parts of the island as shown in **Figure 12**.

Areas of rocky outcropping and caves occur within the Study Area, which could be utilised by the Ghost Bat for roosting. These areas are mostly likely to comprise transient roosts. No areas of rocky outcropping and caves occur within the Stage 2 exploration program area. Foraging by the Ghost Bat within the Study Area would occur in proximity (within 2 km) to roosting habitat and include all of the habitat types recorded within the Study Area, including:

- Closed forest (rainforest) habitats;
- Laterite woodland and forest habitats;
- Sandstone woodland and forest habitats;
- Coastal dune/swale complex habitats;
- Riparian/wetland habitat; and
- Estuarine complex habitats.

Photograph 11 Ghost Bat (Source: EMS in URS Australia Pty Ltd, 2012)

Brush-tailed Rabbit-rat

EPBC Act Status: Vulnerable

TPWC Act Status: Endangered

Species Overview

The Brush-tailed Rabbit-rat appears to have quite specific habitat requirements and is largely restricted to mixed eucalypt open forest and woodland, or on dunes with Casuarina (Threatened Species Scientific Committee 2008). Preference appears to be given to habitats that are not burnt annually, that have an understorey of predominantly perennial grasses and a sparse-to-moderate middle storey (Threatened Species Scientific Committee 2008). It shelters in tree hollows, hollow logs and, less frequently, in the crowns of pandanus or sand-palms (Woinarski and Hill 2012). Most foraging is on the ground, but it is also partly arboreal (Woinarski and Hill 2012). Their mean home range size is approximately 1 ha and males typically have larger home ranges than females (Firth 2007). The diet of the Brush-tailed Rabbit-rat consists primarily of seed, particularly from perennial grasses (Firth 2007) with some fruits, invertebrates and leaves (Woinarski and Hill 2012). Within the NT this species is known to persist only on the Cobourg Peninsula, Bathurst, Melville and Inglis Islands, and Groote Eylandt (Woinarski and Hill 2012). A photograph of a Brush-tailed Rabbit-rat is shown in **Photograph 12**.

EPBC Act Plans

Conservation Advice

Approved Conservation Advice for the Brush-tailed Rabbit-rat has been prepared, which identifies research and action priorities to manage and monitor the species. Identified threats to the Brush-tailed Rabbit-rat include habitat alteration due to inappropriate fire regimes, habitat loss and fragmentation resulting from forestry and mining operations, predation by feral cats, competition with introduced rodents, invasive weeds, and grazing by introduced herbivores (Threatened Species Scientific Committee 2016a).

Recovery Plan

There is no Recovery Plan for the Brush-tailed Rabbit-rat; however, the DAWE Species Profile and Threats Database acknowledges that a recovery plan is required.

Threat Abatement Plan

A Threat Abatement Plan is in place for the Brush-tailed Rabbit-rat for the threat of Feral Cats and for the threat of five listed grasses.

Referral Guideline

There is no Referral Guideline for the Brush-tailed Rabbit-rat.

Groote Archipelago Threatened Species Management Plan

The TSMP has been developed with support from the NT Government and the Australian Government (DENR and ALC 2019). The plan identifies key actions to reduce threats and support conditions for threatened species recovery, and it includes the Brush-tailed Rabbit-rat. The goal for the Brush-tailed Rabbit-rat is to improve viability of populations on Groote Eylandt in five years. Very high and high risk threats identified for the species includes predation by feral cats, weed invasion, inappropriate fire regimes, feral herbivores (deer/buffalo) and major habitat loss/alteration.

Presence and Habitat within the Stage 2 exploration program area and Study Area

Within the Study Area, suitable habitat types for the Brush-tailed Rabbit-rat include:

- Closed forest (rainforest) habitats;
- Laterite woodland and forest habitats;
- Sandstone woodland and forest habitats; and
- Riparian/wetland habitats.

Of these, laterite woodland and forest habitat and riparian/wetland habitats are also found within the Stage 2 exploration program area. The habitat types within the Study Area are suitable for shelter, breeding and foraging; however the suitability of habitat present is reduced in areas where fire frequency is high (burnt annually). In areas that are less frequently burnt, woodland habitats of *Eucalyptus tetrodonta* (Darwin

Stringybark) and *Eucalyptus miniata* (Darwin Woollybutt) with a sparse shrub layer and grassy understorey would provide suitable habitat for this species. Sheltering habitat is present within the Study Area in the form of tree hollows, fallen hollow logs and pandanus palms. Shrubland and grassland habitat is not considered likely to comprise suitable habitat due to the lack of large hollow-bearing trees and limited ground debris suitable for sheltering.

Despite the abundance of suitable habitat within the Study Area, the Brush-tailed Rabbit-rat was not recorded during recent terrestrial surveys by Cumberland Ecology (2019b), which were designed to target the species. Firth (2008) suggests that the high densities of the Northern Quoll (*Dasyurus hallucatus*), which is a known predator of the Brush-tailed Rabbit-rat, has caused highly localised extinctions of this species in pockets of Groote Eylandt. The Brush-tailed Rabbit-rat was recorded extensively north of the Study Area using a very similar survey methodology by Heiniger and Gillespie (2017), giving rise to a high detection probability. Therefore, there is a high degree of confidence that if the species was present within the area studied by Cumberland Ecology (2019b), it would have been recorded. As such, the absence of records by Cumberland Ecology (2019b) is likely related to the absence of the species in the surveyed portions of the Study Area. However, it is noted that there is still some potential for it to be present in low numbers in suitable habitat found in parts of the Study Area that were not specifically sampled, such as to the east of the Innokumanja River.

The Brush-tailed Rabbit-rat was recorded at one location in 2014 during surveys of the nearby Eastern Leases (Cumberland Ecology 2015). Recent surveys by Heiniger and Gillespie (2017) have captured records at 19 locations on Groote Eylandt, with the majority of records occurring approximately 30 km north of the Study Area, two locations within the Eastern Leases and two locations to the east of the Study Area. The Brush-tailed Rabbit-rat was also previously recorded within the Eastern Leases by Ward (2007a) and EMS (2013). None of the records of the Brush-tailed Rabbit-rat are located within the Study Area.

Photograph 12 Brush-tailed Rabbit-rat (Source: K. Brennan in Woinarski and Hill, 2012a)

Northern Hopping-mouse

EPBC Act Status: Vulnerable

TPWC Act Status: Vulnerable

Species Overview

The Northern Hopping-mouse is most often found in areas with sandy substrates and seems to favour coastal sand dunes and sandsheets with a cover of tussock grass or heath (DotE 2013c). It is also found in shrubland, eucalypt open forest, and the margins of coastal rainforest thickets (DotE 2013c). It constructs elaborate communally-used burrow systems, whose vertical entrances may be obscured by a thin layer of sand (Woinarski and Ward 2012b, Diete et al. 2014). Burrows are unmarked by entrances or tracks (Ward 2014). The Northern Hopping-mouse is active at night and it forages entirely on the ground (Woinarski and Ward 2012b). It feeds mainly on a range of seeds from grasses, herbs and shrubs and it is also known to eat insects (DotE 2013c). The Northern Hopping-mouse is restricted to the monsoonal tropics of northern Australia and is found on Groote Eylandt (DotE 2013c). The species is also historically known from north-east and central Arnhem Land, and Cape York Peninsula (DENR and ALC 2019).

EPBC Act Plans

Conservation Advice

Approved Conservation Advice for the Northern Hopping-mouse has been prepared, which identifies threats and conservation actions for the species. Conservation actions include management actions, survey and monitoring priorities and information and research priorities. Threats to the Northern Hopping-mouse have been identified as vegetation change through altered fire regimes, predation by feral cats and strip-mining (Threatened Species Scientific Committee 2015a).

Recovery Plan

There is no current Recovery Plan for the Northern Hopping-mouse; however, the DAWE Species Profile and Threats Database acknowledges that a recovery plan is required. A National Multi-species Recovery Plan has previously been in place for several small mammal species, including the Northern Hopping-mouse (Woinarski 2004a); however DAWE has advised that this plan has ceased to be in effect from 1 October 2015 (DAWE 2020g).

Threat Abatement Plan

A Threat Abatement Plan is in place for the Northern Hopping-mouse for the threat of Feral Cats and for the threat of five listed grasses.

Referral Guideline

There is no Referral Guideline for the Northern Hopping-mouse.

Groote Archipelago Threatened Species Management Plan

The TSMP has been developed with support from the NT Government and the Australian Government (DENR and ALC 2019). The plan identifies key actions to reduce threats and support conditions for threatened species recovery, and it includes the Northern Hopping-mouse. The goal for the Northern Hopping-mouse is to improve viability of populations on Groote Eylandt in five years. Very high and high risk threats identified for the species includes predation by feral cats, major habitat loss/alteration, weed invasion, inappropriate fire regimes and feral herbivores (deer/buffalo).

Presence and Habitat within the Stage 2 exploration program area and Study Area

Laterite woodlands and forests with a suitable grassy understorey and sandy substrate are considered to provide potential suitable habitat for the Northern Hopping-mouse within the Study Area, in particular areas with a sandy substrate and in proximity to white rock. A sandy substrate is required for this species to dig burrows (Diete et al. 2014). The grassy understorey of woodlands and open forests within the Study Area would provide a range of foraging and sheltering opportunities for this species. The Stage 2 exploration program area has been designed to avoid any areas of white rock, including a 100 m buffer around white rock areas.

Despite the abundance of potential suitable habitat within the Study Area and surrounding land, the Northern Hopping-mouse was not recorded during recent terrestrial surveys in the Study Area by Cumberland Ecology (2019b), which was designed to target the species. As part of this survey, the Northern Hopping-mouse was recorded at a few locations north of the Study Area using a very similar survey methodology by Heiniger and Gillespie (2017), and a survey at the Cave Paintings, providing evidence and certainty that the camera trapping method utilised by Cumberland Ecology (2019b) could detect the Northern Hopping-mouse. The lack of records from the Study Area (using a method known to detect the species) suggests that the species is therefore not present in the areas sampled. Given the high survey intensity and sample sites in the full range of suitable habitats and fire types, it is concluded that there is a low probability of occurrence for the species in the Study Area.

Despite the absence of records of the Northern Hopping-mouse within the Study Area (within the area studied by Cumberland Ecology (2019b) and Heiniger and Gillespie (2017)), it is possible the species may occur in low numbers in suitable habitat within the unsurveyed portions of the Study Area, specifically in areas east of the Innokumanja River which were not able to be safely accessed. These unsurveyed portions are located outside of the Stage 2 exploration program area.

Beyond the Study Area, the species has been recorded during the following recent surveys:

- At the Cave Paintings (see **Figure 2**) by Heiniger and Gillespie (2017) and Cumberland Ecology (2019b); a culturally significant area located to the east of the existing GEMCO mine, as shown in **Photograph 13**;
- North of the Cave Paintings (approximately 10 km) by Heiniger and Gillespie (2017); and
- Records in the same broad location along the access corridor to the Eastern Leases by Cumberland Ecology (2015), Anindilyakwa Land & Sea Rangers (2019), and Cumberland Ecology (2019a).

In addition to the records above, the Northern Hopping-mouse has been recorded elsewhere on Groote Eylandt. Previous surveys have recorded the apparent presence of the Northern Hopping-mouse based upon the presence of spoil heaps (e.g. Firth (2008) and Smith (2009a)) and a number of the records held in the NR Maps database appear to correlate to these spoil heaps. It has since been determined that the presence of spoil heaps on their own are not a reliable determinate for the presence of the Northern Hopping-mouse as spoil heaps are also created by the Delicate Mouse (*Pseudomys delicatulus*) (Coffey Environments Pty Ltd 2010, Diete et al. 2015a), which is prevalent on Groote Eylandt, and was also recorded within the nearby Eastern Leases. Records of this species within the Study Area are held in the NR Maps database (**Figure 12**), a number of which represent spoil heap locations.

Photograph 13 Northern Hopping-mouse captured during camera trapping near the Cave Paintings (east of existing GEMCO mine) (April 2018)

6.3.2. TPWC Act Species

Three threatened fauna species listed under the TPWC Act were recorded within the Study Area during the recent terrestrial surveys, namely the Masked Owl (northern), Northern Quoll and Mertens' Water Monitor. The Masked Owl (northern) and Northern Quoll are also listed under the EPBC Act and have been discussed in ***Section 6.3.1***. One TPWC Act listed species, the Yellow-spotted Monitor, is considered to have high likelihood of occurrence within the Study Area. Details on the occurrence and habitat of the Yellow-spotted Monitor and Mertens' Water Monitor within the Study Area are provided below. No other TPWC Act listed threatened fauna species are considered to have a moderate or high likelihood of occurrence within the Study Area and as such are not assessed further within this report.

Yellow-spotted Monitor

EPBC Act Status: Not listed

TPWC Act Status: Vulnerable

Species Overview

The Yellow-spotted Monitor occupies a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands (Ward et al. 2012). Clutches of eggs are typically laid in the wet season in burrows in the ground (Ward et al. 2012). Recent research has indicated that these species make use of large communal burrows / warrens (Doody, *et al*., 2014). It feeds mostly on small terrestrial vertebrates and insects, and often digs up prey, especially eggs of marine and freshwater turtles (Ward et al. 2012). The Yellow-spotted Monitor has a broad geographic range across the far North of Australia from the Kimberley to Cape York Peninsula, and southwards through most of Queensland (Ward et al. 2012). In the NT, it has been recorded across most of the Top End and the Gulf Region (Ward et al. 2012). The advance of the Cane Toad across the NT is the most serious threat facing the Yellow-spotted Monitor as it is highly susceptible to the toxins of the Cane Toad (Ward *et al*., 2012, Doody *et al*. 2009).

Groote Archipelago Threatened Species Management Plan

The TSMP has been developed with support from the NT Government and the Australian Government (DENR and ALC 2019). The plan identifies key actions to reduce threats and support conditions for threatened species recovery, and it includes the Yellow-spotted Monitor. The goal for the Yellow-spotted Monitor is to improve the viability of populations on Groote Eylandt in five years. One very high risk threat identified for the species includes poisoning by cane toads.

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Yellow-spotted Monitor was not recorded during recent terrestrial surveys; however it was recorded beyond the Study Area in 2014 during surveys of the nearby Eastern Leases in laterite woodland and forest habitat using cage traps and cameras (Cumberland Ecology 2015). A photograph of the Yellow-spotted Monitor captured during trapping surveys within the Eastern Leases is shown in **Photograph 14**. The Yellow-spotted Monitor was also recorded from mine rehabilitation areas at the existing GEMCO mine (Cumberland Ecology 2015). URS Australia Pty Ltd (2012) also recorded this species in the existing GEMCO mine.

Due to the range of habitat this species is known to occur in, the majority of vegetation communities within the Study Area are considered potential habitat for this species. This includes:

- Closed forest (rainforest) habitats;
- Laterite woodland and forest habitats;
- Sandstone woodland and forest habitats;
- Coastal dune/swale complex habitats;

- Riparian/wetland habitats; and
- Estuarine complex habitats, excluding mangroves.

Suitable habitat for this species also occurs in the Stage 2 exploration program area. The Yellow-spotted Monitor is known to forage on small vertebrates, and several small terrestrial vertebrates were recorded within the Stage 2 exploration program area including the Grassland Melomys (*Melomys burtoni*), Delicate Mouse (*Pseudomys delicatulus*) and Common Planigale (*Planigale maculata*) (Cumberland Ecology 2019b). Other small terrestrial vertebrates and insects present within these areas would also provide a suitable food source for this species.

Photograph 14 Yellow-spotted Monitor captured during trapping surveys within the Eastern Leases

Mertens' Water Monitor

EPBC Act Status: Not listed

TPWC Act Status: Vulnerable

Species Overview

Mertens' Water Monitor is semi-aquatic and is seldom seen far from water (Ward et al. 2006). It is often observed climbing on rocks or trees near water, often basking on branches overhanging the water or on rocks mid-stream (Ward et al. 2006). It lays eggs in a burrow constructed in the ground, with egg-laying usually in the early dry season (Ward et al. 2006). It feeds mostly on fish, frogs and carrion, and is also known to eat

insects and small terrestrial vertebrates (Ward et al. 2006). Mertens' Water Monitor has a broad geographic range, occupying coastal and inland waters across the far north of Australia from the Kimberley to the west side of Cape York Peninsula (Ward et al. 2006). In the NT it has been recorded across most of the Top End and the Gulf Region (Ward et al. 2006). The advance of the Cane Toad across the NT is the most serious threat facing Mertens' Water Monitor as it is known to consume the Cane Toad and die from the ingested toxins (Ward *et al*., 2012, Doody *et al*. 2009).

Groote Archipelago Threatened Species Management Plan

The TSMP has been developed with support from the NT Government and the Australian Government (DENR and ALC 2019). The plan identifies key actions to reduce threats and support conditions for threatened species recovery, and it includes Mertens' Water Monitor. The goal for Mertens' Water Monitor is to improve viability of populations on Groote Eylandt in five years. One very high risk threat identified for the species includes poisoning by cane toads.

Presence and Habitat within the Stage 2 exploration program area and Study Area

Mertens' Water Monitor was recorded at one location in the Southern Lease during terrestrial surveys in 2014 (Cumberland Ecology 2015) (see **Figure 13**). Cumberland Ecology (2015) recorded the species at numerous locations within the Eastern Leases, including within laterite woodland and forest habitat, and riparian/wetland habitats adjacent to watercourses using cage traps and incidental observations. It was also recorded at two locations within the Study Area in the NR Maps database (see **Figure 12**), however these locations are identical and overlap with the record by Cumberland Ecology (2015). A photograph of a Mertens' Water Monitor recorded on camera within the Eastern Leases is shown in **Photograph 15**. The Mertens' Water Monitor was also recorded in mine rehabilitation areas at the existing GEMCO mine within laterite woodland and forest habitat (Cumberland Ecology 2015). URS Australia Pty Ltd (2012) and Webb (1992) also recorded this species within their respective studies.

The watercourses of the Emerald, Yanbakwa, Amagula, Innokumanja and Mayimokumanja Rivers, and Salt Creek catchments provide suitable habitat for this species; however, the availability of such habitat is reliant on seasonal conditions. Suitable habitat for Mertens' Water Monitor is likely to be more restricted within the dry season when there is less water within the waterways. Habitat types in which this species would occur within the Study Area predominantly comprises riparian/wetland habitats; however, it may also occur within laterite woodland and forest habitat and coastal dune/swale complex habitats. Suitable habitat for this species also occurs in the Stage 2 exploration program area within areas located in proximity to the major waterways. Suitable prey for this species would include frogs and small fish located within riparian and aquatic habitats.

Photograph 15 Mertens' Water Monitor detected by a camera within the Eastern Leases

6.4. Fauna Species: Migratory Species

An analysis of ecological databases was conducted for the Study Area and its surrounds, including interrogation of the DAWE EPBC PMST (DAWE 2020f) and NR Maps search facility (DNRM 2020) for migratory fauna records. Database records identified the presence of a number of migratory species or habitat within the locality of the Study Area (defined in this report as a 20 km radius from the centre of the Study Area). Results of the database searches within the locality of the study area for migratory fauna species listed under the EPBC Act are summarised in **Table 14**. The TPWC Act does not include a separate migratory status.

As the locality includes some ocean areas, the search yielded numerous marine species including fish, turtles and marine mammals. These are not relevant to an assessment of terrestrial ecology within the Study Area and are not considered further in this report.

The full results of the PMST search is presented in **Appendix A**. The migratory fauna records held within the NR Maps database across Groote Eylandt, including the locality, are shown on **Figure 14**.

One migratory fauna species has been recorded within the Study Area during recent studies, namely the Salt-water Crocodile (*Crocodylus porosus*) and the locations of this species are shown on **Figure 13**.

Table 14 Migratory fauna species database records within the locality

Common Name	Scientific Name	Conservation Status[1]		Database Results	
		EPBC Act[2]	TPWC Act	PMST	NR Maps
Birds					
Red Knot	*Calidris canutus*	E, M(w)	V	X	X

Common Name	Scientific Name	Conservation Status[1]		Database Results	
		EPBC Act[2]	TPWC Act	PMST	NR Maps
Curlew Sandpiper	*Calidris ferruginea*	CE, M(w)	V	X	X
Great Knot	*Calidris tenuirostris*	CE, M(w)	V		X
Greater Sand Plover	*Charadrius leschenaultii*	V, M(w)	V		X
Lesser Sand Plover	*Charadrius mongolus*	E, M(w)	V		X
Bar-tailed Godwit	*Limosa lapponica*	V/CE[3], M(w)	V	X	X
Eastern Curlew	*Numenius madagascariensis*	CE, M(w)	V	X	X
Oriental Reed-warbler	*Acrocephalus orientalis*	M(w)		X	
Common Sandpiper	*Actitis hypoleucos*	M(w)		X	X
Common Noddy	*Anous stolidus*	M(m)		X	
Fork-tailed Swift	*Apus pacificus*	M(m)		X	X
Ruddy Turnstone	*Arenaria interpres*	M(w)			X
Sharp-tailed Sandpiper	*Calidris acuminata*	M(w)		X	X
Pectoral Sandpiper	*Calidris melanotos*	M(w)		X	
Red-necked Stint	*Calidris ruficollis*	M(w)			X
Streaked Shearwater	*Calonectris leucomelas*	M(m)		X	
Red-rumped Swallow	*Cecropis daurica*	M(t)		X	
Oriental Plover	*Charadrius veredus*	M(w)		X	X
White-winged Black Tern	*Chlidonias leucopterus*	M(m)			X
Oriental Cuckoo	*Cuculus optatus*	M(t)		X	
Lesser Frigatebird	*Fregata ariel*	M(m)		X	X
Great Frigatebird	*Fregata minor*	M(m)		X	
Oriental Pratincole	*Glareola maldivarum*	M(w)		X	X
Barn Swallow	*Hirundo rustica*	M(t)		X	
Caspian Tern	*Hydroprogne caspia*	M(m)			X
Black-tailed Godwit	*Limosa limosa*	M(w)			X
Grey Wagtail	*Motacilla cinerea*	M(t)		X	
Yellow Wagtail	*Motacilla flava*	M(t)		X	
Whimbrel	*Numenius phaeopus*	M(w)			X
Eastern Osprey	*Pandion cristatus*[6]	M(w)		X	X
Glossy Ibis	*Plegadis falcinellus*	M(w)			X
Pacific Golden Plover	*Pluvialis fulva*	M(w)			X
Grey Plover	*Pluvialis squatarola*	M(w)			X
Roseate Tern	*Sterna dougallii*	M(m)		X	X

Common Name	Scientific Name	Conservation Status[1]		Database Results	
		EPBC Act[2]	TPWC Act	PMST	NR Maps
Common Tern	*Sterna hirundo*	M(m)			X
Black-naped Tern	*Sterna sumatrana*	M(m)			X
Little Tern	*Sternula albifrons*	M(m)			X
Brown Booby	*Sula leucogaster*	M(m)			X
Lesser Crested Tern	*Thalasseus bengalensis*	M(m)			X
Crested Tern	*Thalasseus bergii*	M(w)		X	
Grey-tailed Tattler	*Tringa brevipes*	M(w)			X
Common Greenshank	*Tringa nebularia*	M(w)		X	X
Marsh Sandpiper	*Tringa stagnatilis*	M(w)			X
Terek Sandpiper	*Xenus cinereus*	M(w)			X
Reptiles					
Salt-water Crocodile	*Crocodylus porosus*	M(m)		X	X
Species Restricted to Marine Environment					
Blue Whale	*Balaenoptera musculus*	E, M(m)		X	
Bryde's Whale	*Balaenoptera edeni*	M(m)		X	
Killer Whale	*Orcinus orca*	M(m)		X	
Dugong	*Dugong dugong*	M(m)		X	X
Loggerhead Turtle	*Caretta caretta*	E, M(m)	V	X	
Green Turtle	*Chelonia mydas*	V, M(m)		X	X
Leatherback Turtle	*Dermochelys coriacea*	E, M(m)	CE	X	
Hawksbill Turtle	*Eretmochelys imbricata*	V, M(m)	V	X	X
Olive Ridley Turtle	*Lepidochelys olivacea*	E, M(m)	V	X	X
Flatback Turtle	*Natator depressus*	V, M(m)		X	X
Reef Manta Ray	*Manta alfredi*	M(m)		X	
Giant Manta Ray	*Manta birostris*	M(m)		X	
Australian Snubfin Dolphin	*Orcaella heinsohni*	M(m)		X	X
Indo-Pacific Humpback Dolphin	*Sousa chinensis*	M(m)		X	
Indo-Pacific Bottlenose Dolphin	*Tursiops aduncus*	M(m)			X
Narrow Sawfish	*Anoxypristis cuspidata*	M(m)		X	
Great White Shark	*Carcharodon carcharias*	V, M(m)		X	
Dwarf Sawfish	*Pristis clavata*	V, M(m)		X	
Largetooth Sawfish	*Pristis pristis*	V, M(m)		X	

Common Name	Scientific Name	Conservation Status[1]		Database Results	
		EPBC Act[2]	TPWC Act	PMST	NR Maps
Green Sawfish	*Pristis zijsron*	V, M(m)		X	
Whale Shark	*Rhincodon typus*	V, M(m)		X	

1. Conservation Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory [(m) = marine, (t) = terrestrial, (w) = wetland]

2. Subcategories for EPBC Act listing of migratory species follow those within the PMST report

3. Subspecies of Limosa lapponica have different listings under the EPBC Act. Limosa lapponica baueri is listed as Vulnerable and Limosa lapponica menzbieri is listed as Critically Endangered.

A likelihood of occurrence assessment was undertaken for the migratory species listed in **Table 14** (excluding marine species) to determine if they have the potential to occur within the Study Area, and more specifically to occur within the Stage 2 exploration program area. The likelihood of this species occurring was classified using the criteria presented in **Table 1**. The assessment was based on the species known range, number and age of records, and habitat preferences which were evaluated considering site characteristics observed during the field surveys. The full results of this likelihood of occurrence assessment are presented in **Appendix D**. A summary of the species and their likelihood of occurrence is provided in **Table 15**. Details of the species with a moderate or high potential to occur and their occurrence within the Study Area are provided below.

Table 15 Summary of the likelihood of occurrence of migratory fauna species

Common Name	Scientific Name	Conservation Status[1]		Likelihood of Occurrence	
		EPBC Act[2]	TPWC Act	Study Area	Stage 2 Exploration Program Area
Red Knot	*Calidris canutus*	E, M(w)	V	Low	Low
Curlew Sandpiper	*Calidris ferruginea*	CE, M(w)	V	Low	Low
Great Knot	*Calidris tenuirostris*	CE, M(w)	V	Low	Low
Greater Sand Plover	*Charadrius leschenaultii*	V, M(w)	V	Low	Low
Lesser Sand Plover	*Charadrius mongolus*	E, M(w)	V	Low	Low
Bar-tailed Godwit	*Limosa lapponica*	V/CE[4], M(w)	V	Low	Low
Eastern Curlew	*Numenius madagascariensis*	CE, M(w)	V	Low	Low
Oriental Reed-warbler	*Acrocephalus orientalis*	M(w)		Low	Low
Common Sandpiper	*Actitis hypoleucos*	M(w)		Moderate	Low
Common Noddy	*Anous stolidus*	M(m)		Low	Low
Fork-tailed Swift	*Apus pacificus*	M(m)		Moderate	Moderate
Short-tailed Shearwater	*Ardenna tenuirostris*	M(m)		Low	Low
Ruddy Turnstone	*Arenaria interpres*	M(w)		Low	Low

Common Name	Scientific Name	Conservation Status[1]		Likelihood of Occurrence	
		EPBC Act[2]	TPWC Act	Study Area	Stage 2 Exploration Program Area
Sanderling	*Calidris alba*	M(w)		Low	Low
Sharp-tailed Sandpiper	*Calidris acuminata*	M(w)		Moderate	Low
Pectoral Sandpiper	*Calidris melanotos*	M(w)		Low	Low
Red-necked Stint	*Calidris ruficollis*	M(w)		Low	Low
Streaked Shearwater	*Calonectris leucomelas*	M(m)		Low	Low
Red-rumped Swallow	*Cecropis daurica*	M(t)		Low	Low
Oriental Plover	*Charadrius veredus*	M(w)		Low	Low
White-winged Black Tern	*Chlidonias leucopterus*	M(m)		Low	Low
Oriental Cuckoo	*Cuculus optatus*	M(t)		Low	Low
Lesser Frigatebird	*Fregata ariel*	M(m)		Low	Low
Great Frigatebird	*Fregata minor*	M(m)		Low	Low
Swinhoe's Snipe	*Gallinago megala*	M(w)		Low	Low
Oriental Pratincole	*Glareola maldivarum*	M(w)		Low	Low
Barn Swallow	*Hirundo rustica*	M(t)		Low	Low
Caspian Tern	*Hydroprogne caspia*	M(m)		Low	Low
Black-tailed Godwit	*Limosa limosa*	M(w)		Low	Low
Grey Wagtail	*Motacilla cinerea*	M(t)		Low	Low
Yellow Wagtail	*Motacilla flava*	M(t)		Low	Low
Little Curlew	*Numenius minutus*	M(w)		Low	Low
Whimbrel	*Numenius phaeopus*	M(w)		Low	Low
Eastern Osprey	*Pandion cristatus*[5]	M(w)		Moderate	Low
Glossy Ibis	*Plegadis falcinellus*	M(w)		Low	Low
Pacific Golden Plover	*Pluvialis fulva*	M(w)		Low	Low
Grey Plover	*Pluvialis squatarola*	M(w)		Low	Low
Little Tern	*Sternula albifrons*	M(m)		Low	Low
Roseate Tern	*Sterna dougallii*	M(m)		Low	Low
Common Tern	*Sterna hirundo*	M(m)		Low	Low
Black-naped Tern	*Sterna sumatrana*	M(m)		Low	Low
Brown Booby	*Sula leucogaster*	M(m)		Low	Low
Lesser Crested Tern	*Thalasseus bengalensis*	M(m)		Low	Low
Crested Tern	*Thalasseus bergii*	M(w)		Low	Low
Grey-tailed Tattler	*Tringa brevipes*	M(w)		Low	Low

Common Name	Scientific Name	Conservation Status[1]		Likelihood of Occurrence	
		EPBC Act[2]	TPWC Act	Study Area	Stage 2 Exploration Program Area
Wood Sandpiper	*Tringa glareola*	M(w)		Low	Low
Common Greenshank	*Tringa nebularia*	M(w)		Moderate	Low
Marsh Sandpiper	*Tringa stagnatilis*	M(w)		Moderate	Low
Terek Sandpiper	*Xenus cinereus*	M(w)		Low	Low
Salt-water Crocodile	*Crocodylus porosus*	M(m)		Present	High

1. Conservation Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory [(m) = marine, (t) = terrestrial, (w) = wetland]

2. Subcategories for EPBC Act listing of migratory species follow those within the PMST report

3. Includes record held within the NR Maps Database and recent surveys.

4. Subspecies of Limosa lapponica have different listings under the EPBC Act. Limosa lapponica baueri is listed as Vulnerable and Limosa lapponica menzbieri is listed as Critically Endangered.

5. Species listed as Pandion haliaetus in the Protected Matters Search report. Pandion haliaetus cristatus was previously recognised as a subspecies for Australasia and New Caledonia, however it is currently recognised as a species in its own right.

The following section provides details of the migratory fauna species that have been recorded within the Study Area, or which are considered to have a moderate or high likelihood to occur within the Study Area.

6.4.1. EPBC Act Species (Migratory)

One migratory fauna species listed under the EPBC Act, the Salt-water Crocodile (*Crocodylus porosus*), has been recorded within the Study Area during recent surveys. However, several species listed as migratory under the EPBC Act are considered to have a moderate or high likelihood of occurrence within the Study Area, including the Eastern Osprey (*Pandion cristatus*), Common Sandpiper (*Actitis hypoleucos*), Fork-tailed Swift (*Apus pacificus*), Sharp-tailed Sandpiper (*Calidris acuminata*), Common Greenshank (*Tringa nebularia*) and Marsh Sandpiper (*Tringa stagnatilis*) (refer to **Table 15**). Details on these species and their occurrence and habitat within the Study Area are provided below.

A number of other migratory bird species are considered to have a potential to occur within the estuarine complex habitat located near the south-western boundaries of the Study Area. As the habitats for these species represent a small proportion of the habitat within the Study Area, and do not occur within the Stage 2 exploration program area, these species have been considered as having a low likelihood of occurrence. Summary descriptions of these species are, however, provided in **Appendix D**.

Salt-water Crocodile

EPBC Act Status: Migratory (marine)

Species Overview

The Salt-water Crocodile typically occurs in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast (DAWE 2020d). Preferred nesting habitat of the Salt-water Crocodile includes elevated, isolated freshwater swamps that are not influenced by tidal movements (DAWE 2020d). Floating rafts of vegetation also provide important nesting habitat (DAWE 2020d). The primary food sources of the Salt-water Crocodile include crustaceans, insects and mammals; however, only larger individuals eat mammals (DAWE 2020d). The distribution of the Salt-water Crocodile ranges from Rockhampton in Queensland, throughout coastal NT to King Sound (near Broome) in Western Australia (DAWE 2020d). In Australia, threats to the Salt-water Crocodile include mortality due to fishing nets and the effects of habitat destruction (DAWE 2020d). The Salt-water Crocodile is not, however, a threatened species. The species is managed in the NT under the Management Program for the Salt-water Crocodile in the Northern Territory of Australia (Leach et al. 2009), which predominantly relates to the sustainable harvesting of the species and management of the species in urbanised areas.

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Salt-water Crocodile.

Recovery Plan

There is no Recovery Plan for the Salt-water Crocodile.

Threat Abatement Plan

There are no Threat Abatement Plans in place for the Salt-water Crocodile.

Referral Guideline

There is no Referral Guideline for the Salt-water Crocodile.

Presence and Habitat within the Explorations Areas and Study Area

The Salt-water Crocodile was recorded incidentally within the Study Area at Leske Pools and at the mouth of Salt Creek by Cumberland Ecology (2016), as well as at two locations during aquatic surveys conducted within the Study Area by C&R (2019) (see **Figure 13**). Additional evidence of the Salt-water Crocodile was also observed by C&R (2019). The Salt-water Crocodile was also recorded in 2014 during surveys of the nearby Eastern Leases (Cumberland Ecology 2015) within a tributary of the Amagula River. A photograph of a Salt-water Crocodile recorded on camera within the Eastern Leases is shown in **Photograph 16**.

The well-developed watercourses of the Emerald, Yanbakwa, Amagula, Innokumanja and Mayimokumanja Rivers, and Salt Creek catchments provide suitable habitat for this species; however, the availability of such

habitat is reliant on seasonal conditions. Suitable habitat for the Salt-water Crocodile is likely to be more restricted within the dry season when there is less water within the waterways. Habitat types identified within the Study Area in which the species occurs include riparian/wetland habitats along watercourses. The species is unlikely to move into other habitat types. Suitable prey for this species recorded in the Study Area included the Agile Wallaby (*Macropus agilis*), Northern Brown Bandicoot (*Isoodon macrourus*), and the Northern Quoll (*Dasyurus hallucatus*). Aquatic species such as small fish, macroinvertebrates and riparian reptiles such as water monitors would also be suitable prey for this species.

This species is expected to utilise many of the perennial waterways within the Study Area. No suitable habitat for this species occurs in the Stage 2 exploration program area, which is located outside of major waterways.

Photograph 16 Salt-water Crocodile detected by an IR camera within the Eastern Leases

Eastern Osprey

EPBC Act Status: Migratory (wetland)

Species Overview

The Eastern Osprey occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands (DAWE 2020h). They are mostly found in coastal areas but occasionally travel inland along major rivers (DAWE 2020h). The Eastern Osprey requires extensive areas of open fresh, brackish or saline water for foraging (DAWE 2020h). This species constructs stick nests in a variety of natural and artificial sites including in dead or partly dead trees or bushes; on cliffs, rocks, rock stacks or islets; on the ground on rocky headlands, coral cays, deserted beaches, sandhills or saltmarshes; and on artificial nest platforms, pylons, jetties, lighthouses, navigation towers, cranes, exposed shipwrecks and offshore drilling rigs (DAWE 2020h). The total breeding and non-breeding range of the Eastern Osprey within Australia extends from Esperance in

Western Australia to NSW, where records become scarcer towards the south, and into Victoria and Tasmania, where the species is a rare vagrant (DAWE 2020h). The current main threat to the Eastern Osprey in Australia is habitat loss, degradation or alteration of habitat for urban or tourism development (DAWE 2020h). A photograph of an Eastern Osprey is shown in **Photograph 17**.

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Eastern Osprey.

Recovery Plan

There is no Recovery Plan for the Eastern Osprey.

Threat Abatement Plan

There are no Threat Abatement Plans in place for the Eastern Osprey.

Referral Guideline

A draft Referral Guideline exists for 14 migratory birds, which includes the Eastern Osprey. The draft guideline includes the most current biological and ecological information on this species, important habitat and estimates of ecologically significant proportions of a population (DotE 2015b).

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Eastern Osprey was not recorded within the Study Area during recent surveys. This species was recorded by URS Australia Pty Ltd (2012) on the western side of Groote Eylandt within coastal strand vegetation, however the exact location of the record is unknown. The NR Maps database holds 35 records of this species within the locality of the Study Area (see **Figure 14**), with the latest record from 2019. The NR Maps database holds records of this species at two locations within the Study Area. A single undated record occurs within the Study Area at Castle Rock and it is considered likely that this is a flyover record due to the distance from waterways. Two further records occur at a single location that is the same as 17 other species records, which is considered unlikely to reflect the actual location of the species.

Potential habitat for this species occurs in coastal dune/swale complex habitats and estuarine complex habitats, with some riparian areas along major rivers also providing habitat within the Study Area. This species is expected to utilise the Study Area as part of a much larger foraging range, and has the potential to utilise the Study Area as breeding habitat. No suitable habitat for this species occurs in the Stage 2 exploration program area, which is located outside of major waterways.

Photograph 17 Eastern Osprey (Source: P. Harris in BirdLife International, 2016)

Common Sandpiper

EPBC Act Status: Migratory (wetland)

Species Overview

This species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats (DAWE 2020a). The species feeds for extensive periods in grasslands consuming terrestrial prey, though riverine areas are also utilised (DAWE 2020a). Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves (DAWE 2020a). The species does not breed in Australia (DAWE 2020a). A photograph of a Common Sandpiper is shown in **Photograph 18**.

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Common Sandpiper. However, this species is included under the *Wildlife Conservation Plan for Migratory Shorebirds* (Commonwealth of Australia 2015). This conservation plan addresses topics relevant to the conservation of migratory shorebirds, including the Common Sandpiper, and includes a summary of Australia's commitments under international conventions and agreements, and identification of important habitat.

Recovery Plan

There is no Recovery Plan for the Common Sandpiper.

Threat Abatement Plan

There are no Threat Abatement Plans in place for the Common Sandpiper.

Referral Guideline

There is no Referral Guideline for the Common Sandpiper.

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Common Sandpiper was not recorded within the Study Area during recent surveys or in database records. The NR Maps database holds 14 records of this species within the locality (see **Figure 14**), with the latest record obtained in 2019. None of these records occur within the Study Area. This species has been recorded in a previous survey by URS Australia Pty Ltd (2012).

Potential habitat for this species occurs in estuarine complex habitats and some wetland habitat within the Study Area. The drill pads and access tracks for the Stage 2 exploration program will be located outside of estuarine and wetland habitats.

Photograph 18 Common Sandpiper (Source: P. Harris in BirdLife International, 2016)

Fork-tailed Swift

EPBC Act Status: Migratory (marine)

Species Overview

The Fork-tailed Swift is known to migrate to Australia during its non-breeding season (August to March) (DAWE 2020b). This species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher, mostly over inland plains but sometimes above foothills or in coastal areas (DAWE 2020b). Foraging occurs anywhere from 1 m to 300 m above the ground, with the known diet comprising small bees, wasps, termites and moths (DAWE 2020b). This species breeds in Siberia (DAWE 2020b). There are no significant threats to the Fork-tailed Swift in Australia; however potential threats may include habitat destruction and predation by feral animals (DAWE 2020b). A photograph of a Fork-tailed Swift is shown in **Photograph 19**.

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Fork-tailed Swift.

Recovery Plan

There is no Recovery Plan in place for the Fork-tailed Swift.

Threat Abatement Plan

A Threat Abatement Plan is in place for the Fork-tailed Swift for the threat of Feral Cats.

Referral Guideline

A draft Referral Guideline exists for 14 migratory birds, which includes the Fork-tailed Swift. The draft guideline includes the most current biological and ecological information on the species, important habitat and estimates of ecologically significant proportions of a population (DotE 2015b).

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Fork-tailed Swift was not recorded within the Study Area during the recent surveys or in database records. The NR Maps database holds two records of this species within the locality (see **Figure 14**), with the latest record from 2019. Neither of these records were within the Study Area. URS Australia Pty Ltd (2012) recorded this species in an area to the north of the Study Area.

There is potential fly-over habitat for this species above the vegetation within the Study Area and Stage 2 exploration program area and it is expected to forage aerially about these areas on occasion. No breeding habitat is present within the Study Area (or Groote Eylandt) as breeding occurs outside of Australia.

Photograph 19 Fork-tailed Swift (Source: K. Nicolson in Atlas of Living Australia, 2018)

Sharp-tailed Sandpiper

EPBC Act Status: Migratory (wetland)

Species Overview

This species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation (DAWE 2020c). They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water (DAWE 2020c). The species forages in the wave-wash zone and amongst rotting seaweed (DAWE 2020c). The species roosts on or behind bare sand high on the beach, clumps of washed-up kelp, coastal dunes, and rocky reefs and ledges (DAWE 2020c). The species does not breed in Australia (DAWE 2020c). A photograph of a Sharp-tailed Sandpiper is shown in **Photograph 20**.

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Sharp-tailed Sandpiper. However, this species is included under the *Wildlife Conservation Plan for Migratory Shorebirds* (Commonwealth of Australia 2015). This conservation plan addresses topics relevant to the conservation of migratory shorebirds, including the Sharp-tailed Sandpiper, and includes a summary of Australia's commitments under international conventions and agreements, and identification of important habitat.

Recovery Plan

There is no Recovery Plan for the Sharp-tailed Sandpiper.

Threat Abatement Plan

There are no Threat Abatement Plans in place for the Sharp-tailed Sandpiper.

Referral Guideline

There is no Referral Guideline for the Sharp-tailed Sandpiper.

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Sharp-tailed Sandpiper was not recorded within the Study Area during recent surveys or in database records. The NR Maps database holds eight records of this species within the locality (see **Figure 14**), with the latest record from 2018. None of these records occur within the Study Area. This species has been recorded in a previous survey by Webb (1992).

Potential habitat for this species occurs in estuarine complex habitats and some wetland habitat within the Study Area. The drill pads and access tracks for the Stage 2 exploration program will be located outside of estuarine and wetland habitats.

Photograph 20 Sharp-tailed Sandpiper (Source: K. Jones in DES, 2019)

Common Greenshank

EPBC Act Status: Migratory (wetland)

Species Overview

The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity (DAWE 2020k). It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass (DAWE 2020k). The species is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh (DAWE 2020k). It will occasionally feed on exposed seagrass beds (DAWE 2020k). The Common Greenshank roosts and loafs around wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets (DAWE 2020k). Occasionally the species will perch and roost on stakes (DAWE 2020k). The species does not breed in Australia (DAWE 2020k). A photograph of a Common Greenshank is shown in **Photograph 21**.

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Common Greenshank. However, this species is included under the *Wildlife Conservation Plan for Migratory Shorebirds* (Commonwealth of Australia 2015). This conservation plan addresses topics relevant to the conservation of migratory shorebirds, including the Common Greenshank, and includes a summary of Australia's commitments under international conventions and agreements, and identification of important habitat.

Recovery Plan

There is no Recovery Plan for the Common Greenshank.

Threat Abatement Plan

There are no Threat Abatement Plans in place for the Common Greenshank.

Referral Guideline

There is no Referral Guideline for the Common Greenshank.

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Common Greenshank was not recorded within the Study Area during recent surveys or in database records. The NR Maps database holds 33 records of this species within the locality (see **Figure 14**), with the latest record obtained in 2019. None of these records occur within the Study Area. This species has been recorded in a previous survey by Webb (1992).

Potential habitat for this species occurs in estuarine complex habitats and some wetland habitat within the Study Area. The drill pads and access tracks for the Stage 2 exploration program will be located outside of estuarine and wetland habitats.

Photograph 21 Common Greenshank (Source: J. Bartoš in BirdLife International, 2016)

Marsh Sandpiper

EPBC Act Status: Migratory (wetland)

Species Overview

The species lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks (DAWE 2020l). The species usually forages in shallow water at the edge of wetlands (DAWE 2020l). The species has been recorded roosting or loafing on tidal mudflats, near low saltmarsh, and around inland swamps (DAWE 2020l). The Marsh Sandpiper does not breed in Australia (DAWE 2020l). A photograph of a Marsh Sandpiper is shown in **Photograph 22**.

EPBC Act Plans

Conservation Advice

There is no Approved Conservation Advice for the Marsh Sandpiper. However, this species is included under the *Wildlife Conservation Plan for Migratory Shorebirds* (Commonwealth of Australia 2015). This conservation plan addresses topics relevant to the conservation of migratory shorebirds, including the Marsh Sandpiper, and includes a summary of Australia's commitments under international conventions and agreements, and identification of important habitat.

Recovery Plan

There is no Recovery Plan for the Marsh Sandpiper.

Threat Abatement Plan

There are no Threat Abatement Plans in place for the Marsh Sandpiper.

Referral Guideline

There is no Referral Guideline for the Marsh Sandpiper.

Presence and Habitat within the Stage 2 exploration program area and Study Area

The Marsh Sandpiper was not recorded within the Study Area during recent surveys or in database records. The NR Maps database holds three records of this species within the locality (see **Figure 14**), with the latest record obtained in 2018. None of these records occur within the Study Area.

Potential habitat for this species occurs in estuarine complex habitats and some wetland habitat within the Study Area. The drill pads and access tracks for the Stage 2 exploration program will be located outside of estuarine and wetland habitats.

Photograph 22 Marsh Sandpiper (Source: O. Prosický in BirdLife International, 2016)

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APPENDIX A :

EPBC Act Protected Matters Search Tool Results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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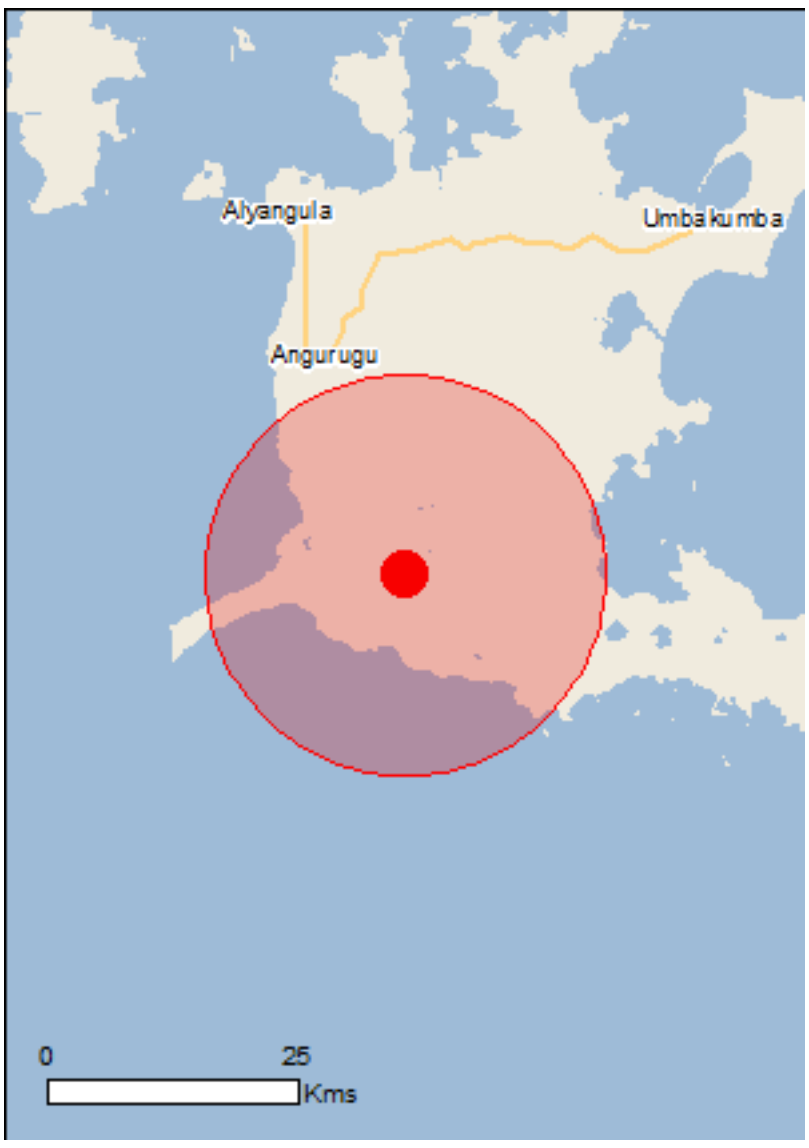

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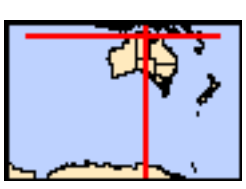

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	28
Listed Migratory Species:	45

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	75
Whales and Other Cetaceans:	10
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	3
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

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

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

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

Name
North

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Notomys aquilo Northern Hopping-mouse, Woorrentinta [123]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta		Species or species habitat likely to occur

Name	Threatened	Type of Presence
Ray [84994]		within area
Manta birostris		
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cecropis daurica		
Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna bergii Crested Tern [816]		Breeding likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area

Name	Status	Type of Presence
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Anindilyakwa	NT

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Key Ecological Features (Marine)	[Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Gulf of Carpentaria coastal zone	North

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-14.17028 136.53333

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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APPENDIX B :
Summary of Previous Survey Reports

Table 16 Summary of previous survey reports utilised within this assessment

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
Ecological gradients in forest communities on Groote Eylandt, Northern Territory, Australia.	Langkamp, P. J., Ashton, D. H. and Dalling, M. J.	1981	Botanical examination of the natural patterns and ecology of forest and woodland on Western Groote Eylandt, particularly in areas where manganese deposits are located on Western Groote Eylandt.	Existing GEMCO Mine and Eastern Leases (see Figure 4).	The document explains the patterns of forest and woodland floristic and structural variation in relation to soils, topography and drainage.
Flora Survey of the GEMCO Mining Lease on the Western Side of Groote Eylandt, Northern Territory.	Brocklehurst, P. and Cowie, I.	1992	Provide baseline data on the flora and fauna within the GEMCO mineral leases and adjoining areas.	Existing GEMCO Mine and Eastern Leases (see Figure 4).	The document provided information on: - Distribution and descriptions of vegetation communities. - Flora and fauna diversity. - Fauna habitats present.
Flora and Fauna Surveys on the Western Side of Groote Eylandt, N.T. (1991-92).	G. Webb Pty Limited.	1992	Provide baseline data on the flora and fauna within the GEMCO mineral leases and adjoining areas.	Existing GEMCO Mine and Eastern Leases (see Figure 4).	The document provided information on: - Distribution and descriptions of vegetation communities. - Flora and fauna diversity. - Fauna habitats present. - Occurrence of threatened fauna species (although no maps of occurrence were provided in the Webb report).
Object based land cover mapping for Groote Eylandt: a tool for reconnaissance and land based surveys.	Crase, B. and Hempel, C.	2005	Provide a land cover map by spatial analysis, which integrates remotely sensed imagery with Geographic Information Systems. Intended to be a useful tool for selection of sites for vegetation investigation.	Entire Groote Eylandt.	The document provided a map of broad land cover types.

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
Northern Hopping Mouse Notomys aquilo - ALC Ranger Report April 2006.	Ward, S.	2006	To examine ways to monitor the Northern Hopping-mouse.	Eningkirra and Yanbakwa.	The document provided background information on: - Small terrestrial mammals occurring on Groote Eylandt. - Survey techniques for the Northern Hopping-mouse. This document provided locations of records of potential Northern Hopping-mouse spoils.
Northern Hopping Mouse Notomys aquilo - ALC Ranger Report November 2006.	Ward, S.	2006	To examine ways to monitor the Northern Hopping-mouse.	Enungwadena (Kings Crossing) and the road to Dalumba Bay and Yingakwumanja.	The document provided background information on: - Small terrestrial mammals occurring on Groote Eylandt. - Survey techniques for the Northern Hopping-mouse. This document provided locations of records of: - Northern Hopping-mouse. - Potential Northern Hopping-mouse spoils. - Brush-tailed Rabbit-rat.
Northern Hopping Mouse Notomys aquilo - ALC Ranger Report April-May 2007.	Ward, S.	2007	To examine ways to monitor the Northern Hopping-mouse.	Amalyikba Creek, Enungwadena (Kings Crossing) and the road to Dalumba Bay, Hempel Bay and tracks joining Umbakumba,	The document provided background information on: - Small terrestrial mammals occurring on Groote Eylandt. - Survey techniques for the Northern Hopping-mouse. This document provided locations of records of:

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
				Mamalingmanja Point (Picnic Beach) and Banyan Tree.	- Northern Hopping-mouse. - Potential Northern Hopping-mouse spoils. - Brush-tailed Rabbit-rat.
Northern Hopping Mouse Notomys aquilo - ALC Ranger Report September 2007.	Ward, S.	2007	To examine ways to monitor the Northern Hopping-mouse.	Tracks joining Umbakumba, Mamalingmanja Point (Picnic Beach) and Banyan Tree, north east of Umbakumba and Enungwadena (Kings Crossing) and the road to Dalumba Bay.	The document provided background information on survey techniques for the Northern Hopping-mouse. This document provided locations of records of potential Northern Hopping-mouse spoils.
Surveys for the Threatened Northern Hopping-mouse, Northern Quoll & Brush-tailed Rabbit-rat on GEMCO Eastern Exploration Leases (Groote Eylandt).	Firth, R.	2008	Undertake targeted surveys for the Northern Hopping-mouse, Northern Quoll and Brush-tailed Rabbit-rat.	Eastern Leases (see Figure 4).	This document provided locations of records of: - Potential Northern Hopping-mouse spoils. - Brush-tailed Rabbit-rat.
F3 Quarry Area Expansion, GEMCO, Groote Eylandt. Terrestrial Fauna Assessment.	Ecological Management Services Pty Ltd.	2008	Assess the terrestrial vertebrate fauna species present within the proposed F3 Quarry expansion area and an additional area to the west.	F3 Quarry and adjacent area to west (see Figure 4).	The document provided background information on fauna assemblages within the GEMCO mineral leases. This document provided locations of records of potential Northern Hopping-mouse spoils.

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
Seasonal detectability of Northern Hopping Mouse spoil heaps on Groote Eylandt.	Smith, D. J.	2009	Collect additional information about the seasonal visibility of Northern Hopping- mouse spoil heaps.	Eastern Leases (see Figure 4).	This document provided locations of records of potential Northern Hopping-mouse spoils.
Surveys for Northern Hopping-mouse, Northern Quoll and Brush-tailed Rabbit-rat across Groote Eylandt.	Smith, D. J.	2009	Undertake targeted surveys for the Northern Hopping-mouse, Northern Quoll and Brush-tailed Rabbit-rat.	Various locations across Groote Eylandt.	The document provided background information on small terrestrial mammals occurring on Groote Eylandt. This document provided locations of records of: - Potential Northern Hopping-mouse spoils. - Northern Quoll. - Brush-tailed Rabbit-rat.
Eastern Leases Pre-clearance Survey for Groote Eylandt Mining Company.	Coffey Environments Pty Ltd.	2010	Pre-clearance surveys for Northern Hopping-mouse and collection of population characteristics through the excavation of spoil heaps, and targeted surveys for the Northern Hopping-mouse.	Eastern Leases (pre-clearing) and Quarries F3, G and D (targeted surveys) (see Figure 4).	The document provided background information on the suitability of using spoils to record the presence of the Northern Hopping-mouse. This document provided locations of records of: - Northern Hopping-mouse. - Potential Northern Hopping-mouse spoils.
Survey for Signs of Northern Hopping-mice on the GEMCO Eastern Leases.	Rankmore, D. B.	2011	Targeted survey for signs of the Northern Hopping-mouse.	Eastern Leases (see Figure 4).	The document provided background information on surveys for the Northern Hopping-mouse.

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
Flora and Fauna Surveys of Western Groote Eylandt.	URS Australia Pty Ltd.	2012	Provide a comprehensive flora and fauna assessment across the GEMCO mineral leases.	Existing GEMCO Mine Figure 4 shows the study area for URS (2012).	The document provided information on: - Distribution and descriptions of vegetation communities. - Flora and fauna diversity. - Fauna habitats present. - Occurrence of threatened fauna species mentioned but not mapped by URS. - Faunal assemblages within mine rehabilitation areas.
Assessment of Northern Hopping Mouse (Notomys aquilo) Habitat Issues, A-South Expansion Area.	Ecological Management Services Pty Ltd.	2012	Provide a preliminary assessment of the potential for a proposed expansion area to support populations of the Northern Hopping-mouse.	West of the A South Quarry (see Figure 4).	The document provided information on mammal species known within the GEMCO mineral leases. This document provided locations of records of potential Northern Hopping-mouse spoils.
Eastern Leases ELR28161/ELR28162 Exploration Drilling Program: Northern Masked Owl/Northern Hopping Mouse Habitat Assessment June – July 2013.	Ecological Management Services Pty Ltd.	2013	Conduct surveys within the footprint of the proposed exploration drilling lines and pads within the Eastern Leases, targeting Masked Owl (northern) individuals and habitat and Northern Hopping-mouse burrows.	Eastern Leases (see Figure 4).	The document provided background information on nesting/roosting habitat features available for use by the Masked Owl (northern). This document provided locations of records of: - Potential Northern Hopping-mouse spoils. - Brush-tailed Rabbit-rat. - Masked Owl (northern).
Eastern Leases ELR28161/ELR28162 Exploration Drilling	Ecological Management	2014	Re-survey uncleared exploration drilling lines and pads in the Eastern Leases and identify Masked Owl	Eastern Leases (see Figure 4).	The document provided background information on nesting/roosting habitat

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
Program: Northern Masked Owl/ Northern Hopping Mouse Habitat Assessment. August 2014.	Services Pty Ltd.		(northern) roost/nest trees and Northern Hopping-mouse spoils.		features available for use by the Masked Owl (northern). This document provided locations of records of potential Northern Hopping-mouse spoils.
Eastern Leases Project – Terrestrial Ecology Assessment Report	Cumberland Ecology Pty Ltd.	2015	To document the findings of a terrestrial ecological assessment of the Eastern Leases Project, to support an Environmental Impact Statement.	Eastern Leases (see Figure 4).	The document provided information on: - Distribution and descriptions of vegetation communities. - Flora and fauna diversity. - Fauna habitats present. - Occurrence of threatened species. The document also provides information on faunal assemblages within mine rehabilitation areas of the existing GEMCO mine.
Southern Lease Area – Ecological Pre-clearance Survey Report for the FY17 Gridded Drill Area	Hansen Bailey.	2016	To describe the ecological pre-clearance survey undertaken for the proposed FY17 gridded drill areas in the Southern Lease Area.	Area within the northern portion of the Southern Lease (see Figure 4).	The document provided information on: - Fauna habitat features present.
Southern Lease Project – Baseline Terrestrial Ecology Report	Cumberland Ecology Pty Ltd.	2016	To document the findings of a baseline terrestrial ecology assessment of the Ecological Survey Area, an area of land in the northern portion of the Southern Lease.	Southern Lease (see Figure 4).	The document provided information on: - Distribution and descriptions of vegetation communities. - Flora and fauna diversity. - Fauna habitats present. - Occurrence of threatened species.

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
					- Occurrence of introduced and invasive species.
Interim Report on Threatened Small Mammal and Feral Cat Surveys on Groote Eylandt	Heiniger, J. and Gillespie, G.	2017	To document the findings of an island wide survey in lowland eucalypt woodland which was undertaken to understand the current distribution and status of threatened mammal species and feral cats on Groote Eylandt to improve knowledge of their current status, and determine the environmental and landscape correlates of their distributions.	Various locations across Groote Eylandt.	The document provided information on: - Fauna diversity. - Occurrence of threatened fauna species. - Occurrence of introduced fauna species. This document provided locations of records of: - Brush-tailed Rabbit-rat. - Northern Quoll. - Northern Hopping-mouse.
GEMCO/South32 Southern Lease Small Mammal Research Project	Cumberland Ecology Pty Ltd.	2019	To document the findings of a small mammal research project, targeting threatened species, within the Southern Lease and surrounds.	Southern Lease and surrounds (see Figure 4).	The document provided information on: - Habitat types. - Fauna diversity. - Occurrence of threatened species. - Occurrence of introduced and invasive fauna species. - Fire history. This document provided locations of records of: - Masked Owl (northern). - Northern Quoll. - Northern Hopping-mouse.

Document Title	Author	Date	Purpose	Location	Information Utilised within this Report
Northern Hopping-mouse Surveys: Final Report to Territory NRM July 2019	Anindilyakwa Land & Sea Rangers	2019	To document the findings of targeted Northern Hopping-mouse surveys across Groote Eylandt.	Various locations across Groote Eylandt.	This document provided details of staged targeted surveys for the Northern Hopping-mouse. This document also provided locations of records of Northern Hopping-mouse spoils and individuals.
Eastern Leases Project. Main Haul Road Corridor Ecological Pre-clearance Survey Report	Cumberland Ecology Pty Ltd.	2019	To document the findings of a pre-clearance assessment completed within the Eastern Leases haul road corridor.	Area in the vicinity of the Eastern Leases haul road corridor (see Figure 4).	The document provided information on: - Fauna habitat features present. This document provided locations of records of: - Northern Hopping-mouse.
Eastern Leases Project. Main Haul Road Corridor - Realigned Road. Ecological Pre-clearance Survey Report	Cumberland Ecology Pty Ltd.	2019	To document the findings of a pre-clearance assessment completed within the Eastern Leases haul road corridor.	Area in the vicinity of the Eastern Leases haul road corridor (see Figure 4).	The document provided information on: - Fauna habitat features present. This document provided locations of records of: - Northern Hopping-mouse.

APPENDIX C :
Vegetation Map Units

Table 17 Vegetation map units within the Study Area

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
Individual VMUs			
1	Mangrove low closed-forest/closed-forest	148.2	-
2	Dry coastal monsoon vine closed forests/low closed-forests	82.2	-
4	Spring monsoon vine-forests	95.7	-
5	Riparian monsoon vine-forests with *Melaleuca cajuputi* and/or *Melaleuca leucadendra*	14.9	-
6	Seepage monsoon vine-forests with *Melaleuca cajuputi* and/or *Melaleuca leucadendra* isolated emergents	3.5	-
10	*Eucalyptus tetrodonta/E. miniata* open-forest to woodland with low shrub or tussock grass understorey	1029.5	0.8
10a	*Eucalyptus tetrodonta/E. miniata* open-forest with low shrub or tussock grass understorey on lowland plains and rises	4783.2	3.7
10b	*Eucalyptus tetrodonta/E. miniata* open-forest with low shrub and mixed tussock/hummock grass understorey on upland plateau surfaces, mostly associated with deeply weathered land surfaces	471.7	10.4
11	*Eucalyptus tetrodonta/E. miniata /Callitris intratropica* open-forest with mixed shrub/tussock grass understorey	2954.6	2.0
12	*Eucalyptus tetrodonta/E. miniata/Callitris intratropica* open-forest with *Acacia* spp., *Grevillea pteridifolia* dense mid layer and sedge/tussock grass understorey. Drainage areas in sandstone.	116.3	-
13	*Eucalyptus tetrodonta/E. kombolgiensis* Woodland with shrubby or open hummock grassland understorey	823.9	-
15	*Callitris intratropica* open-forest; *Acacia* spp. tall shrubland complex on sandstone	80.6	<0.0
17	*Melaleuca viridiflora* or *Melaleuca cajuputi* or *Melaleuca leucadendra* or *Melaleuca ferruginea / Eucalyptus polycarpa/Eucalyptus bigalerita* open-forest with *Pandanus spiralis* and Mixed tussock grassland understorey	384.5	1.1
18	*Melaleuca leucadendra* and/or *Melaleuca cajaputi / Dillenia alata +/- Melaleuca viridiflora* open forest with fern/sedge understorey (Swamp Forests - Emerald River) Gullies in sandstone	35.6	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
19	*Melaleuca cajuputi* or *Melaleuca ferruginea* / *M. leucadendra* open forest with fern/bracken understorey. *Corymbia bella* and/or *Eucalyptus bigalerita* woodland occurs on the fringes	133.5	-
20	*Melaleuca cajuputi* / *Corymbia bella* or *Eucalyptus bigalerita* open forest with shrubby understorey often including monsoon vine forest species	504.3	-
21	Mixed *Melaleuca* open forests/ monsoon vine-forests	80.1	-
22	*Melaleuca cajuputi* low closed-forest / *Dapsilanthus ramosus* sedgeland/closed sedgeland (permanent swamps/sedgelands)	23.2	-
23	*Melaleuca cajuputi* / *M. viridiflora* low open-forest with *Dapsilanthus elatior* sedgeland understorey	87.1	-
26	Riparian woodland to open-forest of *Melaleuca leucadendra*, *Corymbia polycarpa, Eucalyptus tetrodonta* on ephemeral rivers/streams in drier sub-coastal lowlands	118.3	-
27a	*Melaleuca viridiflora* or *Melaleuca ferruginea* low woodland on plains with shrubby or mixed hummock grass/sedge ground layer on lateritic plains	14.7	-
27b	*Melaleuca viridiflora* or *Melaleuca ferruginea* low woodland on plains with shrubby or mixed hummock and tussock grass/sedge ground layer on quaternary sandplains	87.2	0.1
28	*Melaleuca* spp. (*M. viridiflora/M. cajaputi/M. ferruginea*) woodland to low woodland on alluvial plains with sedge understorey	563.7	0.6
29b	*Eucalyptus tetrodonta*, *Corymbia ferruginea +/- Callitris intratropica* low woodland on low hills of sandstone in the north with mixed tussock grass, shrub and *Triodia bitextura* ground layer	15.9	-
30	*Eucalyptus tetrodonta, Corymbia kombolgiensis, Corymbia polycarpa* woodland with shrubby understorey of monsoon vine thicket woodland on deeply weathered lowlands and stabilised coastal sands in the east	1649.1	-
31	*Eucalyptus tertodonta, Corymbia kombolgiensis, Melaleuca viridiflora/leucadendra, Corymbia polycarpa, Corymbia foelscheana* open forest/woodland with shrubby understorey and tussock grasses on lowlands including stabilising sands in the east where transitional into VMU 30.	17.8	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
31a	*Eucalyptus tetrodonta, Corymbia kombolgiensis, Melaleuca viridiflora/leucadendra, Corymbia polycarpa, Corymbia foelscheana* open forest/woodland with shrubby understorey and tussock grasses on lowlands including stabilising sands in the east where transitional into VMU 30.	416.2	0.1
40	*Eucalyptus tetrodonta/E. miniata / E. polycarpa +/- Callitris intratropica* woodland with low shrub or tussock/hummock grass understorey	816.4	1.2
40a	*Eucalyptus tetrodonta/E. miniata +/- E. polycarpa* woodland with low shrub and tussock grass dominated understorey on lateritic plains and low rises (generally lowlands).	1577.3	9.5
40b	*Eucalyptus tetrodonta +/- E. miniata +/- Callitris intratropica* woodland to open woodland with low shrub/hummock/tussock grass understorey on shallow rocky soils usually derived from sandstone. Plateaus, hills and rises.	963.7	-
41	*Callitris intratropica / Eucalyptus tetrodonta / E. kombolgiensis* open- woodland with hummock grassland understorey	742.3	-
42	*Eucalyptus polycarpa /E. tetrodonta /E. miniata* woodland with sedge spp./ low shrub understorey	831.6	3.6
43	*Melaleuca viridiflora / Eucalyptus polycarpa / Grevillea pteridifolia* open woodland with *Asteromytrus symphyocarpa* and *Vetiveria elongata* tussock grassland	612.5	1.5
44	*Melaleuca leucadendra* or *Melaleuca cajaputi* woodland with *Ischaemum* spp. understorey adjacent to the estuarine zone	22.4	-
45	*Eucalyptus polycarpa* open- woodland with sedges, short tussock grass understorey. Also areas of grassland	617.7	2.4
46	*Eucalyptus tetrodonta/E. miniata* low woodland with tussock grass understorey	99.3	0.5
48	*Eucalyptus tetrodonta* and/or *Corymbia kombolgiensis +/- Corymbia polycarpa*, *Corymbia ferruginea* open woodland to woodland with *Acacia* spp., *Grevillea* spp., *Terminalia carpentariae* and mixed hummock/tussock grasses on sandstone	572.6	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
49	Mixed Monsoon species (e.g. *Xanthostemon umbrosus, Pouteria sericea, Drypetes deplanchei, Terminalia carpentariae* etc.) +/- *Corymbia kombolgiensis* scattered trees to open-woodland on margins of Sandstone plateau surfaces	7.6	-
51	Alluvial woodland to open-woodland with *Corymbia bella*, *Corymbia polycarpa* and *Eucalyptus bigalerita* +/- *Corymbia grandifolia, Corymbia foelscheana, Corymbia confertiflora, Eucalyptus tetrodonta, Eucalyptus tectifica, Erythrophleum chlorostachys*	34.0	-
51a	*E. bigalerita* woodland	187.9	-
51c	*E. tectifica* and *E. tetrodonta +/- E. jensenii* low open woodland to woodland. May be associated with alluvial plains on sandy areas on sandstone plateaus	132.9	1.9
52	*Melaleuca viridiflora* and *Pandanus spiralis +/- Corymbia bella* and/or *Eucalyptus bigalerita* and/or *Corymbia polysciada* (in north) open-woodland adjacent to estuarine zone. *Chrysopogon elongatus* tussock grassland	49.4	-
53	*Eucalyptus jensenii* and/or *Eucalyptus bigalerita*, *Eucalyptus foelscheana* on basalt	2.3	-
54	*Melaleuca acacioidies* low open woodland adjacent to estuarine zone	19.4	-
55	*Melaleuca viridiflora* or *M .dealbata* or *M ferruginea +/- P. spiralis* and *G. pteridifolia* low woodland on quaternary/coastal sands or adjacent to floodplains with sedge understorey	38.7	-
55a	*Melaleuca viridiflora* or *M .dealbata* or *M. ferruginea +/- P. spiralis* and *G. pteridifolia* low woodland on quaternary/coastal sands with sedge understorey, *Dapsilanthus elatior* prominent	33.0	-
55b	*Melaleuca viridiflora* or *M .dealbata* or *M ferruginea +/- P. spiralis* and *G. pteridifolia* low woodland adjacent to floodplains with sedge understorey	12.5	-
57	*Acacia* spp., *Melaleuca dealbata, Melaleuca viridiflora, Melaleuca cajuputi, Asteromyrtus symphyocarpa, Banksia dentata, Grevillea pteridifolia, Corymbia polycarpa, Corymbia kombolgiensis, Eucalyptus tetrodonta* low open woodland to tall shrubland with mixed tussock grass/sedge ground layer on quaternary sandplains	140.3	-
59	*Eucalyptus tetrodonta/Erythrophleum chlorostchys/Corymbia polycarpa* woodland on lateritic lowland plains	69.3	0.2

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
60	*Melaleuca viridiflora* or *Melaleuca ferruginea* +/- *Corymbia polycarpa* low open woodland/shrubland on quaternary/coastal sandplains with mixed hummock grass/sedge understorey	51.2	-
61	*Melaleuca ferruginea/Melaleuca viridiflora/Melaleuca cajaputi* +/- *Corymbia polycarpa* open woodland to low open woodland with *Pandanus spiralis, Grevillea pteridifolia* and 'wet' tussock grass ground layer (*Germania grandiflora*, *Ichaemum* spp.) and sedges (*Dapsilanthus* spp.) in wet dune swales and open drainage systems	23.7	-
62	Open-woodland to scattered trees of monsoon species on sand or cemented sand dunes (*Sterculia quadrifida, Diospyros humilis, Drypetes deplanchei, Santalum, Diospyros maratima, Pouteria sericea, Brachychiton paradoxus, Hakea arborescens*)	11.8	-
70	Dry Sandstone shrublands +/- emergent *Corymbia kombolgiensis*	193.7	-
72	*Acacia* spp. and/or mixed species shrublands (*Melaleuca* spp., *Terminalia carpentariae, Buchanania obovata, Grevillea* spp., *Banksia dentata, Verticordia cunninghamii*) on coastal sandplains and stabilising dunes with mixed sedge/tussock grass ground layer (*Triodia microstachya, Dapsilanthus spathaceus, Schoenus sparteus*)	180.7	-
73	*Acacia* spp., *Asteromyrtus symphyocarpa, Banksia dentata, Verticordia cunninghamii* wet shrublands on coastal dunes and plains. *Dapsilanthus spathaceaus* dominant in ground layer	7.2	-
75	Samphire (Chenopod) Shublands on intertidal flats	22.1	-
80	*Eleocharis*, *Cyperus* sedgeland	2.5	-
81	Closed tussock grassland on margins of estuarine zone	2.4	-
81a	Closed tussock grassland on margins of estuarine zone (*Heteropogon triticeus, Chrysopogon elongatus, Triodia* spp. (Dry)	5.0	-
81b	*Pseudoraphis spinescens, Paspalum scrobiculatum* closed grassland in wet swales or plains on quaternary coastal sands with emergent *Pandanus spiralis* +/- *Melaleuca* spp.	36.4	-
82a	Tussock grassland on sandplains and stabilised dunes of *Sorghum plumosum* and *Chrysopogon elongatus*	8.1	-
84	*Lepironia* or *Dapsilanthus ramosus* and *Dapsilanthus elatior* sedgeland fringing permanent waterbodies	19.5	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
86	*Triodia* grassland to open shrubland on sandstone	24.5	-
88	Brackish water sedge swamp - Schoenoplectus littoralis, *Eleocharis* spp., *Cyperus* spp.	1.5	-
100	Saline Tidal Flats +/- emergent isolated trees and (chenopod) shrubs	96.2	-
202	Cleared	1.7	-
500	Lacustrine wetlands	2.0	-
Water		0.5	-
Combination VMUs			
4/21	Spring monsoon vine-forests / Mixed *Melaleuca* open forests/monsoon vine-forests	3.0	-
4/30	Spring monsoon vine-forests / *Eucalyptus tetrodonta, Corymbia kombolgiensis, Corymbia polycarpa* woodland with shrubby understorey of monsoon vine thicket woodland on deeply weathered lowlands and stabilised coastal sands in the east	24.4	-
5/21	Riparian monsoon vine-forests with *Melaleuca cajuputi* and/or *Melaleuca leucadendra* / Mixed *Melaleuca* open forests/monsoon vine-forests	3.4	-
10b/15	*Eucalyptus tetrodonta/E. miniata* open-forest with low shrub and mixed tussock/hummock grass understorey on upland plateau surfaces, mostly associated with deeply weathered land surfaces / *Callitris intratropica* open-forest; *Acacia* spp. tall shrubland complex on sandstone	6.3	-
11/15	*Eucalyptus tetrodonta/E. miniata /Callitris intratropica* open-forest with mixed shrub/tussock grass understorey / *Callitris intratropica* open-forest; *Acacia* spp. tall shrubland complex on sandstone	126.5	-
13/40b	*Eucalyptus tetrodonta/E. kombolgiensis* open-forest/low open forest Woodland with shrubby or open hummock grassland understorey / *Eucalyptus tetrodonta +/- E. miniata +/- Callitris intratropica* woodland to open woodland with low shrub/hummock/tussock grass understorey on shallow rocky soils usually derived from sandstone. Plateaus, hills and rises.	180.7	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
13/70	*Eucalyptus tetrodonta/E. kombolgiensis* open-forest/low open forest Woodland with shrubby or open hummock grassland understorey / Dry Sandstone shrublands +/- emergent *Corymbia kombolgiensis*	79.8	-
17/26	*Melaleuca viridiflora* or *Melaleuca cajuputi* or *Melaleuca leucadendra* or *Melaleuca ferruginea / Eucalyptus polycarpa/Eucalyptus bigalerita* open-forest with *Pandanus spiralis* and Mixed tussock grassland understorey / Riparian woodland to open-forest of *Melaleuca leucadendra, Corymbia polycarpa, Eucalyptus tetrodonta* on ephemeral rivers/streams in drier sub-coastal lowlands	417.1	-
17/28	*Melaleuca viridiflora* or *Melaleuca cajuputi* or *Melaleuca leucadendra* or *Melaleuca ferruginea / Eucalyptus polycarpa/Eucalyptus bigalerita* open-forest with *Pandanus spiralis* and Mixed tussock grassland understorey / *Melaleuca* spp. (*M. viridiflora/M. cajaputi/M. ferruginea*) woodland to low woodland on alluvial plains with sedge understorey	22.2	-
17/5	*Melaleuca viridiflora* or *Melaleuca cajuputi* or *Melaleuca leucadendra* or *Melaleuca ferruginea / Eucalyptus polycarpa/Eucalyptus bigalerita* open-forest with Pandanus spiralis and Mixed tussock grassland understorey / Riparian monsoon vine-forests with *Melaleuca cajuputi* and/or *Melaleuca leucadendra*	55.4	-
18/5	*Melaleuca leucadendra* and/or *Melaleuca cajaputi / Dillenia alata +/- Melaleuca viridiflora* open-forest with fern/sedge understorey (Swamp Forests - Emerald River) Gullies in sandstone / Riparian monsoon vine-forests with *Melaleuca cajuputi* and/or *Melaleuca leucadendra*	29.9	-
18/500	*Melaleuca leucadendra* and/or *Melaleuca cajaputi / Dillenia alata +/- Melaleuca viridiflora* open forest with fern/sedge understorey (Swamp Forests - Emerald River) Gullies in sandstone / Lacustrine wetlands	6.5	-
18/6	*Melaleuca leucadendra* and/or *Melaleuca cajaputi / Dillenia alata +/- Melaleuca viridiflora* open forest with fern/sedge understorey (Swamp Forests - Emerald River) Gullies in sandstone / Seepage monsoon vine-forests with *Melaleuca cajuputi* and/or *Melaleuca leucadendra* isolated emergents	2.9	-
20/51	*Melaleuca cajuputi* / *Corymbia bella* or *Eucalyptus bigalerita* open forest with shrubby understorey often including monsoon vine forest species / Alluvial woodland to open-woodland with Cor*ymbia bella, Corymbia polycarpa* and	71.5	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
	Eucalyptus bigalerita +/- Corymbia grandifolia, Corymbia foelscheana, Corymbia confertiflora, Eucalyptus tetrodonta, Eucalyptus tectifica, Erythrophleum chlorostachys		
21/4	Mixed *Melaleuca* open forests/monsoon vine-forests / Spring monsoon vine-forests	5.5	-
26/17	Riparian woodland to open-forest of *Melaleuca leucadendra, Corymbia polycarpa, Eucalyptus tetrodonta* on ephemeral rivers/streams in drier sub-coastal lowlands / *Melaleuca viridiflora* or *Melaleuca cajuputi* or *Melaleuca leucadendra* or *Melaleuca ferruginea / Eucalyptus polycarpa/Eucalyptus bigalerita* open-forest with *Pandanus spiralis* and Mixed tussock grassland understorey	88.0	-
27b/32	*Melaleuca viridiflora* or *Melaleuca ferruginea* low woodland on plains with shrubby or mixed hummock and tussock grass/sedge ground layer on quaternary sandplains / *Acacia* spp., *Melaleuca dealbata, Melaleuca viridiflora, Corymbia polycarpa, Asteromyrtus symphyocarpa* low woodland on quaternary sandplains	21.3	-
27b/55a	*Melaleuca viridiflora* or *Melaleuca ferruginea* low woodland on plains with shrubby or mixed hummock and tussock grass/sedge ground layer on quaternary sandplains / *Melaleuca viridiflora* or *M .dealbata* or *M ferruginea +/- P. spiralis* and *G. pteridifolia* low woodland on quaternary/coastal sands with sedge understorey, *Dapsilanthus elatior* prominent	158.3	-
28/17	*Melaleuca* spp. (*M. viridiflora/M. cajaputi/M. ferruginea*) woodland to low woodland on alluvial plains with sedge understorey / *Melaleuca viridiflora* or *Melaleuca cajuputi* or *Melaleuca leucadendra* or *Melaleuca ferruginea / Eucalyptus polycarpa/Eucalyptus bigalerita* open-forest with *Pandanus spiralis* and Mixed tussock grassland understorey	6.4	-
32/27b	*Acacia* spp., *Melaleuca dealbata*, *Melaleuca viridiflora*, *Corymbia polycarpa*, *Asteromyrtus symphyocarpa* low woodland on quaternary sandplains / *Melaleuca viridiflora* or *Melaleuca ferruginea* low woodland on plains with shrubby or mixed hummock and tussock grass/sedge ground layer on quaternary sandplains	25.6	-
32/60	*Acacia* spp., *Melaleuca dealbata*, *Melaleuca viridiflora*, *Corymbia polycarpa*, *Asteromyrtus symphyocarpa* low woodland on quaternary sandplains / *Melaleuca viridiflora* or *Melaleuca ferruginea +/- Corymbia polycarpa* low open woodland/shrubland on quaternary/coastal sandplains with mixed hummock grass/sedge understorey	14.4	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
40b/13	*Eucalyptus tetrodonta +/- E. miniata +/- Callitris intratropica* woodland to open woodland with low shrub/hummock/tussock grass understorey on shallow rocky soils usually derived from sandstone. Plateaus, hills and rises. / *Eucalyptus tetrodonta/E. kombolgiensis* open-forest/low open forest Woodland with shrubby or open hummock grassland understorey	577.2	-
40b/48	*Eucalyptus tetrodonta +/- E. miniata +/- Callitris intratropica* woodland to open woodland with low shrub/hummock/tussock grass understorey on shallow rocky soils usually derived from sandstone. Plateaus, hills and rises. / *Eucalyptus tetrodonta* and/or *Corymbia kombolgiensis +/- Corymbia polycarpa, Corymbia ferruginea* open woodland to woodland with *Acacia* spp., *Grevillea* spp., *Terminalia carpentariae* and mixed hummock/tussock grasses on sandstone	137.9	-
42/12	*Eucalyptus polycarpa /E. tetrodonta /E. miniata* woodland with sedge spp./ low shrub understorey / *Eucalyptus tetrodonta/E. miniata/Callitris* intratropica open forest with *Acacia* spp., *Grevillea pteridifolia* dense mid layer and sedge/tussock grass understorey. Drainage areas in sandstone	32.1	0.3
42/43	*Eucalyptus polycarpa /E. tetrodonta /E. miniata* woodland with sedge spp./ low shrub understorey / *Melaleuca viridiflora / Eucalyptus polycarpa / Grevillea pteridifolia* open woodland with *Asteromytrus symphyocarpa* and *Vetiveria elongata* tussock grassland	30.8	-
42/51a	*Eucalyptus polycarpa /E. tetrodonta /E. miniata* woodland with sedge spp./ low shrub understorey / *E. bigalerita* woodland	30.6	0.2
43/45	*Melaleuca viridiflora / Eucalyptus polycarpa / Grevillea pteridifolia* open woodland with *Asteromytrus symphyocarpa* and *Vetiveria elongata* tussock grassland / *Eucalyptus polycarpa* open-woodland with sedges, short tussock grass understorey. Also areas of grassland	64.7	<0.0
43/51	*Melaleuca viridiflora / Eucalyptus polycarpa / Grevillea pteridifolia* open woodland with *Asteromytrus symphyocarpa* and *Vetiveria elongata* tussock grassland / Alluvial woodland to open-woodland with *Corymbia bella, Corymbia polycarpa* and *Eucalyptus bigalerita +/- Corymbia grandifolia, Corymbia foelscheana, Corymbia confertiflora, Eucalyptus tetrodonta, Eucalyptus tectifica, Erythrophleum chlorostachys*	80.3	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
44/17	*Melaleuca leucadendra* or *Melaleuca cajaputi* woodland with *Ischaemum* spp. understorey adjacent to the estuarine zone / *Melaleuca viridiflora* or *Melaleuca cajuputi* or *Melaleuca leucadendra* or *Melaleuca ferruginea / Eucalyptus polycarpa/Eucalyptus bigalerita* open-forest with *Pandanus spiralis* and Mixed tussock grassland understorey	18.3	-
44/54	*Melaleuca leucadendra* or *Melaleuca cajaputi* woodland with Ischaemum spp. understorey adjacent to the estuarine zone / *Melaleuca acacioidies* low open woodland adjacent to estuarine zone	6.9	-
47/43	*Eucalyptus tetrodonta/E. polycarpa Melaleuca viridiflora* low open woodland with *Asteromyrtus symphyocarpa* Shrubland / *Melaleuca viridiflora / Eucalyptus polycarpa / Grevillea pteridifolia* open woodland with *Asteromytrus symphyocarpa* and *Vetiveria elongata* tussock grassland	37.9	0.1
48/70	*Eucalyptus tetrodonta* and/or *Corymbia kombolgiensis +/- Corymbia polycarpa, Corymbia ferruginea* open woodland to woodland with *Acacia* spp., *Grevillea* spp., *Terminalia carpentariae* and mixed hummock/tussock grasses on sandstone / Dry Sandstone shrublands +/- emergent *Corymbia kombolgiensis*	287.9	-
50/60	Quaternary sandplain or stabilized dune *Eucalyptus tetrodonta* open woodland to woodland with mixed *Triodia bitextura* and tussock grass understorey / *Melaleuca viridiflora* or *Melaleuca ferruginea +/- Corymbia polycarpa* low open woodland/shrubland on quaternary/coastal sandplains with mixed hummock grass/sedge understorey	43.1	-
51/20	Alluvial woodland to open-woodland with *Corymbia bella, Corymbia polycarpa* and *Eucalyptus bigalerita +/- Corymbia grandifolia, Corymbia foelscheana, Corymbia confertiflora, Eucalyptus tetrodonta, Eucalyptus tectifica, Erythrophleum chlorostachys / Melaleuca cajuputi / Corymbia bella* or *Eucalyptus bigalerita* open forest with shrubby understorey often including monsoon vine forest species	125.1	-
51/43	Alluvial woodland to open-woodland with *Corymbia bella, Corymbia polycarpa* and *Eucalyptus bigalerita +/- Corymbia grandifolia, Corymbia foelscheana, Corymbia confertiflora, Eucalyptus tetrodonta, Eucalyptus tectifica, Erythrophleum chlorostachys / Melaleuca viridiflora / Eucalyptus polycarpa / Grevillea pteridifolia* open woodland with *Asteromytrus symphyocarpa* and *Vetiveria elongata* tussock grassland	74.4	-
51a/28	*E. bigalerita* woodland / *Melaleuca* spp. (*M. viridiflora/M. cajaputi/M. ferruginea*) woodland to low woodland on alluvial plains with sedge understorey	16.5	-

VMU	Name	Study Area (ha)	Stage 2 Exploration Program Area (ha)[2]
52/100	*Melaleuca viridiflora* and *Pandanus spiralis* +/- *Corymbia bella* and/or *Eucalyptus bigalerita* and/or *Corymbia polysciada* (in north) open-woodland adjacent to estuarine zone. *Chrysopogon elongatus* tussock grassland / Saline Tidal Flats +/- emergent isolated trees and (chenopod) shrubs	9.8	-
54/52	*Melaleuca acacioidies* low open woodland adjacent to estuarine zone / *Melaleuca viridiflora* and *Pandanus spiralis* +/- *Corymbia bella* and/or *Eucalyptus bigalerita* and/or *Corymbia polysciada* (in north) open-woodland adjacent to estuarine zone. *Chrysopogon elongatus* tussock grassland	18.9	-
60/81b	*Melaleuca viridiflora* or *Melaleuca ferruginea* +/- *Corymbia polycarpa* low open woodland/shrubland on quaternary/coastal sandplains with mixed hummock grass/sedge understorey / *Pseudoraphis spinescens, Paspalum scrobiculatum* closed grassland in wet swales or plains on quaternary coastal sands with emergent *Pandanus spiralis* +/- *Melaleuca* spp.	22.7	-
70/48	Dry Sandstone shrublands +/- emergent *Corymbia kombolgiensis / Eucalyptus tetrodonta* and/or *Corymbia kombolgiensis* +/- *Corymbia polycarpa, Corymbia ferruginea* open woodland to woodland with *Acacia* spp., *Grevillea* spp., *Terminalia carpentariae* and mixed hummock/tussock grasses on sandstone	64.5	-
75/1	Samphire (Chenopod) Shublands on intertidal flats / Mangrove low close-forest/closed-forest	0.9	-
75/88	Samphire (Chenopod) Shublands on intertidal flats / Brackish water sedge swamp - *Schoenoplectus littoralis, Eleocharis* spp., *Cyperus* spp.	3.8	-
86/70	*Triodia* grassland to open shrubland on sandstone / Dry Sandstone shrublands +/- emergent *Corymbia kombolgiensis*	11.0	-
Unmapped[1]		9.3	-
Total (nearest hectare)[2]		**26,063**	**40**

1. A few sections of rivers have been unmapped by DENR.

2. In some cases totals may not equal the total number due to rounding.

APPENDIX D :
Likelihood of Occurrence Assessment

Table 18 Likelihood of occurrence assessment

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
PLANTS									
Lantern Tree	*Hernandia nymphaeifolia*		V			**General habitat requirements/preferences:** The Lantern Tree occurs exclusively in coastal areas within the littoral zone at an altitudinal range of only a few metres above sea level. It has been reported to occur along the seashore in littoral rainforest and in coastal swamps (Kerrigan and Cowie 2006, Hyland et al. 2010).	This species was not recorded during recent (2016-2018) field surveys. The NR Maps database identifies occurrences of the species in the north-east coast of Groote Eylandt, but not within the Study Area or locality. The species has not been recorded in areas adjacent to the Study Area in previous surveys performed by Cumberland Ecology (2015), URS (2012) and Webb (1992).	Moderate likelihood of occurrence. Numerous patches of coastal vine thicket and some areas of coastal swamp occur in the south western and southern portion of the Study Area that could be considered potential habitat for the Lantern Tree. This species is considered to have a moderate likelihood of occurring within this area of coastal habitat. However, the remainder of the Study Area does not contain coastal habitat, and is considered unsuitable for this species.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain coastal habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
BIRDS									
Red Knot	*Calidris canutus*	E, M(w)	V	X	X	**General habitat requirements/preferences:** The Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms (Threatened Species Scientific Committeee 2016). They have also been recorded on terrestrial saline wetlands near the coast (Threatened Species Scientific Committeee 2016). **Foraging requirements/preferences:** The species is known to forage near the edge of water on intertidal mudflats and sand flats, as well as sewage ponds, and nearby lakes (Threatened Species Scientific Committeee 2016). **Roosting requirements/preferences:** The species roosts on sandy beaches, spits and islets, and mudflats (Threatened Species Scientific Committeee 2016). The species prefer to roost in open areas far away from potential cover for predators, but close to feeding grounds (Threatened Species Scientific Committeee 2016). **Breeding requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys. The NR Maps database identifies two occurrences of the species in the locality, with the latest record from 1978. No records exist within the Study Area. The species has not been recorded in areas adjacent to the Study Area in previous surveys performed by Cumberland Ecology (2015), URS (2012) and Webb (1992).	Low likelihood of occurrence. The Red Knot is a coastal species. A small area of potential habitat for this species occurs in the south-western portion of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years and extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain coastal habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						The species does not breed in Australia, (Threatened Species Scientific Committeee 2016).			
Curlew Sandpiper	*Calidris ferruginea*	CE, M(w)	V	X	X	**General habitat requirements/preferences:** The Curlew Sandpiper mainly occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms (Threatened Species Scientific Committee 2015c). **Foraging requirements/preferences:** Main requirements for feeding habitats are the presence of mudflats or shallow water up to 60 mm. The Curlew Sandpiper may also forage in low sparse emergent vegetation, such as saltmarsh, and sometimes forage in flooded paddocks or inundated saltflats (Threatened Species Scientific Committee 2015c). **Roosting requirements/preferences:** Roosting occurs in open situations with damp substrate, especially on bare shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands	This species was not recorded during recent (2016-2018) field surveys. The NR Maps database identifies 16 occurrences of the species in the locality, with the latest record from 2019. One record exists within the Study Area from 2019. This record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The species has been recorded previously on the island by Webb (1992), however the exact location is unknown.	Low likelihood of occurrence. The Curlew Sandpiper is a coastal species. A small area of potential habitat for this species occurs in the south-western portion of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						(Threatened Species Scientific Committee 2015c). **Breeding requirements/preferences:** The species does not breed in Australia (Threatened Species Scientific Committee 2015c).			
Great Knot	*Calidris tenuirostris*	CE, M(w)	V		X	**General habitat requirements/preferences:** The Great Knot inhabits sheltered coastal habitats, including inlets, harbours and estuaries. The species prefers habitats with large intertidal mudflats or sand flats. It has also been recorded on rock platforms, ponds in salt works, swamps near the coast, and salt lakes (DotE 2013a). **Foraging requirements/preferences:** The species is known to forage in areas of mud for invertebrates (OEH 2014). **Roosting requirements/preferences:** Roosting habitat for the Great Knot is mainly shallow water in close proximity to feeding grounds (DotE 2013a). **Breeding requirements/preferences:** The species does not breed in Australia (DotE 2013a).	This species was not recorded during recent (2016-2018) field surveys. The NR Maps database identifies 20 occurrences of the species within the locality, with the latest record from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The species has not been recorded in areas adjacent to the Study Area in	Low likelihood of occurrence. The Great Knot is a coastal species. A small area of potential habitat for this species occurs in the south-western portion of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
							previous surveys performed by Cumberland Ecology (2015), URS (2012) and Webb (1992).		
Greater Sand Plover	*Charadrius leschenaultii*	V, M(w)	V		X	**General habitat requirements/preferences:** The Greater Sand Plover inhabits coastal littoral and estuarine environments, and is mainly found on sandy or muddy beaches with intertidal mudflats or sandbanks, rock platforms, inshore reefs or sand cays on coral reefs (DotEE 2019h). **Foraging requirements/preferences:** The species forages visually over the surface of the substrate or just below the surface. It prefers to forage in areas that have low densities of other foraging shorebirds (DotEE 2019h). **Roosting requirements/preferences:** The Greater Sand Plover usually roosts on banks, sand-spits, beaches, or in tidal lagoons. They are also known to roost on rocky points and in salt marshes (DotEE 2019h). **Breeding requirements/preferences:** This species does not breed in Australia (DotEE 2019h).	This species was not recorded during recent (2016-2018) field surveys. The species has been recorded previously on the island by URS (2012), however the exact location is unknown. The NR Maps database identifies 25 occurrences of the species in the locality, with the latest record from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat.	Low likelihood of occurrence. The Greater Sand Plover is a coastal species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
Lesser Sand Plover	*Charadrius mongolus*	E, M(w)	V		X	**General habitat requirements/preferences:** The Lesser Sand Plover is found in coastal littoral and estuarine environment, with preferred habitats including large intertidal sand flats or mudflats in sheltered bays, harbours and estuaries, and sometimes also sandy ocean beaches, coral reefs, and rock platforms (DotEE 2019i). **Foraging requirements/preferences:** Preferred foraging habitat consists of vast, freshly-exposed intertidal sand flats and mudflats in beaches, estuaries and ponds in salt works. They are also known to feed on coral reef, river margins, and muddy areas around lakes (DotEE 2019i). **Roosting requirements/preferences:** Roosting habitat is usually near foraging areas, but it is known to roost inland on sandbanks in swamp, grassy margins of ephemeral pools, and inland claypan (DotEE 2019i). **Breeding requirements/preferences:** The Lesser Sand Plover is a migratory bird which breeds in Mongolia and Siberia, and typically overwinters in Australia. It is not known to breed in Australia (DotEE 2019i).	This species was not recorded during recent (2016-2018) field surveys. The species has been recorded previously on the island by URS (2012) in coastal and estuarine environments. The NR Maps database identifies 22 occurrences of the species in the locality, with the latest record from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat.	Low likelihood of occurrence. The Lesser Sand Plover is a coastal species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
Red Goshawk	*Erythrotriorchis radiatus*	V	V	X		**General habitat requirements/preferences:** The Red Goshawk prefers woodlands and forests with a mosaic of vegetation types that are open enough for fast manoeuvring flight. These favoured areas contain permanent water and have large populations of birds of other species (DotEE 2019n). **Foraging requirements/preferences:** The Red Goshawk generally avoids very dense or very open habitats, preferring to hunt along their ecotones (DotEE 2019n). **Roosting requirements/preferences:** The species nests in tall trees in open forest and woodland near permanent water bodies. Their nest is usually placed on a horizontal branch against a vertical branch (DotEE 2019n). **Breeding requirements/preferences:** Breeding generally occurs from August to November and nesting territories are reused by breeding pairs year after year (DotEE 2019n).	This species was not recorded during recent (2016-2018) field surveys. There are no records of this raptor on Groote Eylandt within the NR Maps database and it has not been recorded during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The EPBC PMST identifies that the species or species habitat is likely to occur within the 20 km search radius. It should be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	Low likelihood of occurrence. The vegetation in the Study Area could provide suitable habitat for the Red Goshawk. However, the species has a low potential to occur on the Study Area, given that it has never been recorded on Groote Eylandt, despite numerous fauna surveys.	Low likelihood of occurrence. The vegetation in the Stage 2 exploration program area could provide suitable habitat for the Red Goshawk. However, the species has a low potential to occur on the Stage 2 exploration program area, given that it has never been recorded on Groote Eylandt, despite numerous fauna surveys.
Gouldian Finch	*Erythrura gouldiae*	E	V	X		**General habitat requirements/preferences:** The main habitat requirements for the Gouldian Finch are the presence of	This species was not recorded during recent (2016-2018) field surveys.	Low likelihood of occurrence. The vegetation in the Study Area could	Low likelihood of occurrence. The vegetation in the Stage 2

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						grasses (especially Sorghum), close proximity to permanent water, and open woodlands dominated by Eucalypts (DotE 2014b). **Foraging requirements/preferences:** The species feeds almost exclusively on seeds taken from grasses such as Sorghum, although they also take seeds from grasses in other genera including *Alloteropsis, Aristida, Chrysopogon, Digitaria, Echinochloa, Eriachne, Heteropogon, Panicum, Schizachyrium, Sehima, Themeda, Triodia* and *Xerochloa*. The species has also been recorded foraging in areas burnt by fire. (DotE 2014b). **Roosting requirements/preferences:** The Gouldian Finch usually nests in Eucalyptus tree hollows, but is also known to nest in shrubs among grass and in termite mound hollows (DotE 2014b). **Breeding requirements/preferences:** Breeding habitat usually occurs on ridges and rocky foothills. A critical habitat requirement for breeding is the presence of unburnt hollow-bearing Eucalyptus trees (DotE 2014b).	The NR Maps database contains a single record of occurrence of this species on Groote Eylandt (although the record is not from within the Study Area or locality). The record is from the year 1924, and there have been no further records of this species since then, despite numerous fauna surveys on the island. In particular, this species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius.	provide suitable habitat for the Gouldian Finch. However, the species is not predicted to occur on the Study Area, given a lack of recent records on Groote Eylandt.	exploration program area could provide suitable habitat for the Gouldian Finch. However, the species is not predicted to occur on the Stage 2 exploration program area, given a lack of recent records on Groote Eylandt.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
Partridge Pigeon	*Geophaps smithii*	V[4]	V		X	**General habitat requirements/preferences:** The Partridge Pigeon inhabits Eucalyptus tetrodonta and E.miniata dominated open forest and woodland (DotE 2013b). **Foraging requirements/preferences:** Main foraging habitat requirements include areas with an open ground layer, or locations which have recently been burnt. It relies on perennial grass species which set seed relatively early (e.g. *Chrysopogon fallax* and *Alloteropsis semialata*) (DotE 2013b). **Roosting requirements/preferences:** The species roosts and nests on the ground, in areas with dense vegetation cover (DotE 2013b). **Breeding requirements/preferences:** Little is known about the breeding of the species, but it is known to lay eggs throughout the year. Nests are usually constructed in a shallow depression and lined with leaves or grass (DotE 2013b).	This species was not recorded during recent (2016-2018) field surveys. Three records of this species on Groote Eylandt are held within the NR Maps database, and date from 1910 (all in the locality). This species has not been recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). It is a relatively conspicuous species and has not been found in any previous surveys of the existing GEMCO mine or the Eastern Leases, despite surveys having been undertaken in these areas within the past 25 years.	Low likelihood of occurrence. Suitable habitat for this species is present in the Study Area in the form of E. tetrodonta and E. miniata dominated open forest and woodland. Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years.	Low likelihood of occurrence. Suitable habitat for this species is present in the Stage 2 exploration program area in the form of E. tetrodonta and E. miniata dominated open forest and woodland. Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years.
Bar-tailed Godwit	*Limosa lapponica*	V/CE[5] M(w)	V	X	X	**General habitat requirements/preferences:** The Bar-tailed Godwit is mainly a coastal species, and inhabits intertidal sand flats, mudflats, estuaries, harbours and coastal lagoons. The species has been recorded	This species was not recorded during recent (2016-2018) field surveys.	Low likelihood of occurrence. The Bar-tailed Godwit is a coastal species. A small area of potential	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						in coastal sewage farms and salt lakes and brackish wetlands, sandy ocean beaches, rock platforms, and around beds of seagrass (DotEE 2019s). **Foraging requirements/preferences:** Preferred feeding habitats include shallow water or the edge of water in tidal estuaries, harbours, or soft mud with seagrass beds (DotEE 2019s). **Roosting requirements/preferences:** Main habitat requirements for roosting include sandy beaches and near-coastal salt marshes (DotEE 2019s). **Breeding requirements/preferences:** The Bar-tailed Godwit does not breed in Australia (DotEE 2019s).	This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 22 occurrences of the species in the locality, with the latest record from 2019. One record exists in the Study Area from 2019. This record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius.	habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	exploration program area, as it does not contain estuarine complex habitat.
Eastern Curlew	*Numenius madagascariensis*	CE, M(w)	V	X	X	**General habitat requirements/preferences:** During the non-breeding season in Australia, the Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays,	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has not been recorded in areas adjacent to the Study Area in	Low likelihood of occurrence. The Eastern Curlew is a coastal species. A small area of potential habitat for	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DotE 2015a). **Foraging requirements/preferences:** The species mainly forages during the non-breeding season on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline (DotE 2015a). **Roosting requirements/preferences:** The species roosts during high tide periods on sandy spits, sandbars and islets, especially on beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves (DotE 2015a). **Breeding requirements/preferences:** The Eastern Curlew does not breed in Australia (DotE 2015a).	previous surveys performed by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 48 occurrences of the species in the locality, with the latest record from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST identifies that the species or species habitat is known to occur within the 20 km search radius.	this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	exploration program area, as it does not contain estuarine complex habitat.
Australian Painted Snipe	*Rostratula australis*	E	V	X		**General habitat requirements/preferences:** Generally inhabits shallow terrestrial freshwater (occasionally brackish)	This species was not recorded during recent (2016-2018) field surveys.	Low likelihood of occurrence. The Australian Painted Snipe is a	Low likelihood of occurrence. No suitable habitat for this

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						wetlands, including temporary and permanent lakes, swamps and claypans (DAWE 2020j). **Foraging requirements/preferences:** Generally remain in dense cover when feeding, although may forage over nearby mudflats and other open areas such as ploughed land or grassland (DAWE 2020j). **Breeding requirements/preferences:** Breeds in shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby (DAWE 2020j).	There are no records of this raptor on Groote Eylandt within the NR Maps database and it has not been recorded during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. It should be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	coastal / wetland species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11), and grassland areas adjacent to wetlands. Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records on Groote Eylandt.	species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat or wetland.
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	V	V		X	**General habitat requirements/preferences:** The northern species of the Masked Owl is known to occur in riparian forest, eucalypt tall open forest, monsoon rainforest, and Melaleuca swamps and the margins of sugar cane fields (DotEE 2019ah). **Foraging requirements/preferences:**	This species was recorded within the Study Area at one location during recent field surveys (Cumberland Ecology 2016) (see Figure 13). The species was recorded flying over *Eucalyptus tetrodonta* shrubland in response to call playback. The species was also recorded immediately adjacent to the Study Area (Cumberland Ecology 2019b).	Present. Suitable habitat is present throughout the Study Area as remnant vegetation exists throughout. There is excellent habitat connectivity in the landscape	Present. Suitable habitat is present throughout the Stage 2 exploration program area as remnant vegetation exists

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						The species forages in open woodland on small to medium-sized terrestrial mammals (DotEE 2019ah). **Roosting requirements/preferences:** The species requires large tree hollows for nesting and usually nests in areas of closed forest (DotEE 2019ah). **Breeding requirements/preferences:** Little is known about the life cycle of the species but it is believed to breed between March-October (DotEE 2019ah).	The Masked Owl (northern) was previously recorded within the nearby Eastern Leases at four locations by Cumberland Ecology (2015) and at 10 locations by EMS (2013). URS (2012) recorded this species at four locations in E. tetrodonta open forest and on the margins of Melaleuca and Eucalyptus-dominated forest types. The NR Maps database identifies eight occurrences of the species in the locality, with the latest record from 2014. No records exist within the Study Area.	with few areas of cleared vegetation. Hollow-bearing trees which may provide suitable roosting habitat are present in the Study Area.	throughout the site. There is excellent habitat connectivity in the landscape with no areas of cleared vegetation on the site. Hollow-bearing trees which may provide suitable roosting habitat are present in the Stage 2 exploration program area.
Oriental Reed-warbler	*Acrocephalus orientalis*	M(w)		X		**General habitat requirements/preferences:** Found in aquatic vegetation along waterways and waterbodies. It has been recorded using Typha sp., in sugar cane plantations, and in mangroves (DotE 2015b). **Foraging requirements/preferences:** Little information on the foraging requirements of this species in Australia is currently known. **Roosting requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys within the Study Area. There are no records of this species from Groote Eylandt on the NR Maps database. It has not been recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. It should	Low likelihood of occurrence. This species has been assessed as having a low potential to occur, given no suitable habitat for this species occurs in the Study Area, and given it has not been recorded on Groote Eylandt, despite	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Little information on the roosting requirements of this species in Australia is currently known. **Breeding requirements/preferences:** This species does not breed in Australia (DotE 2015b).	be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	numerous fauna surveys.	
Common Sandpiper	*Actitis hypoleucos*	M(w)		X	X	**General habitat requirements/preferences:** This species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats (DotEE 2019a). **Foraging requirements/preferences:** The species feeds for extensive periods in grasslands consuming terrestrial prey, though riverine areas are also utilised (DotEE 2019a). The species eats molluscs such as bivalves, crustaceans such as amphipods and crabs and a variety of insects (DotEE 2019a). **Roosting requirements/preferences:** Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves (DotEE 2019a). **Breeding requirements/preferences:** The species does not breed in Australia (DotEE 2019a).	This species was not recorded during recent (2016-2018) field surveys. This species has been recorded in a previous survey by URS (2012) in monsoon/mangrove forest and coastal strand habitats, and Webb (1992) in sewage ponds. The NR Maps database identifies 14 occurrences of the species in the locality, with the latest record from 2019. One record exists within the Study Area from 2018. The record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as	Moderate likelihood of occurrence. The Common Sandpiper is a coastal / wetland species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). This species is considered to have a moderate likelihood of occurring within this area of estuarine complex habitat and wetlands. However, the remainder of the Study Area does not	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
							being at Salt Creek and associated road) and limited available habitat. The EPBC PMST identifies that the species or species habitat is known to occur within the 20 km search radius.	contain suitable habitat.	
Common Noddy	*Anous stolidus*	M(m)		X		**General habitat requirements/preferences:** The species occurs on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoals or cays of coral or sand (DotEE 2019b). **Foraging requirements/preferences:** The species feeds mainly on fish, although they are known to also take squid, pelagic molluscs, medusae, aquatic insects and even Pandanus fruit (DotEE 2019b). **Roosting requirements/preferences:** During the non-breeding period, the species occurs in groups throughout the pelagic zone (DotEE 2019b). **Breeding requirements/preferences:** The species breeds in colonies, and only one breeding location is known within the Northern Territory (DotEE 2019b).	This species was not recorded during recent (2016-2018) field surveys. It has not been recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database has no records of this species in the Study Area or locality. The latest record from Groote Eylandt is from 1980. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius.	Low likelihood of occurrence. The Common Noddy is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area. Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years and the limited extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
Fork-tailed Swift	*Apus pacificus*	M(m)		X	X	**General habitat requirements/preferences:** The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. The species mostly occurs over inland plains, open habitats, riparian woodland, tea-tree swamps, and occasionally above foothills or in coastal areas. They also occur over settled areas, including towns, urban areas and cities (DotEE 2019c). **Foraging requirements/preferences:** The species forages aerially, often in updraughts, near cliffs (DotEE 2019c). This species prefers foraging above dry and open habitats (DotEE 2019c). **Roosting requirements/preferences:** The species is likely to roost aerially, but are occasionally observed to land (DotEE 2019c). **Breeding requirements/preferences:** The Fork-tailed Swift does not breed in Australia (DotEE 2019c).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has been recorded in previous surveys by URS (2012), however the exact location is unknown. The NR Maps database identifies two occurrences of the species in the locality, with the latest record from 2019. No records exist within the Study Area. The EPBC PMST identifies the species or species habitat as being likely to occur within the 20 km search radius.	Moderate likelihood of occurrence. Potential overfly habitat is present in the Study Area, although this species prefers foraging above dry and open habitats rather than in the predominantly wooded forests in the Study Area.	Moderate likelihood of occurrence. Potential overfly habitat is present in the Stage 2 exploration program area, although this species prefers foraging above dry and open habitats rather than in the predominantly wooded forests in the Stage 2 exploration program area.
Ruddy Turnstone	*Arenaria interpres*	M(w)			X	**General habitat requirements/preferences:** The species is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms	This species was not recorded during recent (2016-2018) field surveys.	Low likelihood of occurrence. The Ruddy Turnstone is a coastal species. A	Low likelihood of occurrence. No suitable habitat for this species occurs in

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches (DotEE 2019d). **Foraging requirements/preferences:** Mainly forages between lower supralittoral and lower littoral zones of foreshores, from strand-line to wave-zone (DotEE 2019d). **Roosting requirements/preferences:** Roosting occurs on beaches, above the tideline, among rocks, shells, beachcast seaweed or other debris (DotEE 2019d). **Breeding requirements/preferences:** The Ruddy Turnstone does not breed in Australia (DotEE 2019d).	This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 12 occurrences of the species in the locality, with the latest record from 2018. No records exist within the Study Area. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	the Stage 2 exploration program area, as it does not contain estuarine complex habitat.
Sharp-tailed Sandpiper	*Calidris acuminata*	M(w)		X	X	**General habitat requirements/preferences:** This species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation (DotEE 2019e). **Foraging requirements/preferences:** They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water (DotEE 2019e).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has been recorded in previous surveys by Webb (1992), however the exact location is unknown. The NR Maps database identifies eight occurrences of the species in the locality, with the latest record from 2018. No records exist within the Study Area.	Moderate likelihood of occurrence. The Sharp-tailed Sandpiper is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat or suitable wetland areas.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Roosting requirements/preferences: Roosting occurs at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse vegetation, such as grass or saltmarsh (DotEE 2019e). **Breeding requirements/preferences:** The Sharp-tailed Sandpiper does not breed in Australia (DotEE 2019e).	The EPBC PMST identifies the species or species habitat as known to occur within the 20 km search radius.	habitat (refer Figure 11). Some limited areas of suitable wetlands also occur. This species is considered to have a moderate likelihood of occurring within this area of estuarine complex habitat and wetlands. However, the remainder of the Study Area does not contain suitable habitat for this species.	
Pectoral Sandpiper	*Calidris melanotos*	M(w)		X		**General habitat requirements/preferences:** The species prefers shallow fresh to saline wetlands (DotEE 2019f). The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (DotEE 2019f). **Foraging requirements/preferences:** The species forages in shallow water or soft mud at the edge of wetlands (DotEE 2019f).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. It has not been recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database does not identify any occurrences of the species in the locality.	Low likelihood of occurrence. The Pectoral Sandpiper is a coastal / wetland species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Roosting requirements/preferences: Roosting habitat occurs in proximity to foraging habitat. **Breeding requirements/preferences:** The Pectoral Sandpiper does not breed in Australia (DotEE 2019f).	The EPBC PMST identifies that the species or species habitat is likely to occur within the 20 km search radius.	(refer Figure 11). Some limited areas of wetlands also occur. Nevertheless, the species is assessed as having a low likelihood of occurrence, given the scarcity of records.	
Red-necked Stint	*Calidris ruficollis*	M(w)			X	**General habitat requirements/preferences:** The species is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores (DotEE 2019g). **Foraging requirements/preferences:** The species mostly forages on bare wet mud on intertidal mudflats or sandflats, or in very shallow water; mostly in areas with a film of surface water and mostly close to edge of water (DotEE 2019g). **Roosting requirements/preferences:** The species roosts on sheltered beaches, spits, banks or islets, of sand, mud, coral or shingle, sometimes in saltmarsh or other vegetation (DotEE 2019g).	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 38 occurrences of the species in the locality, with the latest record from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not	Low likelihood of occurrence. The Red-necked Stint is a coastal species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Breeding requirements/preferences: The Red-necked Stint does not breed in Australia (DotEE 2019g).	accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	habitat within the Study Area.	
Streaked Shearwater	*Calonectris leucomelas*	M(m)		X		**General habitat requirements/preferences:** The species has been observed over open ocean and on islands (Takahashi et al. 2008). **Foraging requirements/preferences:** Areas near the continental shelf that have high primary productivity may be suitable foraging habitat (Takahashi et al. 2008). **Roosting requirements/preferences:** The species is known to nest in burrows (Takahashi et al. 2008). **Breeding requirements/preferences:** This species does not breed in Australia (Takahashi et al. 2008).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has not been recorded in areas adjacent to the Study Area in previous surveys performed by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database does not identify any records of the species within Groote Eylandt. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. However, this result should be viewed in light of the fact that the PMST radius includes coastal areas, not	Low likelihood of occurrence. No suitable habitat for this species occurs in the Study Area, which is located outside of marine areas.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, which are located outside of marine areas.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
							predominantly representative of the Study Area.		
Red-rumped Swallow	*Cecropis daurica*	M(t)		X		**General habitat requirements/preferences:** The species is found at locations with wetlands and open areas, such as golf courses (DotE 2015b). **Foraging requirements/preferences:** Predominately forages over wetlands, for example swamps, rivers, dams, or open areas such as golf course or cane fields, where insects are taken on the wing (DotE 2015b). **Roosting requirements/preferences:** As with most swallows and martins, Red-rumped Swallows often perch on bare branches or wires (DotE 2015b). **Breeding requirements/preferences:** This species does not breed in Australia (DotE 2015b).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. It has not been recorded on Groote Eylandt during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database does not identify any records of the species within the locality. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. It should be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	Low likelihood of occurrence. This species has been assessed as having a low potential to occur, given no suitable habitat for this species occurs in the Study Area, and given it has not been recorded on Groote Eylandt in recent years, despite numerous fauna surveys.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area.
Oriental Plover	*Charadrius veredus*	M(w)		X	X	**General habitat requirements/preferences:** The Oriental Plover is known to spend several weeks in coastal areas when first arriving in northern Australia, and then eventually moves further inland. The species prefers flat, open, grasslands with areas of bare ground or areas	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has not been recorded in areas adjacent to the Study Area in	Low likelihood of occurrence. The Oriental Plover a coastal species. A small area of potential habitat for this species occurs in the south-western	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						recently burnt, including dry paddocks or clay pans. The species has also been sighted near terrestrial wetlands and in salt marshes (DotEE 2019j). **Foraging requirements/preferences:** The species is usually found foraging in short grass or on stony bare ground. It is also known to feed on mudflats and on beaches with beach cast seaweed (DotEE 2019j). **Roosting requirements/preferences:** Oriental Plovers roost on wet mud, near the shallow water of beaches, and in salt marshes or paddocks (DotEE 2019j). **Breeding requirements/preferences:** The species does not breed in Australia (DotEE 2019j).	previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies one occurrence of the species in the locality, with the record undated. No records exist within the Study Area. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. However, this result should be viewed in light of the fact that the PMST radius includes coastal areas, not predominantly representative of the Study Area.	corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	it does not contain estuarine complex habitat.
White-winged Black Tern	*Chlidonias leucopterus*	M(m)			X	**General habitat requirements/preferences:** The species mostly inhabits fresh, brackish or saline, and coastal or subcoastal wetlands (DotEE 2019k). They rarely occur on inland wetlands in Australia (DotEE 2019k). **Foraging requirements/preferences:** The species mainly forages aerially, over water or over muddy or sandy edges of wetlands; and also forages over land adjacent to wetlands, especially if	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies two occurrences of the species in the locality, with the latest record from 2016. No records exist within the Study Area.	Low likelihood of occurrence. Only one small area of suitable wetland habitat occurs in the Study Area. This species is considered to have a low likelihood of occurring within this area of wetland habitat.	Low likelihood of occurrence. None of the broad habitats required by this species are present within the Stage 2 exploration program area.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						inundated, including rice paddies and dry paddocks and grassland (DotEE 2019k). **Roosting requirements/preferences:** The species often roosts or loafs on ground at the edges of wetlands, including sandflats, mudflats, beaches, spits, banks, islets and rocks (DotEE 2019k). **Breeding requirements/preferences:** The species does not breed in Australia (DotEE 2019k).	The EPBC PMST does not identify habitat for this species within the 20 km search radius.		
Oriental Cuckoo	*Cuculus optatus*	M(t)		X		**General habitat requirements/preferences:** The species is found in coastal regions across northern and eastern Australia as well as offshore islands (DotE 2015b). The species uses a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types (DotE 2015b). **Foraging requirements/preferences:** This species feeds arborealy, foraging for invertebrates on loose bark on the trunks and branches of trees, and among the foliage, including in mistletoes (DotE	This species was not recorded during recent (2016-2018) field surveys within the Study Area. It has not been recorded on Groote Eylandt during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database does not identify any occurrences of the species in the locality. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. It should be noted that the PMST results are	Low likelihood of occurrence. Although the vegetation on the Study Area has some potential to provide habitat for the Oriental Cuckoo, this species has been assessed as having a low potential to occur, given that it has not been recently recorded on Groote Eylandt, despite numerous fauna surveys.	Low likelihood of occurrence. Although the vegetation on the Stage 2 exploration program area has some potential to provide habitat for the Oriental Cuckoo, this species has been assessed as having a low potential to occur, given that it has never been

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						2015b). It will also forage from the ground (DotE 2015b). **Roosting requirements/preferences:** The species requires shrubs or trees from which it sallies and returns to consume prey items (DotE 2015b). **Breeding requirements/preferences:** This species does not breed in Australia (DotE 2015b).	based on broad scale habitat modelling, rather than actual records of the species.		recorded on Groote Eylandt, despite numerous fauna surveys.
Lesser Frigatebird	*Fregata ariel*	M(m)		X	X	**General habitat requirements/preferences:** This species occurs in pelagic habitat (BirdLife International 2018a). **Foraging requirements/preferences:** It feeds mainly on fish (especially flying-fish) and squid, but also on seabird eggs and chicks, carrion and fish scraps (BirdLife International 2018a). **Roosting requirements/preferences:** This species occurs in pelagic habitat (BirdLife International 2018a). **Breeding requirements/preferences:** breeds on small, remote tropical and sub-tropical islands, in mangroves or bushes, and even on bare ground (BirdLife International 2018a).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has not been recorded in areas adjacent to the Study Area in previous surveys performed by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies four occurrences of the species in the locality, with the latest record from 2016. No records exist within the Study Area. The EPBC PMST identifies that the species or species habitat is likely to occur within the 20 km search radius.	Low likelihood of occurrence. The Lesser Frigatebird is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
								the limited extent of habitat within the Study Area.	
Great Frigatebird	*Fregata minor*	M(m)		X		**General habitat requirements/preferences:** This species occurs in pelagic habitat (BirdLife International 2018b). **Foraging requirements/preferences:** The species feed on fish, squid and chicks of other bird species (BirdLife International 2018b). **Roosting requirements/preferences:** This species occurs in pelagic habitat (BirdLife International 2018b). **Breeding requirements/preferences:** The species breeds on small, remote tropical and sub-tropical islands, in mangroves or bushes and occasionally on bare ground (BirdLife International 2018b).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has not been recorded in areas adjacent to the Study Area in previous surveys performed by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database does not identify any records of the species within Groote Eylandt. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. However, this result should be viewed in light of the fact that the PMST radius includes coastal areas, not predominantly representative of the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Study Area, which is located outside of marine areas, and given it has not been recorded on Groote Eylandt, despite numerous fauna surveys.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, which are located outside of marine areas.
Oriental Pratincole	*Glareola maldivarum*	M(w)		X	X	**General habitat requirements/preferences:** The Oriental Pratincole is found in short grassland or on floodplains in close	This species was not recorded during recent (2016-2018) field surveys within the Study Area.	Low likelihood of occurrence. The Oriental Pratincole is a	Low likelihood of occurrence. No suitable habitat for this

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						proximity to wetlands and lakes, as well as on beaches and mudflats along the coast. It prefers habitats with extensive bare areas (DotEE 2019o). **Foraging requirements/preferences:** The species usually forages aerially in large flocks, from just above the ground to 300 m. They are seen near cyclonic storms or fires to catch prey. They are also seen foraging on the ground (DotEE 2019o). **Roosting requirements/preferences:** The Oriental Pratincole usually roosts in bare areas that have low vegetation, such as salt marshes, airfields or clay pans (DotEE 2019o). **Breeding requirements/preferences:** The species does not breed in Australia (DotEE 2019o).	The species has not been recorded in areas adjacent to the Study Area in previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies two occurrences of the species in the locality, with the latest record from 2018. No records exist within the Study Area. The EPBC PMST identifies the species or species habitat may occur within the 20 km search radius.	coastal / wetland species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11), and grassland areas adjacent to wetlands. Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years.	species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat or areas of flat, open grasslands and floodplains.
Barn Swallow	*Hirundo rustica*	M(t)		X		**General habitat requirements/preferences:** The Barn Swallow occurs in open areas in coastal lowlands, in close proximity to water, towns and cities, as well as around freshwater wetlands, paperbark Melaleuca woodland, and tussock grassland. It is often recorded sitting on	This species was not recorded during recent (2016-2018) field surveys within the Study Area. It has not been recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992).	Low likelihood of occurrence. Some potential habitat for the Barn Swallow is present in the Study Area; however this species prefers more open habitats than the	Low likelihood of occurrence. Although the vegetation on the Stage 2 exploration program area has some potential to provide habitat

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						overhead wires or bare branches (DotEE 2019p). **Foraging requirements/preferences:** The species prefers to feed on insects by aerial pursuit or by skimming plants or water surface. It is occasionally seen feeding on roads, paths and beaches (DotEE 2019p). **Roosting requirements/preferences:** The Barn Swallow nests on small vertical surfaces, such as window-ledges of buildings, typically, two to five metres from the ground (DotEE 2019p). **Breeding requirements/preferences:** The species does not breed in Australia (DotEE 2019p).	There are no records of this species from Groote Eylandt on the NR Maps database. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. It should be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	predominantly wooded forests found in the Study Area. Although the vegetation on the Study Area has some potential to provide habitat for the Barn Swallow, this species has been assessed as having a low potential to occur, given that it has never been recorded on Groote Eylandt, despite numerous fauna surveys.	for the Barn Swallow, this species has been assessed as having a low potential to occur, given that it has never been recorded on Groote Eylandt, despite numerous fauna surveys.
Caspian Tern	*Hydroprogne caspia*	M(m)			X	**General habitat requirements/preferences:** The species is mostly found in sheltered coastal embayments and those with sandy or muddy margins are preferred (DotEE 2019q). **Foraging requirements/preferences:** The species usually forages in open wetlands, including lakes and rivers (DotEE 2019q).	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 19 occurrences of the species in the locality, with the latest record from 2019. One	Low likelihood of occurrence. The Caspian Tern is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Roosting requirements/preferences: Generally roosting occurs on bare exposed sand or shell spits, banks or shores of coasts, lakes, estuaries, coastal lagoons and inlets (DotEE 2019q). **Breeding requirements/preferences:** The species breeds on variable types of sites including low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks (DotEE 2019q).	record exists within the Study Area from 2019. This record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	
Black-tailed Godwit	*Limosa limosa*	M(w)			X	**General habitat requirements/preferences:** The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit (DotEE 2019t). **Foraging requirements/preferences:** The species forages on wide intertidal mudflats or sandflats, in soft mud or shallow water and occasionally in shallow estuaries (DotEE 2019t). **Roosting requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies two occurrence of the species in the locality, with the latest record from 2015. No records exist within the Study Area.	Low likelihood of occurrence. The Black-tailed Godwit a coastal species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11).	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						The claypan may be an important roost site for this species at least during the non-breeding season (DotEE 2019t). **Breeding requirements/preferences:** The Black-tailed Godwit does not breed in Australia (DotEE 2019t).	The EPBC PMST does not identify habitat for this species within the 20 km search radius.	Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years and the limited extent of habitat within the Study Area.	
Grey Wagtail	*Motacilla cinerea*	M(t)		X		**General habitat requirements/preferences:** All confirmed Australian records are associated with water; especially creeks, rivers and waterfalls (DotE 2015b). **Foraging requirements/preferences:** The diet of the Grey Wagtail reflects its habitat with it feeding on a variety of insects as well as other small prey items such as molluscs, crustaceans and occasionally small fish and tadpoles (DotE 2015b). **Roosting requirements/preferences:** Little information on the roosting requirements of this species in Australia is currently known. **Breeding requirements/preferences:** This species does not breed in Australia (DotE 2015b).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. It has not been recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). There are no records of this species from Groote Eylandt on the NR Maps database. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. It should be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	Low likelihood of occurrence. This species has been assessed as having a low potential to occur, given no suitable habitat for this species occurs in the Study Area, and given it has not been recorded on Groote Eylandt, despite numerous fauna surveys.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
Yellow Wagtail	*Motacilla flava*	M(t)		X		**General habitat requirements/preferences:** Habitat requirements for the Yellow Wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves (DotE 2015b). **Foraging requirements/preferences:** Little information on the foraging requirements of this species in Australia is currently known. **Roosting requirements/preferences:** This species roosts in mangroves and other dense vegetation (DotE 2015b). **Breeding requirements/preferences:** This species does not breed in Australia (DotE 2015b).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. It has not been recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). There are no records of this species from Groote Eylandt on the NR Maps database. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius. It should be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	Low likelihood of occurrence. This species has been assessed as having a low potential to occur, given no suitable habitat for this species occurs in the Study Area, and given it has not been recorded recently on Groote Eylandt, despite numerous fauna surveys.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area.
Whimbrel	*Numenius phaeopus*	M(w)			X	**General habitat requirements/preferences:** The species is often found on the intertidal mudflats of sheltered coasts (DotEE 2019u).	This species was not recorded during recent (2016-2018) field surveys.	Low likelihood of occurrence. The Whimbrel is a coastal species. A small area of potential habitat for	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Foraging requirements/preferences: The species generally forages on intertidal mudflats, along the muddy banks of estuaries and in coastal lagoons, either in open unvegetated areas or among mangroves (DotEE 2019u). **Roosting requirements/preferences:** The species often roosts in the branches of mangroves around mudflats and in estuaries and occasionally in tall coastal trees (DotEE 2019u). **Breeding requirements/preferences:** The Whimbrel does not breed in Australia (DotEE 2019u).	This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 37 occurrences of the species in the locality, with the latest record from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	this species occurs in the south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	exploration program area, as it does not contain estuarine complex habitat.
Eastern Osprey	*Pandion cristatus*[6]	M(w)		X	X	**General habitat requirements/preferences:** The species occurs in littoral and coastal habitats and terrestrial wetlands of	This species was not recorded during recent (2016-2018) field surveys within the Study Area.	Moderate likelihood of occurrence. Suitable habitat occurs in estuarine	Low likelihood of occurrence. No suitable habitat for this

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						tropical and temperate Australia and offshore islands (DotEE 2019v). They are mostly found in coastal areas but occasionally travel inland along major rivers (DotEE 2019v). **Foraging requirements/preferences:** They require extensive areas of open fresh, brackish or saline water for foraging (DotEE 2019v). **Roosting requirements/preferences:** This species constructs stick nests in a variety of natural and artificial sites including in dead or partly dead trees or bushes; on cliffs, rocks, rock stacks or islets; on the ground on rocky headlands, coral cays, deserted beaches, sandhills or saltmarshes; and on artificial nest platforms, pylons, jetties, lighthouses, navigation towers, cranes, exposed shipwrecks and offshore drilling rigs (DotEE 2019v). **Breeding requirements/preferences:** Eastern Ospreys typically breed in monogamous pairs from April to February (DotEE 2019v).	This species has been recorded in a previous survey by URS (2012) within coastal strand vegetation. The NR Maps database identifies 35 occurrences of the species in the locality, with the latest record from 2019. Two records exist within the Study Area from 2019. One is a single record at Castle Rock and it is considered likely that this is a flyover record due to the distance from waterways. The second record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST identifies the species as having potential to occur within the 20 km search radius.	complex areas and at the mouths of major rivers within the Study Area.	species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat, or any major rivers.
Glossy Ibis	*Plegadis falcinellus*	M(w)			X	**General habitat requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys.	Low likelihood of occurrence.	Low likelihood of occurrence.

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		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Within Australia, the largest contiguous areas of prime habitat is inland and northern floodplains (DotEE 2019w). **Foraging requirements/preferences:** The preferred habitat for foraging is freshwater marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation (DotEE 2019w). **Roosting requirements/preferences:** The species roost in trees or shrubs usually near, but sometimes far, from water bodies (DotEE 2019w). **Breeding requirements/preferences:** The preferred habitat for breeding is fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation (DotEE 2019w).	This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies one occurrence of the species in the locality from 2017. No records exist within the Study Area. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	Although the estuarine complex habitats within the Study Area have some potential to provide habitat for the Glossy Ibis, this species has been assessed as having a low potential to occur, given that it has not been recently recorded on Groote Eylandt, despite numerous fauna surveys.	No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.
Pacific Golden Plover	*Pluvialis fulva*	M(w)			X	**General habitat requirements/preferences:** In Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands (DotEE 2019x). **Foraging requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys. This species has been recorded in a previous survey by Webb (1992) within tailings/water storage dams.	Low likelihood of occurrence. The Pacific Golden Plover is a coastal species. A small area of potential habitat for this species occurs in the	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						This species usually forages on sandy or muddy shores (including mudflats and sandflats) or margins of sheltered areas such as estuaries and lagoons, though it also feeds on rocky shores, islands or reefs (DotEE 2019x). **Roosting requirements/preferences:** The species usually roost near foraging areas, on sandy beaches and spits or rocky points, islets or exposed reefs, occasionally among or beneath vegetation including mangroves or low saltmarsh, or among beachcast seaweed (DotEE 2019x). **Breeding requirements/preferences:** The species does not breed in Australia (DotEE 2019x).	The NR Maps database identifies eight occurrences of the species in the locality, with the latest record from 2019. One record exists within the Study Area from 2019. This record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	south-western corner of the Study Area, in the area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	it does not contain estuarine complex habitat.
Grey Plover	*Pluvialis squatarola*	M(w)			X	**General habitat requirements/preferences:** The species occurs almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons (DAWE 2020i). **Foraging requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 22 occurrences of the species in the locality, with the latest record from 2019. One	Low likelihood of occurrence. The Lesser Sand Plover is a coastal species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in the area	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						The species usually forages on large areas of exposed mudflats and beaches of sheltered coastal shores such as inlets, estuaries and lagoons (DAWE 2020i). **Roosting requirements/preferences:** The species usually roosts in sandy areas, such as on unvegetated sandbanks or sand-spits on sheltered beaches or other sheltered environments such as estuaries or lagoons (DAWE 2020i). **Breeding requirements/preferences:** This species does not breed in Australia (DAWE 2020i).	record exists within the Study Area from 2019. This record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years and the limited extent of habitat within the Study Area.	
Roseate Tern	*Sterna dougallii*	M(m)		X	X	**General habitat requirements/preferences:** The species occurs in coastal and marine areas in subtropical and tropical seas (DotEE 2019z). The species inhabits rocky and sandy beaches, coral reefs, sand cays and offshore islands (DotEE 2019z). **Foraging requirements/preferences:** The species forages mainly on fish, but also on some crustaceans (DotEE 2019z). **Roosting requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The NR Maps database identifies two occurrences of the species in the locality, with the latest record from 2016. No records exist within the Study Area. The EPBC PMST identifies the species as having potential to occur within the 20 km search radius.	Low likelihood of occurrence. The Roseate Tern is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11).	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						The species usually roosts or loafs in the intertidal zone on islands, including on the upper sections of beaches, above the high-water mark on banks, spits and bars, usually of coral or sand (DotEE 2019z). **Breeding requirements/preferences:** Breeding mainly occurs off the coasts of Western Australia, the Northern Territory and Queensland (DotEE 2019z). In the Northern Territory, some colonies nest between April and June/July, but the majority nest between September and January/February (DotEE 2019z).		Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	
Common Tern	*Sterna hirundo*	M(m)			X	**General habitat requirements/preferences:** The species is marine, pelagic and coastal (DotEE 2019aa). **Foraging requirements/preferences:** The species forages in marine environments, often close to the shore, including sheltered embayments and in the surf-zone, but also well out to sea (DotEE 2019aa). **Roosting requirements/preferences:** The species roosts on unvegetated, intertidal sandy ocean beaches, sandy islands, shores of estuaries or lagoons, and sandbars, as well as on rocky shores,	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 10 occurrences of the species in the locality, with the latest record from 2015. No records exist within the Study Area. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	Low likelihood of occurrence. The Common Tern is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						rock platforms or rocks protruding above the surface of the water (DotEE 2019aa). **Breeding requirements/preferences:** This species does not breed in Australia (DotEE 2019aa).		as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	
Black-naped Tern	*Sterna sumatrana*	M(m)			X	**General habitat requirements/preferences:** The species is mainly associated with small, offshore sand and coral cays, coral reefs and lagoons, and sandy and rocky islands and islets, and in the surrounding seas (DotEE 2019ab). **Foraging requirements/preferences:** The species forages on and around coral reefs, over lagoons, reef-flats, reef-crests and reef-edges as well as rock pools and the open sea beyond the surf-zone along outer reefs (DotEE 2019ab). **Roosting requirements/preferences:** The species usually roost near the edge of the water, on sandy beaches or spits and occasionally on rubble banks or rocks (DotEE 2019ab). **Breeding requirements/preferences:** The species breeds on islands, which are very occasionally close to or attached to the mainland at low tides, and forage in	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies six occurrences of the species in the locality, with the latest record from 2016. No records exist within the Study Area. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	Low likelihood of occurrence. The Black-naped Tern is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						seas surrounding colonies (DotEE 2019ab).			
Little Tern	*Sternula albifrons*	M(m)			X	**General habitat requirements/preferences:** The species inhabits sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches (DotEE 2019ac). **Foraging requirements/preferences:** The species forages in shallow waters of estuaries, coastal lagoons and lakes, frequently over channels next to spits and banks or entrances, and often close to breeding colonies (DotEE 2019ac). **Roosting requirements/preferences:** The species roosts on sand-spits, banks and bars within sheltered estuarine or coastal environments, or on the sandy shores of lakes and ocean beaches (DotEE 2019ac). **Breeding requirements/preferences:** The species nest on sand-spits, banks, ridges or islets in sheltered coastal environments, such as coastal lakes, estuaries and inlets, and also on wide and flat or gently sloping sandy ocean	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 27 occurrences of the species in the locality, with the latest record from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat.	Low likelihood of occurrence. The Little Tern is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						beaches, and also, occasionally, in sand-dunes (DotEE 2019ac).	The EPBC PMST does not identify habitat for this species within the 20 km search radius.		
Brown Booby	*Sula leucogaster*	M(m)			X	**General habitat requirements/preferences:** The species uses both marine and terrestrial habitat. The species occurs in, but is not restricted to, tropical waters of all major oceans, often staying close to breeding islands (DotEE 2019ad). **Foraging requirements/preferences:** The species forages in tropical waters of all major oceans, often staying close to breeding islands (DotEE 2019ad). **Roosting requirements/preferences:** The species cords on the ground in a variety of sites, from rugged rocky terrain (cliffs, steep slopes) on larger islands, to beaches, sand bards, coral rubble and guano flats on cays, as well as artificial structures (DotEE 2019ad). **Breeding requirements/preferences:** The species utilises tropical islands, continental islands, sand cays and atolls for breeding (DotEE 2019ad).	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies one occurrences of the species in the locality from 2016. No records exist within the Study Area. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Study Area, which is located outside of marine areas.	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, which are located outside of marine areas.
Lesser Crested Tern	*Thalasseus bengalensis*	M(m)			X	**General habitat requirements/preferences:** The Lesser Crested Tern occurs in coastal bays and inlets, lakes and large rivers. It	This species was not recorded during recent (2016-2018) field surveys.	Low likelihood of occurrence. The Lesser Crested Tern is a coastal /	Low likelihood of occurrence. No suitable habitat for this

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						frequents coastal seas using shores of sandy beaches, coral cays, exposed reefs, and islands. On parts of the coast it uses mudflats of estuaries, and creek channels (Pizzey and Knight 1997). **Foraging requirements/preferences:** Feed primarily in marine environments, diving for fish (Pizzey and Knight 1997). **Roosting requirements/preferences:** The species roosts in closely packed colonies on small offshore islands. Nests are shallow, unlined scrape in the sand (Pizzey and Knight 1997). **Breeding requirements/preferences:** Breeds in closely packed colonies on low sand and coral cays of reefs, offshore islands or sandbars (Pizzey and Knight 1997).	This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 7 occurrences of the species in the locality, with the latest record from 2018. One record exists within the Study Area, from 2018. This record is from the same location as 17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.
Crested Tern	*Thalasseus bergii*	M(w)		X		**General habitat requirements/preferences:** The species inhabits tropical and subtropical coastlines, foraging in the shallow waters of lagoons, coral reefs, estuaries, bays, harbours and inlets,	This species was not recorded during recent (2016-2018) field surveys within the Study Area.	Low likelihood of occurrence. The Crested Tern is a coastal / marine species. A small area of potential	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						along sandy, rocky, coral or muddy shores, on rocky outcrops in open sea, in mangrove swamps and also far out to sea on open water (BirdLife International 2018c). **Foraging requirements/preferences:** It feeds predominantly on pelagic fish, an opportunistically on cephalopods, crustaceans, prawns, insects and hatchling turtles (BirdLife International 2018c). **Breeding requirements/preferences:** The species nest comprises a shallow scrape in bare sand, rock or coral in flat open sites. The species nests in dense colonies (BirdLife International 2018c).	There are no records of this species from Groote Eylandt on the NR Maps database. The EPBC PMST identifies the species as having potential to occur within the 20 km search radius.	habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the lack of records in recent years and the limited extent of habitat within the Study Area.	exploration program area, as it does not contain estuarine complex habitat.
Grey-tailed Tattler	*Tringa brevipes*	M(w)			X	**General habitat requirements/preferences:** The species is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats (DotEE 2019ae). Foraging requirements/preferences: The species usually forages in shallow water, on hard intertidal substrates, such as reefs and rock platforms, in rock pools and among rocks and coral rubble, over which water may surge (DotEE 2019ae).	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 25 occurrences of the species in the locality, with the latest from 2018. One record exists within the Study Area from 2018. This record is from the same location as	Low likelihood of occurrence. The Grey-tailed Tattler is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Roosting requirements/preferences: The species usually roosts in the branches of mangroves or, rarely, in dense stands of other shrubs, or on snags or driftwood (DotEE 2019ae). **Breeding requirements/preferences:** This species does not breed in Australia (DotEE 2019ae).	17 other species. It appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	complex habitat (refer Figure 11). Nevertheless, the species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	
Common Greenshank	*Tringa nebularia*	M(w)		X	X	**General habitat requirements/preferences:** Found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity (DotEE 2019af). It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass (DotEE 2019af). **Foraging requirements/preferences:** The species is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other	This species was not recorded during recent (2016-2018) field surveys within the Study Area. This species has been recorded in a previous survey by Webb (1992) at the Angurugu township sewerage ponds. The NR Maps database identifies 33 occurrences of the species in the locality, with the latest from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It	Moderate likelihood of occurrence. The Common Greenshank is a coastal / wetland species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Some limited areas	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						sparse, emergent or fringing vegetation, such as sedges or saltmarsh (DotEE 2019af). It will occasionally feed on exposed seagrass beds (DotEE 2019af). **Roosting requirements/preferences:** Roosts and loafs around wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets (DotEE 2019af). Occasionally the species will perch and roost on stakes (DotEE 2019af). **Breeding requirements/preferences:** The species does not breed in Australia (DotEE 2019af).	appears that a single coordinate was utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST identifies the species as likely to occur within the 20 km search radius.	of wetlands also occur. This species is considered to have a moderate likelihood of occurring within this area of estuarine complex habitat and wetlands. However, the remainder of the Study Area does not contain suitable for this species.	
Marsh Sandpiper	*Tringa stagnatilis*	M(w)			X	**General habitat requirements/preferences:** The species lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks (DotEE 2019ag). **Foraging requirements/preferences:** The species usually forages in shallow water at the edge of wetlands (DotEE 2019ag). **Roosting requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys. This species has been recorded in a previous survey by URS (2012) within rehabilitation. The NR Maps database identifies three occurrences of the species in the locality, with the latest from 2018. No records exist within the Study Area.	Moderate likelihood of occurrence. The Marsh Sandpiper is a coastal / wetland species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11).	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat or suitable wetland area.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						The species has been recorded roosting or loafing on tidal mudflats, near low saltmarsh, and around inland swamps (DotEE 2019ag). **Breeding requirements/preferences:** The Marsh Sandpiper does not breed in Australia (DotEE 2019ag).	The EPBC PMST does not identify habitat for this species within the 20 km search radius.	Some limited areas of suitable wetlands also occur. This species is considered to have a moderate likelihood of occurring within this area of estuarine complex habitat and wetlands. However, the remainder of the Study Area does not contain suitable habitat for this species.	
Terek Sandpiper	*Xenus cinereus*	M(w)			X	**General habitat requirements/preferences:** The species occurs on mudflats or in sheltered estuaries, embayments, harbours or lagoons. The species has also been recorded on islets, mudbanks, sandbanks and spits, and near mangroves and occasionally in samphire (DotEE 2019ai). **Foraging requirements/preferences:** This species mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons (DotEE 2019ai).	This species was not recorded during recent (2016-2018) field surveys. This species was not recorded during surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database identifies 13 occurrences of the species in the locality, with the latest from 2019. Two records exist within the Study Area, with the latest record from 2019. Both records (one each from 2018 and 2019) are from the same location as 17 other species. It appears that a single coordinate was	Low likelihood of occurrence. The Terek Sandpiper is a coastal / marine species. A small area of potential habitat for this species occurs in the south-western corner of the Study Area, in an area mapped as estuarine complex habitat (refer Figure 11). Nevertheless, the	Low likelihood of occurrence. No suitable habitat for this species occurs in the Stage 2 exploration program area, as it does not contain estuarine complex habitat.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Roosting requirements/preferences: The species prefers to roost in or among mangroves (DotEE 2019ai). **Breeding requirements/preferences:** This species does not breed in Australia (DotEE 2019ai).	utilised for this species, that doesn't reflect the actual location of the detected individuals. It is therefore considered that the record of this species within the Study Area is not accurate due to the general location description (noted as being at Salt Creek and associated road) and limited available habitat. The EPBC PMST does not identify habitat for this species within the 20 km search radius.	species is assessed as having a low likelihood of occurrence, given the limited extent of habitat within the Study Area.	
MAMMALS									
Brush-tailed Rabbit-rat	*Conilurus penicillatus*	V	E	X	X	**General habitat requirements/preferences:** Most records of this species are from lowland eucalypt forests and woodlands, particularly those dominated by Eucalyptus miniata (Darwin Woollybutt) and/or E. tetrodonta (Darwin Stringybark) (Threatened Species Scientific Committee 2016a). **Foraging requirements/preferences:** The species primarily eats seeds of grass species such as cockatoo grass (Threatened Species Scientific Committee 2016a). Other dietary items include seeds from other grassspecies,	This species was not recorded during recent (2016-2018) field surveys within the Study Area. Heiniger and Gillespie (2017) detected the species at 19 locations outside of the Study Area. It was also recently recorded in the nearby Eastern Leases in 2014 (Cumberland Ecology 2015). This species was recorded on an IR camera within *E. tetrodonta/E. miniata* open forest (Cumberland Ecology 2015). The Brush-tailed Rabbit-rat has also been recorded previously within the Eastern Leases by Ward (2007a) and EMS (2013).	Low likelihood of occurrence. A small mammal research project was recently undertaken by Cumberland Ecology (2019b) to determine the distribution and habitat preferences for this species in the Study Area. No records of this species were obtained. The lack	Low likelihood of occurrence. The species was not detected during recent surveys by Cumberland Ecology (2019b) which specifically targeted the species.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						termites, fruits (including fleshy fruits) and foliage (Threatened Species Scientific Committee 2016a). **Requirements/preferences for shelter sites:** Brush-tailed rabbit-rats shelter during the day in tree hollows and hollow logs,and may also occasionally shelter in Pandanus canopies (Threatened Species Scientific Committee 2016a). **Breeding requirements/preferences:** Breeding season occurs from March to October with a litter size of two or three (Threatened Species Scientific Committee 2016a).	The NR Maps database identifies 15 occurrences of the species in the locality, with the latest from 2014. No records exist within the Study Area. The EPBC PMST identifies that the species or species habitat may occur within the 20 km search radius.	of records suggests that the species is not present in the areas sampled. Given high survey intensity and sample sites in the full range of suitable habitats and fire types, Cumberland Ecology (2019b) concluded that there is a low probability of occurrence for the species in the Study Area. Although the potential for occurrence was rated as low, it was noted that there is still some potential for it to be present in low numbers in parts of the Study Area that were not specifically sampled.	
Northern Quoll	*Dasyurus hallucatus*	E	CE	X	X	**General habitat requirements/preferences:** The broadly described habitats of the Northern Quoll include rocky areas,	This species was recorded at 98 locations within the Study Area during recent (2016-2018) field surveys (see Figure 13).	Present. Recorded at over 110 locations within the Study Area	Present. Recorded at seven locations within the Stage 2

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						Eucalypt forests and woodlands, sandy lowlands, grasslands, shrublands, and deserts (DotEE 2019m). **Foraging requirements/preferences:** The species is known to feed on a wide range of prey including mammals, insects, fruit and human refuse (DotEE 2019m). **Requirements/preferences for shelter sites:** Main habitat requirements for denning include rock crevices, hollow logs and termite mounds (DotEE 2019m). **Breeding requirements/preferences:** Breeding habitat for the Northern Quoll occurs within den sites. Breeding occurs in mid-dry season and breeding territory is likely inherited by female offspring (DotEE 2019m).	This species was recorded within a range of habitats. Heiniger and Gillespie (2017) also recently recorded the species at 15 locations within the Study Area. Cumberland Ecology (2019b) recorded the species at a number of other locations to the south and west of the Study Area. Heiniger and Gillespie (2017) also detected the species extensively to the north of the Study Area. It has been recorded during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). This species is known to occur in areas of mine rehabilitation in the existing GEMCO mine (URS Australia Pty Ltd 2012, Cumberland Ecology 2015). The NR Maps database identifies 870 occurrences of the species in the locality, with the latest from 2014. Numerous records of the species exist within the Study Area.	during recent surveys. Suitable habitat is present throughout the Study Area.	exploration program area. Suitable habitat is present throughout the Stage 2 exploration program area.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
							The EPBC PMST identifies the species or species habitat as being known to occur within the 20 km search radius.		
Ghost Bat	*Macroderma gigas*	V		X		**General habitat requirements/preferences:** This species occupies habitats ranging from the arid Pilbara to tropical savanna woodlands and rainforests (Threatened Species Scientific Committee 2016b). **Foraging requirements/preferences:** They are carnivores, with a broad diet comprising small mammals including other bats, birds, reptiles, frogs and large insects (Threatened Species Scientific Committee 2016b). It perches in vegetation to ambush passing prey (either on the ground or in the air), and it also gleans surfaces such as the ground while in flight (Threatened Species Scientific Committee 2016b). **Roosting requirements/preferences:** During the daytime they roost in caves, rock crevices and old mines (Threatened Species Scientific Committee 2016b). Roost sites used permanently are generally deep natural caves or disused mines with a relatively stable temperature of 23°–28°C and a moderate to high relative humidity of	This species was not recorded during recent (2016-2018) field surveys. This species has been recorded on the existing GEMCO mine in a previous survey by URS (2012). Diete et al. (2015b) recorded the species within open woodland in proximity to the existing GEMCO mine and in coastal grass and shrub habitat in the south west peninsular of the island. The NR Maps database does not identify any occurrences of the species in the locality. The EPBC PMST identifies that the species or species habitat is likely to occur within the 20 km search radius.	High likelihood of occurrence. Suitable roosting and foraging habitat for this species occurs in the Study Area in the form of rocky outcropping and surrounding areas of laterite woodland and forest habitats, sandstone woodland and forest habitats, and riparian/wetland habitats.	High likelihood of occurrence. Suitable foraging habitat for this species occurs in the Stage 2 exploration program area in the form of laterite woodland and forest habitat, and riparian / wetland habitats located in proximity (~2 km) to rocky outcropping.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						50–100 percent (Threatened Species Scientific Committee 2016b). **Breeding requirements/preferences:** Most breeding sites appear to require multiple entranced caves (Threatened Species Scientific Committee 2016b). Females breed at an age of two to three years (Threatened Species Scientific Committee 2016b).			
Northern Hopping-mouse	*Notomys aquilo*	V	V	X	X	**General habitat requirements/preferences:** The Northern Hopping-mouse inhabits coastal dune systems, shrubland, eucalypt woodland, and the margins of coastal rainforest areas. Main habitat requirements are areas with sandy substrates and relatively high rainfall (about 1000-1400 mm per year), preferring areas in close proximity to rocky areas (DotE 2013c). **Foraging requirements/preferences:** The species feeds mainly on seeds from grasses, herbs and shrubs. It is also known to eat insects (DotE 2013c). **Requirements/preferences for shelter sites:** The Northern Hopping-mouse constructs complex burrows that can be used for sheltering which consist of a	This species was not recorded during recent (2016-2018) field surveys within the Study Area. Cumberland Ecology (2019b) recorded the species at one location to the east of the existing GEMCO mine. Heiniger and Gillespie (2017) also detected the species at three locations north of the Study Area. It was also recently recorded in the nearby Eastern Leases in 2014 (Cumberland Ecology 2015). It was recorded within E. tetrodonta/E. miniata open forest. This species was not recorded during surveys by URS (2012) and Webb (1992).	Low likelihood of occurrence. A small mammal research project was recently undertaken by Cumberland Ecology (2019b) to determine the distribution and habitat preferences for this species in the Study Area. No records of this species were obtained. The lack of records suggests that the species is not present in the areas sampled. Given high survey intensity and sample	Low likelihood of occurrence. The species was not detected during recent surveys by Cumberland Ecology (2019b) which specifically targeted the species.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						spoil mound located 2 m from the burrow entrance. The entrance is a vertical shaft that is dug from below (DotE 2013c). **Breeding requirements/preferences:** All breeding information is based on observations made in captivity. The young are born hairless with one to five young being reared at a time (DotE 2013c).	The NR Maps database identifies 40 occurrences of the species in the locality, with the latest from 2014. Five records of the species exist within the Study Area; however these records are associated with the presence of spoil heaps. The presence of spoil heaps is not a reliable determinate for the presence of the Northern Hopping-mouse as spoil heaps are also created by the Delicate Mouse (*Pseudomys delicatulus*) (Coffey Environments Pty Ltd 2010, Diete et al. 2015a). The EPBC PMST identifies the species or species habitat may occur within the 20 km search radius.	sites in the full range of suitable habitats and fire types, Cumberland Ecology (2019b) concluded that there is a low probability of occurrence for the species in the Study Area. Although the potential for occurrence was rated as low, it was noted that there is still some potential for it to be present in low numbers in parts of the Study Area that were not specifically sampled.	
Bare-rumped Sheathtail Bat	*Saccolaimus saccolaimus nudicluniatus*	V		X		**General habitat requirements/preferences:** Occurs mostly in lowland areas, typically in a range of woodland, forest and open environments (DotEE 2019y). **Foraging requirements/preferences:** The species has a fast, direct flight and is likely to forage primarily for aerial insects over the woodland/forest canopy but	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species has not been recorded in areas adjacent to the Study Area in previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992).	Low likelihood of occurrence. Suitable habitat for this species occurs in the Study Area, within open forests and woodland. However, given the lack of records of this species on	Low likelihood of occurrence. Suitable habitat for this species occurs in the Stage 2 exploration program area, within open forests and

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						may fly lower when foraging over open situations (DotEE 2019y). **Roosting requirements/preferences:** No studies have been conducted on the roosting ecology of this species and all located roosts are from incidental records (such as, as a result of land clearance) (DotEE 2019y). In Australia, all confirmed roosting records are from deep tree hollows in the Poplar Gum, Darwin Woollybutt and Darwin Stringybark (DotEE 2019y). **Breeding requirements/preferences:** There is no information available on the type of breeding system or breeding success in this species (DotEE 2019y). In Australia all breeding records have been obtained from trees that were felled during land-clearing operations (DotEE 2019y).	The NR Maps database does not identify occurrences of the species on Groote Eylandt. The EPBC PMST identifies the species as having potential to occur within the 20 km search radius.	Groote Eylandt, it is assessed as having a low likelihood of occurrence.	woodland. However, given the lack of records of this species on Groote Eylandt, it is assessed as having a low likelihood of occurrence.
Water Mouse	*Xeromys myoides*	V		X		**General habitat requirements/preferences:** The broadly described habitats of the Water Mouse include sedgelands, heathlands, clay pans, mangroves and the associated salt marsh, and freshwater wetlands (DotEE 2019aj). In the Northern Territory, the Water Mouse has been known to use both intertidal and	This species was not recorded during recent (2016-2018) field surveys within the Study Area. This species has not been recorded during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992).	Low likelihood of occurrence. Only small areas of coastal habitat occur in the south western portion of the Study Area, and some areas of temporary melaleuca wetlands.	Low likelihood of occurrence. None of the broad habitats required by this species are present within the Stage 2 exploration program area.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						freshwater habitats, including mangroves, sedgelands, clay pans, and freshwater melaleuca wetlands (DotEE 2019aj). **Foraging requirements/preferences:** In the Northern Territory, the species is known to feed on grapsid crabs (i.e. shore crabs), and plant foods are believed to comprise some of its diet (DotEE 2019aj). **Requirements/preferences for shelter sites:** The species is known to make five types of nests which provide refuge from predators at high tide. These are: free-standing, nests or mounds at the base of mangrove trees, mound nests on small elevated 'islands' within the tidal zone, mound nests or holes in supralittoral banks; nests inside hollow tree trunks, and nests in spoil heaps created as a result of human activity (DotEE 2019aj). **Breeding requirements/preferences:** Nests created by the species are important for breeding and it is capable of breeding year-round (DotEE 2019aj).	No records of this species on Groote Eylandt are held within the NR Maps database. The EPBC PMST identifies the species or species habitat may occur within the 20 km search radius.	However, this species has been assessed as having a low potential to occur, given it has not been recorded on Groote Eylandt, despite numerous fauna surveys.	
REPTILES									

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
Plains Death Adder	*Acanthopis hawkei*	V	V	X		**General habitat requirements/preferences:** The Plains Death Adder inhabits flat treeless habitats on the cracking soils of riverine floodplains (Northern Territory Government 2012a). **Foraging requirements/preferences:** When young, the species feeds on frogs and lizards, and when they reach larger sizes the species feeds on mammals (Northern Territory Government 2012a). **Requirements/preferences for shelter sites:** During floods, the species floats on debris or emergent vegetation. During the Dry season, it often rests in deep cracks in the soil (Northern Territory Government 2012a). **Breeding requirements/preferences:** The species breeds from October to November and live young are produced between February and March (Threatened Species Scientific Committee 2012).	This species was not recorded during recent (2016-2018) field surveys within the Study Area. The species was not recorded in areas adjacent to the Study Area during previous surveys by Cumberland Ecology (2015), URS (2012) and Webb (1992). The NR Maps database results do not identify occurrences of the species on Groote Eylandt. The EPBC PMST identifies the species or species habitat may occur within the 20 km search radius. It should be noted that the PMST results are based on broad scale habitat modelling, rather than actual records of the species.	Low likelihood of occurrence. This species has been assessed as having a low potential to occur, given no suitable habitat for this species occurs in the Study Area, and given it has not been recently recorded on Groote Eylandt, despite numerous fauna surveys.	Low likelihood of occurrence. No suitable habitat for this species occurs in Stage 2 exploration program area.
Mertens' Water Monitor	*Varanus mertensi*		V		X	**General habitat requirements/preferences:** The semi-aquatic Mertens' Water Monitor is found in the proximity of water sources, inhabiting both coastal	This species was recorded at one location within the Study Area during a field survey in 2014.	Present. Recorded at one location within the Study Area during a 2014 field survey.	High likelihood of occurrence. Suitable habitat for this species occurs in the

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						and inland waters and riparian areas (Northern Territory Government 2006). **Foraging requirements/preferences:** The species feeds primarily on fish, frogs and carrion, but it will also forage for insects and small terrestrial invertebrates (Northern Territory Government 2006). **Requirements/preferences for shelter sites:** The Mertens' Water Monitor is terrestrial and also has the ability to climb trees (Northern Territory Government 2006). **Breeding requirements/preferences:** The species digs burrows in the ground where it lays its eggs, usually during the early dry season (Northern Territory Government 2006).	It was recently recorded in the Study Area and the nearby Eastern Leases in 2014 (Cumberland Ecology 2015). It was recorded within freshwater streams and in Melaleuca dominated communities, as well as laterite woodland and forests. This species has also been recorded during previous surveys by URS (2012) and Webb (1992) within mine rehabilitation areas at the existing mine. The NR Maps database identifies 15 occurrences of the species in the locality, with the latest record from 2014. Two records occur within the Study Area. Both records are at the same location as the Cumberland Ecology (2015) record.	Suitable habitat for this species occurs in the Study Area in the form of riparian habitats.	Stage 2 exploration program area in the form of riparian habitats.
Yellow-spotted Monitor	*Varanus panoptes*		V		X	**General habitat requirements/preferences:** The Yellow-spotted Monitor occurs in a variety of habitats including grasslands, woodlands, floodplains, and coastal beaches. Its distribution has been recorded across most of the Top End of the Northern Territory (Northern Territory Government 2012b). **Foraging requirements/preferences:**	This species was not recorded during recent (2016-2018) field surveys within the Study Area. It was recently recorded in the nearby Eastern Leases in 2014 (Cumberland Ecology 2015). It was recorded within E. tetrodonta/E. miniata open forest and Melaleuca woodland.	High likelihood of occurrence. Suitable habitat for this species occurs in the Study Area in the form of laterite woodlands and forests, sandstone woodland and forests, and	High likelihood of occurrence. Suitable habitat for this species occurs in the Stage 2 exploration program area in the form of laterite woodlands and forests, and

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						The species forages on primarily small terrestrial insects and vertebrates, including marine and freshwater turtle eggs (Northern Territory Government 2012b). **Requirements/preferences for shelter sites:** The species is known to dig large burrows and take over existing burrows (Atlas of Living Australia 2014). Recent research has indicated that these species make use of large communal burrows / warrens (Doody, et al., 2014). **Breeding requirements/preferences:** The Yellow-spotted Monitor lays its eggs in burrows in the ground, usually during the wet season (Northern Territory Government 2012b).	It has been recorded during surveys by URS (2012) in Melaleuca/riparian habitat, Eucalypt forest habitat and within areas of mine rehabilitation in the existing GEMCO mine. The NR Maps database identifies eight occurrences of the species in the locality, with the latest record from 2014. No records exist within the Study Area.	riparian/wetland habitats.	riparian/wetland habitats.
Salt-water Crocodile	*Crocodylus porosus*	M(m)		X	X	**General habitat requirements/preferences:** The Salt-water crocodile inhabits tidal rivers, coastal floodplains and channels, billabongs and swamps. It may be found up to 150 km inland from the coast, in habitats where salinity levels are sufficient (DotEE 2019l). **Foraging requirements/preferences:** Primary food sources for the Salt-water Crocodile are crustaceans, insects and	This species was recorded incidentally during recent (2016-2019) field surveys within the Study Area. C&R (2019) also recently recorded the species within the Study Area. It was also recorded in the nearby Eastern Leases within the tributaries of the Amagula River (Cumberland Ecology 2015).	Present. Suitable habitat for this species occurs in and directly adjacent to the Study Area in the form of rivers, creeks and their tributaries.	High likelihood of occurrence. Some suitable habitat for this species occurs in the Stage 2 exploration program area in the form of river tributaries.

Common Name	Scientific Name	Conservation Status[1]		Database Records		Habitat Requirements	Occurrence Summary	Likelihood of Occurrence	
		EPBC Act [2]	TPWC Act	PMST	NR Maps			Study Area	Stage 2 Exploration Program Area
						mammals. In high salinity, more crabs are consumed, while in freshwater, more insects are consumed (DotEE 2019l).	This species has also been recorded during previous surveys by URS (2012) and Webb (1992), however the exact location is unknown.		
						Requirements/preferences for shelter sites:			
						The species is often found exposed in the midday sun, but under cover and shaded during the morning and late evening (DotEE 2019l).	The NR Maps database identifies 14 occurrences of the species in the locality, with the latest from 2014. No records exist within the Study Area.		
						Breeding requirements/preferences:			
						Preferred nesting habitat for the species include isolated freshwater swamps that do not have tidal fluctuations (DotEE 2019l).	The EPBC PMST identifies the species or species habitat is likely to occur within the 20 km search radius.		

1. EPBC Act Status / TPWC Act Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory [(m) = marine, (t) = terrestrial, (w) = wetland]

2. Subcategories for EPBC Act listing of migratory species follow those within the Protected Matters Search report

3. EPBC Act Protected Matters Search Tool

4. Two subspecies of Geophaps smithii are listed under the EPBC Act as Vulnerable (Geophaps smithii blaauwi and Geophaps smithii smithii).

5. Subspecies of Limosa lapponica have different listings under the EPBC Act. Limosa lapponica baueri is listed as Vulnerable and Limosa lapponica menzbieri is listed as Critically Endangered.

6. Species listed as Pandion haliaetus the Protected Matters Search report. Pandion haliaetus cristatus was previously recognised as a subspecies for Australasia and New Caledonia, however it is currently recognised as a species in its own right.

APPENDIX E :
Flora Species List

Table 19 Flora species list

Family	Scientific Name	Common Name
Anacardiaceae	*Buchanania obovata*	Green Plum
Apocynaceae	*Alyxia spicata*	Chainfruit
Apocynaceae	*Gymnanthera oblonga*	Gymnanthera
Apocynaceae	*Marsdenia viridiflora*	-
Araliaceae	*Trachymene microcephala*	Lace Flower
Asparagaceae	*Lomandra tropica*	Mat-Rush
Boraginaceae	*Heliotropium ventricosum*	White Heliotrope
Celastraceae	*Stackhousia intermedia*	Wiry Stackhousia
Combretaceae	*Terminalia canescens*	Winged Nut Tree
Combretaceae	*Terminalia carpentariae*	Wild Peach
Commelinaceae	*Cartonema spicatum*	Cartonema
Commelinaceae	*Commelina ensifolia*	Wandering Jew
Convolvulaceae	*Bonamia media*	Grey-vine
Convolvulaceae	*Evolvulus alsinoides*	Blue Periwinkle
Convolvulaceae	*Merremia quinata*	Merremia
Convolvulaceae	*Polymeria ambigua*	Creeping Polymeria
Convolvulaceae	*Xenostegia tridentata*	Morning Vine
Cupressaceae	*Callitris intratropica*	Northern Cypress Pine
Cycadaceae	*Cycas arnhemica*	Cycad
Cyperaceae	*Cyperus haspan subsp. juncoides*	Small Umbrella Rush
Cyperaceae	*Cyperus sp.*	-
Cyperaceae	*Fimbristylis cymosa*	Dainty Fringe-Rush
Cyperaceae	*Fimbristylis depauperata*	Fringe-Rush
Cyperaceae	*Fimbristylis dolera*	-
Cyperaceae	*Fimbristylis pauciflora*	Fringe-Rush
Cyperaceae	*Rhynchospora longisetis*	Tick Grass
Cyperaceae	*Schoenus sparteus*	Bog-Rush
Cyperaceae	*Scleria brownii*	Sedge
Cyperaceae	*Scleria novae-hollandiae*	Sedge
Dilleniaceae	*Hibbertia complanata*	Pink Broom
Dilleniaceae	*Hibbertia dealbata*	Yellow Bush
Dilleniaceae	*Hibbertia sericea*	-
Dioscoreaceae	*Dioscorea sp.*	-
Droseraceae	*Drosera dilatatopetiolaris*	Sundew

Family	Scientific Name	Common Name
Droseraceae	*Drosera fulva*	Sundew
Erythroxylaceae	*Erythroxylum ellipticum*	Kerosene Wood
Euphorbiaceae	*Euphorbia sp.*	-
Euphorbiaceae	*Microstachys chamaelea*	Striped Seed Plant
Fabaceae	*Cajanus geminatus*	Pigeon-pea
Fabaceae	*Erythrophleum chlorostachys*	Northern Ironwood
Fabaceae	*Tephrosia juncea*	Small Pink Pea Bush
Fabaceae	*Tephrosia leptoclada*	Tephrosia
Fabaceae (Faboideae)	*Flemingia parviflora*	
Fabaceae (Faboideae)	*Flemingia sp.*	-
Fabaceae (Faboideae)	*Gompholobium subulatum*	Flemingia
Fabaceae (Faboideae)	*Stylosanthes scabra*	Shrubby Stylo
Fabaceae (Mimosoideae)	*Acacia alleniana*	Needle-leaved Wattle
Fabaceae (Mimosoideae)	*Acacia difficilis*	River Wattle
Fabaceae (Mimosoideae)	*Acacia holosericea*	Candelabra Wattle
Fabaceae (Mimosoideae)	*Acacia lamprocarpa*	Hickory Wattle
Fabaceae (Mimosoideae)	*Acacia latescens*	Ball Wattle
Fabaceae (Mimosoideae)	*Acacia multisiliqua*	Small-ball Wattle
Fabaceae (Mimosoideae)	*Acacia oncinocarpa*	Wattle
Fabaceae (Mimosoideae)	*Acacia yirrkallensis*	Dwarf Wattle
Goodeniaceae	*Goodenia pilosa*	Hairy Goodenia
Goodeniaceae	*Goodenia purpurascens*	Goodenia
Hemerocallidaceae	*Dianella longifolia*	Blueberry Lily
Lamiaceae	*Anisomeles malabarica*	Purple Bush Flower
Lauraceae	*Cassytha filiformis*	Hairy Dodder-laurel
Loganiaceae	*Mitrasacme connata*	Mitre Plant
Malvaceae	*Brachychiton paradoxus*	Red-flowering Kurrajong
Malvaceae	*Grewia retusifolia*	Emu Berries
Malvaceae	*Helicteres cana*	Purple Salvia-flowered Plant
Malvaceae	*Hibiscus meraukensis*	Ballerina Hibiscus
Malvaceae	*Waltheria indica*	Waltheria
Myrtaceae	*Asteromyrtus symphyocarpa*	Liniment Tree
Myrtaceae	*Corymbia polycarpa*	Long-fruited Bloodwood
Myrtaceae	*Eucalyptus miniata*	Darwin Woollybutt
Myrtaceae	*Eucalyptus tetrodonta*	Darwin Stringybark

Family	Scientific Name	Common Name
Myrtaceae	*Lophostemon grandiflorus*	Northern Swamp Box
Myrtaceae	*Melaleuca cajuputi*	Cajuput Tree
Myrtaceae	*Melaleuca viridiflora*	Broad-leaved Paperbark
Oleaceae	*Jasminum molle*	Stiff Jasmine
Opiliaceae	*Opilia amentacea*	Opilia
Orobanchaceae	*Buchnera gracilis*	-
Orobanchaceae	*Buchnera linearis*	Dainty Bush Flower
Pandanaceae	*Pandanus spiralis*	Screw Palm
Passifloraceae	*Passiflora foetida*	Stinking Passion Flower
Phyllanthaceae	*Breynia cernua*	Breynia
Phyllanthaceae	*Phyllanthus carpentariae*	Phyllanthus
Phyllanthaceae	*Phyllanthus exilis*	Phyllanthus
Phyllanthaceae	*Phyllanthus minutiflorus*	Phyllanthus
Phyllanthaceae	*Phyllanthus sp.*	-
Phyllanthaceae	*Phyllanthus virgatus*	Seed-under-leaf
Phyllanthaceae	*Sauropus stenocladus*	Sauropus
Phyllanthaceae	*Sauropus stenocladus subsp. stenocladus*	Sauropus
Picrodendraceae	*Petalostigma pubescens*	Quinine Tree
Poaceae	*Aristida holathera var. holathera*	Erect Kerosene Grass
Poaceae	*Ectrosia leporina*	Haresfoot Grass
Poaceae	*Eriachne avenacea*	Wanderrie Grass
Poaceae	*Eriachne melicaea*	Fire Grass
Poaceae	*Eriachne pallescens*	Wanderrie Grass
Poaceae	*Eriachne schultziana*	Salt-and-Pepper Grass
Poaceae	*Eriachne stipacea*	Wanderrie Grass
Poaceae	*Eriachne triseta*	Wanderrie Grass
Poaceae	*Heteropogon triticeus*	Giant Speargrass
Poaceae	*Ischaemum australe var. villosum*	-
Poaceae	*Mnesithea formosa*	Red Grass
Poaceae	*Mnesithea sp.*	-
Poaceae	*Paspalidium distans*	-
Poaceae	*Paspalum vaginatum*	Saltwater Couch
Poaceae	*Schizachyrium pachyarthron*	Fire Grass
Poaceae	*Setaria apiculata*	Pigeon Grass

Family	Scientific Name	Common Name
Poaceae	*Sorghum timorense*	Downs Sorghum
Poaceae	*Thaumastochloa major*	Thaumastochloa
Poaceae	*Triodia procera*	White Tussock
Poaceae	*Urochloa polyphylla*	Urochloa
Polygalaceae	*Polygala sp.*	-
Proteaceae	*Banksia dentata*	Northern Banksia
Proteaceae	*Grevillea heliosperma*	Rock Grevillea
Proteaceae	*Grevillea pteridifolia*	Fern-leaved Grevillea
Proteaceae	*Hakea arborescens*	Yellow Hakea
Pteridaceae	*Cheilanthes tenuifolia*	Rock Fern
Putranjivaceae	*Drypetes deplanchei*	Yellow Tulipwood
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Rubiaceae	*Larsenaikia suffruticosa (syn. Kailarsenia suffruticosa)*	Native Gardenia
Rubiaceae	*Spermacoce elaiosoma*	Buttonweed
Rubiaceae	*Spermacoce sp.*	-
Rutaceae	*Boronia lanuginosa*	Star Boronia
Rutaceae	*Correa planchonifolia*	-
Santalaceae	*Exocarpos acaciaoides*	-
Sapotaceae	*Planchonella arnhemica (syn. Pouteria arnhemica)*	Yellow Boxwood
Smilacaceae	*Smilax australis*	Austral Smilax
Thymelaeaceae	*Thecanthes concreta*	Thecanthes
Thymelaeaceae	*Thecanthes punicea*	Red Wax Plant
Violaceae	*Hybanchus enneaspermus*	-
Vitaceae	*Ampelocissus acetosa*	Wild Grape
Xyridaceae	*Xyris complanata*	Hatpins

APPENDIX F :
Fauna Species List

Table 20 Fauna species list

Order	Family	Scientific Name	Common Name	EPBC Act Status	TPWC Act Status	Webb (1992)	URS (2012)	Cumberland Ecology (2015)	Cumberland Ecology (2015)	Cumberland Ecology (2016)	Cumberland Ecology (2016)	Heiniger and Gillespie (2017)	Heiniger and Gillespie (2017)	Cumberland Ecology (2019)	Cumberland Ecology (2019)
						Survey Location									
						Eastern Leases & existing mine	*Existing mine*	*Eastern Leases*	*Rehab areas of existing mine*	*Within Study Area*	*Adjacent to Study Area*	*Within Study Area*	*North and East of Study Area*	*Within Study Area*	*Adjacent to Study Area*
AMPHIBIANS															
ANURA	HYLIDAE	*Litoria bicolor*	Northern Dwarf Tree Frog	-	-	X	X	X							
ANURA	HYLIDAE	*Litoria caerulea*	Green Tree Frog	-	-	X	X								
ANURA	HYLIDAE	*Litoria microbelos*	Javelin Frog	-	-		X								
ANURA	HYLIDAE	*Litoria nasuta*	Rocket Frog	-	-	X	X	X							
ANURA	HYLIDAE	*Litoria pallida*	Pale Frog	-	-			X							
ANURA	HYLIDAE	*Litoria rothii*	Roth's Tree Frog	-	-	X	X	X							
ANURA	HYLIDAE	*Litoria rubella*	Desert Tree Frog	-	-	X	X								
ANURA	HYLIDAE	*Litoria tornieri*	Tornier's Frog	-	-		X								
ANURA	HYLIDAE	*Litoria watjulumensis*	Wotjulum Frog	-	-		X								
ANURA	MYOBATRACHIDAE	*Crinia remota*	Remote Froglet	-	-	X	X	X							
ANURA	MYOBATRACHIDAE	*Limnodynastes convexiusculus*	Marbled Frog	-	-	X	X								
ANURA	MYOBATRACHIDAE	*Platyplectrum ornatum*	Ornate Burrowing Frog	-	-	X	X								
ANURA	MYOBATRACHIDAE	*Uperoleia inundata*	Floodplain Toadlet	-	-	X	X	X							
ANURA	MYOBATRACHIDAE	*Uperoleia lithomoda*	Stonemason Toadlet	-	-	X	X								
BIRDS															
ANSERIFORMES	ANATIDAE	*Anas gracilis*	Grey Teal	-	-	X									
ANSERIFORMES	ANATIDAE	*Anas superciliosa*	Pacific Black Duck	-	-	X	X								
ANSERIFORMES	ANATIDAE	*Dendrocygna arcuata*	Wandering Whistling-duck	-	-		X								
ANSERIFORMES	ANATIDAE	*Tadorna tadornoides*	Australian Shelduck	-			X								
APODIFORMES	AEGOTHELIDAE	*Aegotheles cristatus*	Australian Owlet-nightjar	-	-	X	X	X		X		X	X	X	X
APODIFORMES	APODIDAE	*Apus pacificus*	Fork-tailed Swift	M(m)	-		X								
CAPRIMULGIFORMES	CAPRIMULGIDAE	*Caprimulgus macrurus*	Large-tailed Nightjar	-	-	X	X							X	
CAPRIMULGIFORMES	CAPRIMULGIDAE	*Eurostopodus argus*	Spotted Nightjar	-	-	X								X	X
CAPRIMULGIFORMES	PODARGIDAE	*Podargus strigoides*	Tawny Frogmouth	-	-	X	X	X		X				X	X
CHARADRIIFORMES	BURHINIDAE	*Burhinus grallarius*	Bush Stone-curlew	-	-	X	X	X		X				X	X
CHARADRIIFORMES	BURHINIDAE	*Esacus magnirostris*	Beach Stone-curlew	-	-		X								
CHARADRIIFORMES	CHARADRIIDAE	*Charadrius leschenaultii*	Greater Sand Plover	V, M(w)	-		X								
CHARADRIIFORMES	CHARADRIIDAE	*Charadrius mongolus*	Lesser Sand Plover	E, M(w)	-		X								
CHARADRIIFORMES	CHARADRIIDAE	*Charadrius ruficapillus*	Red-capped Plover	-	-		X								
CHARADRIIFORMES	CHARADRIIDAE	*Pluvialis fulva*	Pacific Golden Plover	M(w)	-	X									
CHARADRIIFORMES	CHARADRIIDAE	*Vanellus miles*	Masked Lapwing	-	-	X	X				X				
CHARADRIIFORMES	JACANIDAE	*Irediparra gallinacea*	Comb-crested Jacana	-	-		X								
CHARADRIIFORMES	LARIDAE	*Chroicocephalus novaehollandiae*	Silver Gull	-	-		X								

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CHARADRIIFORMES	LARIDAE	*Gelochelidon nilotica*	Gull-billed Tern	-	-		X								
CHARADRIIFORMES	RECURVIROSTRIDAE	*Himantopus himantopus*	Black-winged Stilt	-	-	X									
CHARADRIIFORMES	SCOLOPACIDAE	*Actitis hypoleucos*	Common Sandpiper	M(w)	-	X	X								
CHARADRIIFORMES	SCOLOPACIDAE	*Calidris acuminata*	Sharp-tailed Sandpiper	M(w)	-	X									
CHARADRIIFORMES	SCOLOPACIDAE	*Calidris ferruginea*	Curlew Sandpiper	CE, M(w)	-	X									
CHARADRIIFORMES	SCOLOPACIDAE	*Tringa brevipes*	Grey-tailed Tattler	M(w)	-		X								
CHARADRIIFORMES	SCOLOPACIDAE	*Tringa nebularia*	Common Greenshank	M(w)	-	X									
CHARADRIIFORMES	SCOLOPACIDAE	*Tringa stagnatilis*	Marsh Sandpiper	M(w)	-		X								
CICONIIFORMES	ARDEIDAE	*Ardea intermedia*	Intermediate Egret	-	-		X								
CICONIIFORMES	ARDEIDAE	*Ardea modesta*	Eastern Great Egret	-	-		X								
CICONIIFORMES	ARDEIDAE	*Butorides striatus*	Striated Heron	-	-		X								
CICONIIFORMES	ARDEIDAE	*Egretta garzetta*	Little Egret	-	-		X								
CICONIIFORMES	ARDEIDAE	*Egretta novaehollandiae*	White-faced Heron	-	-		X	X							
CICONIIFORMES	ARDEIDAE	*Egretta sacra*	Eastern Reef Egret	-	-		X								
CICONIIFORMES	ARDEIDAE	*Nycticorax caledonicus*	Nankeen Night-heron	-	-		X	X			X				
CICONIIFORMES	CICONIIDAE	*Ephippiorhynchus asiaticus*	Black-necked Stork	-	-		X								
COLUMBIFORMES	COLUMBIDAE	*Chalcophaps indica*	Emerald Dove	-	-	X	X	X			X		X	X	X
COLUMBIFORMES	COLUMBIDAE	*Ducula bicolor*	Pied Imperial-pigeon	-	-		X	X							
COLUMBIFORMES	COLUMBIDAE	*Ducula spilorrhoa*	Torresian Imperial Pigeon	-	-	X									
COLUMBIFORMES	COLUMBIDAE	*Geopelia humeralis*	Bar-shouldered Dove	-	-	X	X	X	X	X			X	X	X
COLUMBIFORMES	COLUMBIDAE	*Geopelia striata*	Peaceful Dove	-	-	X	X	X	X	X		X	X	X	X
COLUMBIFORMES	COLUMBIDAE	*Phaps chalcoptera*	Common Bronzewing	-	-	X	X	X	X	X		X	X	X	X
COLUMBIFORMES	COLUMBIDAE	*Ptilinopus regina*	Rose-crowned Fruit-dove	-	-	X	X								
CORACIIFORMES	ALCEDINIDAE	*Ceyx azureus*	Azure Kingfisher	-	-		X								
CORACIIFORMES	ALCEDINIDAE	*Dacelo leachii*	Blue-winged Kookaburra	-	-	X	X	X		X		X	X	X	X
CORACIIFORMES	ALCEDINIDAE	*Todiramphus chloris*	Collared Kingfisher	-	-		X							X	
CORACIIFORMES	ALCEDINIDAE	*Todiramphus macleayii*	Forest Kingfisher	-	-	X	X	X		X	X		X		
CORACIIFORMES	ALCEDINIDAE	*Todiramphus sanctus*	Sacred Kingfisher	-	-		X								X
CORACIIFORMES	CORACIIDAE	*Eurystomus orientalis*	Dollarbird	-	-		X								
CORACIIFORMES	MEROPIDAE	*Merops ornatus*	Rainbow Bee-eater	-	-	X	X	X		X				X	
CUCULIFORMES	CENTROPODIDAE	*Centropus phasianinus*	Pheasant Coucal	-	-		X	X		X			X	X	X
CUCULIFORMES	CUCULIDAE	*Cacomantis variolosus*	Brush Cuckoo	-	-	x	X	X							
CUCULIFORMES	CUCULIDAE	*Chrysococcyx minutillus*	Little Bronze Cuckoo	-	-	X	X								
CUCULIFORMES	CUCULIDAE	*Eudynamys orientalis*	Eastern Koel	-	-	X		X							

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CUCULIFORMES	CUCULIDAE	*Scythrops novaehollandiae*	Channel-billed Cuckoo	-	-			X							
FALCONIFORMES	ACCIPITRIDAE	*Accipiter cirrocephalus*	Collared Sparrowhawk	-	-		X						X		
FALCONIFORMES	ACCIPITRIDAE	*Accipiter fasciatus*	Brown Goshawk	-	-	X	X	X						X	
FALCONIFORMES	ACCIPITRIDAE	*Aquila audax*	Wedge-tailed Eagle	-	-		X	X		X					
FALCONIFORMES	ACCIPITRIDAE	*Aviceda subcristata*	Pacific Baza	-	-	X									
FALCONIFORMES	ACCIPITRIDAE	*Circus assimilis*	Spotted Harrier	-	-		X								
FALCONIFORMES	ACCIPITRIDAE	*Haliaeetus leucogaster*	White-bellied Sea-eagle	-	-		X				X			X	
FALCONIFORMES	ACCIPITRIDAE	*Haliastur indus*	Brahminy Kite	-	-		X								
FALCONIFORMES	ACCIPITRIDAE	*Haliastur sphenurus*	Whistling Kite	-	-	X	X	X	X	X			X	X	
FALCONIFORMES	ACCIPITRIDAE	*Pandion cristatus*	Eastern Osprey	M(w)	-		X								
FALCONIFORMES	FALCONIDAE	*Falco berigora*	Brown Falcon	-	-	X	X							X	
GALLIFORMES	MEGAPODIIDAE	*Megapodius reinwardt*	Orange-footed Scrubfowl	-	-	X	X		X		X		X	X	X
GALLIFORMES	PHASIANIDAE	*Coturnix ypsilophora*	Brown Quail	-	-		X	X		X				X	X
GALLIFORMES	PHASIANIDAE	*Excalfactoria chinensis*	King Quail	-	-		X								
GRUIFORMES	GRUIDAE	*Grus rubicunda*	Brolga	-	-		X				X				
GRUIFORMES	RALLIDAE	*Eulabeornis castaneoventris*	Chestnut Rail	-	-		X								
GRUIFORMES	RALLIDAE	*Gallirallus philippensis*	Buff-banded Rail	-	-									X	
PASSERIFORMES	ACANTHIZIDAE	*Gerygone chloronota*	Green-backed Gerygone	-	-	X	X								
PASSERIFORMES	ACANTHIZIDAE	*Gerygone levigaster*	Mangrove Gerygone	-	-		X								
PASSERIFORMES	ACANTHIZIDAE	*Gerygone magnirostris*	Large-billed Gerygone	-	-	X	X								
PASSERIFORMES	ARTAMIDAE	*Artamus leucorynchus*	White-breasted Woodswallow	-	-	X	X								
PASSERIFORMES	ARTAMIDAE	*Artamus minor*	Little Woodswallow	-	-	X	X								
PASSERIFORMES	ARTAMIDAE	*Cracticus nigrogularis*	Pied Butcherbird	-	-	X	X	X	X	X		X	X	X	
PASSERIFORMES	ARTAMIDAE	*Cracticus tibicen*	Australian Magpie	-	-	X	X	X		X		X	X	X	
PASSERIFORMES	CAMPEPHAGIDAE	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	-	-	X	X	X		X					
PASSERIFORMES	CAMPEPHAGIDAE	*Coracina papuensis*	White-bellied Cuckoo-shrike	-	-	X	X	X		X					
PASSERIFORMES	CAMPEPHAGIDAE	*Coracina tenuirostris*	Cicadabird	-	-	X	X								
PASSERIFORMES	CAMPEPHAGIDAE	*Lalage leucomela*	Varied Triller	-	-	X	X								
PASSERIFORMES	CAMPEPHAGIDAE	*Lalage sueurii*	White-winged Triller	-	-		X								
PASSERIFORMES	CISTICOLIDAE	*Cisticola exilis*	Golden-headed Cisticola	-	-		X								
PASSERIFORMES	CORVIDAE	*Corvus orru*	Torresian Crow	-	-	X	X	X	X	X		X	X	X	X
PASSERIFORMES	DICRURIDAE	*Dicrurus bracteatus*	Spangled Drongo	-	-	X	X	X	X	X					
PASSERIFORMES	ESTRILDIDAE	*Taeniopygia bichenovii*	Double-barred Finch	-	-	X	X	X	X	X				X	
PASSERIFORMES	HIRUNDINIDAE	*Petrochelidon nigricans*	Tree Martin	-	-		X								

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PASSERIFORMES	MALURIDAE	*Malurus melanocephalus*	Red-backed Fairy-wren	-	-	X	X	X		X			X		X
PASSERIFORMES	MEGALURIDAE	*Megalurus timoriensis*	Tawny Grassbird	-	-		X								
PASSERIFORMES	MELIPHAGIDAE	*Conopophila albogularis*	Rufous-banded Honeyeater	-	-	X	X								
PASSERIFORMES	MELIPHAGIDAE	*Conopophila rufogularis*	Rufous-throated Honeyeater	-	-								X		
PASSERIFORMES	MELIPHAGIDAE	*Lichmera indistincta*	Brown Honeyeater	-	-	X	X	X	X	X					X
PASSERIFORMES	MELIPHAGIDAE	*Melithreptus albogularis*	White-throated Honeyeater	-	-	X	X	X		X					
PASSERIFORMES	MELIPHAGIDAE	*Myzomela erythrocephala*	Red-headed Honeyeater	-	-		X								
PASSERIFORMES	MELIPHAGIDAE	*Myzomela obscura*	Dusky Honeyeater	-	-			X							
PASSERIFORMES	MELIPHAGIDAE	*Philemon argenticeps*	Silver-crowned Friarbird	-	-	X	X	X	X	X				X	
PASSERIFORMES	MELIPHAGIDAE	*Philemon citreogularis*	Little Friarbird	-	-	X	X	X	X	X					
PASSERIFORMES	MELIPHAGIDAE	*Philemon sp.*		-	-									X	
PASSERIFORMES	MELIPHAGIDAE	*Ramsayornis fasciatus*	Bar-breasted Honeyeater	-	-	X	X								
PASSERIFORMES	MELIPHAGIDAE	*Stomiopera unicolor*	White-gaped Honeyeater	-	-	X	X	X		X					
PASSERIFORMES	MONARCHIDAE	*Grallina cyanoleuca*	Magpie-lark	-	-	X								X	X
PASSERIFORMES	MONARCHIDAE	*Myiagra alecto*	Shining Flycatcher	-	-	X	X	X			X			X	
PASSERIFORMES	MONARCHIDAE	*Myiagra inquieta*	Restless Flycatcher	-			X								
PASSERIFORMES	MONARCHIDAE	*Myiagra rubecula*	Leaden Flycatcher	-	-	X	X	X	X	X					
PASSERIFORMES	MONARCHIDAE	*Myiagra ruficollis*	Broad-billed Flycatcher	-	-		X	X							
PASSERIFORMES	MONARCHIDAE	*Symposiachrus trivirgatus*	Spectacled Monarch	M(t)	-	X									
PASSERIFORMES	MOTACILLIDAE	*Anthus novaeseelandiae*	Australasian Pipit	-	-	X									X
PASSERIFORMES	NECTARINIIDAE	*Dicaeum hirundinaceum*	Mistletoebird	-	-	X	X	X							
PASSERIFORMES	ORIOLIDAE	*Oriolus flavocinctus*	Yellow Oriole	-	-	X	X			X					
PASSERIFORMES	ORIOLIDAE	*Oriolus sagittatus*	Olive-backed Oriole	-	-	X	X	X	X						
PASSERIFORMES	ORIOLIDAE	*Sphecotheres vieilloti*	Australasian Figbird	-	-	X	X								
PASSERIFORMES	PACHYCEPHALIDAE	*Colluricincla harmonica*	Grey Shrike-thrush	-	-	X	X	X		X				X	
PASSERIFORMES	PACHYCEPHALIDAE	*Colluricincla megarhyncha*	Little Shrike-thrush	-	-	X		X	X						
PASSERIFORMES	PACHYCEPHALIDAE	*Pachycephala rufiventris*	Rufous Whistler	-	-	X	X	X	X	X				X	
PASSERIFORMES	PACHYCEPHALIDAE	*Pachycephala simplex*	Grey Whistler	-	-	X	X	X							
PASSERIFORMES	PARDALOTIDAE	*Pardalotus striatus*	Striated Pardalote	-	-	X	X	X		X		X		X	
PASSERIFORMES	PETROICIDAE	*Microeca flavigaster*	Lemon-bellied Flycatcher	-	-	X	X	X		X				X	X
PASSERIFORMES	PITTIDAE	*Pitta iris*	Rainbow Pitta	-	-	X	X						X	X	X
PASSERIFORMES	POMATOSTOMIDAE	*Pomatostomus temporalis*	Grey-crowned Babbler	-	-	X	X	X		X			X		X
PASSERIFORMES	PTILONORHYNCHIDAE	*Ptilonorhynchus nuchalis*	Great Bowerbird	-	-	X	X			X			X	X	

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PASSERIFORMES	RHIPIDURIDAE	*Rhipidura dryas*	Arafura Fantail	-	-		X			X				X	
PASSERIFORMES	RHIPIDURIDAE	*Rhipidura leucophrys*	Willie Wagtail							X					
PASSERIFORMES	RHIPIDURIDAE	*Rhipidura rufifrons*	Rufous Fantail	-	-	X									
PASSERIFORMES	RHIPIDURIDAE	*Rhipidura rufiventris*	Northern Fantail	-	-	X	X	X	X	X				X	
PASSERIFORMES	TIMALIIDAE	*Zosterops luteus*	Yellow White-eye	-	-	X	X			X					
PELECANIFORMES	ANHINGIDAE	*Anhinga novaehollandiae*	Australasian Darter	-	-		X								
PELECANIFORMES	PHALACROCORACIDAE	*Phalacrocorax sulcirostris*	Little Black Cormorant	-	-	X									
PODICIPEDIFORMES	PODICIPEDIDAE	*Tachybaptus novaehollandiae*	Australasian Grebe	-	-	X	X								
PSITTACIFORMES	CACATUIDAE	*Cacatua galerita*	Sulphur-crested Cockatoo	-	-	X	X	X	X	X					
PSITTACIFORMES	CACATUIDAE	*Cacatua sanguinea*	Little Corella	-	-	X	X		X				X		
PSITTACIFORMES	CACATUIDAE	*Calyptorhynchus banksii*	Red-tailed Black-cockatoo	-	-	X									
PSITTACIFORMES	PSITTACIDAE	*Aprosmictus erythropterus*	Red-winged Parrot	-	-	X	X	X	X	X					
PSITTACIFORMES	PSITTACIDAE	*Trichoglossus haematodus*	Rainbow Lorikeet	-	-	X	X	X	X	X					
STRIGIFORMES	STRIGIDAE	*Ninox novaeseelandiae*	Southern Boobook	-	-	X	X	X		X			X		
STRIGIFORMES	TYTONIDAE	*Tyto novaehollandiae kimberli*	Masked Owl (northern)	V	V		X	X		X					X
TURNICIFORMES	TURNICIDAE	*Turnix castanotus*	Chestnut-backed Button-quail	-	-	X	X	X			X		X	X	
MAMMALS															
CARNIVORA	CANIDAE	*Canis familiaris*	Domestic Dog	-	-	X	X							X	
CARNIVORA	CANIDAE	*Canis familiaris/lupus*	Domestic Dog / Dingo	-	-		X	X	X	X					
CARNIVORA	CANIDAE	*Canis lupus*	Dingo	-	-	X						X	X	X	X
CARNIVORA	FELIDAE	*Felis catus*	Cat	-	-	X	X	X					X	X	X
CHIROPTERA	EMBALLONURIDAE	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	-	-		X	X	X	X					
CHIROPTERA	EMBALLONURIDAE	*Taphozous georgianus*	Common Sheathtail-bat	-	-		X	X		X	X				
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros ater*	Dusky Leafnosed-bat	-	-			X							
CHIROPTERA	MEGADERMATIDAE	*Macroderma gigas*	Ghost Bat	-	-		X								
CHIROPTERA	MOLOSSIDAE	*Chaerephon jobensis*	Northern Freetail-bat	-	-			X^							
CHIROPTERA	MOLOSSIDAE	*Mormopterus beccarii*	Beccari's Freetail-bat	-	-					X^					
CHIROPTERA	PTEROPODIDAE	*Macroglossus minimus*	Northern Blossom-bat	-	-		X		X						
CHIROPTERA	PTEROPODIDAE	*Pteropus alecto*	Black Flying-fox	-	-		X	X							
CHIROPTERA	PTEROPODIDAE	*Pteropus scapulatus*	Little Red Flying-fox	-	-	X	X								
CHIROPTERA	VESPERTILIONIDAE	*Chalinolobus gouldii*	Gould's Wattled Bat	-	-			X^							
CHIROPTERA	VESPERTILIONIDAE	*Chalinolobus nigrogriseus*	Hoary Wattled Bat	-	-		X	X							

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CHIROPTERA	VESPERTILIONIDAE	*Chalinolobus nigrogriseus / [illegible]*		-	-			X	X^	X^	X^				
CHIROPTERA	VESPERTILIONIDAE	*Myotis macropus*	Large-footed Myotis	-	-		X	X							
CHIROPTERA	VESPERTILIONIDAE	*Nyctophilus arnhemensis*	Arnhem Long-eared Bat	-	-		X								
CHIROPTERA	VESPERTILIONIDAE	*Nyctophilus sp.*		-	-			X		X^					
CHIROPTERA	VESPERTILIONIDAE	*Nyctophilus walkeri*	Pygmy Long-eared Bat	-	-			X							
CHIROPTERA	VESPERTILIONIDAE	*Vespadelus caurinus*	Northern Cave Bat	-	-	X	X	X		X	X				
CHIROPTERA	VESPERTILIONIDAE	*Vespadelus finlaysoni*	Finlayson's Cave Bat	-	-		X			X	X				
DASYUROMORPHIA	DASYURIDAE	*Dasyurus hallucatus*	Northern Quoll	E	CE	X	X	X	X	X		X	X	X	X
DASYUROMORPHIA	DASYURIDAE	*Planigale maculata*	Common Planigale	-	-	X	X					X	X	X	X
DIPROTODONTIA	MACROPODIDAE	*Macropus agilis*	Agile Wallaby	-	-	X	X	X	X	X		X	X	X	X
DIPROTODONTIA	MACROPODIDAE	*Petrogale brachyotis*	Short-eared Rock-wallaby	-	-	X		X					X	X	X
DIPROTODONTIA	PETAURIDAE	*Petaurus breviceps*	Sugar Glider	-	-	X	X	X		X			X	X	X
DIPROTODONTIA	PHALANGERIDAE	*Trichosurus vulpecula arnhemensis*	Common Brushtail Possum (northern)	-	-		X								
DIPROTODONTIA	PSEUDOCHEIRIDAE	*Petropseudes dahli*	Rock Ringtail Possum	-	-	X								X	X
MONOTREMATA	TACHYGLOSSIDAE	*Tachyglossus aculeatus*	Short-beaked Echidna	-	-	X	X	X		X		X	X	X	X
PERAMELEMORPHIA	PERAMELIDAE	*Isoodon macrourus*	Northern Brown Bandicoot	-	-	X	X	X	X	X		X	X	X	X
RODENTIA	MURIDAE	*Conilurus penicillatus*	Brush-tailed Rabbit-rat	V	E			X					X		
RODENTIA	MURIDAE	*Hydromys chrysogaster*	Water-rat	-	-		X							X	
RODENTIA	MURIDAE	*Melomys burtoni*	Grassland Melomys	-	-	X	X	X	X	X		X	X	X	X
RODENTIA	MURIDAE	*Mus musculus**	House Mouse	-	-				X						
RODENTIA	MURIDAE	*Notomys aquilo*	Northern Hopping-mouse	V	V			X					X		X
RODENTIA	MURIDAE	*Pseudomys delicatulus*	Delicate Mouse	-	-	X	X	X	X	X		X	X	X	X
RODENTIA	MURIDAE	*Rattus rattus*	Black Rat*	-	-				X						
RODENTIA	MURIDAE	*Zyzomys argurus*	Common Rock-rat	-	-	X		X						X	X
REPTILES	**REPTILES**														
CROCODYLIA	CROCODYLIDAE	*Crocodylus porosus*	Saltwater Crocodile	M(m)	-	X	X	X		X	X				
SQUAMATA	AGAMIDAE	*Chlamydosaurus kingii*	Frilled Lizard	-	-	X	X	X	X	X		X	X	X	X
SQUAMATA	AGAMIDAE	*Diporiphora bilineata*	Two-lined Dragon	-	-	X	X	X		X		X	X	X	X
SQUAMATA	AGAMIDAE	*Diporiphora magna*	Yellow-sided Two-line Dragon	-	-			X							
SQUAMATA	AGAMIDAE	*Lophognathus gilberti*	Gilbert's Dragon	-	-	X	X					X	X	X	X
SQUAMATA	AGAMIDAE	*Unidentified spp.*		-	-								X	X	X
SQUAMATA	BOIDAE	*Antaresia childreni*	Children's Python	-	-	X	X								
SQUAMATA	BOIDAE	*Liasis fuscus*	Water Python	-	-	X	X								

Order	Family	Scientific Name	Common Name	EPBC Act Status	TPWC Act Status	Webb (1992)	URS (2012)	Cumberland Ecology (2015)	Cumberland Ecology (2015)	Cumberland Ecology (2016)	Cumberland Ecology (2016)	Heiniger and Gillespie (2017)	Heiniger and Gillespie (2017)	Cumberland Ecology (2019)	Cumberland Ecology (2019)
						Survey Location									
						Eastern Leases & existing mine	*Existing mine*	*Eastern Leases*	*Rehab areas of existing mine*	*Within Study Area*	*Adjacent to Study Area*	*Within Study Area*	*North and East of Study Area*	*Within Study Area*	*Adjacent to Study Area*
SQUAMATA	BOIDAE	*Liasis olivaceus*	Olive Python	-	-	X		X		X			X	X	
SQUAMATA	BOIDAE	*Morelia spilota*	Diamond Python	-	-			X							
SQUAMATA	COLUBRIDAE	*Boiga irregularis*	Brown Tree Snake	-	-	x	X	X							
SQUAMATA	COLUBRIDAE	*Dendrelaphis punctulatus*	Common Tree Snake	-	-		X								
SQUAMATA	COLUBRIDAE	*Tropidonophis mairii*	Freshwater Snake	-	-	X	X								
SQUAMATA	DIPLODACTYLIDAE	*Amalosia rhombifer*	Zigzag Velvet Gecko	-	-	X	X								
SQUAMATA	DIPLODACTYLIDAE	*Oedura marmorata*	Marbled Velvet Gecko	-	-	X									
SQUAMATA	ELAPIDAE	*Acanthophis praelongus*	Northern Death Adder	-	-		X								
SQUAMATA	ELAPIDAE	*Demansia olivacea*	Olive Whip Snake	-	-									X	X
SQUAMATA	ELAPIDAE	*Pseudechis australis*	King Brown Snake	-	-	X									
SQUAMATA	ELAPIDAE	*Pseudechis weigeli*	Weigel's Black Snake	-	-		X						X	X	X
SQUAMATA	ELAPIDAE	*Pseudonaja nuchalis*	Western Brown Snake	-	-									X	X
SQUAMATA	ELAPIDAE	*Pseudonaja nuchalis*	Northern Brown Snake	-	-		X	X							
SQUAMATA	ELAPIDAE	*Unidentified spp.*		-	-								X		X
SQUAMATA	GEKKONIDAE	*Gehyra australis*	Northern Dtella	-	-	X	X								
SQUAMATA	GEKKONIDAE	*Gehyra pamela*	Arnhemland Watercourse Dtella	-	-	X									
SQUAMATA	GEKKONIDAE	*Hemidactylus frenatus*	House Gecko	-	-		X			X					
SQUAMATA	GEKKONIDAE	*Heteronotia binoei*	Bynoe's Gecko	-	-	X	X	X	X	X					
SQUAMATA	GEKKONIDAE	*Unidentified spp.*		-	-								X	X	X
SQUAMATA	HOMALOPSIDAE	*Enhydris polylepis*	Macleay's Water Snake	-	-	X	X								
SQUAMATA	PYGOPODIDAE	*Delma borea*	Rusty-topped Delma	-	-	X	X	X		X					
SQUAMATA	PYGOPODIDAE	*Lialis burtonis*	Burton's Snake-lizard	-	-	X	X	X	X						
SQUAMATA	SCINCIDAE	*Carlia amax*	Bauxite Rainbow-skink	-	-	X	X	X	X						
SQUAMATA	SCINCIDAE	*Carlia longipes*	Closed-litter Rainbow-skink	-	-	X									
SQUAMATA	SCINCIDAE	*Carlia munda*	Shaded-litter Rainbow-skink	-	-	X	X	X		X					
SQUAMATA	SCINCIDAE	*Carlia sexdentata*		-	-		X	X							
SQUAMATA	SCINCIDAE	*Cryptoblepharus metallicus*	Metallic Snake-eyed Skink	-	-		X								
SQUAMATA	SCINCIDAE	*Cryptoblepharus plagiocephalus*	Péron's Snake-eyed Skink	-	-	X		X							
SQUAMATA	SCINCIDAE	*Ctenotus arnhemensis*	Arnhem Land Ctenotus	-	-			X							
SQUAMATA	SCINCIDAE	*Ctenotus essingtonii*	Port Essington Ctenotus	-	-	X		X							
SQUAMATA	SCINCIDAE	*Ctenotus inornatus*	Bar-shouldered Ctenotus	-	-	X	X			X					
SQUAMATA	SCINCIDAE	*Ctenotus quirinus*		-	-		X		X	X					
SQUAMATA	SCINCIDAE	*Ctenotus robustus*	Robust Ctenotus	-	-		X	X	X						
SQUAMATA	SCINCIDAE	*Ctenotus spaldingi*	Spalding's Ctenotus	-	-		X	X		X					

Order	Family	Scientific Name	Common Name	EPBC Act Status	TPWC Act Status	Webb (1992)	URS (2012)	Cumberland Ecology (2015)	Cumberland Ecology (2015)	Cumberland Ecology (2016)	Cumberland Ecology (2016)	Heiniger and Gillespie (2017)	Heiniger and Gillespie (2017)	Cumberland Ecology (2019)	Cumberland Ecology (2019)
						Survey Location									
						Eastern Leases & existing mine	*Existing mine*	*Eastern Leases*	*Rehab areas of existing mine*	*Within Study Area*	*Adjacent to Study Area*	*Within Study Area*	*North and East of Study Area*	*Within Study Area*	*Adjacent to Study Area*
SQUAMATA	SCINCIDAE	*Eremiascincus isolepis*	Northern Bar-lipped Skink	-	-	X	X	X							
SQUAMATA	SCINCIDAE	*Glaphyromorphus nigricaudis*	Black-tailed Bar-lipped Skink	-	-	X	X								
SQUAMATA	SCINCIDAE	*Lerista carpentariae*	Carpentaria Fine-lined Slider	-	-	X	X	X							
SQUAMATA	SCINCIDAE	*Menetia alanae*	Alana's Menetia	-	-	X	X								
SQUAMATA	SCINCIDAE	*Menetia greyii*	Common Dwarf Skink	-	-			X							
SQUAMATA	SCINCIDAE	*Menetia maini*	Northern Dwarf Skink	-	-			X							
SQUAMATA	SCINCIDAE	*Notoscincus ornatus*	Ornate Soil-crevice Skink	-	-	X	X	X							
SQUAMATA	SCINCIDAE	*Proablepharus tenuis*	Northern Soil-crevice Skink	-	-	X	X	X		X					
SQUAMATA	SCINCIDAE	*Tiliqua scincoides*	Eastern Blue-tongue	-	-			X							
SQUAMATA	SCINCIDAE	*Tiliqua scincoides intermedia*	Northern Blue-tongue Lizard	-	-	X	X	X				X	X	X	X
SQUAMATA	SCINCIDAE	*Unidentified spp.*		-	-							X	X	X	X
SQUAMATA	TYPHLOPIDAE	*Ramphotyphlops minimus*	Groote Dwarf Blind Snake	-	-			X							
SQUAMATA	TYPHLOPIDAE	*Ramphotyphlops unguirostris*	Claw-snouted Blind Snake	-	-	X									
SQUAMATA	VARANIDAE	*Varanus acanthurus*	Ridge-tailed Monitor	-	-										X
SQUAMATA	VARANIDAE	*Varanus glebopalma*	Black-palmed Monitor	-	-	X	X							X	
SQUAMATA	VARANIDAE	*Varanus gouldii*	Sand Goanna	-	-							X	X	X	X
SQUAMATA	VARANIDAE	*Varanus mertensi*	Mertens' Water Monitor	-	V	X	X	X	X						
SQUAMATA	VARANIDAE	*Varanus panoptes*	Yellow-spotted Monitor	-	V		X	X	X						
SQUAMATA	VARANIDAE	*Varanus scalaris*	Spotted Tree Monitor	-	-	X	X	X	X			X	X	X	X
SQUAMATA	VARANIDAE	*Varanus sp.*		-	-									X	X
SQUAMATA	VARANIDAE	*Varanus tristis*	Black-headed Monitor	-	-							X	X	X	X

1. Conservation Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory [(m) = marine, (t) = terrestrial, (w) = wetland]

2. Species listed as Pandion haliaetus the Protected Matters Search report. Pandion haliaetus cristatus was previously recognised as a subspecies for Australasia and New Caledonia, however it is currently recognised as a species in its own right.

** Denotes an exotic species*

^Species identification was not possible, as call could not be positively identified.

FIGURES

Figure 1. Project location

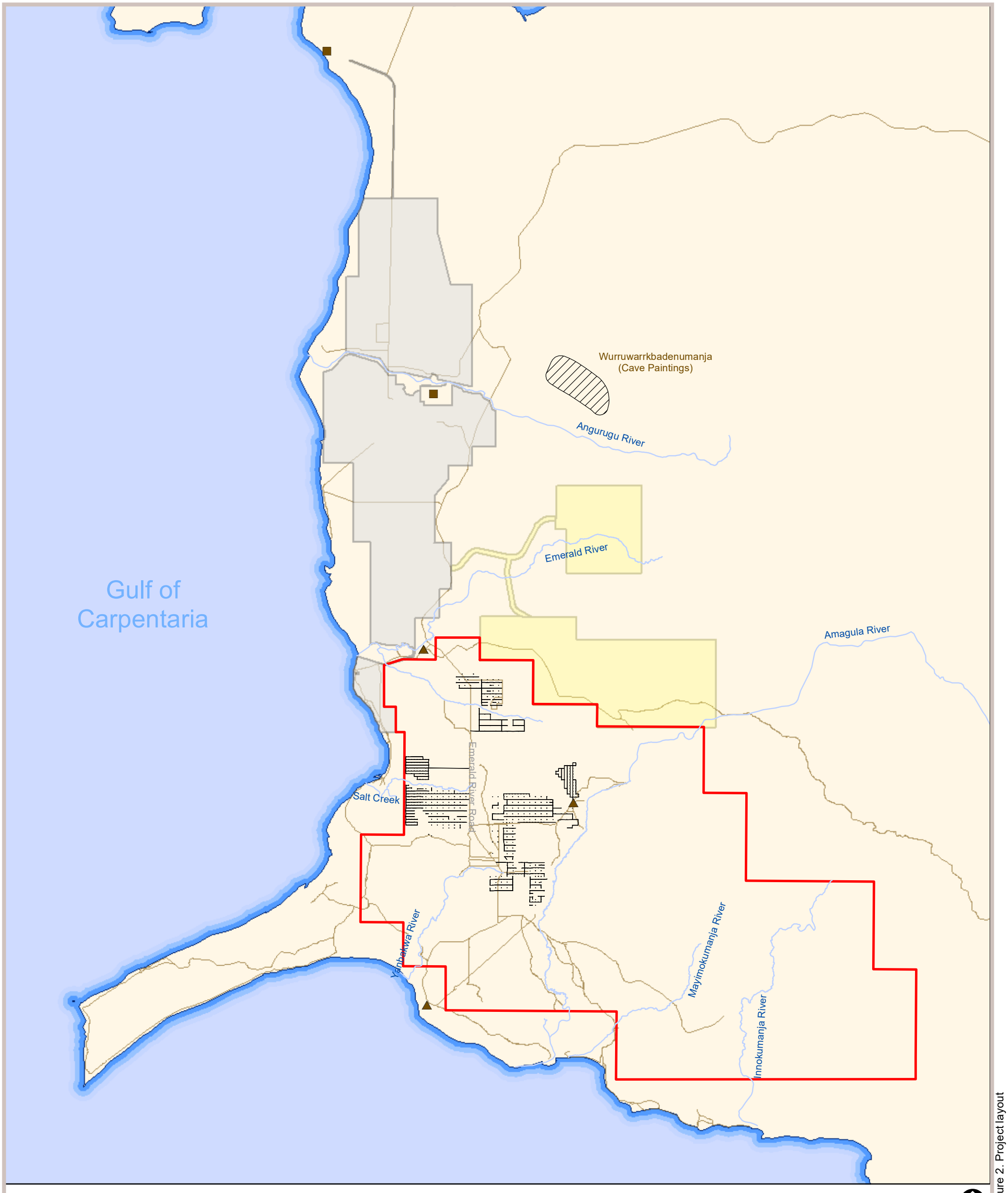

Figure 2. Project layout

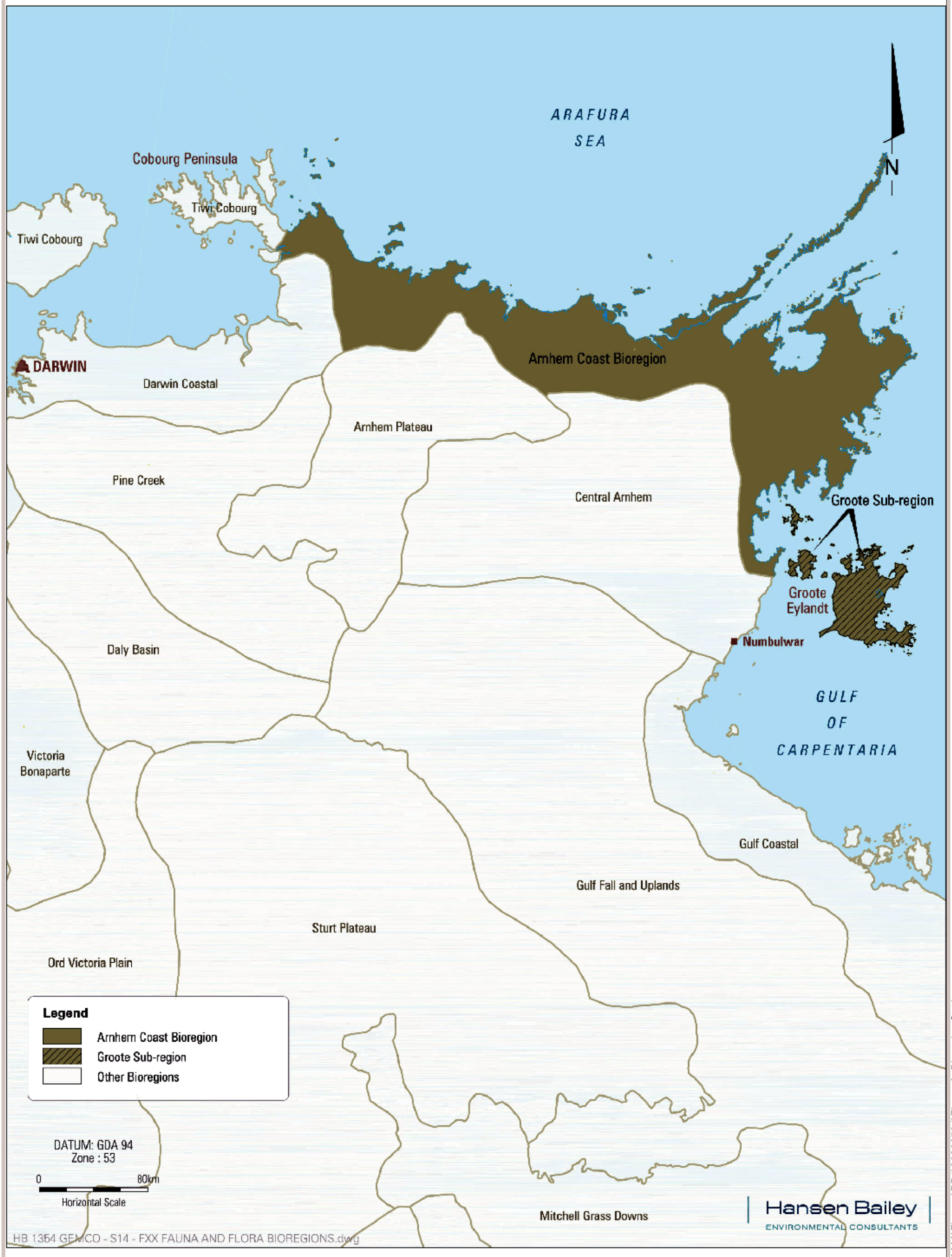

Figure 3. Bioregion Setting

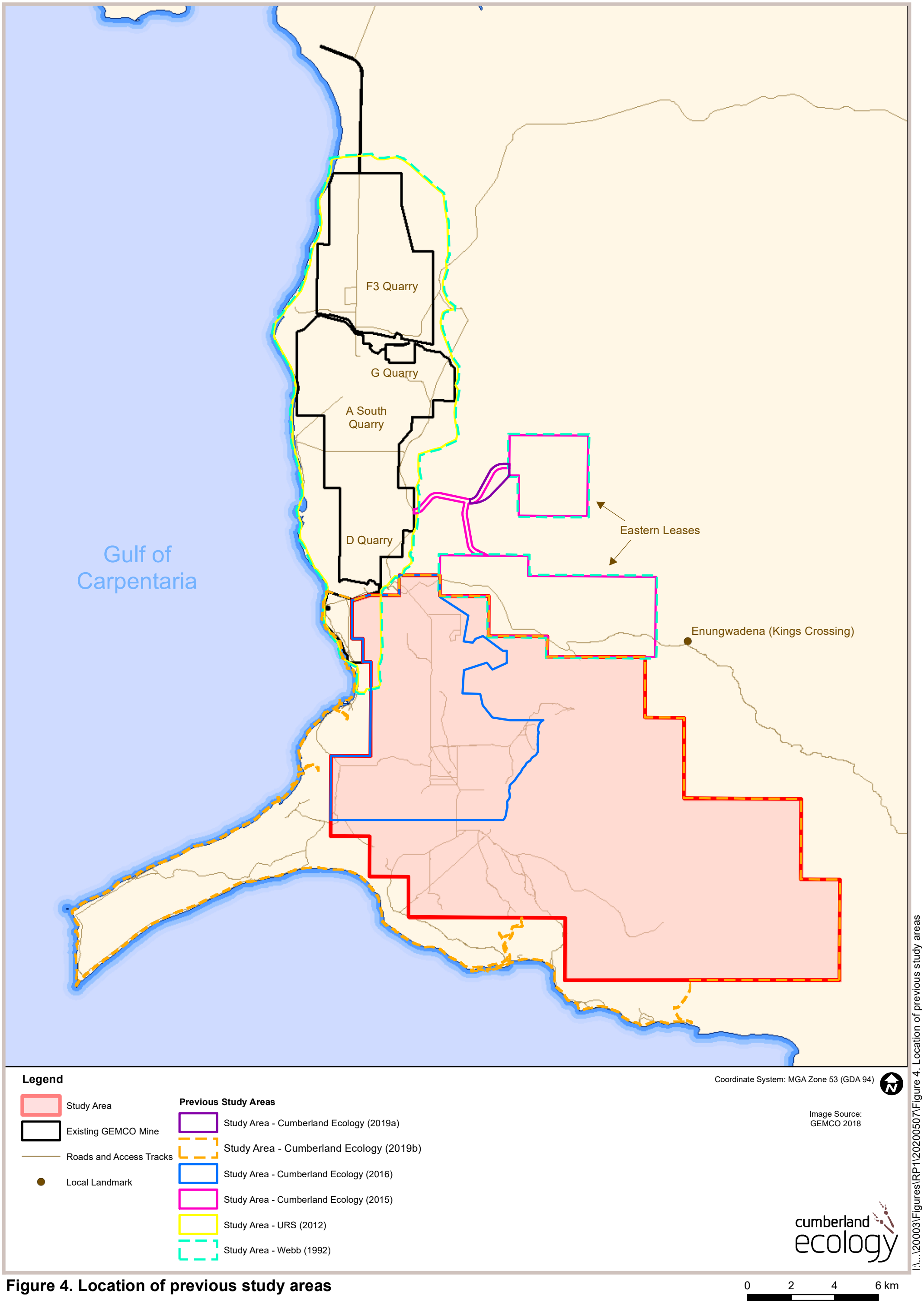

Figure 4. Location of previous study areas

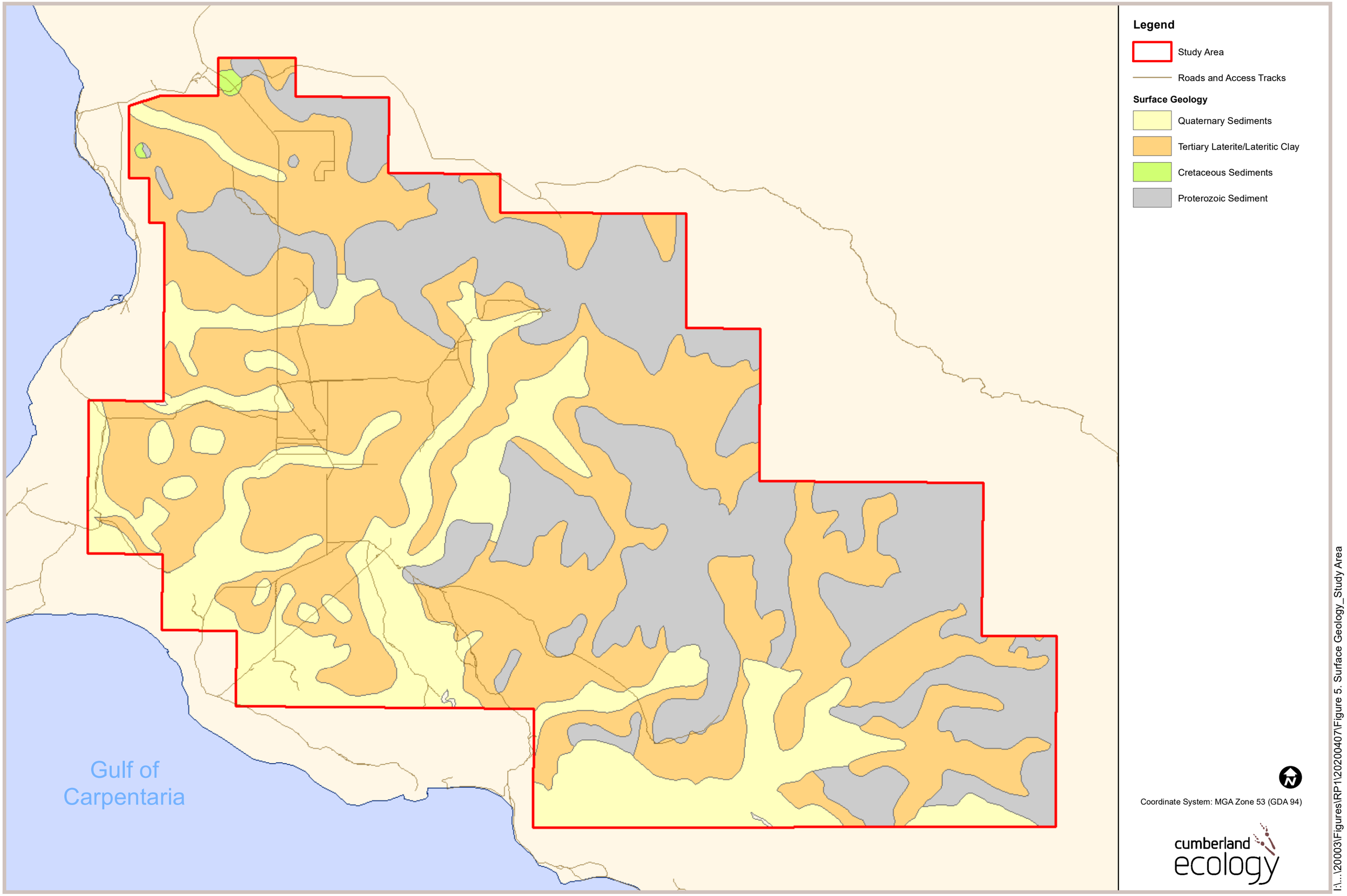

Figure 5. Surface geology within the Study Area

Gulf of Caprentaria

Legend

Study Area

Roads and Access Tracks

Soil Classifications

AC15: Plains with some incised streams and some flat valleys and spillways subject to local flooding: chief soils are yellow earthy sands, both may contain some ironstone gravels.

BA10: Dissected sandstone plateau of high, stony, often steep-sided hills; large areas of bare rock outcrop: chief soils are shallow gritty and stony sands.

B34: Coastal dune systems generally consolidated but with many mobile areas; sometimes with a central core of limestone or ancient coral: chief soils are siliceous sands.

Coordinate System: MGA Zone 53 (GDA 94)

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0 800 1,600 2,400 3,200 m

I:\...\20003\Figures\RP1\20200407\Figure 6. Soils mapping_Study Area

Figure 6. Soils mapping within the Study Area

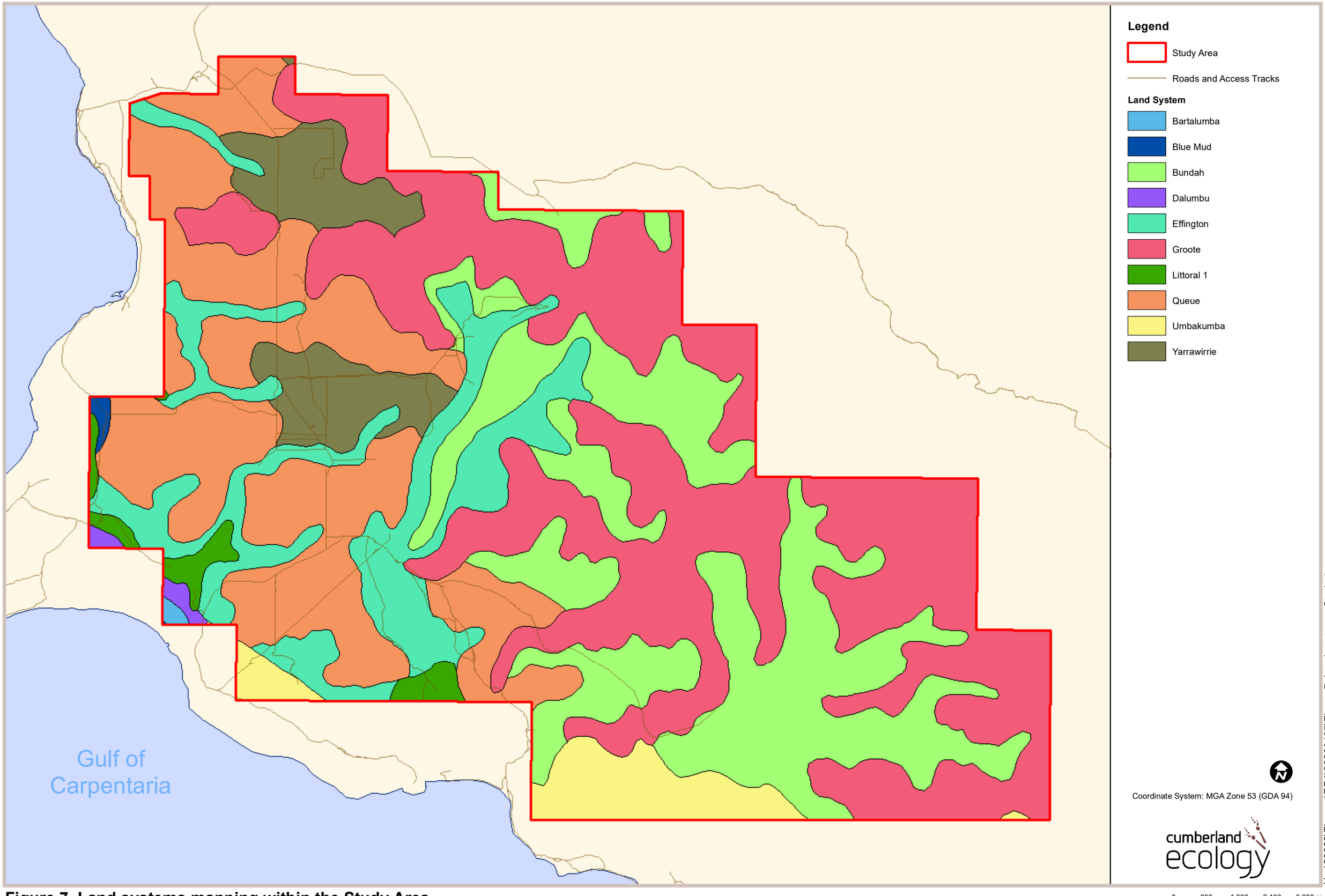


Figure 7. Land systems mapping within the Study Area

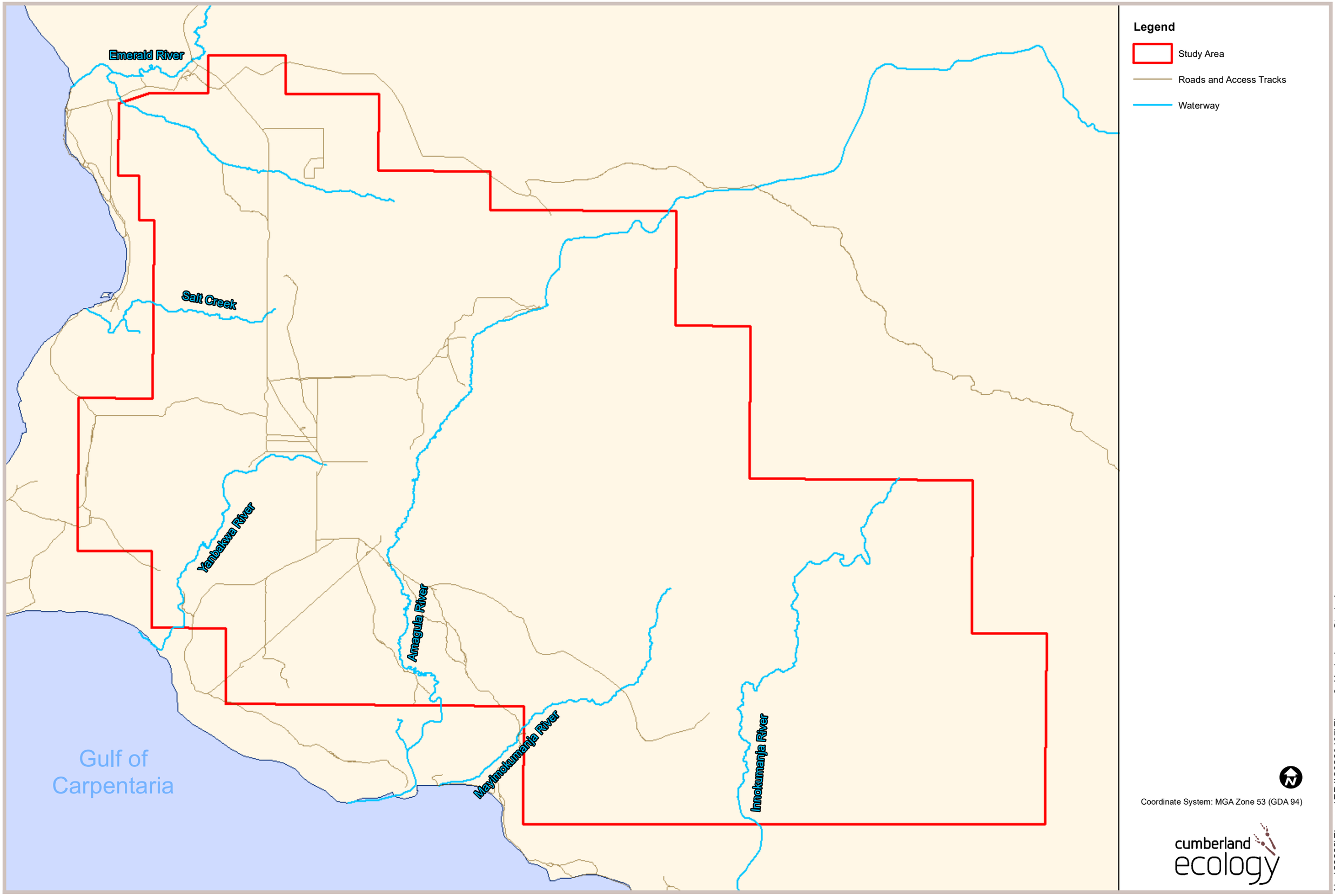
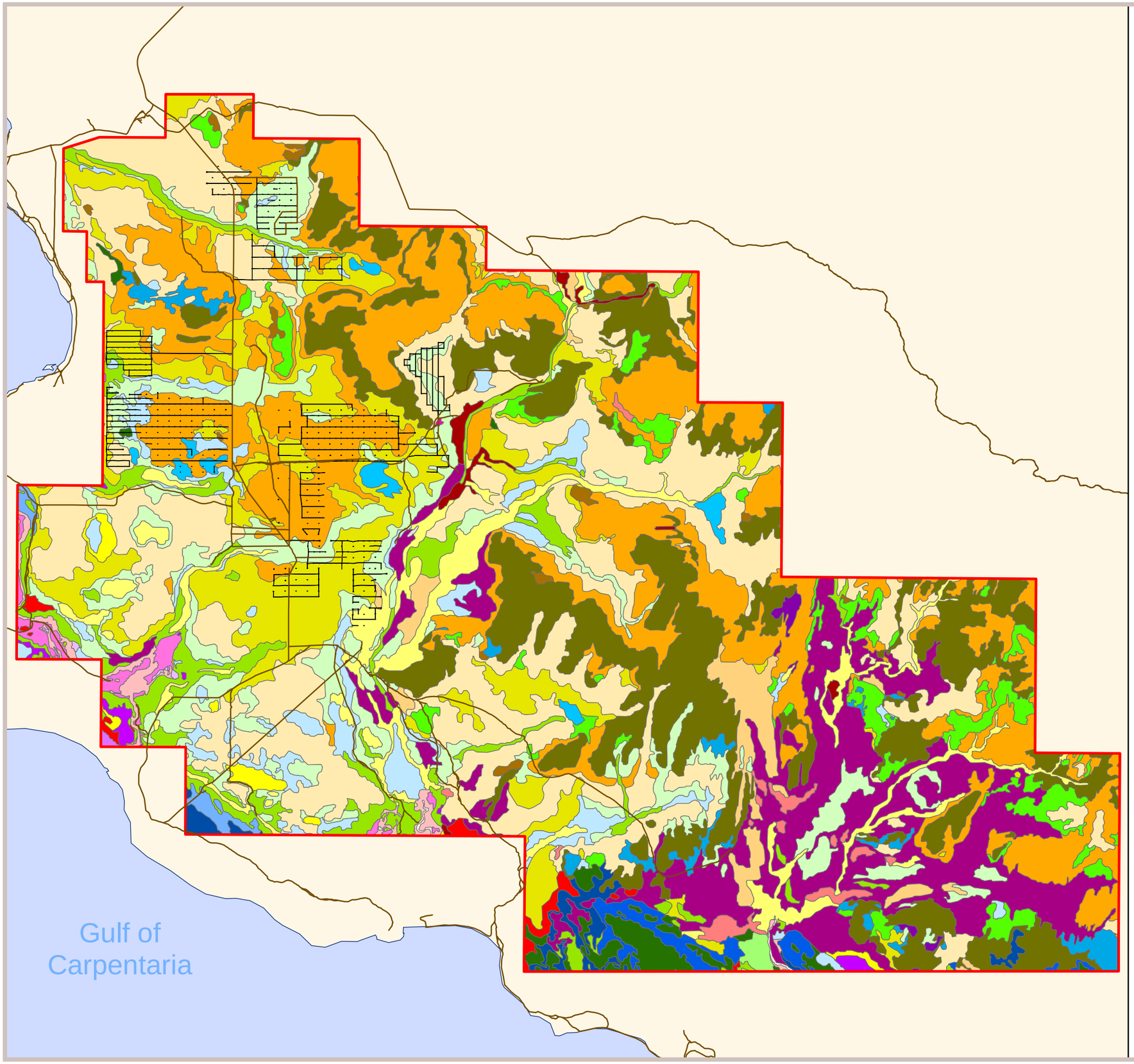


Figure 8. Hydrology within the Study Area



Legend

- Study Area
- Stage 2 Exploration Program
- Roads and Access Tracks

Broad Vegetation Types

- 1: Mangrove
- 2: Spring closed forest (rainforest)
- 3: Dry closed forests or thickets (rainforest) on sand or sandstone
- 4: Riparian and gully closed forests with mixed canopies (rainforest and Melaleuca spp.)
- 5: Eucalypt open forests of lowlands and deeper sandy soils derived from sandstone or deeply weathered parent rocks (lateritic)
- 6: Eucalypt open forests on Quaternary sands
- 7: Eucalypt open forests and woodlands of sandstone uplands
- 8: Callitris open forest
- 9: Melaleuca open forests on alluvial plains and drainage systems
- 10: Melaleuca swamps
- 11: Eucalypt woodlands and open woodlands of lowlands with sandy soils
- 12: Eucalypt woodland and open woodlands on shallow soils associated with basement geologies
- 13: Eucalypt woodlands on alluvial soils
- 14: Eucalypt woodland on quaternary sands
- 15: Callitris woodland and open woodland
- 16: Melaleuca woodlands on alluvial soils (wet)
- 17: Melaleuca woodlands on sandy soils (dry)
- 18: Melaleuca open woodlands on alluvial soils (wet)
- 19: Melaleuca open woodlands on sandy soils (dry)
- 20: Eucalypt low open woodland
- 21: Shrublands on quaternary sand
- 22: Sandstone shrublands
- 23: Acacia thickets etc. on sand or sandstone
- 24: Tussock grasslands on alluvial soils or relict marine plains
- 25: Tussock grasslands on Quaternary sand
- 26: Sedge wetlands
- 28: Hummock grassland on sandstone (or minor basalt)
- 29: Saline tidal flats and shrublands
- 33: Cleared/ disturbed/regrowth
- 34: Water
- 36: Eucalypt and/or Melaleuca open forest/vine thicket complex

Coordinate System: MGA Zone 53 (GDA 94)

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I:\...\20003\Figures\RP1\20200407\Figure 9. Broad Vegetation Types_Study Area

0 850 1,700 2,550 3,400 m

Figure 9. Broad Vegetation Types within the Study Area

Legend

Study Area

Eastern Leases

Existing GEMCO Mine

Locality

Roads and Access Tracks

Threatened Flora

Hernandia nymphaeifolia

Coordinate System: MGA Zone 53 (GDA 94)

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I:\...\20003\Figures\RP1\20200407\Figure 10. NR Maps_threatened flora

0 5 10 15 20 km

Figure 10. NR Maps Database records of threatened flora on Groote Eylandt

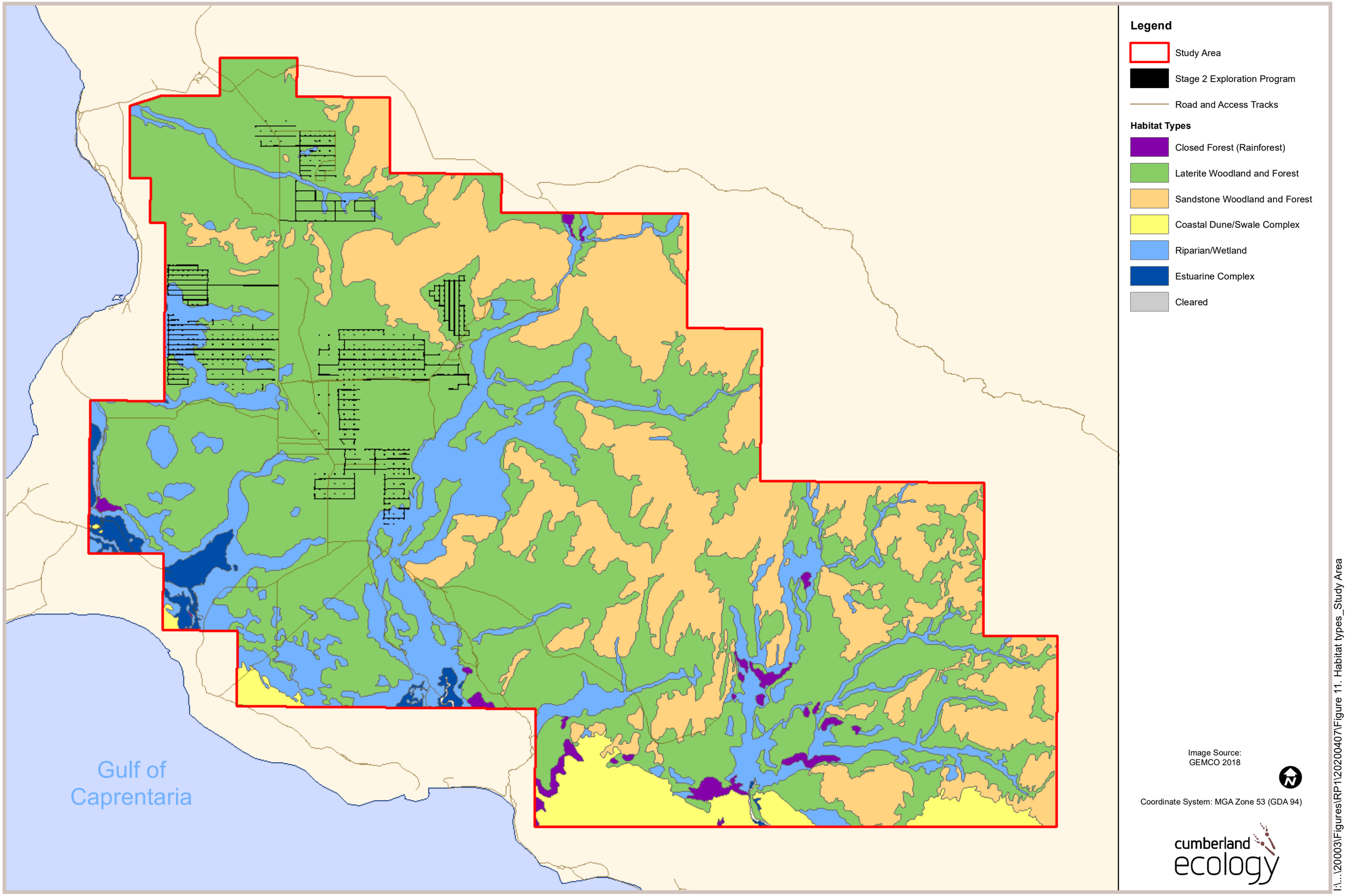

Figure 11. Habitat types within the Study Area

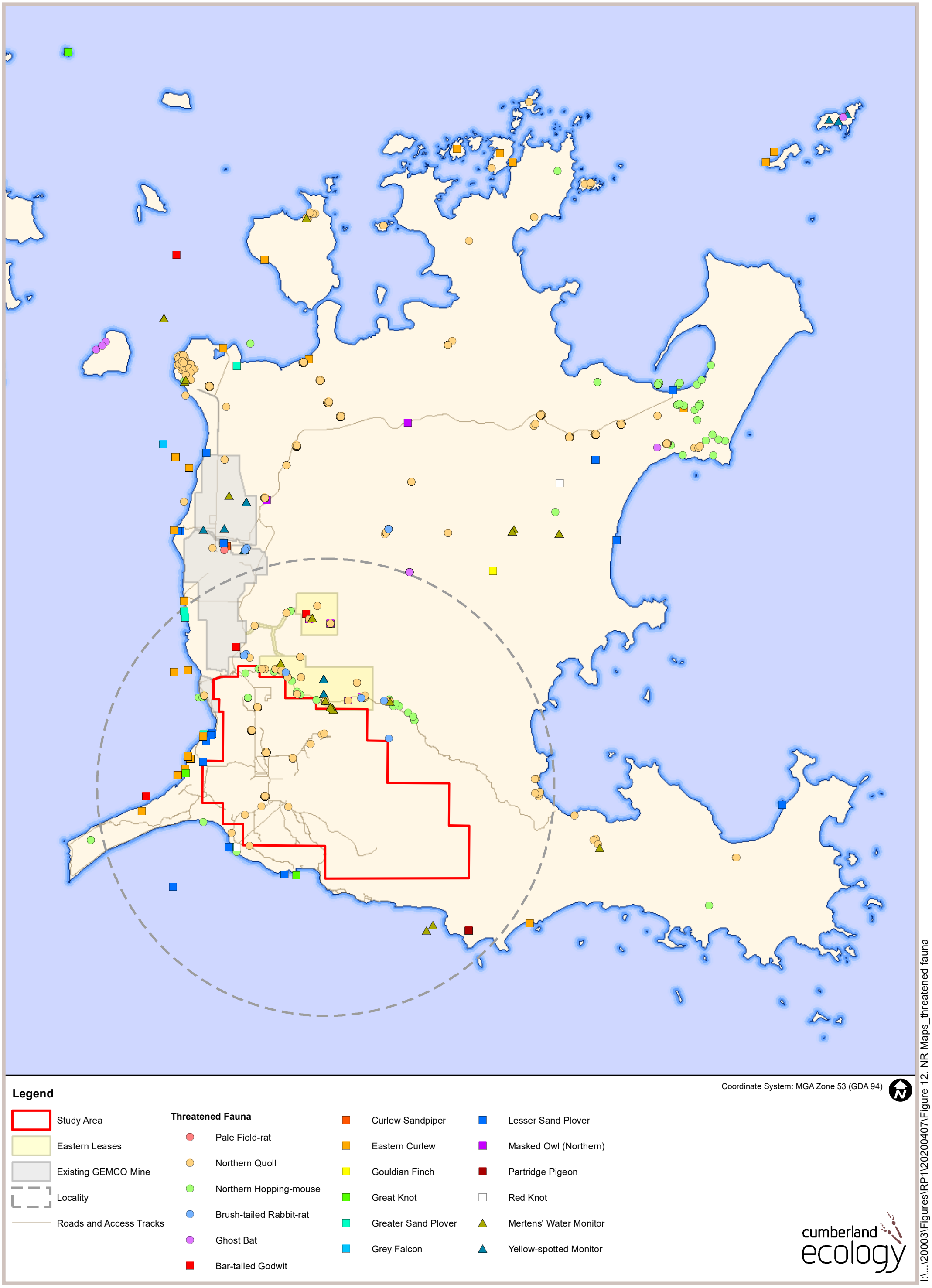

Figure 12. NR Maps database records of threatened fauna on Groote Eylandt

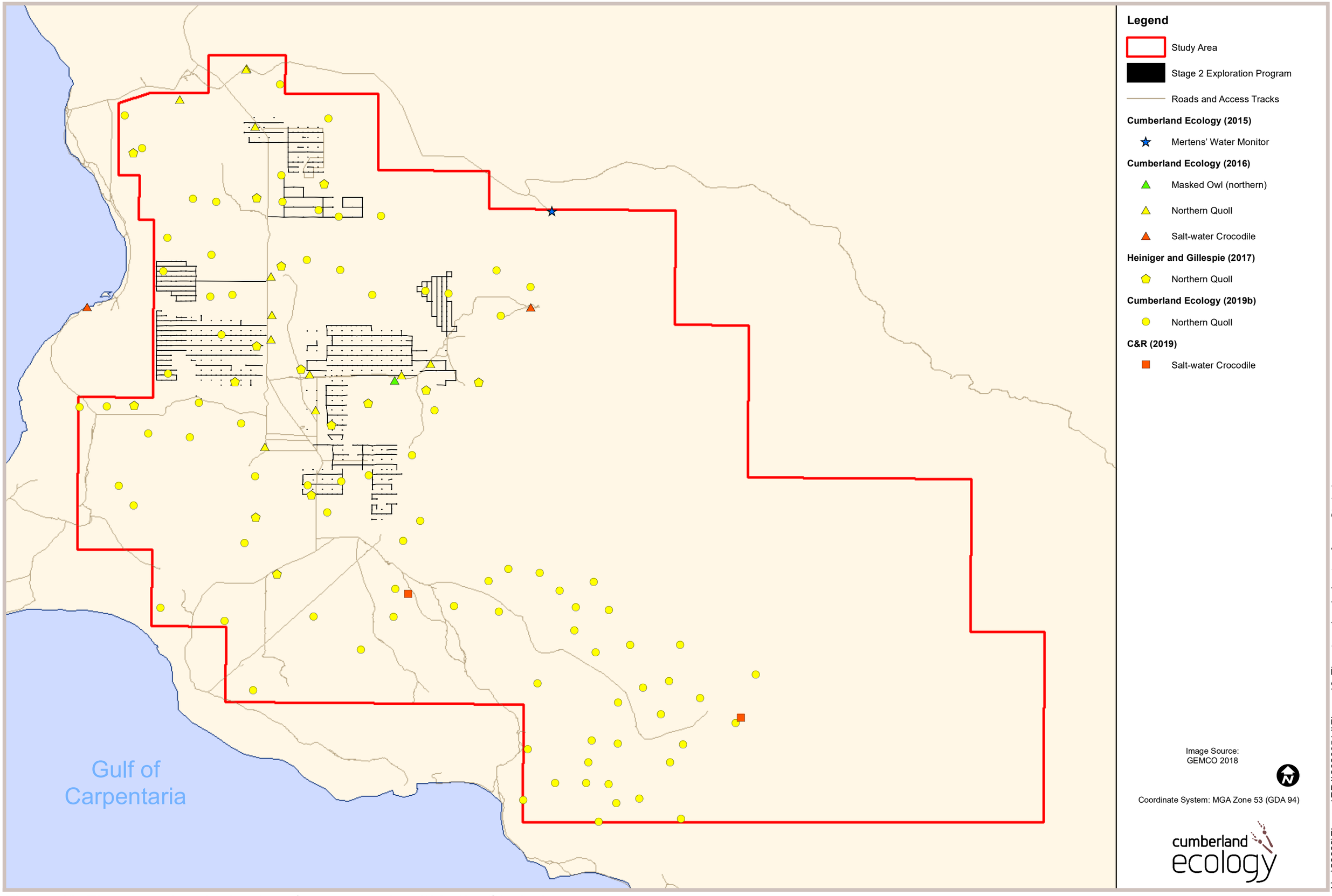

Figure 13. Threatened and migratory fauna records within the Study Area

Coordinate System: MGA Zone 53 (GDA 94)

Legend

- Study Area
- Eastern Leases
- Existing GEMCO Mine
- Locality
- Roads and Access Tracks

Migratory Fauna

- Bar-tailed Godwit
- Black-naped Tern
- Black-tailed Godwit
- Bridled Tern
- Brown Booby
- Caspian Tern
- Common Greenshank
- Common Noddy
- Common Sandpiper
- Common Tern
- Curlew Sandpiper
- Eastern Osprey
- Eastern Curlew
- Fork-tailed Swift
- Glossy Ibis
- Great Knot
- Greater Sand Plover
- Grey Plover
- Grey-tailed Tattler
- Lesser Crested Tern
- Lesser Frigatebird
- Lesser Sand Plover
- Little Curlew
- Little Ringed Plover
- Little Tern
- Marsh Sandpiper
- Oriental Cuckoo
- Oriental Plover
- Oriental Pratincole
- Pacific Golden Plover
- Pectoral Sandpiper
- Red Knot
- Red-necked Stint
- Roseate Tern
- Ruddy Turnstone
- Salt-water Crocodile
- Sanderling
- Sharp-tailed Sandpiper
- Short-tailed Shearwater
- Spectacled Monarch
- Swinhoe's Snipe
- Terek Sandpiper
- Whimbrel
- White-winged Black Tern
- Wood Sandpiper

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I:\...\20003\Figures\RP1\20200415\Figure 14. NR Maps_migratory fauna

Figure 14. NR Maps database records of migratory fauna on Groote Eylandt

0 3.5 7 10.5 14 km

B

Assessment of Impacts on Listed Species

Southern Lease - Stage 2 Exploration Program

Assessment of Impacts on Listed Species Report

GEMCO/South32

21 May 2020

Final

(02) 9868 1933 | PO Box 2474 Carlingford Court NSW 2118 | cumberlandecology.com.au

Report No. 20003RP2

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Approved by:	**Katrina Wolf**
Position:	Principal
Signed:	
Date:	21 May, 2020

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Glossary

Term / Abbreviation	Definition
ALC	*Anindilyakwa Land Council*
DAWE	Federal Department of Agriculture, Water and the Environment
dbh	Diameter at breast height
DENR	Northern Territory Department of Environment and Natural Resources
Eastern Leases	Mineral Leases (MLs) 31219 and 31220; formerly Exploration Licences in Retention (ELR) 28161 and 28162
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
the exploration program	The Stage 2 exploration program, including infill drilling and diamond drilling, as shown in **Figure 2**
GEMCO	Groote Eylandt Mining Company Pty Ltd
GPS	Global Positioning System
Large tree	Tree that is greater than 50 cm dbh
MNES	'Matters of National Environmental Significance' that are listed by the EPBC Act
NR Maps	Northern Territory Natural Resource Maps search facility
NT	Northern Territory
Potential Exploration Area	The maximum extent of future exploration within the Southern Lease, as shown in **Figure 2**
Significant Impact Guidelines	*Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE 2013)
South32	South32 Limited
Southern Lease	Exploration Licence (EL2455) shown on **Figure 1**
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976*
TSMP	*Groote Archipelago Threatened Species Management Plan 2019- 2028* (DENR and ALC 2019)

1. Introduction

Cumberland Ecology was commissioned by the Groote Eylandt Mining Company Pty Ltd (GEMCO), to prepare an assessment of the significance of impacts to threatened or migratory species resulting from GEMCO's proposed Stage 2 Exploration Program (the 'exploration program'). The exploration program is proposed to be undertaken within the Southern Lease, an exploration tenement (Exploration Licence 2455) on Groote Eylandt. The Stage 2 exploration program follows on from the Stage 1 exploration program that was undertaken by GEMCO within the Southern Lease in 2019.

This report utilises the following terms:

- Southern Lease: Exploration Licence (EL2455), shown in **Figure 1**;
- Potential exploration area: represents the maximum extent of future exploration within the Southern Lease and is shown in **Figure 2**;
- Stage 2 exploration program (the exploration program): the exploration program that is the subject of this report. It includes infill drilling and diamond drill holes, as shown in **Figure 2**; and
- Stage 2 exploration program area: represents the area in which the Stage 2 exploration program will be undertaken. **Figure 2** shows the location of activities to be undertaken as part of the Stage 2 exploration program. The Stage 2 exploration program area is located within the potential exploration area.

A Baseline Terrestrial Ecology Report has been prepared for the Southern Lease by Cumberland Ecology. The report provides a comprehensive description of the terrestrial ecological values (including vegetation communities, fauna habitat and threatened species) of the Southern Lease. This includes the results of ecological surveys undertaken within the Southern Lease and surrounds, the location of threatened flora and fauna species recorded, and an assessment of the likelihood of occurrence of threatened flora and fauna species in the Southern Lease and the Stage 2 exploration program area.

This report has been prepared in conjunction with the Baseline Terrestrial Ecology Report and utilises the results of the baseline terrestrial ecology assessment.

1.1. Purpose

The purpose of this report is to provide an assessment of the potential impacts of the exploration program on threatened or migratory species either recorded in, or with potential to occur in the Stage 2 exploration program area using the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE 2013) (hereafter referred to as the 'Significant Impact Guidelines').

The species that are the subject of this report include known or potentially occurring threatened species listed under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and migratory species listed under the EPBC Act. This report is intended to support the application for environmental assessment to be submitted to the Northern Territory (NT) Environment Protection Authority.

The objectives of this report are to:

- Provide a description of the proposed exploration activities;

- Present a summary of the potential impacts of the exploration program to threatened and migratory species;
- Provide a summary of the mitigation measures relevant to threatened and migratory species; and
- Present assessments of significance for known and potentially occurring threatened and migratory species in accordance with the Significant Impact Guidelines.

1.2. Island and Regional Context

The Southern Lease is located on Groote Eylandt, the third largest island off the Australian mainland. It is part of an archipelago to the east of Arnhem Land and is rated as having international significance because of the integrity of its flora and fauna. According to the NT Government (NRETAS 2009), Groote Eylandt and other islands in the archipelago have conservation values including:

- Nationally and internationally significant sites for nesting seabirds and turtles;
- Approximately 900 species of vascular plants and 330 vertebrates; and
- Known occurrences of a suite of threatened species including the nationally listed Northern Hopping-mouse (*Notomys aquilo*), Brush-tailed Rabbit-rat (*Conilurus penicillatus*) and Northern Quoll (*Dasyurus hallucatus*).

The main reason for the conservation significance of the island is thought to be the absence or near absence of key threatening processes that occur on the Australian mainland (NRETAS 2009). Of particular note, many of the feral animals that have impacted native flora and fauna on the mainland are absent from Groote Eylandt. In particular, feral cattle (*Bos taurus*), horses (*Equus caballus*), donkeys (*Equus asinus*), Water Buffalo (*Bubalus bubalis*), the Cane Toad (*Rhinella marina*), Rusa Deer (*Cervus timorensis*), Feral Pig (*Sus scrofa*), and the European Red Fox (*Vulpes vulpes)* are not established on the island.

Groote Eylandt is located in the Groote Sub-region of the Arnhem Coast Bioregion (DSEWPaC 2012). The Arnhem Coast Bioregion comprises a coastal strip extending from just east of the Cobourg Peninsula to just north of the township of Numbulwar in south eastern Arnhem Land, and includes many offshore islands including Groote Eylandt. The Arnhem Coast Bioregion has a tropical monsoonal climate with a distinct wet and dry season, and high temperatures throughout the year (DEWHA 2008).

The vegetation within the Arnhem Coast Bioregion is characterised by eucalypt woodlands, monsoon vine forests and coastal communities, such as mangroves (DEWHA 2008). Coastal vegetation includes well developed heathlands, mangroves and saline flats, with some floodplain and wetland areas (DLRM 2014). Inland from the coast, the dominant vegetation type is eucalypt tall open forest, typically dominated by *Eucalyptus miniata* (Darwin Woollybutt) and *Eucalyptus tetrodonta* (Darwin Stringybark), with smaller areas of monsoon rainforest and eucalypt woodlands (DLRM 2014). Well-developed coastal dune systems and rugged Cretaceous sandstone areas have been recorded on Groote Eylandt (DLRM 2014).

The whole of Groote Eylandt is Aboriginal land under the Commonwealth *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA). Furthermore, the Groote Eylandt Archipelago has been declared an Indigenous Protected Area (IPA); an area of Indigenous-owned land or sea where Traditional Owners have entered into an

agreement with the Federal Government to promote biodiversity and cultural resource conservation (DotEE 2019).

The bioregion is located entirely within Aboriginal land (DEWHA 2008). Land uses within the bioregion include bauxite and manganese mining, as well as tourism (DEWHA 2008). No national parks occur within the bioregion (DLRM 2014).

1.3. Description of the Southern Lease

The Southern Lease includes the catchments of the Emerald, Yanbakwa, Amagula, Innokumanja and Mayimokumanja Rivers, and Salt Creek (see **Figure 3**). It is characterised by areas of flat to undulating sand plains surrounded by low hills of outcropping quartzitic rock to the east, and the coastline to the west and south.

The vegetation and habitats within the Southern Lease are relatively pristine and are strongly influenced by topography and drainage. Eucalypt open forests and woodlands dominate the well-drained areas, with Melaleuca-dominated vegetation occurring in swampy and riparian areas, and coastal vegetation and tidal flats occurring at locations in proximity to the coastline. Fire also plays a very significant role in determining vegetation composition in the open forest and woodland habitats. Overall the vegetation is in a very good condition and is characterised by a high species and structural diversity, although the structure of the understorey and the condition of the ground layer has been modified by a regime of frequent fires. The Southern Lease provides a range of habitats for fauna species and is contiguous with native vegetation in other areas of Groote Eylandt.

Within the Southern Lease there are some areas of disturbance, including exploration activities that took place in 2016 and 2019 in the north western portion of the lease. These activities were localised to the south of the Emerald River and to the west of the Amagula River. Other forms of anthropogenic disturbance include the Emerald River Road and the Wurrumenbumanja outstation (see **Figure 3**). A small number of access tracks occur, predominantly within the western half of the Southern Lease.

1.4. Description of the Stage 2 Exploration Program

The exploration program includes the following activities:

- Approximately 830 infill drill holes; and
- Approximately 75 diamond drill holes.

The infill drilling is located partially in areas where previous exploration has already confirmed that manganese is present, as well as areas in which the mineralisation is thought to extend. The infill drilling will provide further information on the manganese mineralisation (depth, thickness, quality and continuity). The diamond drill holes will provide core samples, which will be subject to laboratory testing for geometallurgical properties including density. The exploration program is intended to be undertaken over at least two dry seasons (generally June to December). The following sections describe the exploration process.

1.4.1. Permit to Clear Process

Prior to any exploration work being undertaken, GEMCO's Permit to Clear process will be followed. This process includes undertaking a pre-clearance survey to identify or confirm environmentally and culturally sensitive areas including habitat of threatened fauna species. The pre-clearance surveys will be undertaken by experienced ecologists and will address the following:

- The limits of clearing will be clearly delineated (via flagging) and will be restricted to the minimum area required to safely complete the drilling program. This will include minimising the width of access tracks and drill pads.
- The adopted buffer distances from sensitive areas and threatened fauna habitats will be checked and the location of any drill holes or access tracks adjusted, if required. The pre-clearance surveys will ensure that exploration activities are located:
    - A minimum of 100 m from waterways and wetlands;
    - A minimum of 100 m from monsoonal vine thicket; and
    - A minimum of 100 m from white rock areas.
- Any large trees [>50 cm diameter at breast height (dbh)] that should be avoided and left in place will be flagged.

The pre-clearance surveys (or advice from the *Anindilyakwa Land Council* [ALC] and/or cultural monitors) may necessitate the relocation of drill holes and tracks. The location of drill holes and tracks shown on **Figure 2** is therefore indicative and subject to change.

1.4.2. Drilling

1.4.2.1. Infill Drilling

Approximately eight-hundred and thirty (830) infill drill holes are proposed as part of the exploration program (**Figure 2**). Holes are distributed in a grid pattern and will be predominantly spaced approximately 120 m apart. The drilling areas will be accessed via either existing tracks cleared during previous exploration programs, or new tracks established for the exploration program.

Infill drilling is proposed to be undertaken using a Reverse Circulation (RC) drill rig. This is commonly used in exploration programs and has been used by GEMCO since 1979. RC drilling is a form of dry hole drilling and no water is required to be added while drilling, apart from small volumes to control dust at the collar when dusty conditions are present.

Due to safety reasons, it will be necessary to clear a pad for each drill hole. Depending on the location of the drill pad, the clearing area will be approximately 10 m x 18 m, or 18 m x 17 m, inclusive of track width. The slightly larger drill pads are required at the end of a row of drill pads to allow for sufficient turn around space for the drill rig. Drill pads will be cleared of vegetation using a D6 scrub dozer. A spotter will work with the dozer operator during the clearing of any vegetation. The spotter is required to ensure compliance with the various restrictions identified during pre-clearance surveys, as well as ensuring the dozer operator maintains

the correct alignment. The dozer operator and spotter will utilise a Global Positioning System (GPS) unit to assist with ensuring constraints identified during pre-clearance surveys are avoided.

Clearing will be conducted using the "blade up" method, whereby the blade of the dozer is lifted to reduce soil disturbance and to avoid disturbing the topsoil horizon. The cleared vegetation will be pushed into windrows to the side of the drill pad.

Vegetation clearing procedures for access tracks will follow a similar process as outlined above for the drill pads. The access tracks will be approximately 3 m in width to allow for safe movement of vehicles and equipment. Tracks will be cleared using a D6 scrub dozer or equivalent.

The extent of clearing for the drilling program will be limited, as far as possible, including minimising the width of access tracks and drill pads. Soil disturbance will also be minimised. An area of approximately 40 ha will be cleared for infill drill holes, comprising approximately 15 ha for the clearing of drill pads and approximately 25 ha for the establishment of access tracks. The cleared areas will be rehabilitated following drilling (see ***Section 1.4.3***).

Multiple rigs will be operated for infill drilling, plus support vehicles.

1.4.2.2. Diamond Drill Holes

Diamond drilling is used to obtain core samples for more detailed geological analysis. Approximately seventy-five (75) diamond drill holes are proposed in the exploration program. It is expected that approximately 25 diamond drill holes will be drilled initially and these are shown in **Figure 2**. The remaining holes will be positioned based on the results from previous infill drilling. The diamond drill holes will be located on previously cleared pads required to be cleared for the exploration program, or an existing pad that was cleared during the 2019 program, which reduces the overall extent of clearing. The holes will be accessed via either existing tracks cleared during previous exploration programs, or new tracks established for the exploration program. One rig will be used.

Water used during diamond drilling will be supplied by a support truck, i.e. no water will be extracted from any nearby waterways or groundwater sources. Waste water will be recaptured in tanks on the support vehicle and reused for each hole. No sumps are required.

1.4.3. Rehabilitation

Rehabilitation of drill pads and tracks is planned to occur at the completion of each season of exploration drilling, and before the onset of the next wet season. Drill pads and access tracks will be rehabilitated using the same methods adopted for the Stage 1 Exploration Program and at the existing GEMCO mine. Holes will be plugged and backfilled with drill cuttings to produce a mound on top of the hole to allow for compaction. Surface materials (such as logs, vegetation cover and leaf litter) will be respread as far as practicable on drill pads, allowing the area to naturally revegetate from seeds in the soil seed bank and from adjacent vegetation. Felled timber and logs will be placed across the entrance to exploration tracks and along a sufficient distance of track to prevent ongoing vehicle access. This measure is designed to prevent the exploration tracks becoming permanent tracks and hence minimise the potential for threatening processes to be introduced (e.g. changes to the fire regime or introduction of weeds due to increased access, and/or facilitation of feral cat movement).

There may be some instances where tracks may be required to remain open longer than a single dry season. For example, if the exploration drilling program is unable to be fully completed in an area before the onset of the wet season, some cleared tracks may need to remain open to enable access to drill sites in the following dry season. These instances would be considered an exception to the rehabilitation process and would be subject to an internal review and approval process.

The drill pads and tracks will be inspected during the dry season, approximately 6 – 12 months after they are rehabilitated. The inspections will identify any erosion or weeds present and any subsidence of drill holes, and will determine if revegetation is occurring. Inspections will also confirm that exploration tracks are not being used and that the log barriers are effective. Photographic monitoring records will be taken of representative sites. This includes pre-clearance photographs and photographs following rehabilitation. The ALC will also be provided with an opportunity to inspect rehabilitated exploration areas to confirm the rehabilitation has been undertaken to the satisfaction of the Traditional Owners.

1.5. Relevant Legislation

1.5.1. Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's principal piece of environmental legislation and is administered by the Federal Department of Agriculture, Water and the Environment (DAWE). It is designed to protect national environmental assets, known as Matters of National Environmental Significance (MNES), which include threatened species of flora and fauna, endangered ecological communities, migratory species as well as other protected matters. Among other things, it defines the categories of threat for threatened flora and fauna, identifies key threatening processes and provides for the preparation of recovery plans for threatened flora, fauna and communities.

Approval is required under the EPBC Act for any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES (including nationally threatened ecological communities and species, and listed migratory species). The Significant Impact Guidelines provide a means for determining whether an action is considered likely to have a significant impact on MNES. For some species, DAWE also publishes species-specific significant impact guidelines and referral guidelines which are to be utilised in conjunction with the Significant Impact Guidelines.

1.5.2. International Treaty Obligations on Migratory Species

Australia is signatory to several agreements relating to migratory species. Migratory species listed under the following agreements and conventions are protected in Australia through being listed as MNES (Migratory Controlling Provision) under the EPBC Act:

- China–Australia Migratory Bird Agreement;
- Japan–Australia Migratory Bird Agreement;
- Republic of Korea–Australia Migratory Bird Agreement; and
- Convention on the conservation of migratory species of wild animals (Bonn Convention).

1.5.3. Territory Parks and Wildlife Conservation Act 1976

The TPWC Act is the primary piece of legislation for managing the protection and conservation of biodiversity, and the sustainable use of wild populations (of predominantly terrestrial life) in the NT.

The TPWC Act makes provision for the study, protection, conservation and sustainable utilisation of wildlife throughout the NT. This legislation covers the classification and management of wildlife; classification and control of feral animals; permits for taking wildlife and entering land; designation and management of protected areas, including joint management with Traditional Owners; and private sanctuaries.

Under the TPWC Act, species are considered as 'threatened' wildlife if they are classified as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable and are assigned protected wildlife status. The categories utilised under the TPWC Act are independent of the listing of wildlife under the EPBC Act as they relate only to their occurrence within the NT.

1.6. Relevant Threatened and Migratory Species

Table 1 lists the threatened and migratory species found to occur, or with a high to moderate potential to occur, within the Stage 2 exploration program area, as determined within the Baseline Terrestrial Ecology Report (Cumberland Ecology 2020). This report therefore focuses on these species. Further details on the habitat requirements and occurrence of these species within the Southern Lease and Stage 2 exploration program area are provided within the Baseline Terrestrial Ecology Report (Cumberland Ecology 2020).

Table 1 Threatened and migratory species known or potentially occurring within the Stage 2 Exploration Program Area

Common Name	Scientific Name	Conservation Status		Likelihood of Occurrence in Stage 2 Exploration Program Area
		EPBC Act	TPWC Act	
Threatened Species				
Birds				
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	V	V	Present
Mammals				
Northern Quoll	*Dasyurus hallucatus*	E	CE	Present
Ghost Bat	*Macroderma gigas*	V	-	High
Reptiles				
Mertens' Water Monitor	*Varanus mertensi*	-	V	High
Yellow-spotted Monitor	*Varanus panoptes*	-	V	High
Migratory Species				
Fork-tailed Swift	*Apus pacificus*	M(m)	-	Moderate
Salt-water Crocodile	*Crocodylus porosus*	M(m)	-	High

An additional two EPBC Act listed threatened fauna species, namely the Brush-tailed Rabbit-rat and Northern Hopping-mouse have been considered within **Chapter 4**. A research project on these two species was recently undertaken (termed the "Small Mammal Research Project") and the results are presented in Cumberland Ecology (2019b). The Small Mammal Research Project targeted these species, but did not record them and concluded that there was a low likelihood of these species occurring in the Southern Lease. Further detail on these species, including a profile of each species, is provided in the Baseline Terrestrial Ecology Report (Cumberland Ecology 2020) and Southern Leases Small Mammal Research Project Report (Cumberland Ecology 2019b). Despite having a low likelihood of occurrence within the Stage 2 exploration program area, these species are considered further in **Chapter 4** due to the significance of these species on Groote Eylandt.

2. Impacts

This section presents a summary of the likely impacts of the exploration program on the threatened and migratory species described in ***Section 1.6***. This includes all threatened and migratory species found to occur, or with a high to moderate potential to occur, within the Southern Lease Stage 2 exploration program area (see **Table 1**). Exploration activities that have the potential to impact these species include:

- Clearing of vegetation and associated habitat for the purpose of establishing drill pads, and access tracks to each drill pad (***Section 2.1***); and
- Indirect impacts such as habitat fragmentation, the introduction of invasive species, changes to fire frequency and other minor indirect impacts (***Section 2.2***).

These direct and indirect impacts are discussed in the following sections.

2.1. Direct Impacts

The primary direct impact of the exploration program on threatened or migratory species is the direct impact resulting from the removal of native vegetation and associated habitat for the establishment of drill pads and access tracks. **Figure 2** shows the proposed location of the drill pads and access tracks within the Stage 2 exploration program area.

A total of approximately 40 ha of vegetation will be cleared for the exploration program. This includes approximately 15 ha for the clearing of drill pads and approximately 25 ha for the establishment of access tracks.

Clearing of the infill drill pads and access tracks will be restricted to the width of the access tracks (3 m) and the footprint of the drill pads, which varies between 180 m^2 and 306 m^2. **Table 2** shows the proposed extent of clearing relative to habitat types. As shown in this table, the majority of clearing (35.6 ha) is within laterite woodland and forest habitat. Although **Table 2** shows that 4.6 ha of riparian/wetland vegetation is proposed to be cleared, this is considered to be an overestimate. A pre-clearing survey will be undertaken to confirm the location of small waterways and wetlands and any of the drill holes or access tracks that are located within 100 m of waterways or wetlands will be relocated. The pre-clearing survey will consequently reduce the extent of riparian/wetland vegetation required to be cleared.

Table 2 Extent of clearing of habitat types

Broad Habitat Type	Southern Lease (ha)	Stage 2 Exploration Program Area (ha)	Cleared (%)
Closed forest (rainforest) habitats	227.0		
Laterite woodland and forest habitats	13,816.2	35.6	0.26
Sandstone woodland and forest habitats	6,850.3		
Coastal dune/swale complex habitats	989.6		
Riparian/wetland habitats	3,849.8	4.6	0.12
Estuarine complex habitats	319.0		
Cleared	1.7		
Total	**26,054**	**40**	**0.15**

The dominant habitat type to be cleared for the exploration program is laterite woodland and forest. Laterite woodland and forest habitat type is associated with undulating laterite plains. Laterite woodland and forest habitats are typically dominated by a canopy of *Eucalyptus tetrodonta,* with *Eucalyptus miniata* being locally common at some locations. *Eucalyptus polycarpa* and *Eucalyptus tectifica* also occur within this habitat type.

Laterite woodland and forest habitats cover approximately 53% of the Southern Lease and are also widespread on Groote Eylandt. The laterite woodland proposed to be cleared represents 0.26% of the laterite woodland within the Southern Lease. Large areas of this habitat type will remain, beyond the area to be affected by exploration activities. It should also be noted that the proposed clearing will be dispersed across the exploration program area. There will be patches of native vegetation remaining between the cleared areas which will continue to provide habitat for native species. It is anticipated that the types of flora and fauna species utilising the habitat within the cleared areas will continue to persist in these adjacent areas where suitable habitat is present.

Laterite woodland and forest habitats provide habitat for a range of flora and fauna species, as well as specific habitat features that provide foraging, shelter and breeding opportunities for fauna. The impacts of clearing will be minimised by implementing a pre-clearance procedure that includes retaining trees with large hollows [i.e. hollows that may be suitable for the Masked Owl (northern)]. In addition, disturbed areas will be rehabilitated upon completion of the drilling program. Drill holes will be capped and rehabilitation will be undertaken of drill pads and access tracks. Rehabilitation of drill pads and access tracks will include:

- Removing and disposing of any rubbish;
- Respreading any remaining drill cuttings;
- Replacing surface materials such as logs, vegetation cover and leaf litter, on the disturbed areas, as far as practicable;
- Placing felled timber and logs across the entrance to exploration tracks and along a sufficient distance of track to prevent the exploration tracks becoming permanent tracks; and
- Allowing the area to naturally revegetate from seeds in the soil seed bank and from adjacent vegetation.

Monitoring of the quality of regeneration has been recently undertaken in areas subject to GEMCO's previous exploration drilling on Groote Eylandt (Cumberland Ecology 2019a), including within the Eastern Leases, Southern Lease and existing GEMCO mine. Regeneration monitoring shows woody species composition appears to rapidly regenerate (within 1 to 2 years) following rehabilitation. This was attributed to the blade up method of clearing, which ensures that topsoil is undisturbed and retains vegetative material, such as roots and tubers, as well as the soil seed bank. This mimics natural regeneration following fire, where suckering occurs from in-situ roots and lignotubers or germination occurs from seeds contained in the soil. Vegetation structure (assessed as basal area, mean tree height and canopy cover) was assessed to return more slowly to pre-disturbance levels, with comparable levels being achieved approximately 30 years after disturbance. Regeneration of vegetation structure was considered to be influenced by recurrent fires, with frequent fire regimes considered likely to extend the timeframe for the establishment of large stems. Overall, the monitoring

indicated that the rehabilitation process and techniques employed by GEMCO allow exploration areas to be successfully revegetated over time.

Direct impacts to vegetation and habitat is considered to constitute the key threat of minor habitat alteration/disturbance as identified within the *Groote Archipelago Threatened Species Management Plan 2019-2028* (TSMP) (DENR and ALC 2019). However, the direct impacts arising from the exploration program are considered minor, as a limited amount of clearing is required and the disturbed areas are expected to naturally regenerate over time. Furthermore, as the Stage 2 exploration program will be undertaken over a two-year period, the impacts will be staged across the exploration program area and will therefore not all occur at the same time. This, along with retaining areas of native vegetation in between cleared areas, will assist the understorey of the cleared areas to regenerate relatively rapidly and, over time, the disturbed areas of habitat will be replaced through natural processes. The expected regeneration is based on results from regeneration monitoring of previously cleared areas (Cumberland Ecology 2019a).

2.2. Indirect Impacts

The exploration program has the potential to increase the risk of introducing or accelerating the introduction of key threatening processes. This has the most potential to occur via indirect impacts, such as habitat fragmentation, introduction of invasive species and altered fire regimes. A number of these indirect impacts are known to result from minor habitat alteration/disturbance and are recognised as key threatening processes for the threatened species identified in **Table 1** as relevant to the Stage 2 exploration program area. These indirect impacts are discussed in ***Sections 2.2.1*** to ***2.2.3***.

Additionally, a number of drilling impacts, such as those relating to noise and vibration, dust, light, erosion and sediment control and vehicle strike have the potential to impact fauna. Indirect drilling impacts are discussed in ***Section 2.2.4***.

2.2.1. Habitat Fragmentation

One of the potential indirect impacts of the exploration program is habitat fragmentation. Fragmentation is the process where habitats that were once continuous become divided into separate fragments isolated from each other by non-forest land (Primack 1993, Fahrig 2003, Lindenmayer and Fischer 2006). The exploration program will increase fragmentation through the clearing of areas of open forest and woodland for the creation of access tracks and drill pads. This may impact less mobile species or species with small home ranges, such as small terrestrial mammals. This is mostly likely to occur within the infill drilling areas where there will be a relatively high density of drill holes and a network of access tracks that will be created to enable access by the drill rigs. However, the access tracks are relatively narrow (approximately 3 m wide), and most of the threatened species potentially impacted are likely to be able to cross these access tracks.

Surveys of the Eastern Leases by Cumberland Ecology (2015) recorded the Northern Quoll at numerous locations within the Eastern Lease, which has been subject to decades of exploration activities.

The impact of the establishment and use of the access tracks and drill pads is also temporary, and after drilling has ceased, disturbed areas are expected to naturally regenerate into native vegetation in the long term. Regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to previous

exploration drilling found that vegetation composition in areas subject to exploration activities achieved a state similar to undisturbed areas through seasonal regrowth after 1-2 wet seasons.

2.2.2. Introduced Species

The exploration program has the potential to introduce invasive species to the Southern Lease. This includes weeds and feral animals. Alterations to habitat conditions often favour introduced and/or hardy native plant and animal species that can proliferate in disturbed conditions. Such species have the potential to impact upon the local native plant and animal species.

GEMCO has a quarantine procedure that provides guidance on how to correctly inspect barges and their cargo coming to the port facilities at Milner Bay. This applies to shipping containers, vehicles and equipment. The procedure is designed to prevent unwanted pests and weeds arriving on Groote Eylandt.

The potential for invasive species to be introduced by the exploration program is discussed in the following sections.

2.2.2.1. Weeds

Weed invasion is identified as a key threat in the TSMP. Weeds have the potential to out-compete native plant species for resources such as nutrients, sunlight and space. Weeds are generally spread via contaminated vehicles and machinery, animals and watercourses (DENR and ALC 2019). Weeds are most likely to occur at disturbed locations where they can be readily spread. The invasion of weeds within native vegetation can alter the diversity and functioning of vegetation communities.

Although the Southern Lease is currently largely unaffected by weed species, it will be important to ensure that exploration is undertaken in a manner that does not give rise to the introduction of weeds. Weed species that are known to occur in the existing mining tenements have the highest potential to establish in the Stage 2 exploration program area. A number of declared weeds have previously been recorded within GEMCO's existing mining tenement including *Cenchrus echinatus* (Mossman River Grass), *Cenchrus polystachios* (Mission Grass), *Senna obtusifolia* (Sicklepod) and *Sida acuta* (Spinyhead Sida) (URS Australia Pty Ltd 2012). The NT Natural Resource Maps database (NR Maps database) (DNRM 2020) holds a number of records within the existing GEMCO mine, such as *Jatropha gossypiifolia* (Bellyache) and *Themeda quadrivalvis* (Grader Grass) which are highly mobile. Weeds that are more common in the existing mining tenements include *Hyptis suaveolens*, *Passiflora foetida* (Stinking Passionflower), *Urochloa mosambicensis* (Sabi Grass) and *Stylosanthes* spp. (the Stylos) (Addison 2013).

Weed management measures in the Southern Lease will continue to focus on preventing the introduction of weeds, the identification and reporting of known invasive weeds species, the early detection and eradication of weeds before they establish and employee awareness. In addition, felled timber will be used to block access to exploration tracks following the completion of the exploration program which will also serve to limit the introduction of weeds. Weed management measures are discussed in further detail in ***Section 3.2***. During recent surveys of regeneration of previous exploration areas, only one monitoring plot (of 72 plots) detected the presence of weeds, indicating that these measures currently being used to prevent the spread of weeds are effective.

2.2.2.2. Feral Animals

Feral animals can cause problems for native fauna species by preying upon them or by competing with them for food and resources. The feral animals that have been recorded in the Southern Lease are the Domestic Dog (*Canis familiaris*), Dingo (*Canis lupus*), Feral Cat (*Felis catus*) and House Gecko (*Hemidactylus frenatus*). The exploration program has the potential to increase the numbers of Domestic Dogs, Dingos and Feral Cats due to the creation of transport vectors such as access tracks. Predation by feral cats is identified as a key threat in the TSMP. The feral cat population on Groote Eylandt appears to have a low density, however significant predation may still exist (DENR and ALC 2019). The TSMP indicated that vulnerability to predation by cats may be exacerbated by inappropriate fire regimes (DENR and ALC 2019). However, as access tracks will be closed and rehabilitated following the completion of the exploration program, and regeneration is expected to occur relatively rapidly, the exploration program is considered unlikely to significantly increase the risk of introduction of these feral animal species, including the Feral Cat.

Poisoning by the Cane Toad (*Rhinella marina*) is identified as a key threat in the TSMP. The Cane Toad (*Rhinella marina*) is currently absent from Groote Eylandt. In addition to the quarantine procedure described above, GEMCO also has a specific Cane Toad Management Plan which operates across all of the GEMCO leases and more broadly across the island. This plan will continue to operate and will be applicable for the Stage 2 exploration program area. The exploration program is unlikely to exacerbate the risk of the introduction of this species to the island beyond current conditions, given that it will not significantly increase transport vectors for the Cane Toad. Further details about the management of cane toads is provided in ***Section 3.2***.

2.2.3. Fire Frequency

The creation of additional access tracks in the Southern Lease has the potential to increase accessibility within the lease, particularly in areas that were previously inaccessible. Increased access may increase fire frequency, which may alter the floristic composition and structure within these areas. Although the exploration program utilises cleared access tracks from previous exploration activities, approximately 94 km of additional tracks are required.

Inappropriate fire regimes are identified as a key threat in the TSMP. Increased frequency and intensity of fires alters floristic composition, removes coarse woody debris, simplifies understorey and mid-storey vegetation structure; and ultimately removes large, old, trees (DENR and ALC 2019). These changes disadvantage many fauna species through reduced food resources (e.g. perennial grass seeds, nuts and fruit), breeding habitat (e.g. tree hollows and hollow logs), and habitat complexity and increasing vulnerability to predation (DENR and ALC 2019).

Felled timber and logs will be placed across the entrance to exploration tracks and along a sufficient distance of track to prevent ongoing access. This measure is designed to prevent the exploration tracks becoming permanent tracks. Monitoring will also inspect rehabilitated tracks to ensure the tracks are not being used and the log barriers are effective.

2.2.4. Other Indirect Impacts

There are a number of minor indirect impacts that may arise from the exploration program, including:

- Noise and vibration from clearing activities and drilling;
- Dust from clearing activities and drilling;
- Artificial lighting at night;
- Erosion and sedimentation; and
- Vehicle strike.

These minor indirect impacts are discussed in the following sections. However, the majority of these potential indirect impacts will only occur during exploration activities and will cease upon completion of the drilling program. As the Stage 2 exploration program will be undertaken over a two-year period, the impacts will be staged across the exploration program area. For this reason, the indirect impacts are not considered likely to result in a significant impact on terrestrial ecology values.

2.2.4.1. Noise and Vibration

The exploration program will generate noise and vibration during establishment of access tracks and during drilling. However, this will be a temporary form of disturbance to fauna because of the short duration of the proposed activities (e.g. approximately 45 minutes to drill each RC drill hole). The impacts from noise emissions and vibrations will also be localised close to the drill pads and access tracks and will cease as soon as drilling of each area is completed. Noise and vibration is therefore not likely to have a significant, long-term impact on wildlife populations.

2.2.4.2. Dust

Increased levels of dust could impact vegetation within woodland communities, reducing the health of some species along the edge of drill pads and access tracks. It could also result in an impact upon potential foraging resources for wildlife. Dust minimisation strategies such as maintaining speed limits and employing dust suppression practices during drilling will minimise the creation of dust. The impacts from dust are likely to be localised close to the access tracks and drill pads. Considering the scale of the exploration program, dust is not considered likely to cause a significant impact on the ecological values of the Stage 2 exploration program area.

2.2.4.3. Light

In the unlikely event the exploration program involves 24-hour operations, night lighting will be required. This has the potential to impact fauna species, particularly nocturnal species. Sources of light will be limited to vehicle headlights and lighting plants for infill drilling areas and will be short term. As the impacts from night light pollution are also likely to remain close to the light sources, light is unlikely to have a significant or long-term impact on fauna species.

2.2.4.4. Erosion and Sedimentation

The exploration program has the potential to increase the amount of erosion occurring in the Stage 2 exploration program area due to vegetation clearing required to create the access tracks and drill pads. The Stage 2 exploration program area is located in a tropical climate, and during the wet season heavy rainfall can erode and wash away any disturbed earth relatively easily. Erosion and sedimentation impacts will be limited

by rehabilitating drill pads and access tracks at the completion of each season of exploration drilling, and prior to the wet season commencing. Inspections of the rehabilitated drill pads and tracks will also be undertaken to monitor the success of rehabilitation, including to identify any areas of erosion. The impacts from erosion and sedimentation are, therefore, likely to be localised close to the access tracks and drill pads and are not likely to have a significant, long-term, impact on waterways used by wildlife.

2.2.4.5. Vehicle Strike

The exploration program will create access tracks which will be used by exploration vehicles. Exploration vehicles traversing these tracks to access drill pads can have an impact on animals that may cross and navigate these tracks. Due to the limited number of vehicles required for the exploration program and the low frequency of movement along these tracks, the potential for vehicle strikes is considered to be low.

2.3. Cumulative Impacts

The exploration program is part of the proponent's broader exploration campaign within the Southern Lease. Exploration is undertaken in an iterative, structured manner, which is designed to progressively gain more information about the geology and mineralisation of the area. Regional exploration holes are initially drilled to determine if any manganese mineralisation is present, as well as the potential extent of mineralisation. Subsequent planning of infill drilling is based on the results of the regional exploration holes. In areas where manganese is found to be present, additional holes are required to be drilled in grid patterns to improve the understanding of the extent, thickness and quality of the mineralisation, with the goal of defining a resource. The impacts of this iterative process, particularly in relation to clearing of vegetation, have the potential to result in cumulative impacts.

Cumulative impacts result when many small-scale alterations to the environment combine to cause an overall greater level of impact. Cumulative impacts can arise from either persistent losses of one resource, or the compounding effects of two or more impacts (Lindenmayer and Fischer 2006). Direct and indirect impacts that may be considered insignificant on their own may be significant when considered together with other actions being undertaken (or undertaken previously) in the same locality.

GEMCO has undertaken two previous rounds of exploration within the Southern Lease – in 2016 and 2019. Each exploration program is required to complete rehabilitation of all drill pads and tracks following the completion of drilling activities. As a result of this planned rehabilitation process, and the observed natural regeneration of disturbed areas over time, it is not expected that the Stage 2 exploration program would have the potential to result in cumulative impacts with the 2016 program. However, there is a potential for the Stage 2 exploration program to have a potential cumulative impact with the 2019 (Stage 1 exploration program) in areas of the Stage 1 exploration program that have not yet been rehabilitated or begun to regenerate by the time the subsequent Stage 2 exploration program commences. This has the most potential to occur when there has been an unexpected delay in the timing of rehabilitation (for example due to an inability to access drill pads or tracks due to wet weather or other factors) or if pads or tracks are planned to be used for subsequent exploration programs. The Stage 2 exploration program will utilise some drill pads and access tracks created as part of the Stage 1 exploration program and this will delay the regeneration process for these drill pads and tracks. While this process delays rehabilitation of these areas, creating a short-term cumulative impact, it minimises the extent of additional clearing required for each subsequent exploration program. In

any case, where rehabilitation of an exploration program is not completed prior to the subsequent program, rehabilitation will occur as soon as possible following the completion of subsequent activities in that area.

For these reasons, the potential cumulative impacts of subsequent exploration programs are not considered likely to result in a long-term impact on vegetation or a decrease in the available habitat for MNES.

3. Mitigation Measures

The purpose of this chapter is to outline the avoidance and mitigation measures proposed to minimise the potential impacts of the exploration program on threatened or migratory species.

3.1. Avoidance and Minimisation

The Stage 2 exploration program area is biodiverse and provides known and potential habitat for a wide range of flora and fauna, including several threatened fauna or migratory species listed under the EPBC Act and/or the TPWC Act. As such, it has been necessary to implement a number of impact avoidance and minimisation measures relevant to the location and design of the exploration program. These are discussed in the following sections.

3.1.1. Exploration Program Planning

The exploration program was designed through an iterative process, informed by data on environmental constraints. The process included:

- Defining the potential mineralised area (i.e. the area in which manganese may potentially occur). This was based on high level geological information and represents the area in which exploration would be undertaken if there were no environmental constraints.
- Identifying the environmental constraints in the potential mineralised area. This was based on an extensive fieldwork program undertaken over a 2-3 year period in consultation with the ALC and regulators. The following work was undertaken to identify environmental constraints:
    - Baseline terrestrial ecology surveys.
    - Review of vegetation mapping including vegetation mapping prepared by DENR, supplemented by fieldwork.
    - An aquatic ecology field survey and mapping of watercourses using field survey results, aerial photography, drone imagery and Lidar data (i.e. topography).
    - Digitisation of sandstone outcropping (termed white rock) areas, based on LiDAR, aerial photography and ground-truthing.
    - Consultation with the ALC to understand cultural considerations.
- The significance of constraints was then assessed using a risk-based approach. This process culminated in approximately 7,500 ha of the potential mineralised area being permanently excised from future drilling programs. The revised area is termed the potential exploration area (see **Figure 2**). The potential exploration area was developed based on the principle that there would be no exploration within the following features:
    - Areas of sandstone outcropping (white rock) as mapped by GEMCO, including an additional 100 m buffer from the toe of any defined outcrop areas;
    - Areas of monsoon forests, including an additional 100 m buffer;

- Waterways and wetlands and directly adjacent areas; and
- All areas to the east of the Innokumanja River.

The Stage 2 exploration program area was then delineated within the potential exploration area. This process has resulted in the proponent committing to forgoing exploration and sterilising potential manganese ore in a number of areas in the Southern Lease, due to the environmental and cultural sensitivity of these areas. The areas that have been excluded from the exploration program provide important resources for many species, including threatened species which may potentially be located in these areas. The undisturbed vegetation along waterways will also provide a connection between areas disturbed by exploration activities and undisturbed vegetation, ultimately allowing fauna to colonise rehabilitation areas. Impacts from exploration activities on these areas will be avoided not only for the proposed exploration program, but also any future exploration within the Southern Lease.

3.1.2. Stage 2 Exploration Program

Key avoidance measures undertaken during development of the exploration program design that are specific to biodiversity values within the Stage 2 exploration program area include:

- Positioning infill drill holes along previously cleared tracks, where possible;
- Positioning diamond drill holes on previously cleared pads, or pads requiring clearing for an infill drill hole;
- Limiting clearing at drill holes to the smallest possible area (18 x 10 m pads, or 18 x 17 m pads for holes located at the end of a row to allow sufficient turn around space for the drill rig); and
- Utilising existing access tracks where possible.

GEMCO will also endeavour to achieve further impact avoidance and minimisation through the implementation of mitigation measures described in the following section.

3.2. Mitigation

GEMCO has been mining on Groote Eylandt since the 1960s. A suite of mitigation measures have been progressively developed to minimise impacts on flora and fauna. The policies and plans that currently apply to the management of terrestrial biodiversity will continue to apply to the exploration program and are discussed in the following sections. The mitigation measures to be implemented for the exploration program target the management of a number of key threats identified within the TSMP, including vegetation/habitat removal and fragmentation, inappropriate fire regimes and introduction of invasive species, such as weeds, feral cats and cane toads.

3.2.1. Permit to Clear and Pre-clearance Survey Procedure

All clearing will be undertaken in accordance with the proponent's Permit to Clear process. This process includes:

- Undertaking pre-clearance surveys to define the precise locations of access tracks and drill holes based on the presence of habitat features for threatened species and distance from local environmental constraints;

- Approval from the GEMCO Environment Department; and
- Endorsement from the ALC, where appropriate.

The pre-clearance survey is designed to protect environmentally and culturally sensitive areas as well as to identify key habitat features of threatened fauna species that are required to be avoided. The pre-clearance survey will be undertaken by an experienced ecologist prior to the commencement of clearing. It is noted that although the potential exploration area already takes account of key environmental constraints (as detailed in ***Section 3.1.1***), pre-clearance surveys are required because the mapping scale used to delineate the potential exploration is not suitable for defining the precise location of features such as small waterways.

The procedure to be followed is based on previous EPBC Act decisions provided by the Commonwealth Department of Environment and Energy for the Eastern Leases (EPBC Act referrals 2013/6848, 2010/5455, and 2008/4563). These previous exploration programs were found to be Not a Controlled Action, subject to undertaking the work in a particular manner. Specific pre-clearance measures were specified to be undertaken and these measures form the basis of the pre-clearance surveys proposed to be undertaken for the Stage 2 exploration program. Furthermore, recommendations made by the NT EPA in relation to the Stage 1 exploration program have also been incorporated into the procedure.

A pre-clearance survey area will be established by flagging the centre line of the proposed access track and the centre of each drill hole. The distances from local environmental constraints will be checked to ensure that the following adopted buffers are maintained:

- A minimum of 100 m from waterways and wetlands;
- A minimum of 100 m from monsoonal vine thicket; and
- A minimum of 100 m from white rock areas.

The location of any drill pads or access tracks will be adjusted to provide these minimum buffers, if required.

Searches will be undertaken of each survey area to identify and flag key habitat features of threatened fauna species (listed under the EPBC Act) that are to be protected from clearing. The key habitat features include large trees (i.e. greater than 50 cm dbh) and all hollow-bearing trees. The following measures will be implemented:

- The habitat feature will be flagged.
- All large trees along tracks will be avoided.
- All large trees within drill pads will be avoided where possible. However, should a large tree within the drill pad also be suitable for, or occupied by, the Masked Owl (northern), the required buffers detailed below will apply, in which case the pad will be moved.
- A 10 m buffer will be created around non-occupied hollow-bearing trees suitable for the Masked Owl (northern).

- A 100 m buffer will be created around hollow-bearing trees assessed as occupied by a Masked Owl (northern), as determined by indirect evidence of occupation (e.g. white wash, prey).
- Where drill pads or access tracks are located within areas identified as having key habitat features, their locations will be moved to beyond the buffer areas and searches undertaken at the new locations.

In addition to the above measures, the pre-clearance survey will involve the flagging of all hollow-bearing trees that are not also large trees. Controlled felling will be undertaken for hollow-bearing trees to enable hollows to continue to be used by other fauna species. This process includes:

- Trees are tapped to encourage any animals within the tree to vacate; and
- Trees will be felled with any hollows facing upward to enable the continued use of the felled tree as possible habitat.

Although the Northern Hopping-mouse is considered to have a low likelihood of occurrence within the exploration program area, the following pre-clearance process will be followed should any suitable spoils be encountered:

- Where two or more spoil heaps or pop holes are found within 200 m^2, cameras will be installed to determine if these features are due to the presence of the Northern Hopping-mouse. The Delicate Mouse (*Pseudomys delicatulus*) produces spoil heaps and pop holes that are similar from those of the Northern Hopping-mouse and hence it is necessary to determine the source of the spoil heaps and pop holes.
- If Northern-hopping mice are confirmed as present using the cameras, a 100 m buffer will be established and the access track/drill hole re-aligned to ensure the area is avoided. If cameras do not identify the presence of Northern-hopping mice, the exploration can proceed as planned.

3.2.2. Clearing Procedures

The extent of clearing will be restricted to the minimum area required to safely complete the drilling program. This will include minimising the width of access tracks and area of drills pads. Clearing of large, mature trees will also be generally avoided, where possible. Disturbance of topsoil will be kept to a minimum by using a "blade up" method (i.e. the blade of the dozer is lifted so that the soil is not disturbed).

A spotter will work with the dozer operator during the clearing of any vegetation. The spotter will ensure compliance with the various restrictions identified during pre-clearance surveys, such as maintaining adopted buffer distances from flagged trees, as well as ensuring the dozer operator maintains the correct alignment. The dozer operator will utilise a GPS unit to assist with ensuring constraints identified during pre-clearance surveys are avoided.

3.2.3. Rehabilitation

Rehabilitation activities are proposed to assist in minimising the impacts of habitat fragmentation, as well as reducing the potential threat of inappropriate fire regimes and introduction and dispersal of invasive species, such as weeds and feral cats. Following cessation of the exploration activities, the cleared areas will be rehabilitated and left to naturally regenerate as described in ***Section 1.4.3***. GEMCO has had considerable

success with this approach towards rehabilitation of exploration drill holes and access tracks. A recent survey of rehabilitated drill pads and tracks has been conducted of exploration sites disturbed in 2017 to as far back as the 1960s (Cumberland Ecology 2019a). Analysis was made of vegetation in areas cleared or disturbed by exploration activities compared to adjacent, uncleared areas. The survey included assessment of 72 sites comprising both disturbed and analogue (undisturbed) sites. Sites were monitored for vegetation structure, woody species regeneration, ground cover, time since fire, fire impact and weed species cover. Results from this regeneration monitoring has determined that:

- Composition of woody species regeneration returns to composition similar to analogue sites immediately (i.e. within one wet season); and
- Ground cover (determined by the cover of bare ground) returns to similar levels to analogue sites within six years.

The success of this regeneration of vegetation was attributed to the "blade up" method of clearing, which ensures that topsoil is undisturbed and contains vegetative material, such as roots and tubers, as well as the soil seed bank. This mimics natural regeneration following fire, where suckering occurs from in-situ roots and lignotubers or germination of soil stored seed occurs.

Results also showed that vegetation structure (assessed as basal area, canopy cover and mean tree height) returns more slowly to pre-disturbance levels, with comparable levels being achieved approximately 30 years after disturbance. Regeneration of vegetation structure was considered to be influenced by recurrent fires, with frequent fire regimes likely to extend the timeframe for the establishment of large stems.

With the exception of one monitoring plot (of 72 plots), no weeds were identified within any sites, indicating that measures to prevent the spread of weeds are effective. Overall, the monitoring indicates that the rehabilitation procedures and techniques used by GEMCO allow exploration areas to be successfully revegetated over time.

3.2.4. Track Closure

Felled timber and logs will be placed across the entrance to exploration tracks and along a sufficient distance of track to prevent ongoing access. This aims to avoid a permanent public access track becoming established. Closure of the tracks is targeted towards reducing the potential threats of inappropriate fire regimes and the introduction and dispersal of invasive species, such as weeds and feral cats. Tracks will be inspected during rehabilitation monitoring for the exploration program, to ensure that tracks are not in use and are revegetating.

3.2.5. Weed Management

Weed management will be undertaken throughout all stages of the exploration program, including during pre-clearing activities, drilling activities and rehabilitation activities and monitoring. Within the TSMP, weed invasion is identified as a high threat to the Masked Owl (northern) and Northern Quoll, and can also impact the overall quality of native vegetation.

Weed management measures in the Southern Lease will focus on preventing the introduction of weeds, the early detection and eradication of weeds before they establish and on employee awareness. In particular, weed

control and monitoring will be undertaken within the cleared areas in accordance with GEMCO's Weed Management Manual and Exploration Weed Hygiene Procedure. These documents include measures to ensure that exploration activities do not introduce weeds and include inspecting and washing vehicles that enter the Southern Lease. These measures include the following:

- Prior to clearing taking place in the Southern Lease, a pre-clearance survey will be undertaken of the area to be cleared. This survey will include identifying the location of any weeds that exist in the area to be cleared. Any weeds that are identified will be GPS recorded and sprayed or removed prior to any clearing.
- Weeds that are recorded within the Southern Lease, either through pre-clearance surveys, monitoring of exploration rehabilitation, or through incidental sighting of weeds will be recorded in the proponent's geographic information system database. The database will also include a record of weed control actions that are required, a record of the actions that have been undertaken, and details of follow up monitoring.
- All vehicles will be subject to washdown and inspection procedures before entering the Southern Lease. This will apply to all GEMCO and contractor vehicles that will be working in these areas, including drill rigs, scrub dozers, light vehicles and other support vehicles. The existing vehicle wash bay facilities are located at the mine industrial area adjacent to the Maintenance Workshop and at the Ndunga Industrial Facility adjacent to the Rowell Highway. The inspection procedure involves checking the entire piece of equipment for noticeable traces of soil/seeds and plant material. This includes checking the deck area, wheel arches, belly plates, front grill and radiator. Plant or equipment that are observed to contain seeds or plant material will be refused access to the Southern Lease until it has been adequately cleaned.
- Personnel working in the Southern Lease will undertake a daily check for weed seeds on work clothes or boots prior to entering the Southern Lease.
- Contractors and suppliers will be required, as part of the proponent's standard supply contract, to ensure that all plant, vehicles and equipment have been adequately washed down prior to arrival on the island. Prior to arrival on the island, the proponent's nominated representative will be required to inspect all plant and equipment on the Australian mainland to ensure compliance with washdown requirements.
- Weed control will be undertaken in accordance with existing procedures, as required.
- Communication and reporting on weeds will occur as part of the Mining Management Plan prepared under the NT *Mining Management Act*. In addition, site-wide communication briefs will be used to alert workers and the Groote Eylandt community of any new weed threats, and to provide weed identification information.
- As part of the site inductions and pre-start meetings, all staff and contractors will be made aware of their responsibilities regarding weed management.

As noted in ***Section 3.2.3***, monitoring of the quality of regeneration in areas subject to previous exploration drilling has been undertaken (Cumberland Ecology 2019a). With the exception of one plot (of 72), no weeds were identified within rehabilitation sites, indicating that measures to prevent the spread of weeds are effective.

3.2.6. Cane Toad Management

The proponent has a Cane Toad Management Plan and associated quarantine procedures in place. The prevention of the introduction of the Cane Toad is critical to maintaining populations of small mammals on Groote Eylandt including threatened species such as the Northern Quoll. The management plan includes monitoring, and, in the event of a Cane Toad being found, reporting and disposal procedures. These procedures would apply to the exploration program. Current Cane Toad management activities include:

- Cane Toad awareness programs conducted through:
    - Site inductions;
    - Inductions of airport and barge personnel;
    - Contractor inductions prior to arrival on Groote Eylandt;
    - 'Keep Groote Cane Toad Free' signage at the airport, the main road in Alyangula, throughout the accommodation facilities, mess facilities and at the mine and port operations;
    - Community information posters in Alyangula which include the process to be adopted in the event of a Cane Toad being sighted;
    - Information cards on Cane Toads being provided in airplane seat pockets for all commercial flights to Groote Eylandt, and for the proponent's charter flights;
    - In-flight announcements by flight attendants for all commercial flights to Groote Eylandt, and for the proponent's charter flights; and
    - Sitewide Communication Briefs.
- Barge inspections of every barge coming to Milner Bay are undertaken by barge operators. The proponent's Environment Team and the ALC rangers also undertake periodic inspections of the barges to ensure compliance with quarantine protocols.
- Lockers are provided to fly-in fly-out staff to store work boots and other luggage on the island, as a means of reducing the probability of accidentally transporting toads.
- Cane Toad-proof fencing designed to contain and prevent toad movement surrounds the perimeter of the Shipping Yards in Milner Bay and Darwin. The fences are inspected on a monthly basis, and repairs are undertaken as required, to ensure the integrity of the fencing.

4. Assessment of Significance

4.1. Introduction

This chapter presents Assessments of Significance for threatened or migratory fauna species listed under the EPBC Act that are present or have a moderate or high potential to occur in the Stage 2 exploration program area. Assessments of Significance are threshold tests of significance prepared according to the Significant Impact Guidelines to gauge the significance of predicted impacts to threatened and migratory species. The guidelines are designed specifically to determine whether an activity is considered, under the EPBC Act, to have a significant impact on the species.

The Significant Impact Guidelines note the following on page 32 in respect of exploration drilling:

> *All exploratory drilling (including new field, wildcat, and appraisal drilling, auger, rotary air blast (RAB), open hole percussion, reverse circulation (RC), diamond drilling and wide diameter drilling), including the construction of drill pads, would not be expected to have a significant impact on a matter of national environmental significance where the discharges, emissions and waste from the drilling are contained and managed in an environmentally sensitive manner. However, an action involving exploratory drilling may have a significant impact on an endangered or critically endangered species if, for example, it is likely to damage habitat critical to the survival of the species or disrupt the breeding cycle of a population of the species. Such an action may also have a significant impact on listed threatened ecological communities where, for example, it adversely impacts on habitat.*

Assessments of Significance have also been prepared for TPWC Act species that may potentially be impacted by the exploration program.

The following threatened fauna species that are present or have a moderate or high potential to be present have been assessed in accordance with the Significant Impact Guidelines:

- Masked Owl (northern) (*Tyto novaehollandiae kimberli*);
- Ghost Bat (*Macroderma gigas*);
- Mertens' Water Monitor (*Varanus mertensi*); and
- Yellow-spotted Monitor (*Varanus panoptes*).

The Northern Quoll (*Dasyurus hallucatus*) has been assessed in accordance with the Northern Quoll Referral Guideline (DotE 2016). This is the only species potentially impacted by the exploration program that has a species-specific guideline available. Species-specific guidelines provide more detailed guidance on assessing the significance of impacts on particular threatened species.

The following migratory species have also been assessed in accordance with the Significant Impact Guidelines:

- Fork-tailed Swift (*Apus pacificus*); and
- Salt-water Crocodile (*Crocodylus porosus*).

This section also includes a discussion of potential impacts on the Brush-tailed Rabbit-rat (*Conilurus penicillatus*) and Northern Hopping-mouse (*Notomys aquilo*).

4.2. Definitions

The definitions listed in **Table 3** are utilised within the Significant Impact Guidelines and are addressed for the relevant species in the sections below.

Table 3 Definitions used in the Significant Impact Guidelines

Term	Definition	Status to which Term is Relevant
Population of a species	A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to: - a geographically distinct regional population, or collection of local populations, or - a population, or collection of local populations, that occurs within a particular bioregion.	Critically Endangered, Endangered, Vulnerable
Important population of a species	An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: - key source populations either for breeding or dispersal - populations that are necessary for maintaining genetic diversity, and/or - populations that are near the limit of the species range.	Vulnerable
Invasive species	An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.	Critically Endangered, Endangered, Vulnerable
Habitat critical to the survival of a species	'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: - for activities such as foraging, breeding, roosting, or dispersal - for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)	Critically Endangered, Endangered, Vulnerable

Term	Definition	Status to which Term is Relevant
	- to maintain genetic diversity and long-term evolutionary development, or -for the reintroduction of populations or recovery of the species or ecological community. Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.	
Important habitat for a migratory species	An area of 'important habitat' for a migratory species is: a. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or b. habitat that is of critical importance to the species at particular life-cycle stages, and/or c. habitat utilised by a migratory species which is at the limit of the species range, and/or d. habitat within an area where the species is declining.	Migratory
Ecologically significant proportion	Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).	Migratory
Population of a migratory species	'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.	Migratory

4.3. Masked Owl (Northern)

Scientific Name: *Tyto novaehollandiae kimberli*

EPBC Act Status: Vulnerable

TPWC Act Status: Vulnerable

Important Population Assessment

Key source population either for breeding or dispersal

Data on occurrences of the species across the island has historically been quite limited. Surveys for the Masked Owl (northern) have been largely restricted to the mineral leases on the western side of the island and the majority of potential habitat on the island has not been surveyed. The low number of records for the species is likely to be an artefact of the low number of surveys completed on the island, rather than reflecting the rarity of the Masked Owl (northern) on Groote Eylandt.

However, individuals of the Masked Owl (northern) have been observed across Groote Eylandt. There is a record from 2016 within the Southern Lease, in close proximity to the Stage 2 exploration program area, (Cumberland Ecology 2016) The species was also recorded to the west of the Southern Lease in 2017 by Cumberland Ecology (2019b) and within the Eastern Leases in 2014 by Cumberland Ecology (2015). The NR Maps database also holds nine records of the species observed between 2012 and 2014. The location of Masked Owl (northern) records on Groote Eylandt, based on the NR Maps database and recent records by Cumberland Ecology (2015, 2016, 2019b) are shown in **Figure 4**. In some instances, the records held in the NR Maps database reflect the records from the Cumberland Ecology studies, and at these locations only the latter are visible in the figure. **Figure 4** does not show each individual record, given that in some cases there were multiple sightings of the Masked Owl (northern) at a single location, however only one of these records is show in the figure.

Habitat for the Masked Owl (northern) includes open forest and woodland, which is widespread and contiguous on the island.

The Masked Owl (northern) is sedentary and territorial. Little is known of the home ranges of the northern subspecies, however individual home ranges of the southern form of the species are known to vary between 150 ha and 1,200 ha in breeding and non-breeding seasons respectively. Individual owls detected on the island would likely disperse across home ranges that include the Stage 2 exploration program area.

The sex and breeding status of individuals potentially occurring within the Stage 2 exploration program area are unknown, but for the purposes of this assessment it is assumed that they represent one to several breeding pairs of birds.

Although the Masked Owl (northern) occurs widely across northern Australia, with the limited data available, it is assumed that the owls on Groote Eylandt constitute a distinct and important population. The individuals that potentially occur within the Stage 2 exploration program area are considered to comprise a subset, or small part of the Groote Eylandt population, which for the purposes of this assessment is considered to be a key source population.

Populations that are necessary for maintaining genetic diversity

Groote Eylandt is a large island with relatively pristine vegetation and intact assemblages of native flora and fauna. The owl population on the island has not been studied in detail; however, given an approximate home

range of 1,200 ha in the non-breeding season, individuals are likely to move around the extensive available habitat across the island.

It is unclear if and to what extent the species travels between Groote Eylandt, and other islands and the mainland.

Island populations of fauna are often genetically distinct. For the purposes of this assessment it is assumed that the island population could represent a distinct form of the species and so is important for maintaining genetic diversity.

Populations that are near the limit of the species range

The Stage 2 exploration program area is not located near the limit of the range of the Masked Owl (northern). It occurs across the top end of the NT, Queensland and Western Australia.

Conclusion

For the reasons outlined above, the population of the Masked Owl (northern) that is likely to occur within the Stage 2 exploration program area is considered to comprise an 'important population' as defined by the Significant Impact Guidelines.

Significant Impact Criteria

Lead to a long-term decrease in the size of an important population of a species

The exploration program will reduce the area of potentially occupied habitat for this species by removing approximately 40 ha of forest and woodland habitat (excluding known and potential nesting trees). This constitutes a very small portion of the open forest and woodland on Groote Eylandt and the overwhelming majority of this habitat on the island would remain. Despite this clearing of potential foraging habitat, a key mitigation measure to be implemented for this species is the avoidance of large trees and hollow-bearing trees suitable for nesting. This will avoid impacts on potential breeding habitat for the species. Furthermore, following the cessation of drilling, drill pads and access tracks will be closed and rehabilitated and are expected to naturally regenerate over time. Regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to previous exploration drilling found that woody species composition appears to regenerate rapidly following the cessation of disturbance. Accordingly, in the long term the exploration program is unlikely to lead to a long-term decrease in the size of an important population of the species.

Reduce the area of occupancy of an important population

The exploration program will clear approximately 40 ha of open forest and woodland (excluding known and potential nesting trees) and, in the absence of rehabilitation, would marginally reduce the area of occupancy of an important population. This is a very minor area when considering the very large areas of similar habitat that will remain in the Southern Lease and island as a whole. Rehabilitation of disturbed areas will also occur following cessation of drilling. Regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to previous exploration drilling found that woody species composition appears to regenerate

rapidly following the cessation of disturbance, with structure returning to pre-disturbance levels after approximately 30 years.

The Masked Owl (northern) has previously been recorded within, and in close proximity, to areas subject to previous exploration activities within the Eastern Leases (Cumberland Ecology 2015), suggesting that exploration does not permanently reduce the area of occupancy. Overall, it is considered unlikely the exploration program will reduce the area of occupancy of an important population.

Fragment an existing important population into two or more populations

The population of the Masked Owl (northern) is not likely to be fragmented as a result of the exploration program as the areas of foraging habitat to be removed are very small and this species is highly mobile and able to fly over disturbed areas to access other habitats. Retaining large trees and hollow-bearing trees that provide suitable nesting sites for the species will also limit potential fragmentation impacts to breeding habitat.

Adversely affect habitat critical to the survival of a species

The habitat to be removed within the Stage 2 exploration program area includes approximately 40 ha of open forest and woodland which contains foraging habitat. Extensive areas of foraging habitat will remain within the Southern Lease and across the island. In addition, exploration will not give rise to a permanent loss of foraging habitat, given that cleared areas are expected to regenerate over time and provide suitable habitat for this species in the long term. As such, the removal of a small area of foraging habitat is not expected to adversely impact habitat critical to the survival of the species. The habitat within the Stage 2 exploration program area has the potential to contain hollow-bearing trees suitable for use for breeding. However, the pre-clearance survey will ensure that hollow-bearing trees suitable for breeding are not removed and that a buffer is placed around them. No impact on nesting habitat is therefore anticipated.

Disrupt the breeding cycle of an important population

Hollow-bearing trees suitable for breeding will be retained and buffers placed around them by the exploration program as part of the pre-clearance survey. Accordingly, the exploration program is not considered likely to disrupt the breeding cycle of an important population of the Masked Owl (northern).

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Masked Owl (northern) population of Groote Eylandt is unlikely to decline as a result of habitat to be removed for the exploration program. The exploration program will remove only a very small area of potential foraging habitat for this species which will be rehabilitated and naturally regenerate over time. Inappropriate fire regimes and weed invasion are known to be a high threat to the Masked Owl (northern), however such impacts are to be managed as part of the exploration program and are not anticipated to significantly impact the species. Large areas of similar habitat within the Southern Lease and across the island will remain and continue to provide habitat for this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

DENR and ALC (2019) have identified weed invasion, feral cats and potential invasive species (e.g. ants) as posing a medium to high threat to the Masked Owl (northern). Weed invasion has been categorised as having a high threat rating. GEMCO's Weed Management Manual and Exploration Weed Hygiene Procedure will be implemented for the exploration program to ensure exploration activities do not introduce weeds. These measures include inspecting and washing vehicles that enter the Southern Lease.

It is considered unlikely that the exploration program will result in other invasive species becoming established in habitat for the Masked Owl (northern). Few feral animals occur on Groote Eylandt and these are strictly managed by GEMCO and the ALC. It is unlikely that any invasive plant or animal will become established as a result of the exploration program.

Introduce disease that may cause the species to decline

Disease is not known to be a threat to this species and no disease that may affect it is present on Groote Eylandt. It is therefore considered unlikely that the exploration program will introduce any form of pathogen or disease that may cause the Masked Owl (northern) to decline.

Interfere substantially with the recovery of the species

The exploration program is not expected to interfere substantially with the recovery of the Masked Owl (northern). The exploration program will result in the removal of a small area of habitat (excluding known and potential nesting trees) for this species. Large areas of similar habitat occur in the locality that will remain and continue to provide high quality habitat for this species. In addition, the loss of foraging habitat should not be considered a permanent impact, given that cleared areas are expected to regenerate over time and provide suitable foraging habitat for this species in the long term.

Conclusion

For the purposes of this assessment it is assumed that the occurrence of the Masked Owl (northern) in the Stage 2 exploration program area is a subset or small part of an important population found on Groote Eylandt. The exploration program will result in the removal of approximately 40 ha of foraging habitat for the species which constitutes a very small portion of the open forest and woodland on Groote Eylandt. Breeding habitat in the form of large hollow-bearing trees will be retained and buffers placed around them in accordance with the pre-clearance procedures. The vast majority of habitat for this species will remain. The exploration program will not cause the establishment of invasive species in the suitable habitat that remains, and will not increase the risk of disease or interfere with the recovery of the species.

Accordingly, no significant impact is predicted to occur to the Masked Owl (northern) as a result of the exploration program.

4.4. Northern Quoll

Scientific Name: *Dasyurus hallucatus*

EPBC Act Status: Endangered

TPWC Act: Critically Endangered

Introduction

The Northern Quoll Referral Guideline (DotE 2016) has been utilised to assess the significant of impacts of the exploration program on the Northern Quoll. The guideline:

- Outlines likely habitats critical to the survival of the Northern Quoll;
- Outlines populations important for the long-term survival of the Northern Quoll
- Details survey and mitigation expectations; and
- Clarifies what is likely to constitute a significant impact on the northern quoll.

Each of these items are discussed in the sections below in relation to potential impacts from the exploration program.

Critical Habitat

Habitat critical to the survival of the Northern Quoll is defined in the Northern Quoll Referral Guideline (DotE 2016) as:

> *Habitat within the modelled distribution of the northern quoll (refer to maps 1–5) which provides shelter for breeding, refuge from fire / or predation and potential poisoning from cane toads. Habitat critical to the survival usually occurs in the form of:*
>
> *- off shore islands where the northern quoll is known to exist*
>
> *- rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines*
>
> *- structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.*
>
> *Dispersal and foraging habitat associated with or connecting populations important for the long-term survival of the northern quoll is also considered habitat critical to the survival of the northern quoll.*

The habitat within the Stage 2 exploration program area, the Southern Lease and Groote Eylandt all occur within the modelled distribution of the Northern Quoll and provides shelter for breeding, refuge from predation and potential poisoning from cane toads. Within the Southern Lease, this available habitat includes rocky habitats and structurally diverse woodland or forest. The habitat is also located on an offshore island

where the northern quoll is known to exist. Therefore the habitat is considered critical to the survival of the Northern Quoll.

Population Assessment

According to the Significant Impact Guidelines, all occurrences of endangered species are taken to represent a "population of a species". The population of the Northern Quoll on Groote Eylandt is known to be substantial and widespread across the island. **Figure 5** shows the location of Northern Quoll records on Groote Eylandt.

The Groote Eylandt population is one of the few remaining populations in Australia that appears to be thriving, as it is not impacted by the Cane Toad, which is a key threat to the Northern Quoll on the mainland. As such, the population of Northern Quoll on Groote Eylandt is considered to have high conservation significance (NRETAS 2009).

An important population of the Northern Quoll is defined in the Northern Quoll Referral Guideline as populations which are:

- high density quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present

- occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water

- subject to ongoing conservation or research actions i.e. populations being monitored by government agencies or universities or subject to reintroductions or translocation.

The population within the Stage 2 exploration program area, the Southern Lease and Groote Eylandt all constitute an important population in accordance with this definition as they occur in habitat that is free of cane toads.

Survey

The population of the Northern Quoll on Groote Eylandt is known to be substantial and widespread across the island. Previous studies undertaken within the Southern Lease have detected the species at numerous locations (Cumberland Ecology 2016, Heiniger and Gillespie 2017). In recognition of the potential impacts to threatened small mammals resulting from exploration activities, Cumberland Ecology (2019b) undertook the Small Mammal Research Project within the Southern Lease and surrounds on behalf of South32/GEMCO, based on a study designed by DENR. The research project included an extensive survey at 152 locations within the Southern Lease and surrounds between 2017 and 2018. The surveys included:

- Motion-sensor camera trapping to determine species occurrence and detection rates. This trapping included the use of four cameras at each location, two of which were established as unfenced sites and two of which were established as fenced sites; and
- Habitat assessment to collect environmental and management attributes. The habitat assessment included collection of information on recent fire, trees and logs, vegetative cover.

The surveys undertaken as part of the Small Mammal Research Project are in line with the recommended survey methods detailed within the Northern Quoll Referral Guideline. The Northern Quoll was detected during these surveys across a wide variety of habitats including lateritic and sandstone woodland and forest, riparian habitats and coastal habitats.

Mitigation

The Northern Quoll Referral Guideline details the main threats to the Northern Quoll and provides mitigation advice for the various threats. **Table 4** details the threats relevant to the exploration program and the mitigation measures proposed. Mitigation measures proposed for the exploration program align with the recommended mitigation measures within the Northern Quoll Referral Guideline.

Table 4 Key threats and relevant mitigation measures for the Northern Quoll

Threats and Key Impacts	Relevant Exploration Program Mitigation Measures
Habitat clearing, modification or land use change	Table 2 of the Northern Quoll Referral Guideline recommends a range of mitigation measures relevant to habitat clearing, with measures targeted towards minimising habitat clearing and rehabilitating disturbed areas. The following mitigation measures will be implemented for the exploration program. These measures are consistent with those outlined in the Northern Quoll Referral Guideline. • Delineating a potential exploration area that avoids the most environmentally sensitive areas in the Southern Lease, including all areas to the east of the Innokumanja River. Approximately 7,500 ha of the potential mineralised area has been excised from future drilling programs for environmental reasons. • Avoiding areas of sandstone outcropping, including an additional 100 m buffer • Positioning drill holes in previously cleared areas, where possible, or along existing tracks • Limiting clearing at drill holes to the smallest possible area • Utilising existing access tracks where possible • Rehabilitation of drill pads and access tracks following cessation of drilling • Providing workforce training on threatened species, including Northern Quolls and their ecology.
Introduction and increases of invasive species (e.g. cane toads, gamba grass, feral cats and pigs, wild dogs)	Table 2 of the Northern Quoll Referral Guideline recommends a range of mitigation measures for invasive species. Relevant mitigation measures from this guideline will be implemented for the exploration program. These include: • Implementation of GEMCO's Cane Toad Management Plan. This includes procedures relating to barging of equipment, inspections of barges and vehicles, Cane Toad fencing at the port and use of a Cane Toad detection dog at the port and airport

Threats and Key Impacts	Relevant Exploration Program Mitigation Measures
	• Implementation of GEMCO's quarantine and weed management procedures. These include inspecting and washing vehicles prior to entering the Southern Lease • Personnel responsible for vegetation clearing and exploration drilling will participate in workforce training on quarantine protocols and associated risks involved with invasive species • Felled timber and logs will be placed across the entrance to exploration tracks and along a sufficient distance of track to prevent ongoing access.
Traffic	Table 2 of the Northern Quoll Referral Guideline recommends a range of mitigation measures for traffic impacts (which may lead to direct mortality or habitat fragmentation). The following mitigation measures will be implemented for the exploration program. These measures are consistent with those outlined in the Northern Quoll Referral Guideline. • Using only small numbers of dozers and rigs • Leaving drill rigs in-situ, reducing vehicle movements • Rehabilitation of drill pads and access tracks following cessation of drilling • Implementing speed controls and ensuring, through workforce training, that speed controls are understood.
Inappropriate fire regimes	Table 2 of the Northern Quoll Referral Guideline recommends a range of mitigation measures for fire. The following mitigation measures will be implemented for the exploration program. These measures are consistent with those outlined in the Northern Quoll Referral Guideline. • Establishment of access tracks has the potential to increase access to new areas, which may lead to a change in the fire regime within remote areas. Exploration tracks will be allowed to naturally regenerate once the exploration program has been completed. • Felled timber and logs will be placed across the entrance to exploration tracks and along a sufficient distance of track to prevent ongoing access. • Workforce training addresses procedures in the event of unexpected fire events.

Significant Impact Criteria (Northern Quoll Referral Guidelines)

Result in the loss of habitat critical to the survival of the northern quoll

The habitat within the Stage 2 exploration program area and across Groote Eylandt is considered to represent critical habitat for the species as they occur within the modelled distribution of the Northern Quoll. The exploration program will clear approximately 40 ha of habitat within the Stage 2 exploration program area which constitutes a very small portion of the closed forest, open forest, woodland, coastal vegetation and

riparian vegetation that the species is known from on Groote Eylandt. This is considered to be a very small portion of the foraging and breeding habitat for the Northern Quoll that occurs on the island.

Northern Quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats that have a high structural diversity used for foraging and dispersal (DAWE 2020c). All mapped areas of sandstone outcropping is being avoided by the exploration program, including an additional 100 m buffer around these areas.

Following the completion of drilling, drill holes will be capped and the drill pads and access tracks will be rehabilitated. Regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to exploration drilling found that woody species composition appears to regenerate rapidly following the cessation of disturbance. As such, approximately 40 ha of habitat to be cleared for exploration activities will be returned to native vegetation following cessation of exploration activities. Vegetation composition in areas subject to previous exploration activities have been monitored, and it can be shown that they achieved a state similar to undisturbed areas through seasonal regrowth after 1-2 wet seasons (Cumberland Ecology 2019a).

Decrease the size of a population important for the long-term survival of the northern quoll and therefore interfere with the recovery of the species

Extensive information exists about the status of the Northern Quoll on Groote Eylandt and there is a high degree of confidence that this species is currently abundant and widespread in all suitable habitat types across the island. Both foraging and breeding habitat occurs across the island. **Figure 5** shows the location of records held within the NR Maps database and from recent studies by Heiniger and Gillespie (2017) and Cumberland Ecology (2019b). The NR Maps databased holds over 2,500 records of the Northern Quoll across Groote Eylandt including within and beyond the Southern Lease. In some instances, the records held in the NR Maps database reflect the records from the aforementioned studies, and at these locations only the latter is visible in the figure. **Figure 5** does not show each individual record, given that in some cases there were multiple sightings of the Northern Quoll at a single location, however only one of these records is shown in the figure.

Northern Quolls are highly mobile and are known to forage in disturbed habitats around roads and towns on Groote Eylandt. They have also been found to occur within areas of mine rehabilitation in the existing mine and exploration areas within the Eastern Leases (Cumberland Ecology 2015). Recent studies by Cumberland Ecology (2019b) identified the occurrence of the species across a wide variety of habitats including lateritic and sandstone woodland and forest, riparian habitats and coastal habitats.

The exploration program will clear approximately 40 ha of habitat within the Stage 2 exploration program area. This is considered to be a very small portion of the foraging and breeding habitat for the Northern Quoll that occurs on the island, and the vast majority will remain. In addition, following the completion of drilling, exploration holes will be capped and the drill pads and access tracks will be rehabilitated. Approximately 40 ha of habitat to be cleared for exploration activities will be returned to native vegetation following cessation of exploration activities. Vegetation composition in areas subject to previous exploration activities achieved a state similar to undisturbed areas through seasonal regrowth after 1-2 wet seasons (Cumberland Ecology 2019a).

Considering the small area of potential habitat to be impacted, the wide habitat preferences of this species, known occurrence of the species within similarly disturbed areas, and likely success of rehabilitation of cleared areas, the exploration program is considered unlikely to lead to a long term decrease in the size of the population of Northern Quolls on the island.

Introduce inappropriate fire regimes or grazing activities (i.e. increasing the risk of late dry season high intensity fires to the area) that substantially degrade habitat critical to the survival of the northern quoll or decrease the size of a population important for the long term survival of the species

Inappropriate fire regimes have been identified as a key threat to the Northern Quoll in the TSMP. Large portions of the Southern Lease are regularly burnt by the Traditional Owners. The Stage 2 exploration program area is predominantly located within areas that have been burnt within the last five years (Darwin Centre for Bushfire Research 2019). Establishment of access tracks has the potential to increase access to new areas, which may lead to a change in the fire regime within remote areas. Felled timber and logs will be placed across the entrance to exploration tracks and along a sufficient distance of track to prevent a permanent public access track becoming established.

The project does not involve the introduction of grazing activities.

Fragment a population important for the long term survival into two or more populations

Northern Quolls are highly mobile and are known to forage in disturbed habitats around roads and towns on Groote Eylandt. They have also been found to occur within areas of mine rehabilitation in the existing mine and previous exploration areas within the Eastern Leases (Cumberland Ecology 2015). Exploration of the Eastern Leases and within the existing GEMCO mine has not resulted in the exclusion of the Northern Quoll within these areas and adjoining habitats, as evidenced by the distribution of records shown in **Figure 5**.

The Northern Quoll is able to cross disturbed areas relatively easily in search of alternative habitat. The relatively narrow access tracks (approximately 3 m wide) to be created for the exploration program are not likely to prevent dispersal and movement of the Northern Quoll.

Furthermore, the exploration program will not have a permanent impact and the drill pads and access tracks are expected to quickly regenerate back into native vegetation. Vegetation composition in areas subject to exploration activities was shown to achieve a state similar to undisturbed areas through seasonal regrowth after 1-2 wet seasons (Cumberland Ecology 2019a).

Accordingly, the exploration program is unlikely to fragment the existing important population into two or more populations.

Result in invasive species or increases of them that are harmful to the northern quoll becoming established in its habitat, namely cane toads, feral cats, red foxes or exotic grasses which increase fire risk. This includes actions which have inadequate quarantine measures in place for movements between the mainland and offshore islands where northern quolls occur

DENR and ALC (2019) have identified cane toads, feral cats, pigs, herbivores and weeds as posing a medium to very high threat to the Northern Quoll.

Cane Toads are not present on Groote Eylandt, and GEMCO/South32 actively seek to ensure this invasive species is not inadvertently introduced to the island. GEMCO/South32 has a Cane Toad Management Plan which includes quarantine measures to protect Groote Eylandt from Cane Toads and the exploration program will not exacerbate this risk beyond current levels.

Low numbers of feral cats were observed within the Southern Lease and surrounds during recent surveys by Cumberland Ecology (2019b). Feral cats occurred in areas not subject to disturbances (such as previous exploration activities) and it is likely they opportunistically move throughout the landscape to areas with abundant prey. The exploration program is unlikely to exacerbate the impact of feral cats beyond current conditions.

Feral Pigs (*Sus scrofa*) and feral herbivores are not established on the island and the exploration program is unlikely to result in the establishment of the species in suitable habitat for the Northern Quoll.

GEMCO's Weed Management Manual and Exploration Weed Hygiene Procedure will be implemented for the exploration program to ensure exploration activities do not introduce weeds and include inspecting and washing vehicles that enter the Southern Lease. With the exception of one plot (out of 72), no weeds were identified within any sites during regeneration monitoring of GEMCO's exploration areas elsewhere on Groote Eylandt, indicating that measures to prevent the spread of weeds are effective (Cumberland Ecology 2019a).

No other invasive species are considered likely to become established as a result of the exploration program.

Conclusion

The habitat within the Stage 2 exploration program area and across Groote Eylandt is considered to represent critical habitat for the species as they occur within the modelled distribution of the Northern Quoll. The population of the Northern Quoll on Groote Eylandt is known to be substantial, and it is recognised as an important population for the conservation of the species. A number of avoidance and mitigation measures will be implemented by the exploration program to reduce impacts to the Northern Quoll.

Northern Quolls are highly mobile and are known to forage in disturbed habitats around roads and towns on Groote Eylandt. They have also been found to occur within areas of mine rehabilitation in the existing mine and exploration areas within the Eastern Leases (see **Figure 5**)(Cumberland Ecology 2015). The exploration program will result in the removal of approximately 40 ha of habitat for the Northern Quoll. Following the completion of drilling, drill holes will be capped and the drill pads and access tracks will be closed and rehabilitated.

Accordingly, no significant impact is predicted to occur to the Northern Quoll as a result of the exploration program.

4.5. Ghost Bat

Scientific Name: *Macroderma gigas*

EPBC Act Status: Vulnerable

TPWC Act Status: Not Listed

Important Population Assessment

Key source population either for breeding or dispersal

The Ghost Bat was not recorded within the Southern Lease during recent surveys, although it is noted that these surveys were not targeted towards recording bats. The Ghost Bat has been previously recorded within dry eucalypt forest within the existing GEMCO mine (URS Australia Pty Ltd 2012), within open woodland in proximity to the existing GEMCO mine (Diete et al. 2015) and in coastal grass and shrub habitat in the south west peninsular of the island (Diete et al. 2015). These habitats are considered to constitute foraging habitat for the species. The NR Maps database has records of this species in the central and northern parts of the island. The location of Ghost Bat records on Groote Eylandt, based on the NR Maps database and Diete et al. (2015) are shown in **Figure 6**. This figure does not show each individual record, given that in some cases there were multiple sightings of the Ghost Bat at a single location, however only one of these records is shown in the figure. Although the Ghost Bat has not been recorded in the Stage 2 exploration program area, it has been assumed that this area may provide foraging habitat for this species.

During the daytime, the Ghost Bat roosts in caves, rock crevices and old underground mines (Threatened Species Scientific Committee 2016). Maternity roosts have very specific microclimate requirements and generally comprise deep natural caves or disused underground mines with relatively stable temperatures of 23°−28°C (Threatened Species Scientific Committee 2016). Most breeding sites appear to require multiple entranced caves (Threatened Species Scientific Committee 2016). Foraging by the Ghost Bat on Groote Eylandt and in the Southern Lease (including the Stage 2 exploration program area) would likely occur in proximity to roosting habitat and include a range of habitat types, including closed forest, open forest, sandstone woodland and rock outcrops, woodland/shrubland, riparian/wetland habitat and coastal habitat.

It is assumed for this assessment, that the population of the Ghost Bat potentially occurring within the Southern Lease is likely to be part of a broader population on Groote Eylandt. The population of Ghost Bats on Groote Eylandt should be considered to potentially be a key source population as it is an island population that is separate from the declining populations on the mainland.

Populations that are necessary for maintaining genetic diversity

Offshore islands can be important to the overall genetic diversity of a species because the species is typically protected from some of the threats experienced on the mainland (NRETAS 2009).

Therefore, it is assumed for this assessment, that the population of the Ghost Bat potentially occurring within the Southern Lease is likely to be part of a broader population on Groote Eylandt, which may be important to the species for the maintenance of genetic diversity.

Populations that are near the limit of the species range

The species' current distribution is discontinuous, with geographically disjunct colonies occurring in the Pilbara, Kimberley, northern portion of the NT (including Groote Eylandt), the Gulf of Carpentaria, coastal and near coastal eastern Queensland from Cape York to near Rockhampton, and western Queensland (Threatened

Species Scientific Committee 2016). The population of the Ghost Bat on Groote Eylandt is considered to be towards its northern geographic limits.

Conclusion

For the reasons outlined above, the population of the Ghost Bat that potentially occurs within the Stage 2 exploration program area within the Southern Lease is considered to be a part of an 'important population' found on Groote Eylandt as defined by the Significant Impact Guidelines.

Significant Impact Criteria

Lead to a long-term decrease in the size of an important population of a species

The exploration program will remove approximately 40 ha of foraging habitat that is potentially suitable for the species. The Ghost Bat is likely to forage in a wide range of habitat types and the area to be cleared represents a very small portion of the foraging habitat on the island. In addition, the loss of foraging habitat is not considered a permanent impact, given that cleared areas are expected to regenerate over time and provide suitable foraging habitat for this species in the long term. The species has been previously recorded within dry eucalypt forest within the existing GEMCO mine (URS Australia Pty Ltd 2012) and therefore it is likely to have some tolerance to disturbance.

No potential roosting or breeding habitat will be removed for the Stage 2 exploration program area, as exploration activities will not be undertaken within 100 m of sandstone outcrop areas (locally known as 'white rock' areas). These are the only areas within the Southern Lease that may provide roosting or breeding habitat for the species.

Accordingly, the removal of habitat for the Ghost Bat within the Stage 2 exploration program area is not considered likely to lead to a long-term decrease in the size of an important population of this species.

Reduce the area of occupancy of an important population

The exploration program will clear approximately 40 ha of the potential foraging habitat for this species on the island. The foraging habitat to be removed represents a very small proportion of the available habitat on the island and the vast majority will be retained. Furthermore, the drill pads and access tracks are expected to regenerate relatively rapidly back into native vegetation due to the surrounding vegetation. Regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to previous exploration drilling found that woody species composition appears to regenerate rapidly following the cessation of disturbance.

As noted above, the white rock areas in the Southern Lease are the only areas that have potential to provide roosting or breeding habitat. **Figure 3** shows the location of white rock areas, but it should be noted that not all of these areas would support caves; in some areas the white rock is restricted to scatters of rock on the ground. Although some of the white rock areas may contain caves that could be suitable for the Ghost Bat, it is currently unknown if any individuals of the species occupy any of these areas.

Exploration activities are located at least 100 m away from white rock areas and the majority of the exploration program is significantly further away (well over 1 km from areas of white rock). Given this distance, the small

number of drill rigs used, and the short term nature of exploration (i.e. each RC hole is drilled in approximately 45 minutes), it is unlikely that noise and vibration from the exploration program will significantly impact roosting or breeding habitat for the Ghost Bat.

For these reasons, it is unlikely that the exploration program will reduce the area of occupancy of an important population of the species.

Fragment an existing important population into two or more populations

No potential roosting or breeding habitat will be removed for the Stage 2 exploration program area, as the design of the exploration area has sought to avoid areas of sandstone outcropping, which may support suitable roosting or breeding features. The Ghost Bat is highly mobile and is able to fly over disturbed areas to access alternative habitats relatively easily. Radio-tracking of the Ghost Bat has indicated that foraging areas were centred, on average, 1.9 km from the day roost (Tidemann et al. 1985). The exploration program will result in the removal of a very small proportion of the available foraging habitat for this species and it is unlikely that the removal of this small area of foraging habitat will fragment an existing population into two or more populations.

Adversely affect habitat critical to the survival of a species

The habitat to be removed within the Stage 2 exploration program area includes approximately 40 ha of open forest and woodland which contains foraging habitat for the Ghost Bat. The drill pads and access tracks will be rehabilitated following the completion of the exploration program. Regeneration is expected to occur relatively rapidly back into native vegetation due to the surrounding vegetation. Extensive areas of foraging habitat will also remain within the Southern Lease and across the island. The removal of this small area of foraging habitat is unlikely to adversely affect habitat critical to the survival of the species.

No potential roosting or breeding habitat will be removed for the Stage 2 exploration program area, as the design of the exploration area has sought to avoid areas of sandstone outcropping, which may support suitable roosting or breeding features.

Disrupt the breeding cycle of an important population

As noted above, the white rock areas in the Southern Lease are the only areas that have potential to provide roosting or breeding habitat for the Ghost Bat. Not all areas of white rock shown on **Figure 3** would support caves suitable for breeding. Although some of the white rock areas may contain caves that could be suitable for Ghost Bats, it is currently unknown if Ghost Bats occupy any of these areas.

No exploration will be undertaken within 100 m of white rock areas and the majority of the exploration program is significantly further away (well over 1 km from areas of white rock). The avoidance of areas within 100 m of mapped white rock is therefore a conservative and key mitigation of potential impacts on breeding habitat for this species. Furthermore, given the distance of the Stage 2 exploration program areas from white rock, the small number of drill rigs used, and the short term nature of exploration (i.e. each RC drill hole is drilled in approximately 45 minutes), it is unlikely that noise and vibration from the exploration program will significantly impact breeding habitat for the Ghost Bat.

Accordingly, the exploration program is not considered likely to disrupt the breeding cycle of an important population of the Ghost Bat.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Ghost Bat population of Groote Eylandt is unlikely to decline as a result of habitat removed for the exploration program. The exploration program will remove only a very small area of potential foraging habitat for this species, and large areas of similar habitat within the Southern Lease and across the island will remain and continue to provide high quality habitat for this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

DENR and ALC (2019) have identified cane toads and feral cats as posing a threat to the Ghost Bat. Cane Toads are not present on Groote Eylandt, and GEMCO/South32 actively seek to ensure this invasive species is not inadvertently introduced to the island. GEMCO/South32 has a Cane Toad Management Plan which includes quarantine measures to protect Groote Eylandt from Cane Toads and the exploration program will not exacerbate this risk beyond current levels. Low numbers of feral cats were observed within the Southern Lease and surrounds during recent surveys by Cumberland Ecology (2019b). The exploration program is unlikely to exacerbate the impact of feral cats beyond current conditions.

No other invasive species are considered likely to become established as a result of the exploration program.

Introduce disease that may cause the species to decline

Disease is not known to be a threat to this species and no disease that may affect it is present on Groote Eylandt. It is considered unlikely that the exploration program will introduce a disease that may cause the Ghost Bat to decline.

Interfere substantially with the recovery of the species

The exploration program is not expected to interfere substantially with the recovery of the Ghost Bat. The exploration program will result in the removal of a small area of foraging habitat for this species, however, large areas of similar habitat occur in the locality that will remain and continue to provide high quality habitat for this species. Furthermore, cleared areas are expected to regenerate over time to open forest and woodland habitats that will provide suitable foraging habitat for this species in the long term.

Conclusion

For the purposes of this assessment it is assumed that the occurrence of the Ghost Bat on Groote Eylandt is an important population. The exploration program will result in the removal of approximately 40 ha of foraging for the species. All areas of potential roosting and breeding habitat is being avoided by the exploration program, with a conservative 100 m buffer being applied to mapped white rock. Furthermore, the areas disturbed by the exploration program for the purposes of the creation of drill pads and access tracks are expected to regenerate into native vegetation in the long term. The exploration program will not cause the

establishment of invasive species in the suitable habitat, and will not increase the risk of disease or interfere with the recovery of the species.

Accordingly, no significant impact is predicted to occur to the Ghost Bat as a result of the exploration program.

4.6. Mertens' Water Monitor

Scientific Name: *Varanus mertensi*

EPBC Act Status: Not listed

TPWC Act Status: Vulnerable

Important Population Assessment

Key source population either for breeding or dispersal

The Mertens' Water Monitor has been recorded across Groote Eylandt including 27 records of the species across the middle of the island between 1969 and 2014 (NR Maps database), and during surveys of the nearby Eastern Leases in 2014 (Cumberland Ecology 2015). The low number of records for the species is likely to be an artefact of the low number of monitor surveys completed on the island in the past, rather than reflecting the rarity of the monitor on Groote Eylandt. The majority of potential habitat on the island has not been surveyed. The location of Mertens' Water Monitor records on Groote Eylandt, based on the NR Maps database and recent records by Cumberland Ecology (2015) are shown in **Figure 7**. In some instances, the records held in the NR Maps database reflect the records from Cumberland Ecology (2015), and at these locations only the latter are visible in the figure. **Figure 7** does not show each individual record, given that in some cases there were multiple sightings of the Mertens' Water Monitor at a single location, however only one of these records is shown in the figure.

The major waterways and their tributaries on Groote Eylandt provide suitable habitat for this species; however the availability of such habitat is reliant on seasonal conditions. During surveys of the Eastern Leases, the Mertens' Water Monitor was found within laterite woodland and forest habitat, and riparian/wetland habitats adjacent to watercourses (Cumberland Ecology 2015).

Although the Mertens' Water Monitor occurs widely across northern Australia, with the limited data available, it is assumed that the monitors on Groote Eylandt constitute a distinct and important population. The individuals that potentially occur within the Stage 2 exploration program area are considered to comprise a subset, or small part of the Groote Eylandt population, which for the purposes of this assessment is considered to be a key source population.

Populations that are necessary for maintaining genetic diversity

Groote Eylandt is a large island with relatively pristine vegetation and intact assemblages of native flora and fauna. The monitor population on the island has not been studied in detail; however, individuals are likely to move around the available habitat across the island. Offshore islands can be important to the overall genetic diversity of a species because the species is typically protected from some of the threats experienced on the mainland (NRETAS 2009).

Therefore, it is assumed for this assessment, that the population of the Mertens' Water Monitor on Groote Eylandt may be important to the species for the maintenance of genetic diversity.

Populations that are near the limit of the species range

The species is known to occupy coastal and inland waters across the far north of Australia from the Kimberley to the west side of Cape York Peninsula (Ward et al. 2006). In the NT it has been recorded across most of the Top End and the Gulf Region (Ward et al. 2006). The population of the Mertens' Water Monitor on Groote Eylandt is considered to be towards its northern geographic limit.

Conclusion

For the reasons outlined above, the population of the Mertens' Water Monitor that likely occur within the Stage 2 exploration program area is considered a subset, or small part of the Groote Eylandt population, which comprises an 'important population' as defined by the Significant Impact Guidelines.

Significant Impact Criteria

Lead to a long-term decrease in the size of an important population of a species

The exploration program will largely avoid impacting suitable breeding and foraging habitat for Mertens' Water Monitor that may occur within the Stage 2 exploration program area, such as waterways and riparian areas. This is achieved by designing the program to be a minimum of 100 m away from waterways, thereby avoiding impacts on aquatic habitat suitable for breeding and foraging by the Merten's Water Monitor.

Impacts will therefore be limited to adjacent riparian habitat that occurs more than 100 m from waterways, which may be removed as part of the establishment of drill pads and access tracks. In these areas, the disturbed areas will be rehabilitated following the cessation of the exploration program. Drill pads and access tracks are expected to regenerate relatively rapidly back into native vegetation over time. This has been confirmed by regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to previous exploration drilling, which found that woody species composition appears to regenerate rapidly following the cessation of disturbance.

Reduce the area of occupancy of an important population

This species is semi aquatic and is therefore restricted to coastal areas and vegetation communities adjacent to waterways (Ward et al. 2006). The availability of suitable habitat within the Southern Lease is reliant on seasonal water availability which is likely to be more restricted within the dry season when there is less water within the waterways. The exploration program will not impact water availability in the Southern Lease. Furthermore, the exploration program will largely avoid any suitable breeding and foraging habitat for Mertens' Water Monitor by restricting exploration to beyond 100 m from waterways. These areas will be confirmed as part of pre-clearance surveys to ensure adopted buffers from waterways are maintained.

Fragment an existing important population into two or more populations

Mertens' Water Monitor is a highly mobile species that is able to travel long distances in search of more suitable habitats in response to seasonal variability, and it will be able to cross the relatively narrow access tracks with

ease. The Mertens' Water Monitor has also previously been recorded within, and in close proximity, to areas subject to exploration activities within the Eastern Leases (Cumberland Ecology 2015).

The population of Mertens' Water Monitor is not likely to be fragmented as a result of the exploration program as riparian areas will largely be avoided by the exploration program.

Adversely affect habitat critical to the survival of a species

The riparian habitat across Groote Eylandt is considered to contain some critical habitat for the species. The exploration program will largely avoid any suitable breeding and foraging habitat for Mertens' Water Monitor by avoiding riparian habitat within 100 m of a waterway. The Stage 2 exploration program area may impact a small area of riparian habitat beyond 100 m of waterways, which is considered to constitute habitat critical to the survival of the species. This area is small and waterways and riparian habitats will be avoided where possible. As such, the habitat for the species within the Stage 2 exploration program area is unlikely to be adversely affected by the exploration program.

Disrupt the breeding cycle of an important population

The exploration program will largely avoid any suitable breeding and foraging habitat for the Mertens' Water Monitor as the Stage 2 exploration program area has been designed to be a minimum of 100 m from waterways. Pre-clearance surveys will ensure adopted buffers from waterways are maintained. Accordingly, the exploration program is unlikely to disrupt the breeding cycle of the population of Mertens' Water Monitor on Groote Eylandt.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Mertens' Water Monitor population of Groote Eylandt is unlikely to decline as a result of the exploration program. The exploration program will largely avoid any suitable breeding and foraging habitat for the Mertens' Water Monitor that may occur within the Stage 2 exploration program area, such as riparian areas within 100 m of a waterway.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

DENR and ALC (2019) have identified cane toads and pigs as posing a medium to very high threat to the Mertens' Water Monitor. Cane Toads are not present on Groote Eylandt, and GEMCO/South32 actively seek to ensure this invasive species is not inadvertently introduced to the island. GEMCO/South32 has a Cane Toad Management Plan which includes quarantine measures to protect Groote Eylandt from Cane Toads and the exploration program will not exacerbate this risk beyond current levels. Feral Pigs (*Sus scrofa*) are not established on the island and the exploration program does not involve activities that would result in the establishment of the species.

No other invasive species are considered likely to become established as a result of the exploration program.

Introduce disease that may cause the species to decline

Disease is not known to be a threat to this species and no disease that may affect it is present on Groote Eylandt. It is considered unlikely that the exploration program will introduce a disease that may cause the Mertens' Water Monitor to decline.

Interfere substantially with the recovery of the species

The exploration program is not expected to interfere substantially with the recovery of the Mertens' Water Monitor. The exploration program will result in the disturbance to small areas adjacent to riparian habitats occupied by this species, however, large areas of similar habitat which occur in the locality will remain and continue to provide high quality habitat for this species.

Conclusion

For the purposes of this assessment it is assumed that the occurrence of the Mertens' Water Monitor on Groote Eylandt is an important population. The exploration program will largely avoid any suitable breeding and foraging habitat for the Mertens' Water Monitor that may occur within the Stage 2 exploration program area by designing the program to be a minimum of 100 m from waterways. Pre-clearance surveys will ensure adopted buffer distances from waterways are maintained. The exploration program will result in the disturbance to small areas of riparian habitats that are located more than 100 m from waterways, however, large areas of similar habitat will remain and continue to provide high quality habitat for this species. The exploration program will not cause the establishment of invasive species to the island, and will not increase the risk of disease or interfere with the recovery of the species.

Accordingly, no significant impact is predicted to occur to Mertens' Water Monitor as a result of the exploration program.

4.7. Yellow-spotted Monitor

Scientific Name: *Varanus panoptes*

EPBC Act Status: Not listed

TPWC Act Status: Vulnerable

Important Population Assessment

Key source population either for breeding or dispersal

The NR Maps databases holds 18 records of the species in the existing mine from between 1976 and 2014. The species has also been recorded in 2014 during surveys of the Eastern Leases. The low number of records for the species is likely to be an artefact of the low number of monitor surveys completed on the island, and not being able to readily identify the species from camera data due to similar features to the Sand Goanna (*Varanus gouldii*), rather than reflecting the rarity of the monitor on Groote Eylandt. The majority of potential habitat on the island has not been surveyed. The location of Yellow-spotted Monitor records on Groote Eylandt, based on the NR Maps database and recent records by Cumberland Ecology (2015) are shown in

Figure 8. In some instances, the records held in the NR Maps database reflect the records from Cumberland Ecology (2015), and at these locations only the latter are visible in the figure. **Figure 8** does not show each individual record, given that in some cases there were multiple sightings of the Yellow-spotted Monitor at a single location, however only one of these records is shown in the figure.

The majority of vegetation communities across Groote Eylandt are considered to form potential habitat for this species. During surveys of the nearby Eastern Leases, the species was found in laterite woodland and forest habitat (Cumberland Ecology 2015).

Although the Yellow-spotted Monitor occurs widely across northern Australia, with the limited data available, it is assumed that the monitors on Groote Eylandt as a whole, constitute a distinct and important population. The individuals that potentially occur within the Stage 2 exploration program area are considered to comprise a subset, or small part of the Groote Eylandt population, which for the purposes of this assessment, is considered to be a key source population.

Populations that are necessary for maintaining genetic diversity

Groote Eylandt is a large island with relatively pristine vegetation and intact assemblages of native flora and fauna. The monitor population on the island has not been studied in detail; however, individuals are likely to move around the available habitat across the island. Offshore islands can be important to the overall genetic diversity of a species because the species is typically protected from some of the threats experienced on the mainland (NRETAS 2009).

Therefore, it is assumed for this assessment, that the population of the Yellow-spotted Monitor on Groote Eylandt may be important to the species for the maintenance of genetic diversity.

Populations that are near the limit of the species range

The Yellow-spotted Monitor has a broad geographic range across the far North of Australia from the Kimberley to Cape York Peninsula, and southwards through most of Queensland (Ward et al. 2012). In the NT, it has been recorded across most of the Top End and the Gulf Region (Ward et al. 2012). The population of the Yellow-spotted Monitor on Groote Eylandt is considered to be towards its northern geographic limit.

Conclusion

For the reasons outlined above, the population of the Yellow-spotted Monitor that likely occurs within the Stage 2 exploration program area is considered to comprise an 'important population' as defined by the Significant Impact Guidelines.

Significant Impact Criteria

Lead to a long-term decrease in the size of an important population of a species

The exploration program will reduce the area of potentially occupied habitat for this species by removing approximately 40 ha of forest and woodland habitat. The area of potential habitat to be removed constitutes a very small portion of the open forest and woodland on Groote Eylandt and the overwhelming majority of this habitat on the island would remain. Furthermore, drill pads and access tracks would be rehabilitated

following the exploration program. Regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to previous exploration drilling found that woody species composition appears to regenerate rapidly following the cessation of disturbance.

The Yellow-spotted Monitor is known to colonise mine rehabilitation sites and has been recorded from both mine rehabilitation at the existing GEMCO mine (Cumberland Ecology 2015) and in the existing GEMCO mine by URS (2012). Accordingly, the exploration program is unlikely to lead to a long-term decrease in the size of an important population of the species.

Reduce the area of occupancy of an important population

The exploration program will clear approximately 40 ha of open forest and woodland and, in the absence of rehabilitation, would marginally reduce the area of occupancy of an important population. However, this is very minor area considering the very large areas of similar habitat that will remain in the Southern Lease and island. Regeneration monitoring undertaken by Cumberland Ecology (2019a) within areas subject to previous exploration drilling found that woody species composition appears to regenerate rapidly following the cessation of disturbance. The species has also been recorded on mine rehabilitation sites at the existing GEMCO mine (Cumberland Ecology 2015). Overall, the exploration program is therefore unlikely to reduce the area of occupancy for this population.

Fragment an existing important population into two or more populations

The population of the Yellow-spotted Monitor is not likely to be fragmented as a result of the exploration program as the areas of vegetation to be removed are very small and large areas of suitable habitat for this species remain. The species is also highly mobile and is able to cross relatively narrow access tracks with ease and thereby access alternative habitat. In the long term, the impact areas will regenerate naturally from surrounding areas and replace the small areas of habitat removed.

Adversely affect habitat critical to the survival of a species

The habitat to be removed within the Stage 2 exploration program area includes approximately 40 ha of open forest and woodland which contains suitable habitat for this species. Extensive areas of foraging habitat will remain within the Southern Lease and across the island. In addition, the loss of foraging habitat should not be considered a permanent impact, given that cleared areas are expected to regenerate over time and provide suitable foraging habitat for this species in the long term. The habitat within the Stage 2 exploration program area is unlikely to be adversely affected by the exploration program.

Disrupt the breeding cycle of an important population

The exploration program will remove a relatively small area of potential breeding habitat, which is located within woodland and forest vegetation, which is expected to regenerate in the long term. Accordingly, the exploration program is unlikely to disrupt the breeding cycle of the population of the Yellow-spotted Monitor on Groote Eylandt.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Yellow-spotted Monitor population of Groote Eylandt is unlikely to decline as a result of habitat modified or removed for the exploration program. The Yellow-spotted Monitor is known to colonise disturbed areas having been recorded within mine rehabilitation at the existing GEMCO mine (Cumberland Ecology 2015) and in the existing GEMCO mine by URS (2012). The exploration program will remove only a very small area of potential habitat for this species, and large areas of similar habitat within the Southern Lease and across the island will remain and continue to provide high quality habitat for this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

DENR and ALC (2019) have identified cane toads and pigs as posing a medium to very high threat to the Yellow-spotted Monitor. Cane Toads are not present on Groote Eylandt, and GEMCO/South32 actively seek to ensure this invasive species is not inadvertently introduced to the island. GEMCO/South32 has a Cane Toad Management Plan which includes quarantine measures to protect Groote Eylandt from Cane Toads and the exploration program will not exacerbate this risk beyond current levels. Feral Pigs (*Sus scrofa*) are not established on the island and the exploration program does not involve activities that would result in the establishment of the species.

No other invasive species are considered likely to become established as a result of the exploration program.

Introduce disease that may cause the species to decline

Disease is not known to be a threat to this species and no disease that may affect it is present ion Groote Eylandt. It is therefore considered unlikely that the exploration program will introduce a disease that may cause the Yellow-spotted Monitor to decline.

Interfere substantially with the recovery of the species

The exploration program is not expected to interfere substantially with the recovery of the Yellow-spotted Monitor. The exploration program will result in the removal of small areas of habitat for this species, however, large areas of similar habitat occur in the locality that will remain and continue to provide high quality habitat for this species. Furthermore, cleared areas are expected to regenerate over time to open forest and woodland habitats that will provide suitable habitat for this species in the long term.

Conclusion

For the purposes of this assessment it is assumed that the occurrence of the Yellow-spotted Monitor on Groote Eylandt is an important population. The exploration program will result in the removal of approximately 40 ha of foraging habitat for the species. The areas disturbed by the exploration program to create drill pads and access tracks are expected to regenerate into native vegetation in the long term. The exploration program will not cause the establishment of invasive species to the island, and will not increase the risk of disease or interfere with the recovery of the species.

Accordingly, no significant impact is predicted to occur to the Yellow-spotted Monitor as a result of the exploration program.

4.8. Fork-tailed Swift

Scientific Name: *Apus pacificus*

EPBC Act Status: Migratory

TPWC Act Status: Not Listed

Important Habitat Assessment

Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species

The Fork-tailed Swift occurs across the entire mainland and is also found on various offshore islands. It has broad habitat preferences, and is typically found in forest and woodland habitat, which is the main habitat type across Groote Eylandt. This bird species are likely to forage in the forest and woodland areas of the Stage 2 exploration program area, and these habitats are widespread across the island. Therefore, the Stage 2 exploration program area would not support an ecologically significant proportion of the population of this species. The location of Fork-tailed Swift records on Groote Eylandt are shown in **Figure 9**.

Habitat that is of critical importance to the species at particular life-cycle stages

This species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher, mostly over inland plains but sometimes above foothills or in coastal areas (DAWE 2020a). There is potential fly-over habitat for this species above the vegetation within Stage 2 exploration program area and it is expected to forage aerially about these areas on occasion. Foraging habitat is not of critical importance to the occurrence of the species as a whole on Groote Eylandt. No breeding habitat is present within the Stage 2 exploration program area (and Groote Eylandt) as breeding occurs outside of Australia.

Habitat utilised by a migratory species which is at the limit of the species range

The Fork-tailed Swift occurs throughout much of mainland Australia and offshore islands. None of the habitat within the Stage 2 exploration program area is at the limit of the range for this species.

Habitat within an area where the species is declining

Groote Eylandt is not reported to be an area where the species is declining. Suitable habitat for the Fork-tailed Swift is relatively pristine across the majority of Groote Eylandt.

Conclusion

For the reasons outlined above, the Stage 2 exploration program area is not considered to be an important habitat for the Fork-tailed Swift as defined by the Significant Impact Guidelines.

Significant Impact Criteria

Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The habitat within the Stage 2 exploration program area is not considered an important habitat for the Fork-tailed Swift.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

The habitat within the Stage 2 exploration program area is not considered important habitat for the Fork-tailed Swift.

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

As stated above, the Stage 2 exploration program area (and Groote Eylandt) is not considered to support an ecological significant proportion of the population of the Fork-tailed Swift.

Conclusion

Habitat within the Stage 2 exploration program area does not provide important habitat for the Fork-tailed Swift and is not considered to support an ecologically significant proportion of the population of this species.

Accordingly, no significant impact is predicted to occur to the Fork-tailed Swift as a result of the exploration program.

4.9. Salt-water Crocodile

Scientific Name: *Crocodylus porosus*

EPBC Act Status: Migratory

TPWC Act Status: Not Listed

Important Habitat Assessment

Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species

The Salt-water Crocodile occurs widely throughout the coastal areas of northern Australia, typically inhabiting reef, coastal and inland waterways. Small numbers of animals occur in the waterways of the Southern Lease, but these would represent a very small proportion of the overall population of the species on Groote Eylandt, as crocodiles occur in all major waterways on the island, in lagoons and around the coastline. Therefore, the Stage 2 exploration program area would not support an ecologically significant proportion of the population of this species. The location of Salt-water Crocodile records on Groote Eylandt are shown in **Figure 10**. The

low number of records for the species is likely to be an artefact of the low number of crocodile surveys completed on the island, rather than reflecting the rarity of the Salt-water Crocodile on Groote Eylandt.

Habitat that is of critical importance to the species at particular life-cycle stages

The Salt-water Crocodile was recorded incidentally within and in close proximity to the Southern Lease at Leske Pools and at the mouth of Salt Creek by Cumberland Ecology (2016), as well as at two locations during recent aquatic surveys within the Study Area by C&R (2019). Salt-water Crocodiles are known to breed in the larger and more permanent sections of the waterways that occur in the Southern Lease. While such waterways could be used for breeding by some animals, such habitat is not of critical importance to the occurrence of the species as a whole on Groote Eylandt. Moreover, such areas do not occur within the Stage 2 exploration program area, which has been designed to be a minimum of 100 m from major waterways.

Habitat utilised by a migratory species which is at the limit of the species range

The distribution of the Salt-water Crocodile ranges from Rockhampton in Queensland, throughout coastal NT to King Sound (near Broome) in Western Australia (DAWE 2020b). None of the habitat within the Stage 2 exploration program area is at the limit of the range for this species.

Habitat within an area where the species is declining

Groote Eylandt is not reported to be an area where the species is declining. Suitable habitat for the Salt-water Crocodile is relatively pristine across the majority of Groote Eylandt.

Conclusion

For the reasons outlined above, the Southern Lease (including the Stage 2 exploration program area) is not considered to be important habitat for the Salt-water Crocodile as defined by the Significant Impact Guidelines.

Significant Impact Criteria

Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The habitat within the Stage 2 exploration program area is not considered important habitat for the Salt-water Crocodile.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

The habitat within the Stage 2 exploration program area is not considered important habitat for the Salt-water Crocodile.

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

As stated above, the Stage 2 exploration program area (and Groote Eylandt) is not considered to support an ecological significant proportion of the population of the Salt-water Crocodile.

Conclusion

The Stage 2 exploration program area does not provide important habitat for the Salt-water Crocodile and is not considered to support an ecologically significant proportion of the population of this species.

Accordingly, no significant impact is predicted to occur to the Salt-water Crocodile as a result of the exploration program.

4.10. Brush-tailed Rabbit-rat and Northern Hopping-mouse

The Brush-tailed Rabbit-rat and Northern Hopping-mouse occur on Groote Eylandt. Records of each species on Groote Eylandt are shown on **Figure 11** and **Figure 12**. The Northern Hopping-mouse is listed as Vulnerable under the EPBC Act and the TPWC Act. The Brush-tailed Rabbit-rat is listed as Vulnerable under the EPBC Act and Endangered under the TPWC Act.

In 2017, the proponent undertook a large scale research project (termed "Small Mammal Research Project"), in consultation with DENR, to confirm the presence and habitat preferences of the Northern Hopping-mouse and Brush-tailed Rabbit-rat within the Southern Lease. The research project comprised detailed camera surveys, between August 2017 and August 2018, at 152 locations within and adjacent to the Southern Lease. Sampling was undertaken across a range of habitat types, with varying fire histories. The research project represents a rigorous assessment that is supported by a robust data set. Although over 1.58 million images were obtained, including almost 200,000 images from fauna triggers, no individuals of the Northern Hopping-mouse or Brush-tailed Rabbit-rat were recorded. It was concluded that there is a low probability of occurrence for the two species in the area studied, which includes the Stage 2 exploration program area. However, it was noted that there is still some potential for one or both species to be present in low numbers in areas that were not specifically sampled, such as to the east of the Innokumanja River.

Given this finding, an Assessment of Significance has not been prepared for these two species. The criteria outlined in the Significant Impact Guidelines are based on the assumption that the species is present, or likely to be present, in the area that will be impacted by an action. Many of the criteria cannot be responded to in a meaningful way for species that may not be present in the area to be impacted. Although an Assessment of Significance has not been provided, **Chapter 2** of this report outlines the potential impacts of the exploration program to biodiversity values and **Chapter 3** describes proposed mitigation measures. Key points from these sections, as relevant to the Northern Hopping-mouse and Brush-tailed Rabbit-rat, are provided below.

The exploration program has been planned to reduce the clearing footprint as far as possible and avoid environmentally sensitive areas. As part of this planning process, a potential exploration area has been delineated, which represents the maximum extent of future exploration within the Southern Lease (**Figure 2**). This area avoids the most environmentally and culturally sensitive areas. In restricting exploration to this area, approximately 7,500 ha of the potential mineralised area has been excised from future drilling programs. This is a key measure for reducing potential impacts on any fauna species that may be present in the Southern Lease.

Clearing for the exploration program has been restricted to the minimum area necessary to safety undertake the work, with a total of approximately 40 ha proposed to be cleared. This represents 0.15% of the Southern Lease.

As detailed in ***Section 3.2.1***, a pre-clearance survey will be undertaken prior to any clearing. It will ensure that buffers from sensitive areas (e.g. waterways) are maintained and will also identify specific habitat features for threatened species. In particular, the pre-clearance survey includes a search for pop holes and spoil heaps that may be indicators of the presence of the Northern Hopping-mouse. If two or more pop holes and spoil heaps are found within 200 m^2, cameras will be installed to determine if the Northern Hopping-mouse is present and a buffer of at least 100 m will be established if the species is located. The pre-clearance survey also includes flagging trees that contain hollows. Hollows may be used by a variety of fauna species, including the Brush-tailed Rabbit-rat. The trees are tapped before being felled to encourage any animal using the hollow to vacate and trees are felled with hollows facing upwards, where possible, to enable the continued use of the felled tree. The inclusion of these measures in the pre-clearance survey represents a conservative, precautionary approach, given that the Northern Hopping-mouse and Brush-tailed Rabbit-rat have not been recorded in the Southern Lease.

As detailed in ***Section 3.2.3***, disturbed areas are closed and rehabilitated and monitoring of rehabilitated drill pads and tracks on Groote Eylandt has shown that vegetation re-establishes rapidly. The clearing that is required as part of the exploration program should not, therefore, be viewed as a permanent impact on habitat. ***Section 2.2*** discusses indirect impacts (e.g. introduction of weeds, changes to fire frequency) and describes the measures that will be adopted to minimise indirect impacts. This section concludes that the project is not anticipated to give rise to significant indirect impacts. Therefore any indirect impacts that may impact the Northern Hopping-mouse or Brush-tailed Rabbit-rat are not considered to be significant.

5. Conclusion

The Stage 2 exploration program will remove approximately 40 ha of open forest and woodland vegetation within the Southern Lease. The program also has the potential to increase the risk of introducing or accelerating the introduction of key threatening processes including indirect impacts, such as habitat fragmentation, introduction of invasive species and altered fire regimes. Both direct and indirect impacts are relevant to the threatened and migratory fauna species known from, or potentially occurring within, the Stage 2 exploration program area.

The following threatened fauna species that are present or have a moderate or high potential to be present have been assessed in accordance with the Significant Impact Guidelines:

- Masked Owl (northern) (*Tyto novaehollandiae kimberli*);
- Ghost Bat (*Macroderma gigas*);
- Mertens' Water Monitor (*Varanus mertensi*); and
- Yellow-spotted Monitor (*Varanus panoptes*).

The Northern Quoll has been assessed in accordance with the Northern Quoll Referral Guideline. This is the only species potentially impacted that has a species-specific guideline available.

A discussion of the potential impacts has been provided for the Brush-tailed Rabbit-rat (*Conilurus penicillatus*) and Northern Hopping-mouse (*Notomys aquilo*).

The following migratory species have also been assessed in accordance with the Significant Impact Guidelines:

- Fork-tailed Swift (*Apus pacificus*); and
- Salt-water Crocodile (*Crocodylus porosus*).

For all threatened or migratory species, it was concluded that the potential direct and indirect impacts of the exploration program is unlikely to have a significant impact on the species.

Key factors considered in the assessment include the following avoidance and mitigation measures that will be adopted for the exploration program:

- Exploration activities will be located:
    - A minimum of 100 m from waterways and wetlands;
    - A minimum of 100 m from monsoonal vine thicket;
    - A minimum of 100 m from white rock areas; and
    - To the west of the Amagula River;
- Direct impacts will be minimised as much as practical to approximately 40 ha;
- Pre-clearance procedures will be implemented targeting threatened fauna species and their habitats;

- Exploration tracks will be closed after cessation of use for drilling activities;
- Rehabilitation of cleared areas will be undertaken following the completion of each season of exploration drilling, and before the onset of the wet season. Rehabilitated areas will be inspected approximately 6-12 months later to confirm that vegetation is regenerating, that no weeds are present, and that exploration tracks are no longer in use; and
- Weed management will be undertaken throughout all stages of the exploration program, including during pre-clearing activities, drilling activities and rehabilitation activities and monitoring.

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Ward, S., J. Woinarski, and L. McKay. 2006. Threatened Species of the Northern Territory MERTENS WATER MONITOR *Varanus mertensi in* Department of Natural Resources Environment and the Arts, editor., Darwin.

FIGURES

SOUTHERN LEASE EXPLORATION PROGRAM

Location Plan

FIGURE 1

SOUTH32

I:\...\20003\Figures\RP2\20200408\Figure 1. Location plan

Figure 1. Location plan

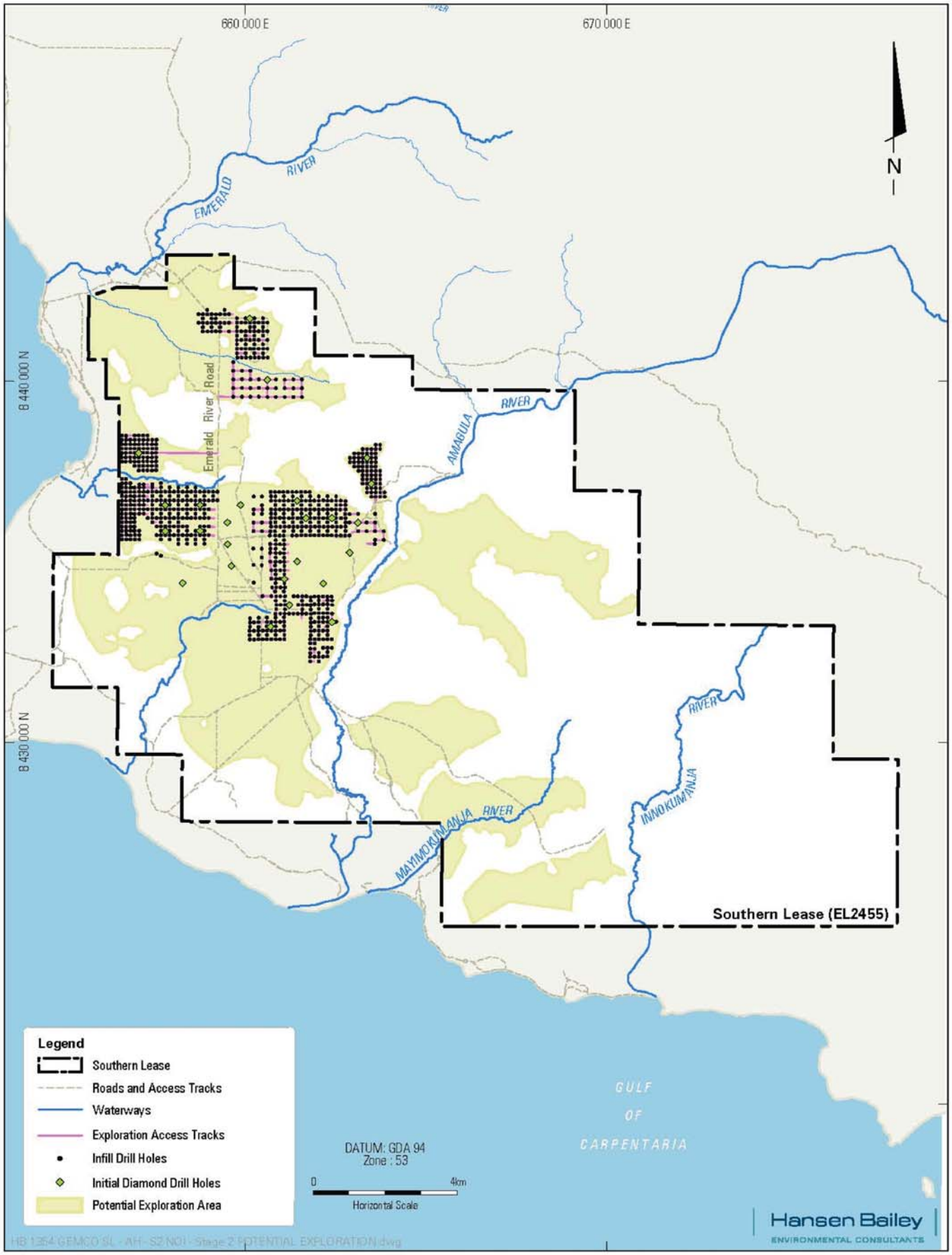
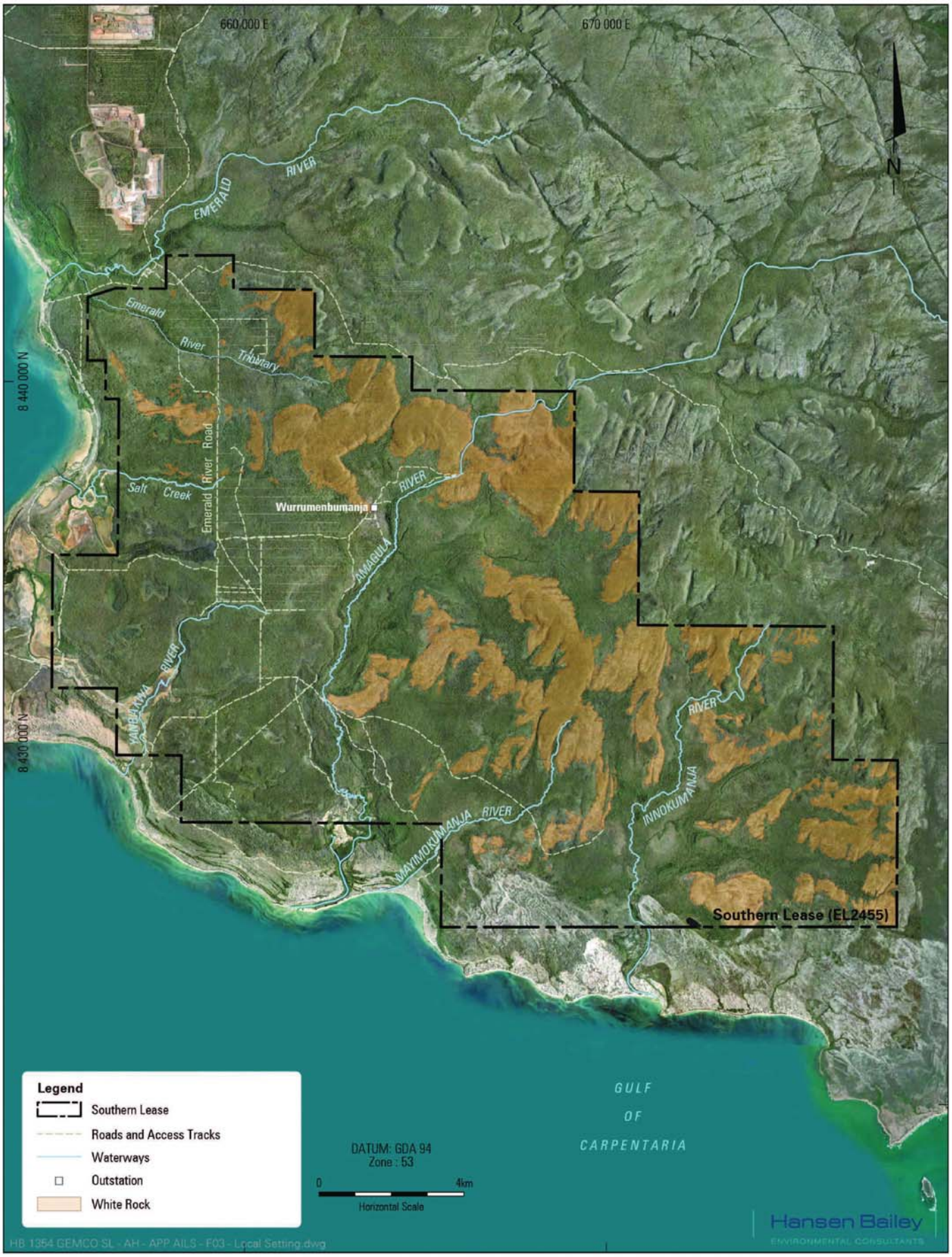


Figure 2. Layout of Stage 2 Exploration Program



SOUTHERN LEASE EXPLORATION PROGRAM

Local Setting

FIGURE 3

SOUTH32

I:\...\20003\Figures\RP2\20200515\Figure 3. Local setting

Figure 3. Local setting

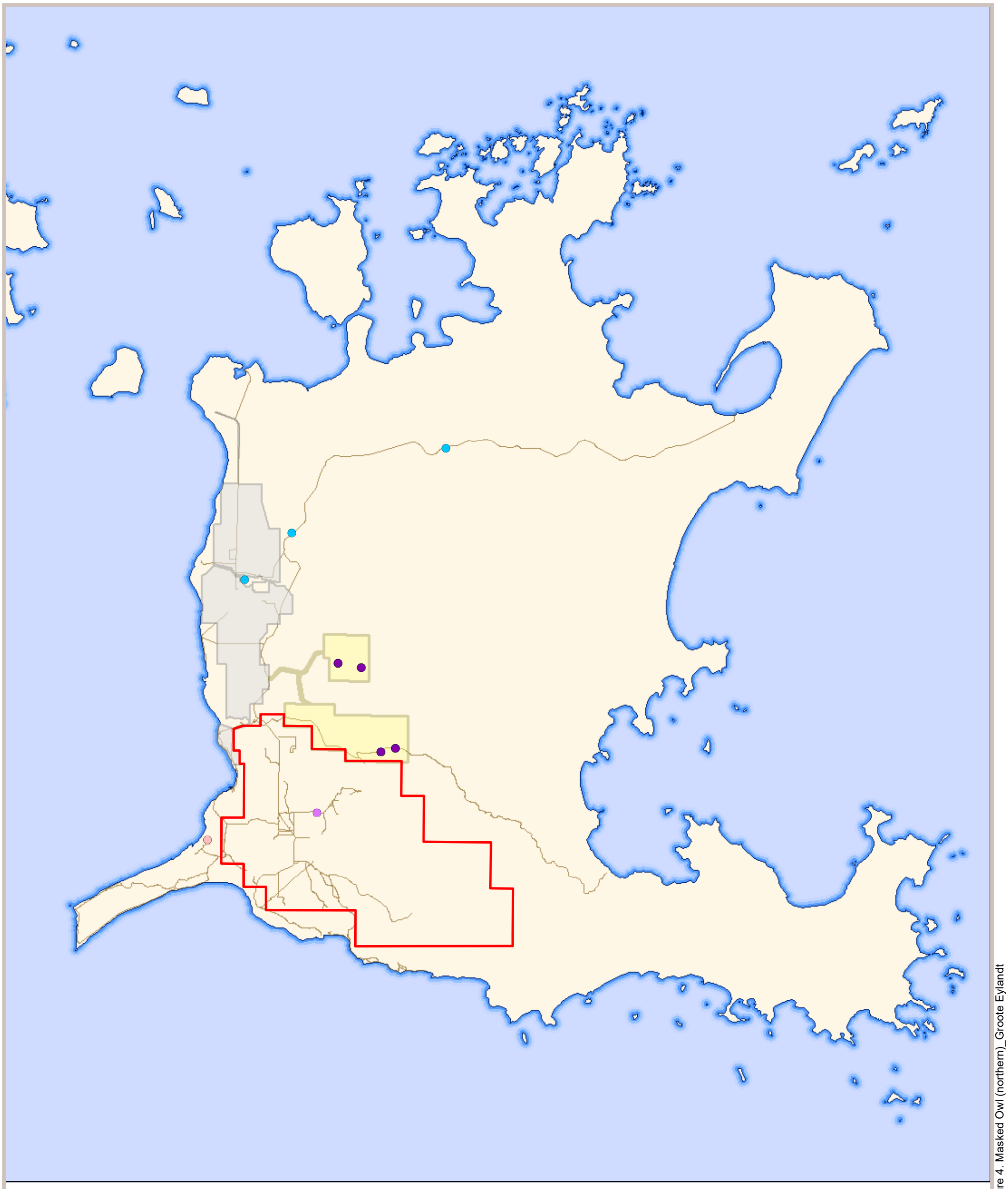


Figure 4. Location of Masked Owl (northern) records on Groote Eylandt

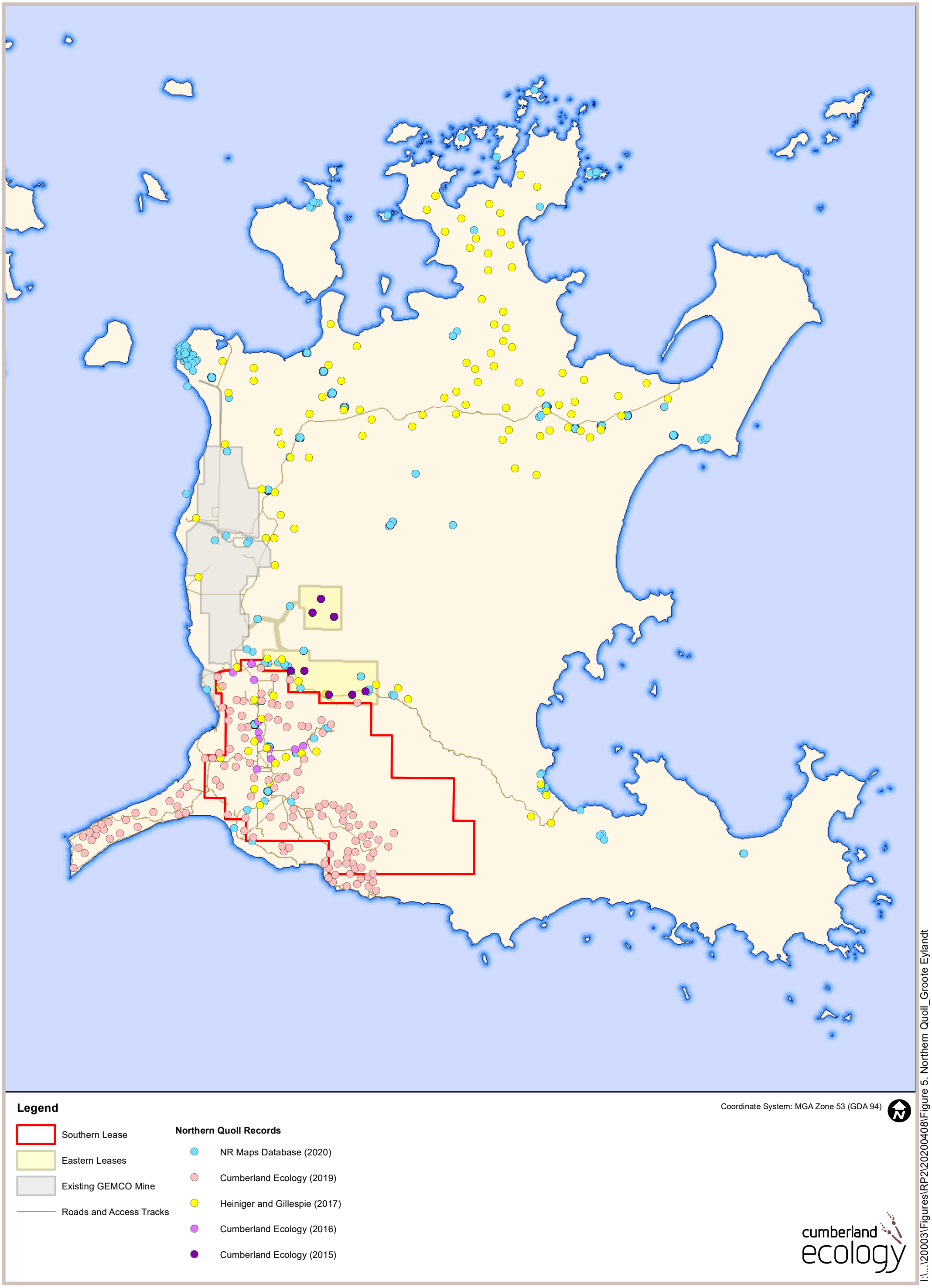


Figure 5. Location of Northern Quoll records on Groote Eylandt

Legend

Southern Lease

Eastern Leases

Existing GEMCO Mine

Roads and Access Tracks

Ghost Bat Records

NR Maps Database (2020)

Diete et al. (2015)

Coordinate System: MGA Zone 53 (GDA 94)

cumberland ecology

0 5 10 15 20 km

I:\...\20003\Figures\RP2\20200408\Figure 6. Ghost Bat_Groote Eylandt

Figure 6. Location of Ghost Bat records on Groote Eylandt

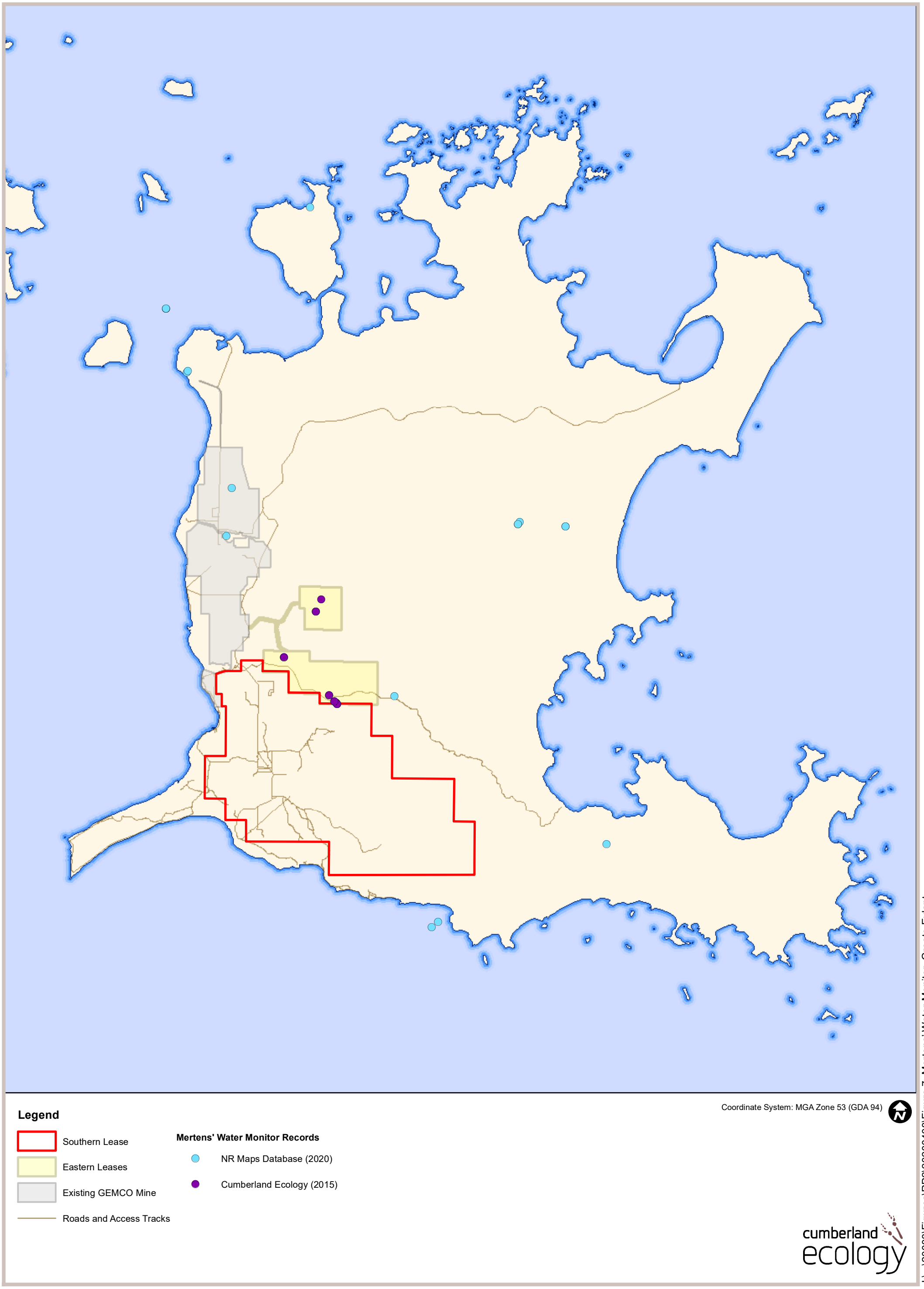


Figure 7. Location of Mertens' Water Monitor records on Groote Eylandt

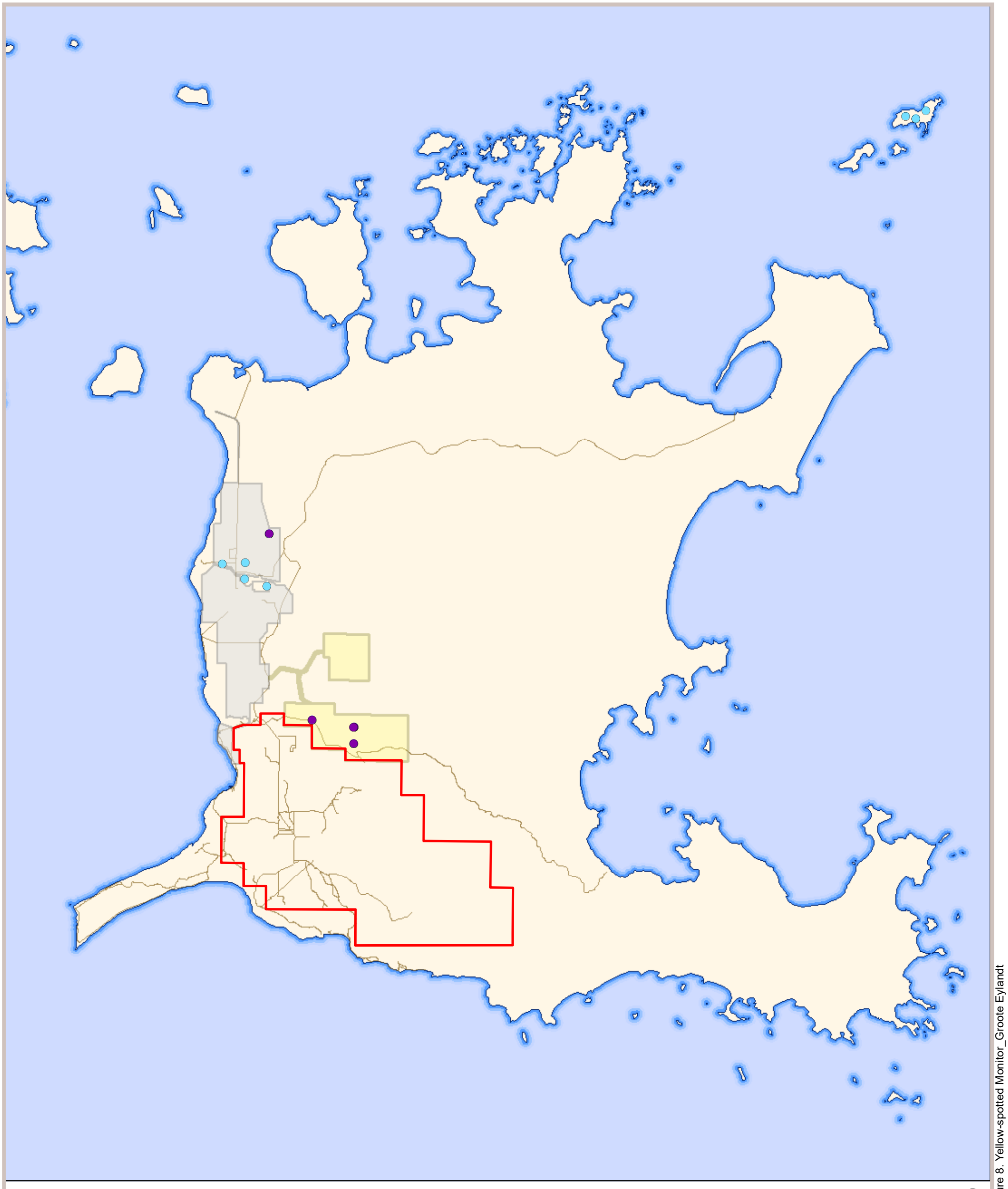


Figure 8. Location of Yellow-spotted Monitor records on Groote Eylandt

Legend

Southern Lease

Eastern Leases

Existing GEMCO Mine

Roads and Access Tracks

Fork-tailed Swift Records

NR Maps Database (2020)

Coordinate System: MGA Zone 53 (GDA 94)

cumberland ecology

0 5 10 15 20 km

I:\...\20003\Figures\RP2\20200408\Figure 9. Fork-tailed Swift_Groote Eylandt

Figure 9. Location of Fork-tailed Swift records on Groote Eylandt

Legend

Southern Lease

Eastern Leases

Existing GEMCO Mine

Roads and Access Tracks

Salt-water Crocodile Records

NR Maps Database (2020)

C&R (2019)

Cumberland Ecology (2016)

Cumberland Ecology (2015)

Coordinate System: MGA Zone 53 (GDA 94)

cumberland ecology

0 5 10 15 20 km

I:\...\20003\Figures\RP2\20200415\Figure 10. Salt-water Crocodile_Groote Eylandt

Figure 10. Location of Salt-water Crocodile records on Groote Eylandt

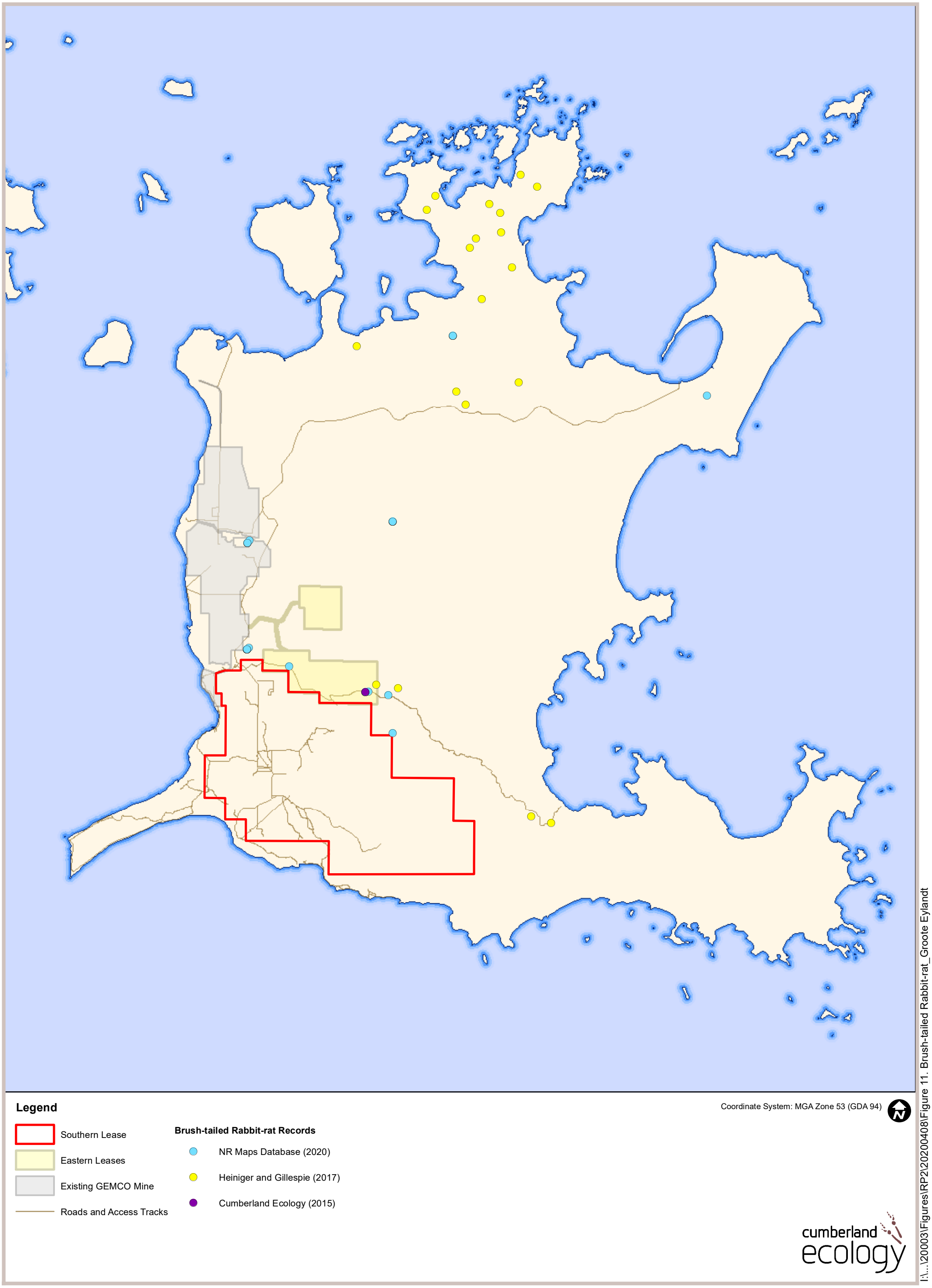


Figure 11. Location of Brush-tailed Rabbit-rat records on Groote Eylandt

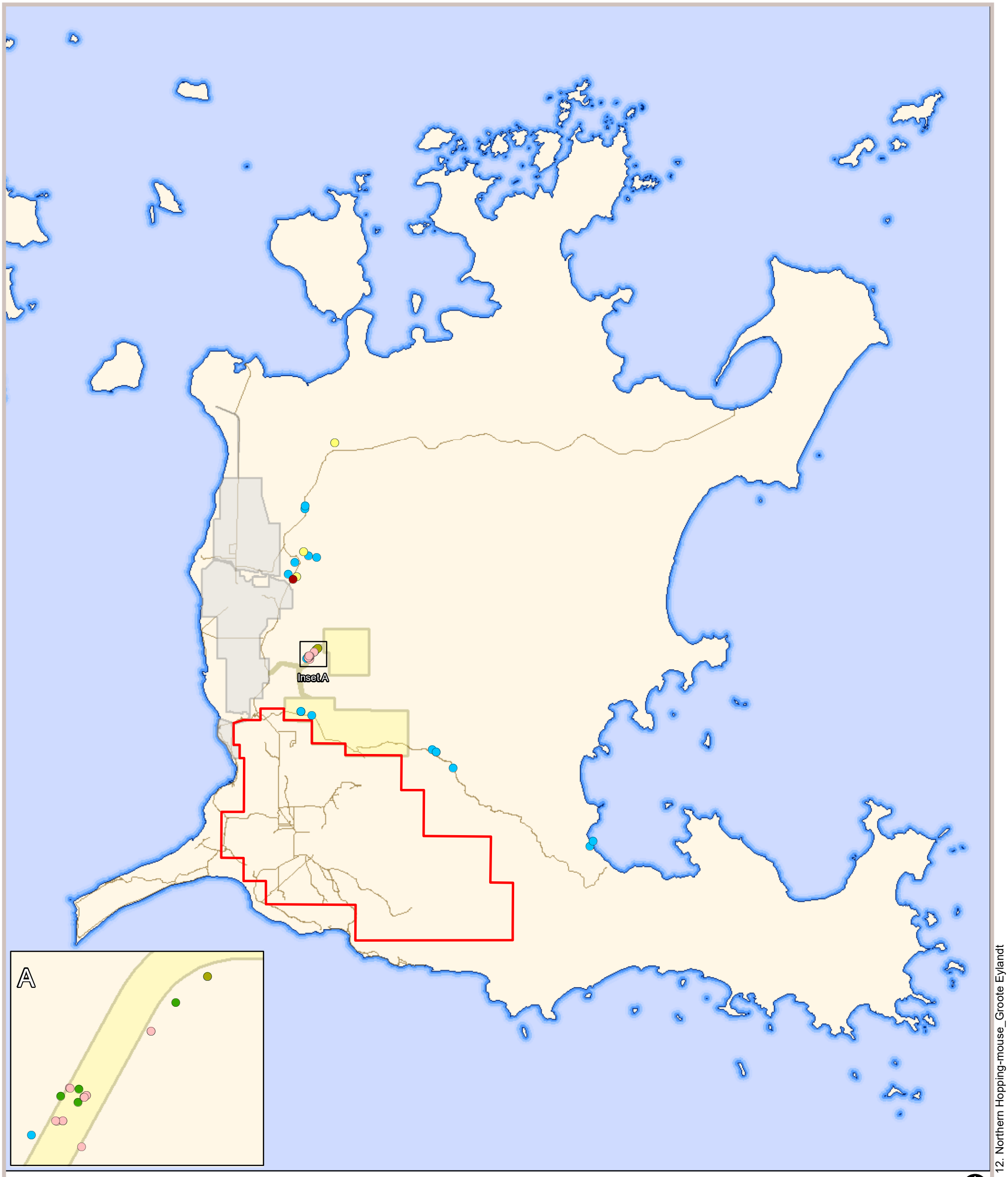


Figure 12. Location of Northern Hopping-mouse records on Groote Eylandt