

4



Terrestrial Ecosystems



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4 TERRESTRIAL ECOSYSTEMS

4.1 INTRODUCTION

This section addresses the following environmental factor and objective from the *Northern Territory Environment Protection Authority Environmental Factors and Objectives* guideline (NT EPA, 2022):

THEME	FACTOR	ENVIRONMENTAL OBJECTIVE
LAND	TERRESTRIAL ECOSYSTEMS	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

This section provides a summary of the key findings of the terrestrial ecology assessment undertaken for the Southern Lease Exploration Program (2023-2025) (the exploration program). It describes the biodiversity values in the Southern Lease and the exploration program disturbance footprint, the potential impacts of the exploration program, and the avoidance and mitigation measures to be adopted. This section draws on information from the following three specialist ecology reports that have been prepared by Cumberland Ecology:

- *Baseline Terrestrial Ecology Report* (Appendix A). This report documents the findings of the baseline terrestrial ecology assessment of the Southern Lease.
- *Assessment of Impacts on Listed Species Report* (Appendix B). This report provides an assessment of the potential impacts of the exploration program on listed species, and accompanies the *Baseline Terrestrial Ecology Report* (Appendix A).
- *2021 Camera Fauna Monitoring Program Report* (Appendix C). This report provides the results of a camera monitoring program undertaken to assess the impacts of exploration activities on the Northern Quoll (*Dasyurus hallucatus*) and Feral Cat (*Felis catus*). The results of this monitoring program have assisted with informing an assessment of impacts.

As discussed in Section 2 – Project Description, the exploration program includes undertaking exploration drilling, geotechnical investigations, and access track development within an area in the north-west part of the Southern Lease. Figure 4-1 shows the disturbance footprint associated with the exploration program, which has been designed to avoid the most environmentally sensitive parts of the Southern Lease (refer Section 2 – Project Description).

4.2 REGULATORY REQUIREMENTS

4.2.1 Key Regulatory Requirements of the Federal Government

EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) prescribes the Federal Government’s role in environmental assessment, biodiversity conservation and the management of protected Matters of National Environmental Significance (MNES). MNES include listed threatened species and migratory species. The Department of Climate Change, Energy, the Environment and Water (DCCEEW) is the administering authority for the EPBC Act.



Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES is termed a “controlled action” and is subject to assessment and approval under the EPBC Act.

Threatened and migratory species listed under the EPBC Act have been included in this assessment.

EPBC Act Guidance Materials

A variety of documents have been produced in accordance with the requirements of the EPBC Act to provide guidance on listed threatened and migratory species, key threatening processes that may impact those species, and survey techniques for the species. In addition, recovery plans and conservation advice are available for many species. These documents were consulted in assessing the baseline ecology values and the potential impacts on EPBC Act listed species

4.2.2 Key Northern Territory Legislation and Guidelines

Territory Parks and Wildlife Conservation Act

The *Territory Parks and Wildlife Conservation Act 1976* (NT) (TPWC Act) is the principal legislation that provides for the protection and conservation of the Northern Territory’s biodiversity. The TPWC Act classifies threatened flora and fauna into a number of conservation categories, including Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, and Least Concern. These categories are based on the recognition of how threatened a species is, and what action needs to be taken to protect it. The TPWC Act also provides for the classification and control of feral animals; permits for taking wildlife and entering land; designation and management of protected areas; and private sanctuaries. The TPWC Act is administered by the Department of Parks and Water Security (DEPWS).

No permits are required under this Act for clearing associated with the exploration program, given the program will be authorised under the *Mining Management Act 2001* (NT).

Weeds Management Act

The *Weeds Management Act 2001* (NT) (WM Act), which is administered by DEPWS, makes provision for the control and eradication of declared weeds in the Northern Territory. Weeds that have been identified impacting the Northern Territory’s economic, environmental, cultural and social values are declared under the WM Act. Some declared weed species in the Northern Territory are also subject to “Statutory Weed Management Plans” which are legal documents that describe the necessary actions to manage high priority weeds.

Weed management measures to be implemented for the exploration program are discussed in Section 4.6.2.

Land Clearing Guidelines

The *Land Clearing Guidelines – Northern Territory Planning Scheme* (DEPWS, 2021a) (Land Clearing Guidelines) establish standards for native vegetation clearing approved under the *Planning Act 1999* (NT) (Planning Act). The guidelines are administered by DEPWS and the Northern Territory Department of Infrastructure, Planning and Logistics, and seek to manage clearing in a way that promotes the net benefit from the use of land that is cleared of native vegetation. The guidelines also identify native vegetation that is sensitive and/or significant. Sensitive vegetation is a term in the Land Clearing Guidelines applied to ecosystems easily impacted by neighbouring or adjacent land uses or management. Significant vegetation is a term applied to spatially restricted habitat types that are important to a relatively large number of wildlife species (DEPWS, 2021a). Sensitive or significant vegetation can include rainforest, monsoon vine forest or vine thicket, sandsheet heath, riparian vegetation, mangroves, wetlands, and vegetation containing large trees with hollows suitable for fauna.



Mining and exploration activities are controlled by the *Mining Management Act 2001* (NT) rather than the Planning Act. As such, these activities are not required to formally consider the Land Clearing Guidelines. Nevertheless, there are sections of the guidelines that provide useful information on minimising the impact of environmental degradation resulting from clearing of native vegetation.

4.3 METHODOLOGY

4.3.1 Overview

This section describes the methodology adopted for the terrestrial ecology assessment. The methodology has included:

- Desktop assessments, including database searches;
- Review of relevant field surveys that have been undertaken within the Southern Lease and vicinity;
- Undertaking a likelihood of occurrence assessment for listed species identified in database searches or field surveys to determine their potential to occur within the Southern Lease and/or disturbance footprint;
- Mapping major habitat types; and
- Assessing impacts, including undertaking an assessment of impacts on listed species using relevant guidelines, including the *Matters of National Environmental Significance. Significant Impact Guidelines 1.1* (DotE, 2013) (the Significant Impact Guidelines).

4.3.2 Desktop Assessment

A desktop assessment was undertaken to obtain background information on the potential presence and distribution of species and ecological communities (particularly those listed under the TPWC Act and EPBC Act), and to determine potential habitat values. The desktop study involved:

- Database searches including the Northern Territory Natural Resource Maps (NR Maps) database and the EPBC Act Protected Matters Search Tool (PMST).
- Review of available literature, including government reports, and reports prepared on behalf of the proponent (Groote Eylandt Mining Company Pty Ltd (GEMCO)). Numerous ecological studies have been conducted within and in proximity to the Southern Lease, including several recent detailed flora and fauna investigations. A full list of the ecological surveys reviewed as part of the baseline ecology assessment is included in the *Baseline Terrestrial Ecology Report* (Appendix A). A brief overview of the most relevant reports is provided in Section 4.3.3.
- Review of mapping of Threatened Ecological Communities (TECs) in the Northern Territory.
- Review and interpretation of recent high-resolution aerial photography and topographic information.
- Review of published DEPWS vegetation mapping (DENR, 2018).
- Review of published geological and soils mapping.



4.3.3 Field Surveys

A substantial number of recent (2016-2022) terrestrial ecology field surveys have been undertaken in the Southern Lease. These included two large scale research projects, which were designed by DEPWS and undertaken to provide information to inform the assessment of impacts of exploration on threatened species. In addition to these research projects, several general field surveys and pre-clearance surveys have been undertaken and have provided data on the terrestrial biodiversity values in the Southern Lease.

The proponent recently initiated work on a Pre-feasibility Study for a potential future mining project in the Southern Lease. As part of this, additional flora and fauna surveys were undertaken in 2021 and 2022 and are continuing into 2023. These surveys have provided further data on ecological values in the Southern Lease.

Table 4-1 provides a summary of these studies and the information that they have provided. Further detail on these studies is provided in the *Baseline Terrestrial Ecology Report* (Appendix A).

Table 4-1 Terrestrial Ecology Field Surveys Undertaken (2016-2022)

FIELD SURVEY	METHODOLOGY	INFORMATION PROVIDED
<p>Baseline Terrestrial Ecology Assessment (Cumberland Ecology, 2016)</p>	<p>Cumberland Ecology undertook a baseline terrestrial ecology assessment of the western part of the Southern Lease in May 2016. The field survey comprised a terrestrial flora and fauna survey, which was designed to comply with relevant Northern Territory and Commonwealth guidelines.</p> <p>The terrestrial flora survey component included vegetation mapping and threatened flora searches.</p> <p>The terrestrial fauna survey component included:</p> <ul style="list-style-type: none"> ● Elliott, cage, pitfall and funnel trapping targeting mammals, reptiles and frogs; ● Bird census (diurnal and nocturnal bird counts); ● Active searches, targeting reptiles, amphibians and mammals; ● Ultrasonic call detection surveys for microchiropteran bats; ● Harp trapping for microbats; ● Spotlighting along major tracks from a slow-moving vehicle targeting birds, mammals and reptiles; ● Motion-sensor cameras, targeting small, trap shy ground-dwelling fauna; ● Incidental observations throughout the study area; and ● Habitat assessments. <p>The study area and survey sites for the baseline terrestrial ecology assessment is shown in Figure 4-2.</p>	<p>This assessment provided an understanding of the flora and fauna values of the study area (i.e. the western part of the Southern Lease), including:</p> <ul style="list-style-type: none"> ● Distribution and descriptions of vegetation communities; ● Flora and fauna diversity; ● Fauna habitats present; ● Occurrence of threatened species, including the Masked Owl (northern) (<i>Tyto novaehollandiae kimberli</i>) and Northern Quoll; and ● Occurrence of introduced and invasive species.



FIELD SURVEY	METHODOLOGY	INFORMATION PROVIDED
<p>Small Mammal Research Project (Cumberland Ecology, 2019)</p>	<p>Cumberland Ecology undertook a Small Mammal Research Project within the Southern Lease and surrounds between 2017 and 2018. The project was designed in consultation with DEPWS (then the Department of Environment and Natural Resources (DENR)) to obtain an understanding of the occurrence and habitat preferences of two threatened species, the Northern Hopping-mouse (<i>Notomys aquilo</i>) and the Brush-tailed Rabbit-rat (<i>Conilurus penicillatus</i>). The design of the study also enabled collection of information on habitat types and a suite of other fauna species. The project included field surveys undertaken at 152 survey sites, stratified according to habitat types and time since fire.</p> <p>Field surveys included the following at each survey site:</p> <ul style="list-style-type: none"> ● Four motion-sensor cameras and bait stations (two with and two without drift fences), with cameras left to record for a minimum of 28 days; ● A 50 x 50 m habitat assessment quadrat to collect photographs, vegetation descriptions, evidence of fire, tree circumferences, log lengths/circumferences, vegetation cover, and soil information; and ● Four 20 x 20 m Northern Hopping-mouse burrow search quadrats. <p>The study area and survey sites for the Small Mammal Research Project is shown in Figure 4-2.</p>	<p>This research project yielded approximately 26,000 trap nights of data, and 74 fauna species were identified to species level. The assessment also provided information on the following:</p> <ul style="list-style-type: none"> ● Habitat types; ● Fauna diversity; ● Occurrence of threatened species within the Southern Lease and surrounds, including the Masked Owl (northern) and Northern Quoll; ● Occurrence of introduced and invasive fauna species; and ● Fire history. <p>No records of the target species were obtained, and it was concluded that this was due to the absence of these species in the areas surveyed. The Small Mammal Research Project included survey sites within the disturbance footprint and, based on the findings of this research project, neither the Brush-tailed Rabbit-rat or Northern Hopping-mouse are likely to be present in the disturbance footprint.</p>
<p>Western Leases Baseline Vegetation Survey (Cumberland Ecology, 2021)</p>	<p>Cumberland Ecology undertook a baseline vegetation survey within the existing GEMCO mine (i.e. the Western Leases) and surrounding areas on Groote Eylandt between 2018 and 2019 (including an area in the north-west of the Southern Lease). The study aimed to confirm (based on ground-truthing) the presence of Vegetation Map Units (VMUs) within the study area. Draft versions of island-wide mapping prepared by DENR were supplied to the proponent and utilised as a base for the survey. The surveys involved:</p> <ul style="list-style-type: none"> ● The collection of data at 61 Road Note Points (as described in Brocklehurst et al., 2007) and 717 Rapid Data Points (determined in consultation with DENR); and ● Recording new boundaries using a GPS unit and aerial imagery mark-up; and subsequent preparation of a revised VMU map of the study area. 	<p>This survey provided an understanding of the vegetation across the existing GEMCO mine (i.e. the Western Leases) and adjoining area (including parts of the Southern Lease). It provided information on the following for the portion of the surveys that occurred within the Southern Lease:</p> <ul style="list-style-type: none"> ● Information on the distribution of VMUs; ● Association between VMUs and sensitive or significant vegetation; and ● Flora diversity.



FIELD SURVEY	METHODOLOGY	INFORMATION PROVIDED
<p>2021 Camera Fauna Monitoring Program (Cumberland Ecology, 2023) (Appendix C)</p>	<p>The study area and survey sites for the baseline vegetation survey is shown in Figure 4-2.</p> <p>Cumberland Ecology undertook a camera fauna monitoring program on Groote Eylandt in 2021, which aimed to provide quantitative data to assist in understanding the impacts of vegetation disturbance associated with exploration activities on the density of the Feral Cat and the occurrence of the Northern Quoll. The camera fauna monitoring program was recommended by DEPWS who assisted in the scoping of the program. The program built upon similar research undertaken by Heiniger et al. (2020). The surveys involved the establishment of two camera monitoring grids, one within an area of the Southern Lease disturbed by exploration activities, and the other within an area in the northern portion of Groote Eylandt that has not been disturbed by exploration. Each survey grid consisted of 75 grid points, in rows of five, spaced approximately 500 m apart. At each site, a motion-sensor camera was deployed and left to record for approximately 15-17 weeks. Baits and lures were used to attract predators and mammals to the camera sites. Baits were alternated between sites, consisting of either soiled cat litter or standard mammal baits.</p> <p>The study area and survey sites within the Southern Lease (i.e. within the southern grid) for the 2021 camera fauna monitoring program is shown in Figure 4-2.</p>	<p>This monitoring program yielded approximately 16,000 trap nights of data, and 52 fauna species were identified to species level.</p> <p>This study provided information on the following:</p> <ul style="list-style-type: none"> ● Fauna diversity. ● Occurrence of threatened fauna species, including the Northern Quoll, which was recorded at 74 sites within the southern grid within the Southern Lease, and 71 sites in the northern grid. The Brush-tailed Rabbit-rat was only recorded in the northern monitoring grid at 54 sites; and ● Occurrence of Feral Cats, which were recorded at two locations each in the southern and northern grids. <p>The monitoring program concluded that exploration activities within the Southern Lease have not resulted in an increase in the naïve occupancy¹ of Feral Cats or a decrease in the naïve occupancy of the Northern Quoll.</p> <p>The full report is provided as Appendix C.</p>
<p>Pre-feasibility Field Surveys (Cumberland Ecology, Ongoing)</p>	<p>Cumberland Ecology has recently (between 2021 and 2022) undertaken additional flora and fauna surveys within the Southern Lease. The surveys have included the following:</p> <ul style="list-style-type: none"> ● Ground-truthing vegetation surveys. The extent of VMU boundaries mapped by DEPWS (issued to the proponent in 2018), have been ground-truthed, focussing on VMUs identified as being potentially sensitive or significant in the Land Clearing Guidelines, and VMUs along watercourses and adjoining areas. Data was collected from 226 Rapid Data Points and two Mapping Notes. Where VMUs were found to differ from the DEPWS mapping, the mapping 	<p>These surveys provided an understanding of the vegetation across the Southern Lease, and provided information on the following:</p> <ul style="list-style-type: none"> ● Information on the distribution of VMUs; ● Association between VMUs and sensitive and/or significant vegetation; ● The location of sensitive and/or significant vegetation, such as wetlands and riparian vegetation;

¹ Naïve occupancy relates to the proportion of surveyed sites in which the species is detected (assuming perfect detectability)



FIELD SURVEY	METHODOLOGY	INFORMATION PROVIDED
	<p>has been updated. The vegetation surveys also included recording any incidental weed observations. The study area and survey sites for the ground-truthing vegetation surveys is shown in Figure 4-2.</p> <ul style="list-style-type: none"> Threatened species observations. Cumberland Ecology, in consultation with DEPWS, is currently undertaking several targeted fauna studies within the Southern Lease. Although these studies are not being undertaken for the purpose of this assessment, any threatened species observations made to date have been incorporated into the terrestrial ecology assessment. 	<ul style="list-style-type: none"> Flora diversity; Weed distribution; Fauna diversity; Occurrence of threatened species within the Southern Lease, including the Ghost Bat (<i>Macroderma gigas</i>), Masked Owl (northern), Mertens' Water Monitor (<i>Varanus mertens</i>), and Northern Quoll.

4.3.4 Likelihood of Occurrence Assessment

A likelihood of occurrence assessment was undertaken for listed species identified in database searches or field surveys to determine their potential to occur within the Southern Lease and disturbance footprint. The potential for species to be present was assessed based on:

- The known range of the species;
- The number, age and reliability of records of the species (including from field surveys and the NR Maps database); and
- The habitat preferences of the species relative to site characteristics.

This exercise was undertaken for the Southern Lease and the disturbance footprint. Given that the disturbance footprint has been specifically designed to avoid the most sensitive features in the Southern Lease (including watercourses, wetlands and riparian vegetation), a smaller suite of threatened species occurs in the disturbance footprint, compared to the broader Southern Lease.

4.3.5 Habitat Mapping

The major habitat types in the Southern Lease were delineated by combining VMUs of similar structure. The habitat mapping was based on the following:

- Vegetation mapping of the Southern Lease as prepared for this assessment;
- Observations made during recent (2016-2022) terrestrial ecology surveys of the Southern Lease; and
- Review of aerial imagery, LiDAR data (1 m contour data) and mapping of white rock.

4.3.6 Assessments of Significance

Assessments of Significance were undertaken for threatened or migratory fauna species listed under the EPBC Act that are present or have potential to occur in the disturbance footprint. Assessments of Significance are threshold tests of significance prepared according to the Significant Impact Guidelines and any applicable species-specific referral guidelines. Assessment was undertaken 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.



4.4 BASELINE ECOLOGY SETTING

4.4.1 Introduction

This section summarises the *Baseline Terrestrial Ecology Report* (Appendix A). It provides an overview of the terrestrial ecology values in the Southern Lease and the disturbance footprint.

The Southern Lease comprises approximately 26,000 ha and encompasses large watercourse and wetland systems, rocky escarpments and estuarine areas. In contrast, the disturbance footprint is approximately 63 ha and is located in the north-western part of the Southern Lease. As detailed in Section 2 – Project Description, the disturbance footprint has been located to avoid the most environmentally sensitive areas and features of the Southern Lease, hence the values are different to those within the broader Southern Lease. The discussion of baseline ecology values therefore distinguishes between those in the broader Southern Lease and those in the disturbance footprint.

4.4.2 Vegetation Structure

The vegetation in the Southern Lease is remnant vegetation that has not been subject to previous clearing other than relatively minor clearing for public access roads/tracks and exploration. As discussed, the majority of previous clearing for exploration has been rehabilitated and is successfully regenerating. Overall, the vegetation is in very good condition, and it is characterised by a high species and structural diversity. Parts of the Southern Lease are regularly burned by the Traditional Owners, which has resulted in a reduction in the amount of woody debris and has potentially also 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 currently utilise the Southern Lease. Due to the absence of broad scale vegetation clearing, habitat connectivity in the landscape is excellent and unbroken throughout. The Southern Lease provides a range of habitats for fauna species, including watercourses and wetlands, rocky outcrops and extensive areas of woodland. Few weeds occur within the Southern Lease.

The disturbance footprint has a similar vegetation structure to the broader Southern Lease and the vegetation is in very good condition. The disturbance footprint comprises woodland, but does not include watercourses, wetlands, and rocky outcrops. Few weeds occur in the disturbance footprint and the weeds that do occur are primarily isolated to the verges of the public Yenbakwa Road.

4.4.3 Vegetation Communities

The vegetation community patterns within the Southern Lease 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 woodlands 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 south-western and southern boundaries of the Southern Lease in proximity to the coastline, including tidal flats near the western boundary.

The most extensive vegetation communities within the disturbance footprint comprise open woodlands to open forests dominated by *Eucalyptus tetradonta* (Darwin Stringybark), which occur on both gently undulating sandy and lateritic soils, as well as within rocky sandstone areas. The disturbance footprint has been sited to avoid riparian vegetation, wetlands, rainforests, vine thickets and coastal vegetation.



Mapping Units

Vegetation mapping of the Southern Lease was undertaken by DENR in 2018, which identified over 100 individual Vegetation Mapping Units (VMUs) or combination VMUs. As discussed in Section 4.3.3, parts of the DENR mapping were verified during field surveys undertaken on behalf of the proponent. A detailed list of the individual VMUs and combination VMUs occurring within the Southern Lease and disturbance footprint is provided in the *Baseline Terrestrial Ecology Report* (Appendix A).

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 Southern Lease. The map of EPBC Act listed TECs in the Northern Territory (Department of Sustainability, Environment, Water, Population and Communities, 2013) also does not show the occurrence of any TECs within the Southern Lease, or Groote Eylandt.

There are no TECs within or surrounding the disturbance footprint.

Habitat Types

The Southern Lease contains extensive areas of remnant vegetation which provide a range of habitats for fauna species. The matrix of fauna habitats 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 Southern Lease are summarised in Table 4-2 and are shown on Figure 4-3.

Of these habitats found within the Southern Lease, the disturbance footprint contains only laterite woodland and forest habitat, and a very small area of sandstone woodland and forest.

The *Baseline Terrestrial Ecology Report* (Appendix A) provides a detailed description of each habitat type.

Table 4-2 Key Habitats within the Southern Lease and Disturbance Footprint

HABITAT TYPE	SOUTHERN LEASE		DISTURBANCE FOOTPRINT	
	AREA (ha)	%	AREA (ha)	%
Closed forest (rainforest)	234.7	0.9	-	-
Laterite woodland and forest	13,914.9	53.4	62.6	99.9
Sandstone woodland and forest	6,791.6	26.1	0.04	0.1
Coastal dune/swale complex	989.6	3.8	-	-
Riparian/wetland	3,792.4	14.6	-	-
Estuarine complex	328.6	1.3	-	-
<i>Cleared</i>	1.8	<0.0	-	-
<i>Unmapped</i>	9.3	<0.0	-	-
Total¹	26,063	100	63	100

¹In some cases totals may not equal the appropriate total number due to rounding.



4.4.4 Flora Species

Over 250 plant species were recorded within the western portion of the Southern Lease by Cumberland Ecology during recent field surveys (2016-2022). The data indicated that the floristic assemblage across the north-western portion of the Southern Lease 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.*).

Weeds

The NR Maps database (DEPWS 2022) only holds records of one weed species, *Distimake dissectus* (Merremia), within the Southern Lease, at two locations. This species is not a declared weed under the WM Act.

The following Class B declared weeds under the WM Act were recorded within the Southern Lease during recent field surveys:

- *Hyptis suaveolens* (Hyptis);
- *Sida cordifolia* (Flannel Weed); and
- *Stachytarpheta cayennensis* (Snakeweed).

An additional five non-declared weed species have also been recorded within the Southern Lease during recent field surveys. A full list of these species is provided in the *Baseline Terrestrial Ecology Report* (Appendix A).

No weed species that are subject to Northern Territory Statutory Weed Management Plans have been detected in the Southern Lease.

Weed occurrences are generally associated with disturbed areas (including public roads and in the vicinity of outstations), and watercourses.

Threatened Flora Species

No threatened EPBC Act listed flora species were recorded within the Southern Lease during recent field surveys.

However, database records identified the presence of one threatened flora species within the Southern Lease, namely *Utricularia singeriana* (EPBC Act Status: Not Listed, TPWC Act Status: Vulnerable). *Utricularia singeriana* is known to occur within wetland areas and near watercourses and requires seasonally inundated grassland/low open woodland. The database record is located along Second Creek, outside the disturbance footprint (Figure 4-4).

Utricularia singeriana is considered unlikely to occur in the disturbance footprint due to the absence of suitable habitat in the form of wetlands and riparian habitat. No other threatened flora species are expected to occur in the disturbance footprint.

4.4.5 Fauna Species

A total of 98 fauna species have been recorded within the Southern Lease during recent field surveys, including 56 birds, 20 mammals and 22 reptiles. Additional species have also been identified in database searches.

The following sections identify the EPBC Act and TPWC Act threatened and migratory fauna species, as well as exotic/feral species, that are known or likely to occur in the Southern Lease. It is noted that marine and solely aquatic species (e.g. fish, turtles, and marine mammals) are not relevant to an assessment of terrestrial ecology within the Southern Lease and are not considered further.



EPBC Act Listed Threatened Fauna Species

Database searches indicated that 20 fauna species listed as threatened under the EPBC Act potentially occur in the Southern Lease. Of these, three species have been recorded during recent field surveys or on the NR Maps database (two of which have been recorded in the disturbance footprint). NR Map database records of these species within the Southern Lease are shown in Figure 4-4 and field survey records are shown in Figure 4-5. A likelihood of occurrence assessment (refer Section 4.3.4) was undertaken for the remaining species. This assessment concluded that none of the remaining additional species have the potential to occur within the Southern Lease or disturbance footprint.

EPBC Act listed threatened species that were recorded or assessed as having potential to occur in the Southern Lease and disturbance footprint are listed in Table 4-3.

Table 4-3 EPBC Act Listed Threatened Species Recorded or with Potential to Occur in the Southern Lease and Disturbance Footprint

SPECIES	EPBC ACT STATUS	TPWC ACT STATUS	LIKELIHOOD OF OCCURRENCE	
			SOUTHERN LEASE	DISTURBANCE FOOTPRINT
Masked Owl (northern) (<i>Tyto novaehollandiae kimberli</i>)	Vulnerable	Vulnerable	Present	Present
Northern Quoll (<i>Dasyurus hallucatus</i>)	Endangered	Critically Endangered	Present	Present
Ghost Bat (<i>Macroderma gigas</i>)	Vulnerable	Not Listed	Present	Potential

Further detail on these species and the likelihood of occurrence assessment is provided in the *Baseline Terrestrial Ecology Report* (Appendix A). This report also provides further detail on each species record.

EPBC Act Listed Migratory Fauna Species

Database searches indicated that 48 fauna species listed as migratory under the EPBC Act potentially occur in the Southern Lease. Of these, two species have been recorded within the Southern Lease during recent field surveys or on the NR Maps database. The NR Maps database records of these species within the Southern Lease are shown in Figure 4-4 and field survey records are shown in Figure 4-5. No migratory species have been recorded within the disturbance footprint. A likelihood of occurrence assessment (refer Section 4.3.4) was undertaken for the remaining species. This assessment concluded that three of the remaining additional species have the potential to occur within the Southern Lease (one of which also has the potential to occur in the disturbance footprint). The remaining 41 species have been assessed as unlikely to occur.

EPBC Act listed migratory species that were recorded or assessed as having potential to occur in the Southern Lease and disturbance footprint are listed in Table 4-4.



Table 4-4 EPBC Act Listed Migratory Species Recorded or with Potential to Occur in the Southern Lease and Disturbance Footprint

SPECIES	EPBC ACT STATUS	TPWC ACT STATUS	LIKELIHOOD OF OCCURRENCE	
			SOUTHERN LEASE	DISTURBANCE FOOTPRINT
Common Sandpiper (<i>Actitis hypoleucos</i>)	Migratory	Not Listed	Potential	Unlikely
Common Greenshank (<i>Tringa nebularia</i>)	Migratory	Not Listed	Potential	Unlikely
Salt-water Crocodile (<i>Crocodylus porosus</i>)	Migratory	Not Listed	Present	Unlikely
Eastern Osprey (<i>Pandion cristatus</i>)	Migratory	Not Listed	Present	Unlikely
Fork-tailed Swift (<i>Apus pacificus</i>)	Migratory	Not Listed	Potential	Potential
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	Migratory	Not Listed	Potential	Unlikely
Marsh Sandpiper (<i>Tringa stagnatilis</i>)	Migratory	Not Listed	Potential	Unlikely

Further detail on these species and the likelihood of occurrence assessment is provided in the *Baseline Terrestrial Ecology Report* (Appendix A). This report also provides further detail on each species record.

TPWC Listed Fauna Species

Database searches indicated that two fauna species listed as threatened under the TPWC Act (but not listed under the EPBC Act) potentially occur in the Southern Lease. Of these, one species was found to be present within the Southern Lease, namely the Mertens' Water Monitor (*Varanus mertens*) (TPWC Act Status: Vulnerable). This species is semi-aquatic and inhabits riparian and wetland areas. It has been recorded along several watercourses in the Southern Lease (Figure 4-4). A likelihood of occurrence assessment (refer Section 4.3.4) was undertaken for the remaining species (Yellow-spotted Monitor (*Varanus panoptes*)) and concluded that it is not likely to occur in the Southern Lease (recent genetic testing has concluded that this species does not occur on Groote Eylandt).

There are no records of the Mertens' Water Monitor in the disturbance footprint, and the species has been assessed as unlikely to occur given that the disturbance footprint has been specifically located to avoid watercourses and wetlands.

Further detail on these species and the likelihood of occurrence assessment is provided in the *Baseline Terrestrial Ecology Report* (Appendix A).

Exotic/Feral Species

Feral Dogs (*Canis familiaris*) and Dingoes (*Canis lupus*) have been recorded within the Southern Lease. A very small number of Feral Cats were recorded during the field surveys listed in Table 4-1. This is consistent with Heiniger, Davies, & Gillespie (2020) which states there is a low density of Feral Cats on Groote Eylandt. This is also consistent with the results of the *2021 Camera Fauna Monitoring Program Report* (Appendix C) which recorded low densities of Feral Cats in a camera monitoring grid placed within the Southern Lease. One House Gecko (*Hemidactylus frenatus*) was recorded during spotlighting surveys on a sandstone outcropping in the Southern Lease in 2016.



The exotic/feral species in the disturbance footprint are expected to be similar to those within the broader Southern Lease.

4.5 IMPACT ASSESSMENT

The exploration program has the potential to give rise to direct and indirect impacts on flora and fauna. These include:

- Direct impacts such as clearing of vegetation and potential habitat for drill pads and access tracks; and
- Indirect impacts such as habitat fragmentation, the introduction of invasive species, increased fire frequency and other minor indirect impacts.

These impacts are described in the remainder of this section and avoidance and mitigation measures for these impacts are discussed in Section 4.6.

4.5.1 Clearing

A total of approximately 63 ha of vegetation is proposed to be cleared for the exploration program. This includes approximately 37 ha for clearing along access tracks and approximately 26 ha to clear drill pads for the exploration and geotechnical drill holes. The clearing will be restricted to the width of the access tracks (3 m) and the footprint of the drill pads, which varies between 162 m² and 300 m². The area disturbed at any time will be less than the total area given that the disturbance occurs over a three year period and the disturbed area will be progressively rehabilitated.

Table 4-5 and Figure 4-3 shows the proposed extent of clearing relative to habitat types.

Table 4-5 Extent of Clearing of Habitat

HABITAT TYPE	SOUTHERN LEASE	CLEARING REQUIRED FOR EXPLORATION PROGRAM
	AREA (ha)	AREA (ha)
Closed forest (rainforest) habitats	234.7	-
Laterite woodland and forest habitats	13,914.9	62.6
Sandstone woodland and forest habitats	6,791.6	0.04
Coastal dune/swale complex habitats	989.6	-
Riparian/wetland habitats	3,792.4	-
Estuarine complex habitats	328.6	-
Cleared	1.8	-
Unmapped	9.3	-
Total (rounded to nearest hectare)	26,063	63

The dominant habitat type to be cleared for the exploration program is laterite woodland and forest, with approximately 62.6 ha proposed to be cleared. Laterite woodland and forest habitat type is associated with undulating laterite plains and typically dominated by a canopy of *Eucalyptus tetrodonta*, with *Eucalyptus miniata* being locally common at some locations. *Eucalyptus polycarpa* and *Eucalyptus tectifera* also occur within this habitat type.



A small area of sandstone woodland and forest habitat (approximately 0.04 ha) will also be cleared for the exploration program. This habitat type is associated with the sandstone plateaus and rocky outcropping within the Southern Lease. Sandstone woodland and forest habitats have a mixed canopy and include *Eucalyptus tetrodonta*, *Corymbia kombolgiensis*, *Callitris intratropica*, and *Corymbia polycarpa*.

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 0.45% of the laterite woodland within the Southern Lease. Sandstone woodland and forest habitats cover approximately 26% of the Southern Lease. The sandstone woodland proposed to be cleared represents 0.001% of the sandstone woodland within the Southern Lease.

Laterite and sandstone 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. However, large areas of both the laterite and sandstone woodland and forest habitat types will remain, beyond the area to be affected by exploration activities. In addition, the proposed clearing will be dispersed across the exploration area, with patches of native vegetation remaining between the cleared areas continuing to provide habitat for native species. It is anticipated that the types of flora and fauna species utilising the habitat proposed to be cleared will continue to persist in these adjacent areas where suitable habitat is present and will recolonise cleared areas as they regenerate following rehabilitation.

The impacts of clearing will be minimised by implementing a pre-clearance procedure that involves relocating access tracks and drill pads to ensure that large trees (i.e. trees with a diameter at breast height (DBH) > 50 cm) are not cleared for access track development and are avoided, where possible, for drill pad development. Drill pads and access tracks are also relocated to ensure that large trees that contain hollows suitable for the Masked Owl (northern) are not cleared for drill pad development. Further detail on the pre-clearance procedure is provided in Section 6 – Avoidance and Mitigation.

Rehabilitation of drill pads and tracks is planned to occur progressively during the three year exploration program and is designed to occur before the onset of the next wet season. Drill holes will be capped and rehabilitation will be undertaken of drill pads and access tracks. Rehabilitation will include respreading the windrows of cleared vegetation (e.g. logs, vegetation cover and leaf litter) on the disturbed area and placing felled timber and logs across the start of exploration tracks to prevent the exploration tracks becoming permanent tracks. Completion of these rehabilitation tasks is recorded in the proponent's geographic information system database for the Southern Lease. The area is then allowed to naturally revegetate from seeds in the soil seed bank and from adjacent vegetation. Further detail on rehabilitation is provided in Section 6 – Avoidance and Mitigation.

Regeneration monitoring was undertaken in the Southern Lease in 2021 to assess exploration areas that were cleared between 2016 and 2019. Regeneration was assessed based on the presence/absence of species in different stratum. The assessment involved collecting data on the key canopy species, mid-layer (small trees and shrubs) species, and the presence of regeneration (grasses, sedges, rushes, herbs, vines and small shrubs) and leaf litter within the ground layer. Monitoring showed that canopy species were regenerating at 98% of sites, while mid-layer and ground layer regeneration was present at all sites. Monitoring has also been undertaken within the Eastern Leases (Cumberland Ecology, 2019). Overall, monitoring undertaken in both the Eastern Leases and Southern Lease indicates that the rehabilitation process and techniques employed by the proponent allow exploration areas to successfully regenerate over time.

The direct impacts of habitat loss and disturbance arising from the exploration program are considered minor, as a limited amount of clearing is required and, following rehabilitation, disturbed areas are expected to naturally regenerate successfully over time. Furthermore, as the exploration program will be undertaken over a three year period, the impacts will not all occur at the same time. This, along with the progressive rehabilitation of disturbed areas and the retention of areas of native vegetation in between cleared areas, will assist the understorey of the cleared areas to regenerate relatively rapidly and re-establish habitat.



4.5.2 Indirect Impacts

The exploration program has the potential to increase the risk of facilitating key threatening processes in the Southern Lease. These threatening processes include habitat fragmentation, introduced species (weeds and feral animals) and altered fire regimes. Additionally, a number of drilling impacts, such as those relating to noise and vibration, dust, erosion and sedimentation, and vehicle strike have the potential to impact fauna. These potential impacts are discussed in the following sections.

Habitat Fragmentation

The exploration program will increase habitat fragmentation by clearing areas of open forest and woodland to create 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 higher density of drill pads 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 the threatened species potentially impacted are likely to be able to cross these access tracks.

The impact of clearing tracks and drill pads is not a permanent impact given that disturbed areas are expected to naturally regenerate into native vegetation once rehabilitation has been completed.

The *2021 Camera Fauna Monitoring Program Report* (Appendix C) documents a research program that was conducted to provide quantitative data to assist in understanding the impacts of vegetation disturbance associated with exploration on the density of Feral Cats and the occurrence of the Northern Quoll. The program concluded that exploration activities within the Southern Lease have not resulted in an increase in the naïve occupancy of Feral Cats, or a decrease in the naïve occupancy of the Northern Quoll. Based on this research, the fragmentation of habitat resulting from previous exploration activities in the Southern Lease has not modified habitat such that it would change the suitability of the habitat for the two species that were studied. These findings provide a high degree of confidence in the impact assessment predictions.

Introduced Species

The exploration program has the potential to introduce invasive species to the Southern Lease. The proponent has biosecurity and quarantine procedures that provide guidance on how to correctly inspect barges and their cargo coming to the port facility at Milner Bay. This applies to shipping containers, vehicles and equipment. These procedures are 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.

Weeds

As 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. 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 et al., 2019) and 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.

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 Southern Lease, and the existing mining tenements, have the highest potential to establish in the disturbance footprint. As discussed in Section 4.4.4, a small number of declared weeds under the WM Act have recently been recorded within the Southern Lease.

Weed management measures in the Southern Lease will 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. All vehicles, including drill rigs, are required to be washed down prior to



entering the Southern Lease. 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 4.6.2 and Section 6 – Avoidance and Mitigation.

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 only feral animals that have been recorded in the Southern Lease are the Feral Dog, Feral Cat and House Gecko. The exploration program has the potential to increase the numbers of these feral animals due to the creation of transport vectors such as access tracks. However, several mitigation measures are in place to prevent this occurring, notably the closure of access tracks following exploration and the rehabilitation of disturbed areas.

The *2021 Camera Fauna Monitoring Program Report* (Appendix C) provides quantitative data to assist in understanding the impacts of vegetation disturbance associated with exploration, including the impacts on the density of Feral Cats. This study concluded that previous exploration activities within the Southern Lease have not resulted in an increase in the naïve occupancy of Feral Cats. This study provides a high degree of confidence in the conclusion of the impact assessment that exploration is unlikely to lead to an increase in the density of Feral Cats.

The Cane Toad (*Rhinella marina*) is currently absent from Groote Eylandt. In addition to the quarantine procedure described above, the proponent also has a specific Cane Toad Management Plan which operates across all mineral and exploration leases and more broadly across the island. This plan will continue to operate and will be applicable to the exploration program. 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 detail about the management of Cane Toads is provided in Section 4.6.2 and Section 6 – Avoidance and Mitigation.

Fire Frequency

The creation of additional access tracks in the Southern Lease has the potential to increase public access within the area, particularly in areas that were previously largely inaccessible. Increased frequency and intensity of fires alters floristic composition, removes coarse woody debris, simplifies understorey and mid-story vegetation structure, and ultimately removes large, old trees (DENR et al., 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 et al., 2019).

However, upon completion of rehabilitation, and before commencement of the wet season, felled timber and logs will be placed across the entrance to access tracks and along a sufficient distance of track to prevent ongoing access. This measure is designed to prevent the access tracks becoming permanent tracks, given that increasing access to the area could lead to increased fire frequency. Rehabilitation monitoring will inspect closed tracks to ensure the tracks are not being used and the vehicle barriers are effective. 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 fire frequency.

Other Indirect Impacts

There are a number of potential 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;
- Erosion and sedimentation; and
- Vehicle strike.



These minor indirect impacts are discussed in the following sections. However, these potential indirect impacts will only occur during drilling and will cease upon completion of the drilling program. As the exploration program will be undertaken over a three year period, the impacts will be staged across the disturbance footprint. For these reasons, these minor indirect impacts are not considered likely to result in a significant impact on terrestrial ecology values. Activities will only be undertaken during daytime hours, meaning that the exploration program will not give rise to any impacts related to lighting.

Noise and Vibration

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

Dust

Increased levels of dust could potentially impact vegetation within woodland communities, reducing the health of some species along the edge of drill pads and access tracks. It could also have an impact on potential foraging resources for wildlife. Dust minimisation strategies such as 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 adjacent areas.

Erosion and Sedimentation

The exploration program has the potential to increase the amount of erosion occurring in the disturbance footprint due to the vegetation clearing that is required to create the access tracks and drill pads. The disturbance footprint is 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 only undertaking exploration in the dry season and rehabilitating drill pads and access tracks at the completion of each season of exploration drilling, and before the onset of the next wet season. Inspections of the rehabilitated drill pads and tracks will also be undertaken to monitor the success of rehabilitation, including 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 impact on watercourses used by wildlife. Furthermore, there are no watercourses within the disturbance footprint. Erosion and sediment control is discussed further in Section 6 – Avoidance and Mitigation.

Vehicle Strike

The exploration program will create access tracks which will be used by exploration vehicles. Exploration vehicles traversing these tracks can have an impact on animals that may cross and navigate these tracks. However, due to the small 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.

4.5.3 Impacts on Vegetation Communities

No TECs occur within the disturbance footprint and, as such, no impacts to EPBC Act listed communities are anticipated. The TPWC Act contains no listings for TECs.



4.5.4 Impacts to Threatened Flora Species

No threatened flora species listed under the EPBC Act or TPWC Act have been assessed as having the potential to occur within the disturbance footprint. As such, no impacts to threatened flora species are anticipated.

4.5.5 Impacts to Threatened Fauna Species

As described in Section 4.4.5, three threatened fauna species listed under the EPBC Act have been recorded or have the potential to occur within the disturbance footprint. Assessments of significance were conducted on these species in accordance with the Significant Impact Guidelines, or species-specific Significant Impact Guidelines, where relevant (refer to the *Assessment of Impacts on Listed Species Report* (Appendix B)).

The assessments of significance concluded that the exploration program will not give rise to significant impacts on these threatened species, the reasons for which are discussed in the following sections.

Impact avoidance and mitigation measures relevant to listed threatened and migratory species are provided in Section 4.6.

Masked Owl (northern)

There is approximately 63 ha of roosting and breeding habitat for this species within the disturbance footprint, comprising laterite woodland and forest habitats, and sandstone woodland and forest habitats. These habitats provide roosting and breeding habitat where there is denser vegetation and areas containing hollow-bearing trees with large-sized hollows. A key mitigation measure to be implemented for this species is the avoidance of large trees (greater than 50 cm DBH) and hollow-bearing trees that may be suitable for nesting, which are identified as part of the pre-clearance survey. Suitable habitat trees for the Masked Owl (northern) will be retained and a buffer put in place to avoid impacts on habitat trees. Removal of roosting and breeding habitat, in the form of large hollow-bearing trees, will therefore be avoided.

There is also foraging habitat within the disturbance footprint in the form of laterite woodland and forest habitat and sandstone woodland and forest habitat. The exploration program will result in the removal of approximately 63 ha of this habitat. The foraging habitat to be cleared constitutes a very small portion of the available habitat on Groote Eylandt and the overwhelming majority of this habitat on the island would remain. This is unlikely to have a significant impact on the species, as the species is highly mobile and is expected to occupy the large areas of suitable habitat that will remain across Groote Eylandt.

Areas disturbed by exploration will be rehabilitated and, over time, the disturbed foraging habitat for this species will regenerate. Regeneration monitoring undertaken by Cumberland Ecology within areas subject to previous exploration drilling in the Eastern Leases and Southern Lease found that woody species composition appears to regenerate rapidly following the cessation of disturbance. Food resources for this species will also remain readily available in areas subject to exploration activities. The *2021 Camera Fauna Monitoring Program Report* (Appendix C) provides the results of fauna monitoring, including records of medium-sized prey species in areas previously subject to exploration.

Northern Quoll

There is approximately 63 ha of foraging, shelter and breeding habitat for this species within the disturbance footprint, comprising laterite woodland and forest habitats, and sandstone woodland and forest habitats. The habitat to be cleared constitutes a very small portion of the available habitat on Groote Eylandt and the overwhelming majority of this habitat on the island would remain.

This species is widely distributed across Groote Eylandt and has been recorded extensively throughout all habitat types in the Southern Lease. The *2021 Camera Fauna Monitoring Program Report* (Appendix C) detected this species at 74 of the 75 sites sampled and concluded that exploration activities within the Southern Lease have not



resulted in a decrease of the naïve occupancy of the Northern Quoll. It has also been recorded within the rehabilitated areas of the existing mine, is known to occur in areas adjacent to main roads and in populated community areas and is assumed to have a relatively high tolerance to light and noise.

Following the completion of drilling, drill pads and access tracks will be rehabilitated. Felled timber and logs will be placed across the entrance to tracks to prevent them becoming permanent access tracks. Preventing permanent access tracks from being formed will assist in reducing the risk of them acting as a transport vector for feral animals such as Feral Cats that prey on threatened species such as the Northern Quoll.

Ghost Bat

There is approximately 63 ha of foraging habitat for this species in the disturbance footprint, comprising laterite woodland and forest habitats, and sandstone woodland and forest habitats. This habitat to be cleared constitutes a very small portion of the available habitat on Groote Eylandt and the overwhelming majority of this habitat on the island would remain. In addition, the loss of foraging habitat will not be a permanent impact, given that cleared areas are expected to regenerate over time and re-establish suitable foraging habitat for this species. Regeneration is expected to occur relatively rapidly and regeneration monitoring undertaken in the Southern Lease in 2021 showed that canopy species were regenerating at 98% of sites, while mid-layer and ground layer regeneration was present at all sites.

Sandstone woodland and forest habitats have the potential to support roosting or breeding habitat for this species in the Southern Lease. Whilst a small area of rocky outcropping occurs within the disturbance footprint, this area comprises low lying rubble and is not considered to contain suitable features, such as crevices and caves, that would support roosting or breeding habitat for this species. Areas with features that would be suitable for roosting or breeding habitat (i.e. crevices and/or caves) are located at least 500 m from the disturbance footprint.

Exploration drilling is a short term activity (each drill hole is drilled in approximately 45 minutes) and only a small number of drill rigs will be used. Consequently, exploration would be unlikely to give rise to significant indirect impacts (e.g. noise and vibration) on roosting or breeding habitat, even if this kind of habitat was present in close proximity to the proposed drilling activities. No breeding habitat is present within the disturbance footprint due to the absence of caves.

Migratory Species and Other Species of Interest

The assessment of significance undertaken on the EPBC Act listed migratory species with potential to occur in the disturbance footprint (i.e. the Fork-tailed Swift) concluded that the disturbance footprint area did not contain an ecologically significant proportion of the species, or important habitat for the species, and no significant impacts were likely to occur as a result of the exploration program.

The Brush-tailed Rabbit-rat and Northern Hopping-mouse are listed as threatened under the EPBC Act and TPWC Act and are present on Groote Eylandt. As discussed in Table 4-1, the Small Mammal Research Project targeted these species, but did not record them, and it was concluded that there was a low likelihood of these species occurring in the Southern Lease. Nevertheless, the *Assessment of Impacts on Listed Species Report* (Appendix B) contains a high-level description of potential impacts and describes the way in which the mitigation measures developed for the exploration program would be relevant to these species, if they were present.



4.5.6 Cumulative Impacts

The exploration program is part of the proponent's broader exploration campaign within the Southern Lease. Exploration is undertaken in a structured, progressive manner, which is designed to gain increasing levels of understanding of the geology and mineralisation of the area. Regional exploration holes are drilled initially to provide information on whether 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 discovered, exploration holes are drilled in a defined grid pattern. Initially, this involves drilling at a relatively wide spacing, with exploration holes (and tracks) being 240 m apart. The results from this drilling are used to identify areas where further geological information is required and a narrower grid spacing (e.g. 120 m apart) is used in subsequent exploration programs for these areas. 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, 2013). 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 local area.

The proponent has undertaken exploration within the Southern Lease between 2016 and 2022. 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 rehabilitation process, and the observed successful natural regeneration of disturbed areas over time, it is not expected that the exploration program would result in significant cumulative impacts with the previous exploration programs undertaken between 2016 and 2022.

The exploration program will utilise some drill pads and access tracks created as part of the previous exploration programs. Some of these tracks (e.g. those used for exploration in late 2022) may still be open at the time that the exploration program is undertaken or may comprise regrowth that is only 1-2 years old. However, in assessing impacts of the exploration program, a conservative approach has been taken whereby the use of previous tracks is assessed as new clearing (i.e. the 63 ha disturbance footprint includes the use of tracks from previous exploration programs). This ensures that a full account of impacts is included, including cumulative impacts with previous exploration programs.

Overall, due to the relatively small and dispersed disturbance areas, progressive rehabilitation and successful regeneration of the previous exploration programs, the exploration program is not considered likely to result in any significant cumulative impacts on terrestrial ecosystems.

4.6 AVOIDANCE AND MITIGATION

4.6.1 Measures to Avoid Impacts

The Southern Lease 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, a number of impact avoidance measures have been adopted in locating and designing the proposed exploration program. This section explains that a comprehensive planning process, informed by baseline environmental data, was undertaken to ensure that the exploration program is located to avoid the most environmentally sensitive features in the Southern Lease. In addition, the proposed exploration program includes several design features to further avoid impacts, and these design features are also discussed below.



Exploration Program Planning

Overview

Groote Eylandt, including the Southern Lease, has significant environmental and cultural values. The proponent has therefore located and designed its activities in the Southern Lease (including the exploration program) to avoid environmental impacts where possible. This has been achieved through:

- Gathering baseline data on environmental and cultural values to ensure that the most sensitive features in the Southern Lease are identified.
- Undertaking an iterative project planning process to:
 - Locate the exploration program in a broad area that avoids the most sensitive environmental and cultural features in the Southern Lease.
 - Design the disturbance footprint to avoid and minimise impacts on key features, such as riparian corridors and wetlands.

Further detail on these elements is provided below.

Baseline Data

The proponent signed an Exploration Agreement for the Southern Lease with the Anindilyakwa Land Council (ALC), under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) on 17 May 2016. This agreement provides the proponent with the legal right to access the Southern Lease for exploration purposes, subject to the terms of the agreement. An exploration licence (EL2455) was granted soon after this on 12 October 2016.

In 2016 the proponent commenced exploration drilling to gain a better understanding of the manganese resource. Figure 4-6 shows the potential mineralised area in the Southern Lease (i.e. the area in which manganese may potentially occur). This is the area in which exploration would be undertaken if there were no environmental or cultural considerations.

The proponent also commenced baseline environmental studies in 2016. Baseline environmental work was undertaken with the permission of the ALC. The Traditional Owners were provided with an opportunity to participate in fieldwork and most field surveys included Traditional Owner participation. Baseline environmental work has included:

- Terrestrial ecology work, which is summarised in Table 4-1 and described further in the *Baseline Terrestrial Ecology Report* (Appendix A).
- Undertaking an aquatic ecology field survey in 2019 to determine the baseline condition of aquatic ecosystems associated with each of the watercourses in the Southern Lease. Surveys included assessment of macroinvertebrate, fish and flora communities, and water and sediment quality.
- Mapping catchment areas.
- Engaging the ALC to undertake a study to define the location of sacred sites and delineate the required buffer zones around these sites (termed restricted work areas).

Project Planning Process

In 2019 the proponent undertook an internal planning process, guided by baseline environmental work, to delineate the most environmentally sensitive areas of the Southern Lease. The kinds of features that were identified and considered were large perennial rivers and their floodplains, estuarine areas, significant wetlands, and monsoonal vine thicket (this vegetation type is culturally and environmentally sensitive). The proponent then delineated an area for future exploration that avoids the identified sensitive areas. This area was referred to as the



“potential exploration area” and it is shown in Figure 4-6. It comprises 9,521 ha, which is approximately 57% of the potential mineralised area. All the proponent’s recent exploration in the Southern Lease has been limited to the potential exploration area, which has minimised the impacts of exploration.

In 2022, the proponent began planning a potential future exploration program. By this time, the alignments of watercourses had been mapped, the boundaries of riparian and wetland vegetation had been confirmed through fieldwork, and the ALC had mapped the location of sacred sites. This information, together with the proponent’s knowledge of the manganese resource, was used to locate the proposed exploration program in the north-western part of the Southern Lease, with the disturbance footprint comprising approximately 63 ha, which is 0.4% of the potential mineralised area (16,830 ha) and 0.7% of the potential exploration area (9,521 ha) (Figure 4-6). The disturbance footprint has been designed to ensure that all activities are located beyond watercourses, wetlands or riparian vegetation. The proposed exploration program has been limited to this area because of the proponent’s objective of avoiding and minimising impacts on the most sensitive environmental and cultural values in the Southern Lease.

Exploration Program Activities

Key avoidance measures, specific to biodiversity values, that were applied to the design of the exploration program include:

- Positioning drill holes along previously cleared tracks, where possible;
- Utilising the track width as part of the drill pad area;
- Where possible, positioning slightly larger drill pads at the end of an access track to enable the drill rig to turnaround, as opposed to clearing a new access track to connect adjacent tracks;
- Where possible, geotechnical drill holes and test pits have been sited on previously cleared tracks or on pads used for infill drilling.
- Limiting clearing at drill holes to the smallest possible area;
- Utilising existing access tracks where possible; and
- Avoiding watercourses, wetlands and riparian vegetation (Figure 4-7).

4.6.2 Measures to Mitigate Impacts

The proponent has been undertaking exploration activities on Groote Eylandt for nearly 60 years and consequently has substantial experience with exploration and potential impact sources and pathways relating to terrestrial ecosystems. Mitigation measures have been developed to address all potential impacts and used successfully during previous exploration in the Southern Lease. Data from previous exploration programs has provided a high level of confidence in the effectiveness of the management measures. Mitigation measures also reflect feedback obtained from regulators (NT EPA and DEPWS) on previous approval applications for exploration. These mitigation measures will apply to the exploration program. Mitigation measures are discussed in full in Section 6 – Avoidance and Mitigation. However, those that are relevant to impacts on terrestrial ecosystems are summarised below:

- Clearing procedures, including a permit to clear process and pre-clearance survey. All clearing will be undertaken in accordance with the proponent’s Permit to Clear process. This process includes a pre-clearance survey to determine the precise locations of drill pads and access tracks, based on the presence of habitat features for threatened species and distance from local environmental constraints. The process also includes endorsement from the ALC. 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 avoided, where possible. Disturbance of topsoil will be kept to a



minimum by using a “blade up” method for vegetation clearing, whereby the blade of the dozer is lifted so that the topsoil is not disturbed.

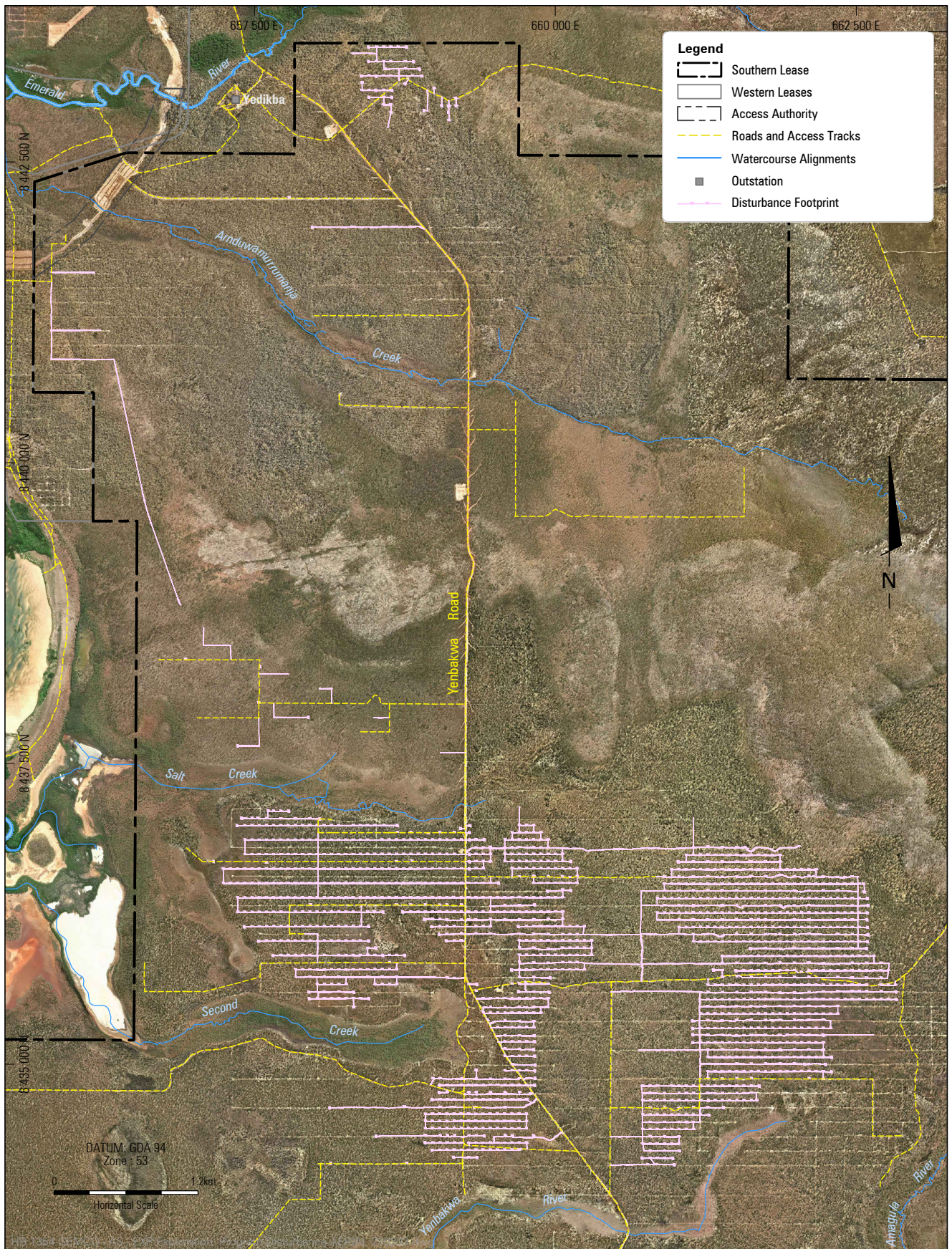
- Rehabilitation and monitoring. Rehabilitation of drill pads and tracks is planned to occur progressively during the three year exploration program and is designed to occur before the onset of the next wet season. As each drill pad and track is rehabilitated, a checklist is completed confirming that rehabilitation has been undertaken according to the proponent’s rehabilitation procedure. Monitoring of rehabilitated areas will be undertaken by an experienced ecologist or environmental practitioner, one to two wet seasons after rehabilitation has been completed. As detailed in Section 4.5.1, the proponent has had considerable success with the rehabilitation of drill pads and access tracks.
- Weed management. 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 employee awareness. Weed control and monitoring will be undertaken within cleared areas in accordance with the proponent’s Weed Management Plan. The Weed Management Plan includes measures to ensure that exploration activities will not introduce or spread weeds in the Southern Lease. Such measures include washdown and inspection procedures for all vehicles and equipment, along with daily inspections of work clothes and boots for all personnel prior to entering the Southern Lease.
- 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 preventative measures such as quarantine procedures relating to barging of equipment, inspections of barges and vehicles, Cane Toad fencing at key freight facilities in Darwin and on Groote Eylandt, and use of Cane Toad detection dogs. There are also monitoring measures and, in the event of a Cane Toad being found, reporting, disposal and response procedures.

Refer to Section 6 – Avoidance and Mitigation for further detail on the mitigation measures listed above.

4.7 ENVIRONMENTAL OBJECTIVE

The objective for the *Terrestrial Ecosystems* environmental factor is to “*Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning*” (NT EPA, 2022). Section 4.4 describes the environmental values of the Southern Lease and disturbance footprint. Section 4.5 describes the potential impacts on terrestrial ecosystems, including direct and indirect impacts, and Section 4.6 describes the way in which the exploration program has been designed to avoid and minimise impacts. These sections conclude that, given the measures to avoid and minimise impacts, no significant impacts on terrestrial ecosystems, biological diversity and ecological integrity are predicted.

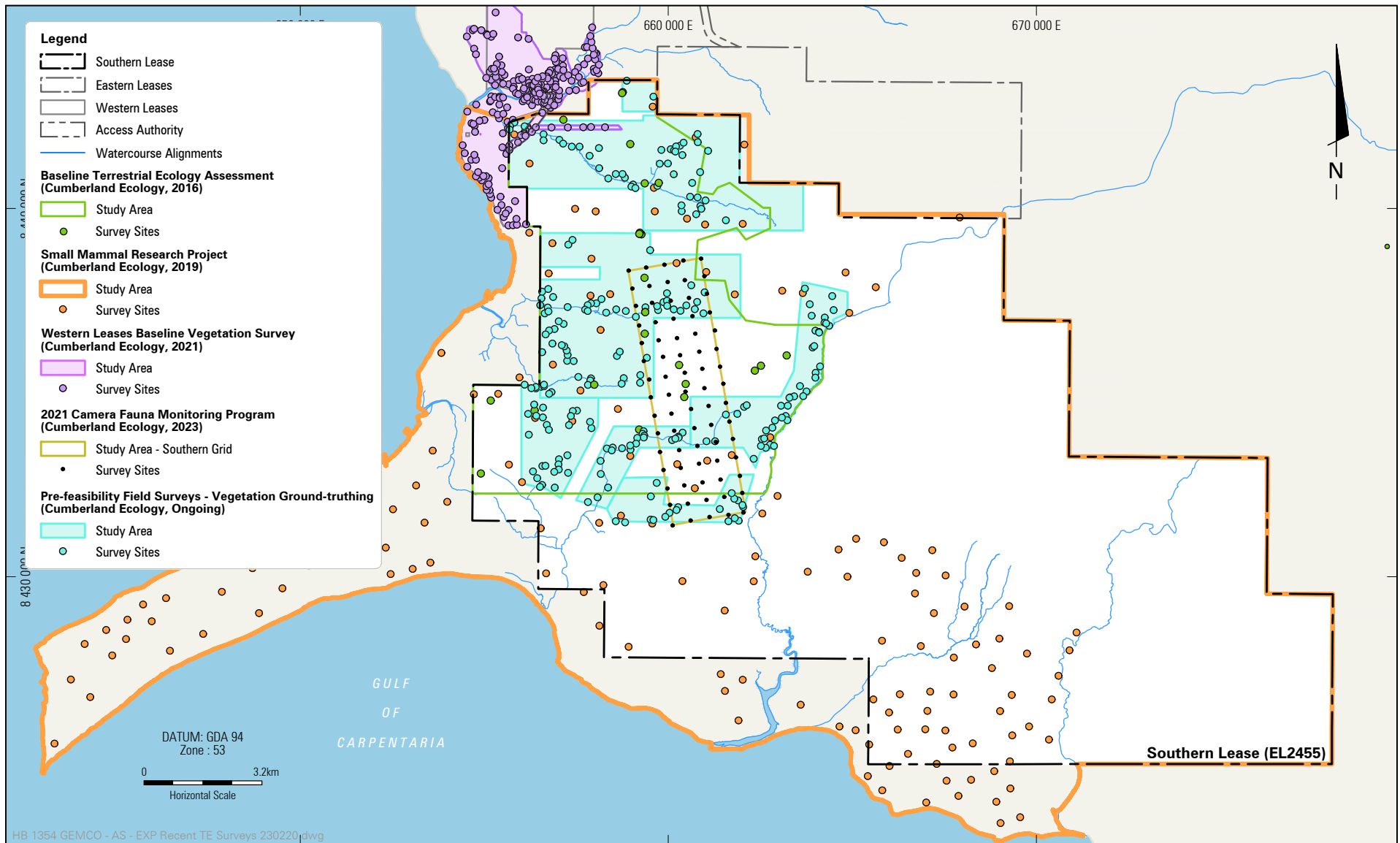
FIGURES



SOUTHERN LEASE EXPLORATION PROGRAM
Exploration Program Disturbance Footprint
Aerial Imagery



FIGURE 4-1

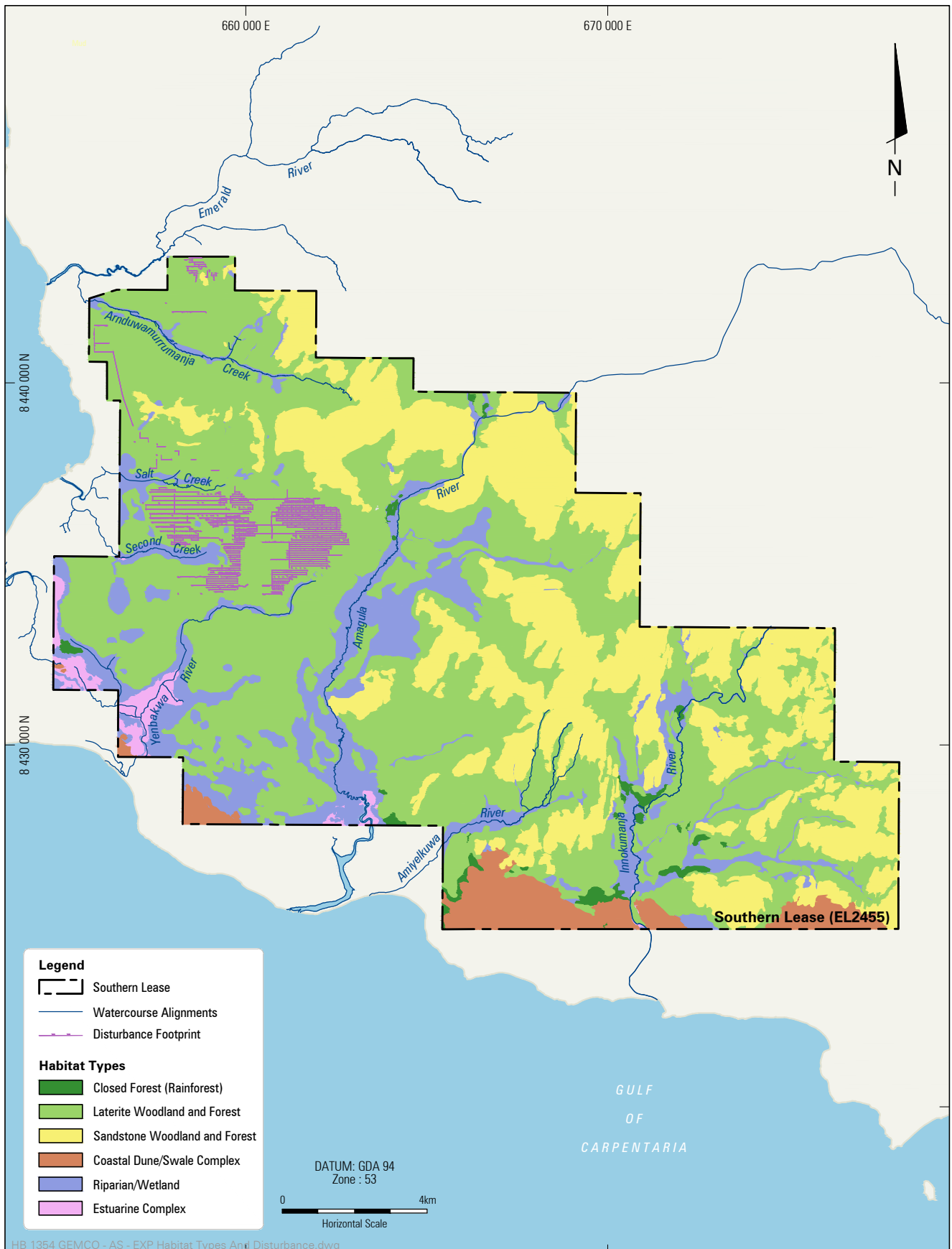


SOUTHERN LEASE EXPLORATION PROGRAM

Location of Recent Terrestrial Ecology Surveys within the Southern Lease

FIGURE 4-2





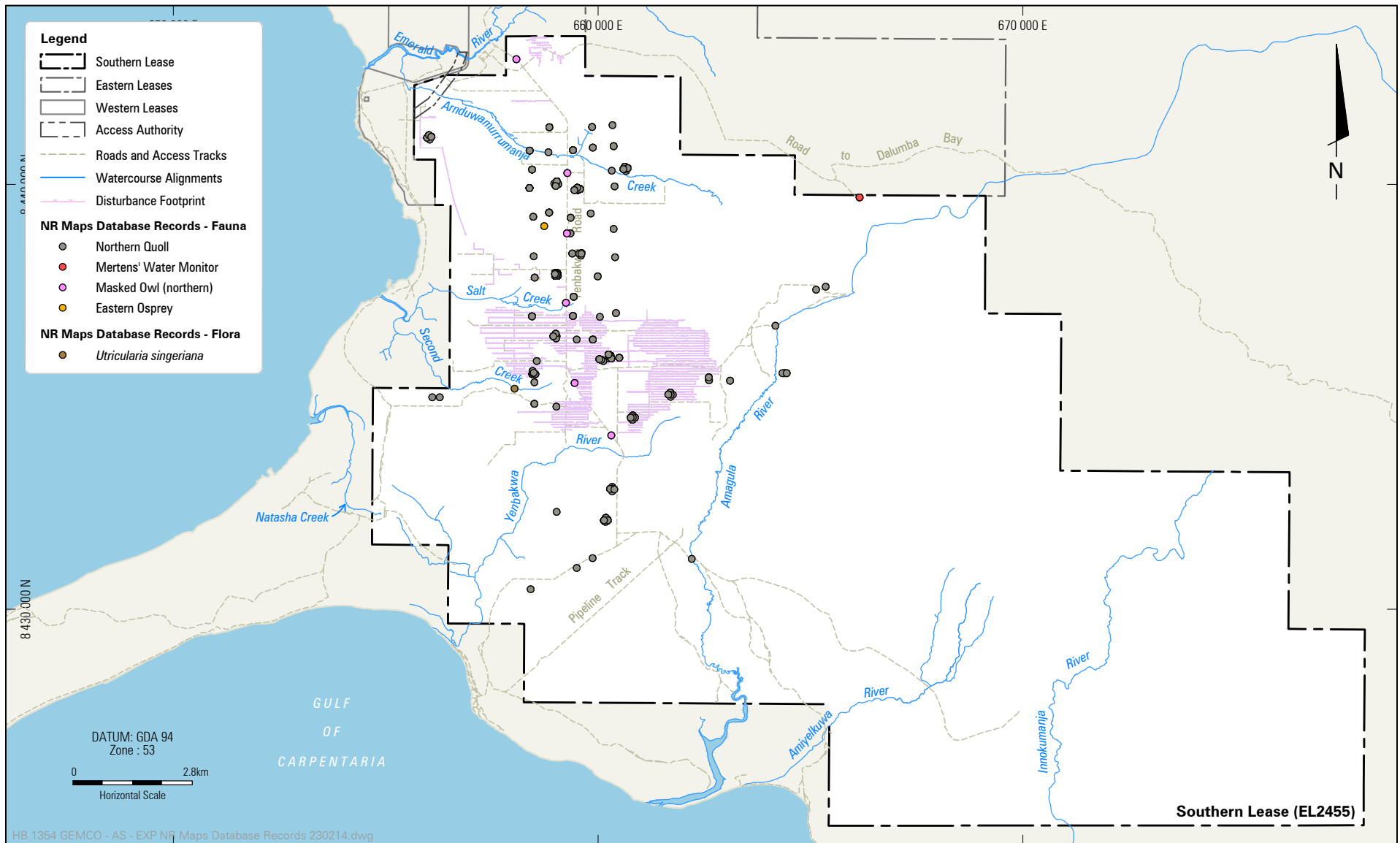
HB 1354 GEMCO - AS - EXP Habitat Types And Disturbance.dwg

SOUTHERN LEASE EXPLORATION PROGRAM

Habitat Types within the Southern Lease and Disturbance Footprint

FIGURE 4-3

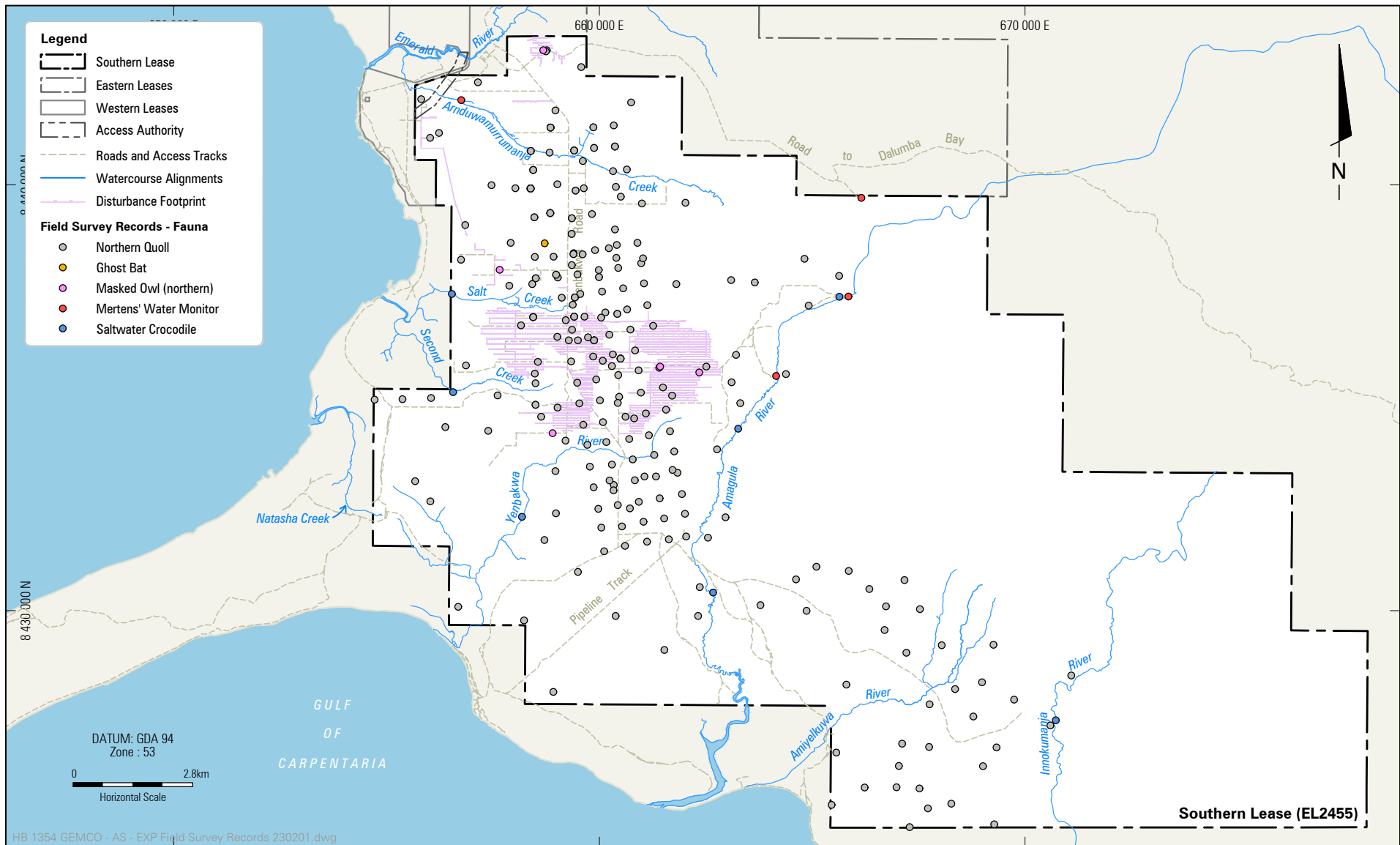




SOUTHERN LEASE EXPLORATION PROGRAM

NR Maps Database Records
within the Southern Lease

FIGURE 4-4

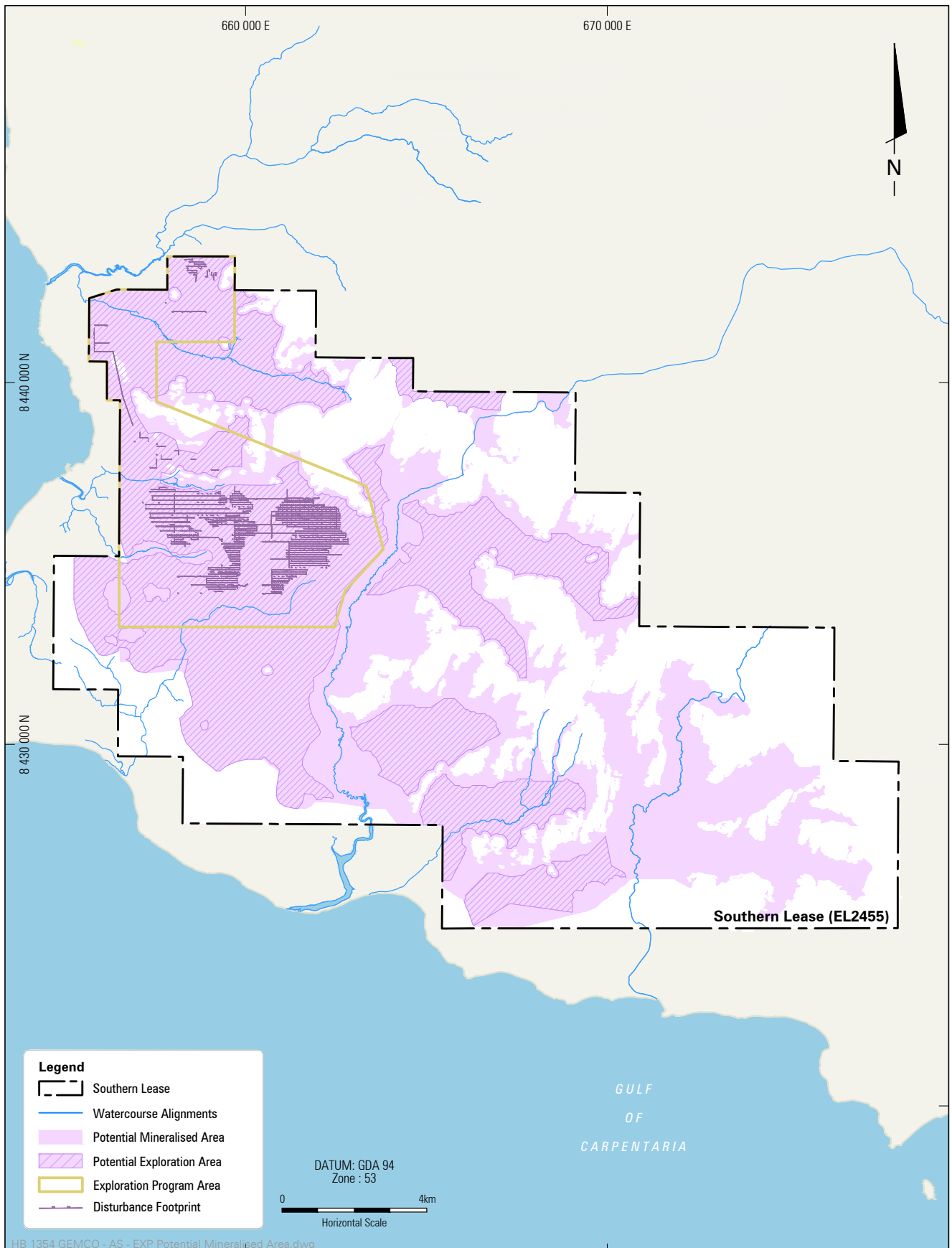


SOUTHERN LEASE EXPLORATION PROGRAM

Field Survey Records
within the Southern Lease

FIGURE 4-5



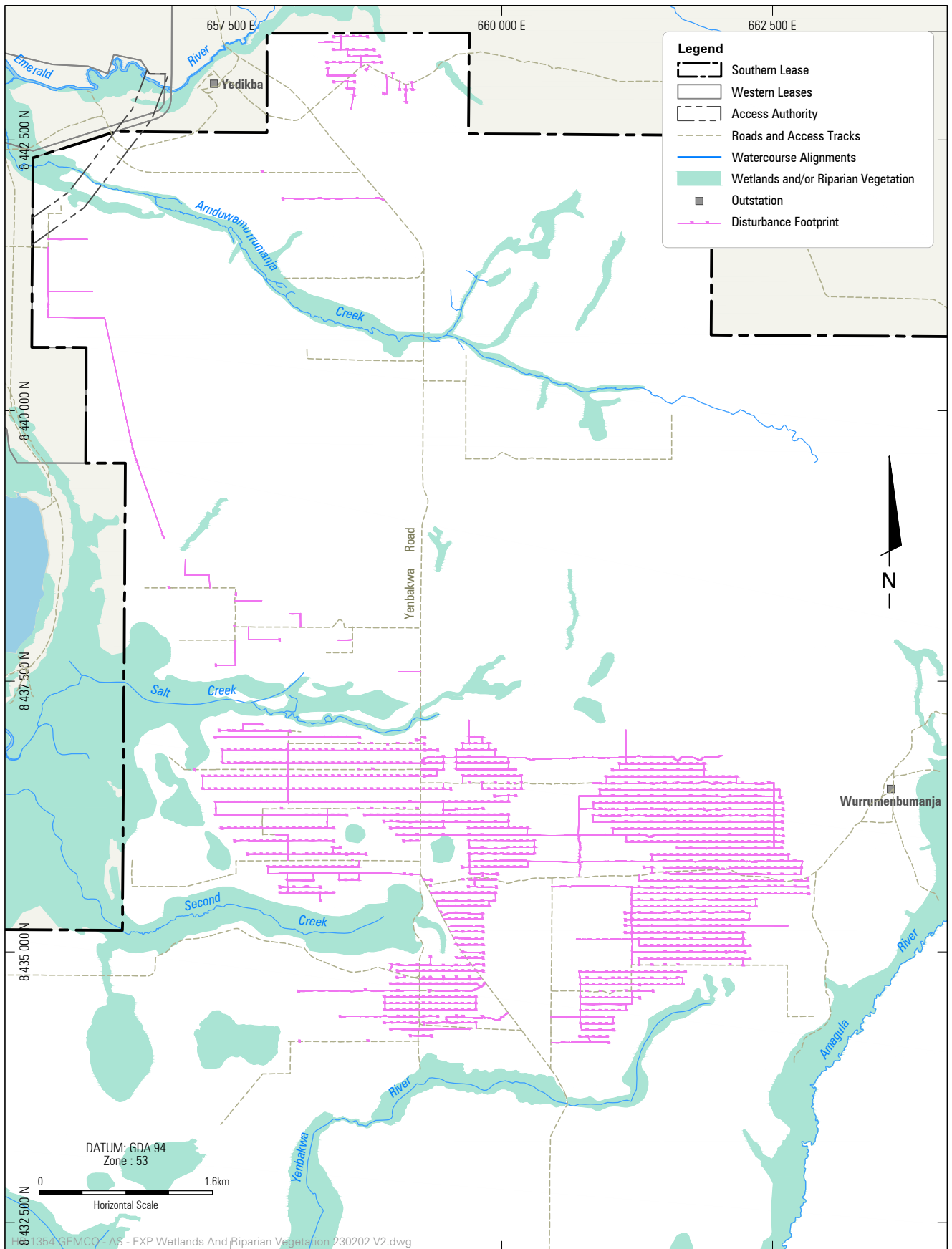


SOUTHERN LEASE EXPLORATION PROGRAM

Potential Mineralised Area

FIGURE 4-6





SOUTHERN LEASE EXPLORATION PROGRAM

Exploration Program Disturbance Footprint

FIGURE 4-7

