

Appendix K - Ecological Flora and Fauna Reports

Appendix K-1 - Flora and Fauna Report 2017



TOMS GULLY, RUSTLERS ROOST AND QUEST 29 Flora and Fauna Report

For

Primary Gold Limited

Prepared by: Low Ecological Services P/L

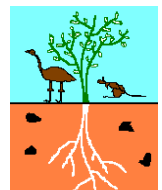
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PREFACE

All information on proposed operations contained in this document has been supplied by Primary Gold Limited.

1 EXECUTIVE SUMMARY

Toms Gully, Rustlers Roost and Quest 29 are existing, non-operational mines located within the Old Mount Bundy and McKinlay River pastoral leases, approximately 90 km south-east of Darwin, Northern Territory (NT). The mines were operational for discontinuous periods from 1988 and have been in care and maintenance since 2007. Primary Gold Ltd (Primary Gold) acquired the existing mine sites in 2013 and is undergoing an Environment Impact Statement (EIS) process via the NT EPA.

Primary Gold commissioned Low Ecological Services P/L (LES) to undertake an on-ground flora and fauna survey across areas defined by Primary Gold at Toms Gully, Rustlers Roost and Quest 29. A desktop assessment was undertaken to provide prior information of the existing environment within the survey areas and the likelihood that threatened species may occur. Eleven threatened species were identified by the NT Environment Protection Authority (NT EPA) in the Toms Gully EIS as potentially occurring within the survey area and requested targeted on-ground surveys be undertaken. These were the yellow-snouted gecko (*Luccasium occultum*), *Helicteres macrothrix*, black-footed tree-rat (*Mesembriomys gouldii*), bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus nudiclunatus*), northern quoll (*Dasyurus hallucatus*), fawn antechinus (*Antechinus bellus*), pale field-rat (*Rattus tunneyi*), partridge pigeon (*Geophaps smithii smithii*), floodplain monitor (*Varanus panoptes*), Merten's water monitor (*V. mertensi*) and Mitchell's water monitor (*V. mitchelli*).

An on-site flora and fauna surveys of the Toms Gully, Rustlers Roost and Quest 29 survey areas was undertaken from 1st – 7th November 2016 to assess fauna presence in the late dry season and 4th – 10th May 2017 to assess diversity in the early dry season. The surveys were designed to gain a detailed understanding of the environment of the survey areas, as well as to survey for species of conservation significance. Survey sites were chosen to incorporate the main habitat types in each area. Additionally, motion-sensing cameras and bat detectors were used to detect nocturnal or difficult to detect species.

Nine habitats were recorded within the Toms Gully, Rustlers Roost and Quest 29 survey areas with woodland on slope, open woodland on slope and lowland woodland being the most common. There were 102 flora species from 34 families identified during the November 2016 survey. There were 186 flora species from 47 families identified during the May 2017 survey. No flora species of conservation significance were identified within the survey areas during November 2016 or May 2017. In particular, targeted threatened species, *Helicteres macrothrix*, *Goodenia quadrifida* and *Schoutenia ovata* were not recorded within the survey areas during November 2016 or May 2017.

Eight introduced flora species were recorded during the November 2016 survey, including three declared Weeds of National Significance (WoNS); *Andropogon gayanus* (gamba grass), *Hymenachne amplexicaulis* (hymenachne) and *Mimosa pigra* (mimosa). These three species are also listed as Class B and C weeds in the NT along with *Mesophaerum suaveolens*, which was also recorded during November 2016. Seventeen introduced flora species were recorded during the May 2017 survey, including the WoNS *A. gayanus* and *H. amplexicaulis*. Another four introduced flora species are listed as Class B and C weeds in the NT; *Xanthium strumarium*, *Sida acuta*, *Pennisetum polystachion* and *M. suaveolens*.

One hundred and thirty-nine fauna species were recorded during the November 2016 survey. This included 89 bird species, 20 mammal species, 15 reptile species, 12 amphibian species and three arthropod species. One hundred and twenty-one fauna species were recorded during the May 2017

survey; nine amphibians, one arthropod, 82 birds, 19 mammals and nine reptiles. One threatened fauna species, Merten's water monitor (*Varanus mertensi*), was recorded during the May 2017 survey. Three near threatened species were recorded during the November 2016 survey; orange leaf-nosed bat (*Rhinonictus aurantia*), Arnhem sheath-tailed bat (*Taphozous kapalgensis*) and bush stone-curlew (*Burhinus grallarius*). Two data deficient species were also recorded during the November 2016 survey; red-cheeked dunnart (*Smithopsis virginiae*) and black-spotted ridge-tailed monitor (*Varanus baritji*). Four near threatened species were recorded during the May 2017 survey; yellow-rumped manikin (*Lonchura flaviprymma*), bush stone-curlew, Arnhem sheath-tailed bat and orange leaf-nosed bat. No data deficient species were recorded during the May 2017 survey. No fauna species listed as migratory were recorded during the November 2016 or May 2017 on-ground surveys.

Seven introduced fauna species were recorded during the November 2016 survey; cattle (*Bos Taurus*), water buffalo (*Bubalus bubalus*), cane toad (*Rhinella marinus*), horse (*Equus caballus*), house mouse (*Mus musculus*) and pig (*Sus scrofa*). Four introduced fauna species were recorded during the May 2017 survey; cane toad, cattle, horse and pig.

A discussion of the recorded weed species, species of conservation significance in relation to the abundance of records across the region in the NT Fauna Atlas and introduced fauna species in relation to listed Key Threatening Processes is provided in the conclusion. It was assessed that the proposed operations are not likely to negatively affect the conservation status of any species recorded during the November 2016 and May 2017 on-ground surveys.

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1 INTRODUCTION

1.1 Overview

Toms Gully, Rustlers Roost and Quest 29 are existing, non-operational mines located within the Old Mount Bundy and McKinlay River pastoral leases, approximately 90 km south-east of Darwin, Northern Territory (NT) (Figure 1-1). The mines were operational for discontinuous periods from 1988 and have been in care and maintenance since 2007. Primary Gold Ltd (Primary Gold) acquired the existing mine sites in 2013 and propose to conduct exploration programs. Existing infrastructure at the sites include open pits at all three sites, access roads, waste rock dumps (WRDs), , evaporation dams, and drains and sumps. In addition, Toms Gully contains two tails storage facilities, an underground mine, 22 Kv power reticulation, processing facility, maintenance shed and lay-down yards, stores shed and yards and administration offices.

1.2 Purpose of this report

Primary Gold commissioned Low Ecological Services P/L (LES) to undertake two on-ground flora and fauna surveys across areas defined by Primary Gold at Toms Gully, Rustlers Roost and Quest 29 which will be used in the EIS process assessed by the NT EPA (Figure 1-1 and Figure 1-2). A desktop assessment was undertaken to provide prior information of the existing environment of the survey areas and the likelihood that threatened species may occur in the areas. A number of threatened flora and fauna species were identified by the NT Environment Protection Authority (NT EPA) as potentially occurring on the Toms Gully, Rustlers Roost and Quest 29 survey areas including:

- Yellow-snouted gecko (*Lucasium occultum*)
- A shrub (*Helicteres macrothrix*)
- Black-footed tree-rat (*Mesembriomys gouldii*)
- Bare-rumped sheath-tail bat (*Saccolaimus saccolaimus nudiclunatus*)
- Northern quoll (*Dasyurus hallucatus*)
- Fawn antechinus (*Antechinus bellus*)
- Pale field-rat (*Rattus tunneyi*)
- Gouldian finch (*Erythrura gouldiae*)
- Partridge pigeon (*Geophaps smithii smithii*)
- Floodplain monitor (*Varanus panoptes*)
- Merten's water monitor (*Varanus mertensi*)
- Mitchell's water monitor (*Varanus mitchelli*)

The on-ground surveys were based on the findings of the desktop assessment, with surveys targeting threatened species and all major habitat types. Weeds within the survey areas were also recorded. Surveys were designed in line with the NT EPA "Guidelines for Assessment of Impacts on Terrestrial Biodiversity" and the "Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping".

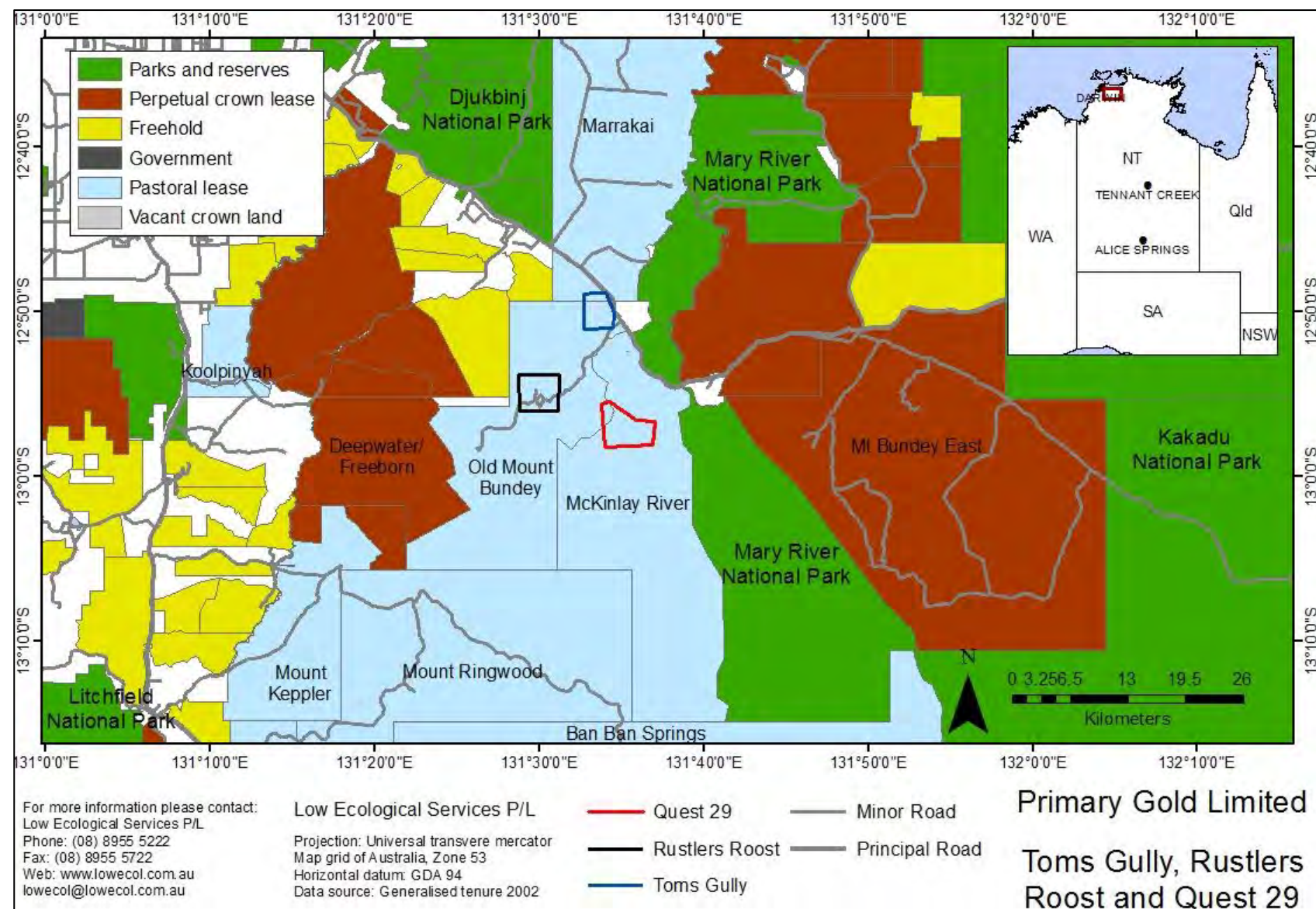


Figure 1-1: Location of the Toms Gully, Rustlers Roost and Quest 29 survey and land tenure in the surrounding area. Inset: location of the area within the Northern Territory.

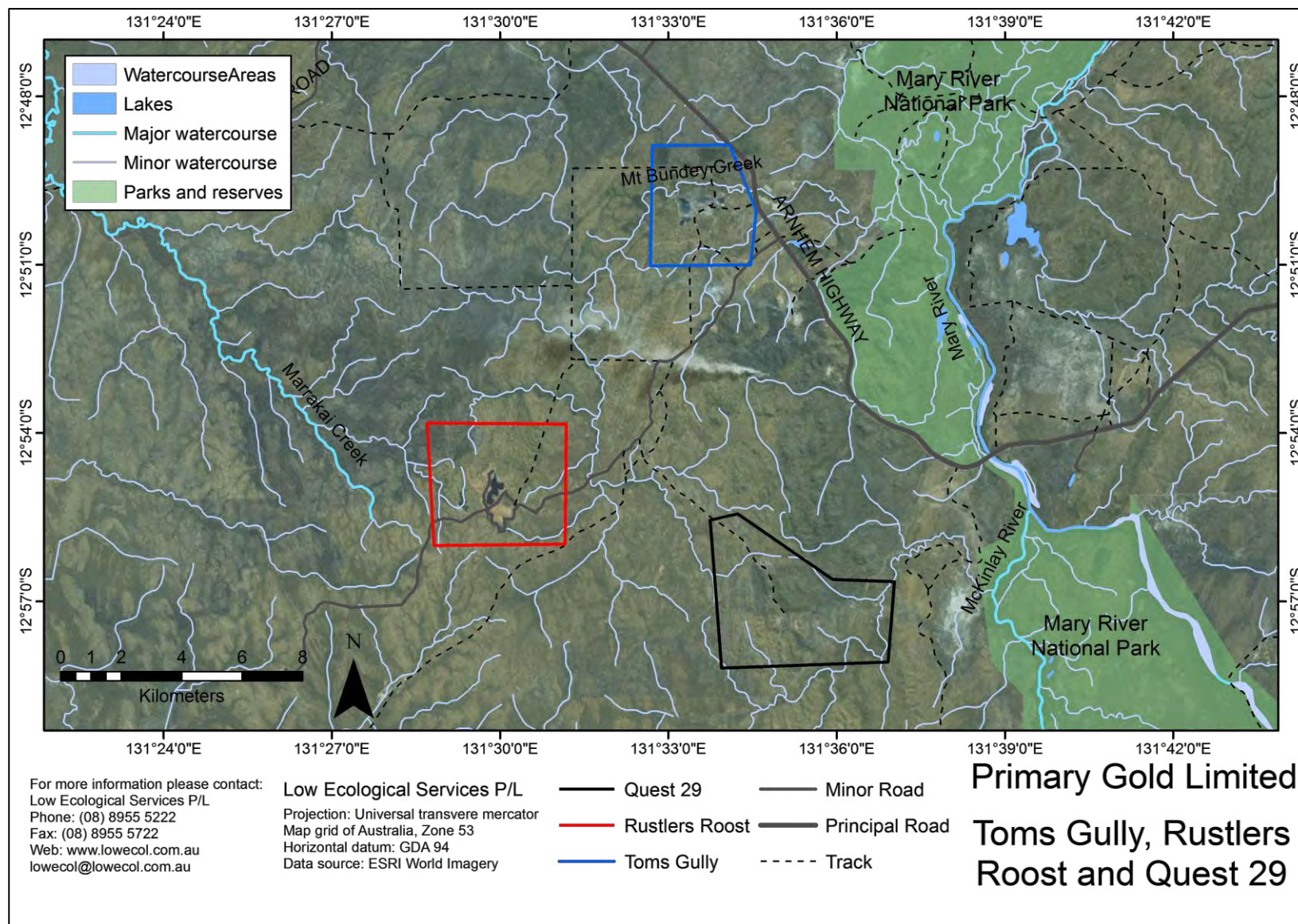


Figure 1-2: Location of Toms Gully, Rustlers Roost and Quest 29 in relation to watercourses, roads and Mary River National Park

1.3 Legislative context

1.3.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The objects of the EPBC Act are to provide for the protection of matters of national environmental significance (MNES) and to promote the conservation of biodiversity. The EPBC Act focuses on the protection of MNES, with the states and territories having responsibility for matters of state and local significance. The EPBC Act identifies MNES as:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar wetlands).
- Threatened species and ecological communities;
- Migratory species.
- Commonwealth marine areas.
- Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development.

1.3.2 State legislation

Northern Territory Parks and Wildlife Conservation Act 2000

The NT *Parks and Wildlife Conservation Act 2000* (TPWC Act) is “an Act to make provision for and in relation to the establishment of Territory Parks and other Parks and Reserves, and the study, protection, conservation and sustainable utilisation of wildlife”. Under the TPWC Act, all threatened species are classed as protected wildlife. The Act includes ‘Principles of Management’, which require that a threatened species be managed in a manner that “maintains or increases their population or the extent of their distribution at or to a sustainable level”.

Environmental Assessment Act 1982 (EA Act) and Environmental Assessment Administrative Procedures 1984

The EA Act and the *Environmental Assessment Administrative Procedures 1984* is administered by the NT Environmental Protection Agency (EPA). The Act provides a framework for the assessment of potential environmental impacts of developments. The object of the Act is to ensure that matters affecting the environment to a significant extent are fully examined and taken into account in decisions by the Northern Territory Government. The assessment process also evaluates the effectiveness of the proposed safeguards to mitigate these impacts during construction and operational phases of the development.

Mining Management Act 2001

The *Mining Management Act 2001* (MM Act) is administered by the Department of Primary Industry and Resources (DPIR). The objectives of the MM Act are to ensure that mining in the NT is conducted in accordance with best practice standards for health, safety and the environment. Under the MM Act, an application for authorisation to carry out mining activities must include a Mining Management Plan (MMP).

Weeds Management Act 2001

The *Weeds Management Act 2001* is administered by the NT Department of Environment and Natural Resources (DENR). The objective of the Act is to prevent the spread of weeds in, into and out of the NT and to ensure that the management of weeds is an integral component of land management. The Act is linked to the *Northern Territory Weeds Management Strategy 1996-2005* which led to a series of Statutory Plans being developed for each declared weed. Declared weeds are grouped into three categories; Schedule A (weeds to be eradicated), Schedule B (Weeds which growth and spread must be controlled) and Schedule C (weeds not to be introduced to the Territory).

Other legislation that may be applicable to the proposed mining activities includes:

General:

- *Mineral Titles Act 2016.*
- *Northern Territory Environmental Protection Authority Act 2012.*

Land Use:

- *Planning Act 2016.*
- *Aboriginal Land Act 2013.*
- *Crown Lands Act 2014.*
- *Soil Conservation and Land Utilization Act 2016.*
- *Bushfires Act 2014.*
- *Pastoral Land Act 2016.*

Cultural and Heritage:

- *Northern Territory Aboriginal Sacred Sites Act 2013.*
- *Heritage Act 2016.*

Water Quality and Biodiversity Conservation:

- *Water Act 2016.*
- *Biological Control Act 2016.*
- *Public and Environmental Health Act 2016.*
- *Weeds Management Act 2013.*

Air Quality, Noise and Waste Management:

- *Waste Management and Pollution Control Act 2016.*
- *Public and Environmental Health Act 2016.*

Safety and Environmental Compliance:

- *Work Health and Safety (National Uniform Legislation) Act 2016.*
- *Environmental Offences and Penalties Act 2011.*
- *Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2016.*
- *Dangerous Goods Act 2012.*

2 METHODOLOGY

2.1 Desktop review

Literature and database searches were undertaken to gain an understanding of the ecological context of the lease areas and to update assessments. Data collated from database searches provided information on the fauna and flora species known to occur in the region, particularly those of conservation significance. Geographic information system (GIS) mapping and a search of Australian Bureau of Meteorology (BoM) climate data were undertaken to provide an overview of the climate, soils, vegetation and habitats of the lease areas and surrounds. A literature review was performed to obtain an understanding of data available within and surrounding the lease areas and the validity thereof.

2.1.1 Database review

GIS mapping was undertaken using several data sources to provide an ecological context of the landscape, vegetation, habitats and climate of the lease areas. The sources include:

- Climate data online (BoM, 2016).
- Interim Biogeographic Regionalisation of Australia (IBRA) (Environment Australia, 2000).
- Digital Atlas of Australian Soils (Northcote, 1968).
- NTVIS - NT Data Compilation for the National Vegetation Information System to determine vegetation communities present in the lease areas.
- Vegetation Survey of the Northern Territory Australia: Notes to accompany 1: 100, 000 Map Sheets (Wilson, et al., 1990).
- Report on the land units of the western section of Annaburroo Station (Fett & Hall 1983)
- Fire history from the North Australia and Rangelands Fire Information (2016)
- Aerial photographs and satellite imagery.

Database searches conducted provide lists of species of conservation significance that occur or are likely to occur within the vicinity of the survey areas. Species of conservation significance are those that are listed as such under the EPBC Act and/or TPWC Act.

The Commonwealth Government Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) identifies Matters of National Environmental Significance (MNES) that may occur in a given area. The PMST is based on predicted distributions of EPBC listed flora and fauna species and communities and/or their habitat, rather than known records. The PMST may predict the occurrence of a species or community in an area when there are no documented records from the area. A PMST search was conducted within a 20 km radius around the survey areas.

The NT Species Atlas which is maintained by the DENR and includes the NT Fauna Atlas, NT Flora Atlas, Sites of Conservation Significance (SoCS) and Sites of Botanical Significance (SoBS), The NT Fauna and Flora Atlas search provided a list of records of threatened, non-threatened and introduced fauna and flora species within a 20 km radius around the survey areas. A search of Sites of Conservation Significance (SoCS) and Sites of Botanical Significance (SoBS) was also undertaken to determine if any SoCS or SoBS were in the vicinity of the survey areas.

Geology, soil, land unit and vegetation mapping was studied to identify habitats present within the survey areas. This was then cross-referenced with information on threatened species habitat requirements obtained from the published literature and habitats in which mapped records occur, to determine if

threatened species habitat is present or likely to be present. Each species listed as threatened was then given a likelihood of occurrence in the lease areas of either low, moderate or high.

2.1.2 Literature review

A literature review provided information on the species occurring or potentially occurring within the lease areas and surrounds. Information was collated to assess the potential for species of conservation significance to occur within the lease areas and surrounds, and the likelihood that proposed operations would impact on these species of conservation significance. Sources of literature reviewed include:

- Species Profile and Threats Database (DoEb, 2015) for information about species listed in the EPBC Act – Information sheets, survey guidelines, recovery plans, and Threat Abatement Plans for Key Threatening Processes;
- Northern Territory Threatened Species fact sheets published by the Department of Land Resource Management (DENR); and
- Scientific literature (various referenced sources).

2.2 Field surveys

On-site flora and fauna surveys of the Toms Gully, Rustlers Roost and Quest 29 survey areas were undertaken from 1st – 7th November 2016 and 4th – 10th May 2017. These surveys were designed to gain a more detailed understanding of the environment of the survey areas, as well as to survey for species of conservation significance. Four sites in each survey area were chosen for detailed surveying and establishment of trapping grids (Figure 2-1). These sites were chosen to incorporate the main habitat types in each area. Additionally, motion-sensing cameras were set up at four sites in each survey area (Figure 2-1). Camera sites were chosen to replicate the habitat types of the trapping grids. Co-ordinates for the survey sites are provided in Appendix 1.

2.2.1 Landscape, vegetation and flora surveys

Site descriptions were carried out within a 50 m x 50 m quadrat at all live- and camera-trapping sites (eight sites in each survey area). Site descriptions provided an overall snapshot of the landscape, geology, soil, dominant flora species and vegetation structure and density at each site. The presence of termite mounds, woody debris, impact from disturbance, weeds and current vegetation condition were also noted. Photographs were taken at each site representative of the landscape and vegetation community, facing north, south, east and west. Flora species lists were completed by doing a walkover of the quadrat. Voucher specimens were taken where plants could not be identified in the field. Voucher specimens were identified by botanists at the Northern Territory Herbarium, Darwin.

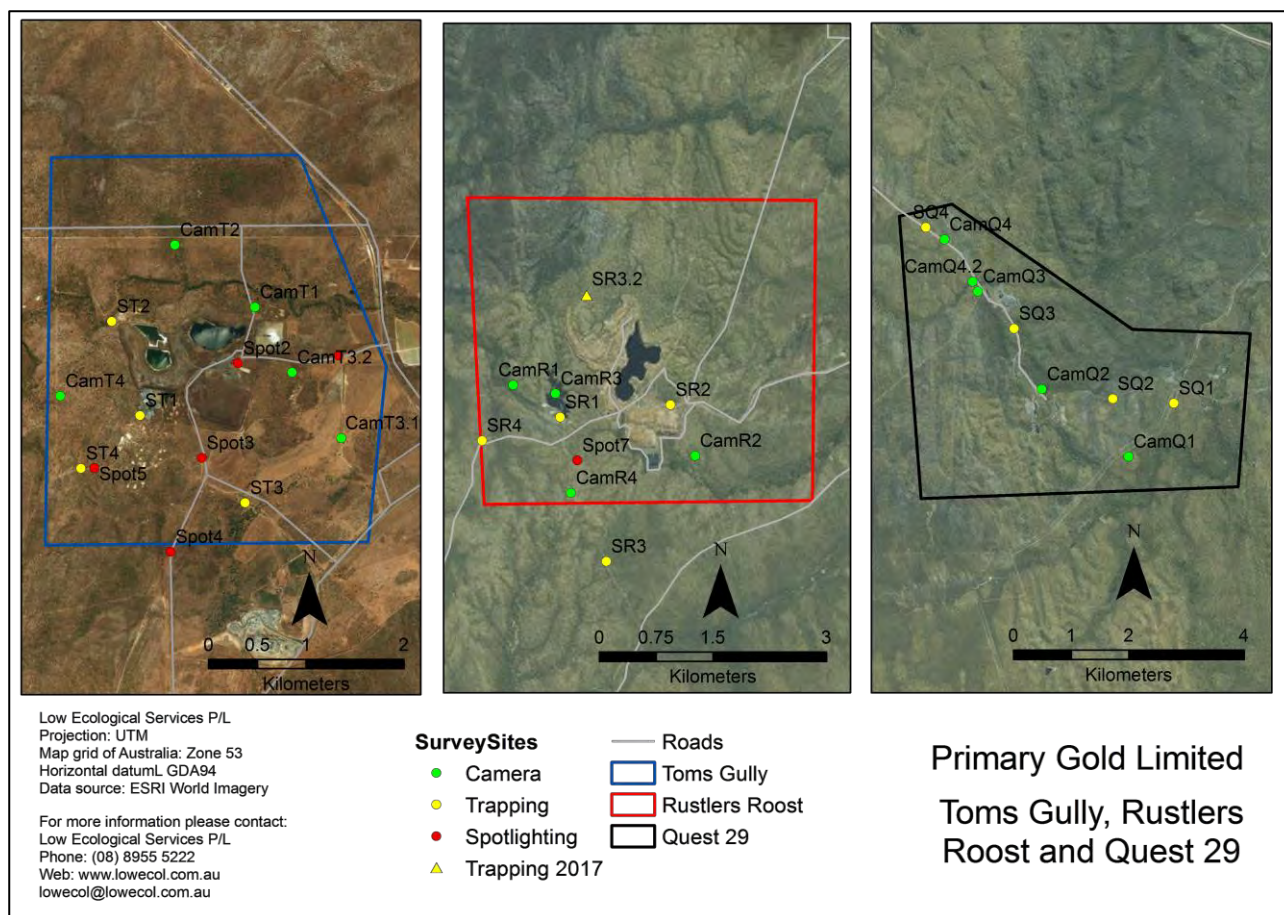


Figure 2-1: Location of camera, trapping and spotlight sites for surveys undertaken by LES of Quest 29, Rustlers Roost and Toms Gully

2.2.2 Fauna surveys

General survey methodology follows the NT EPA *Guidelines for Assessment of Impacts on Terrestrial Biodiversity* (NT EPA, 2013).

Survey methods used to determine the presence of threatened species follow those suggested in the *Survey Guidelines for Australia's Threatened Mammals* (Department of Sustainability, Environment, Water, Population and Communities, 2011a) *Survey Guidelines for Australia's Threatened Bats* (Department of the Environment, Water, Heritage and the Arts, 2010), *Survey Guidelines for Australia's threatened reptiles* (Department of Sustainability, Environment, Water, Population and Communities, 2011) and *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment, Water, Heritage and the Arts, 2010). Targeted searches were conducted on-ground for threatened species that may occur within the appropriate habitat in the survey area as identified by the desktop survey and for the threatened species identified by the NT EPA (section 1.2). Surveys were also undertaken to target other species listed as threatened under the EPBC Act and TPWC Act identified by the PMST and NT Fauna Atlas as occurring or potentially occurring within the survey areas.

Habitat search

Searches for potentially suitable habitat for threatened species were undertaken while traversing the survey area.

Trapping

Elliott, cage and funnel traps were used at all sites. A grid of 25 Elliott traps at 10 m spacing was laid out at each of the trapping sites with a cage trap placed on the outside of each grid corner. Both cage and Elliott traps were baited with a mixture of peanut butter and oats. Four funnel traps were placed randomly within the grid of Elliott traps, with two situated along a 10 m drift fence. When possible, pitfall traps were used, with a 10 m drift fence centred over the trap and two of the funnel traps placed at either end. Pitfall traps were not used at all sites due to the difficulty of digging in the rocky substrate. For this reason, additional Elliott traps and funnel traps were used at rocky sites. All traps were checked each morning and animals processed (i.e. noting sex, reproductive status, body length, tail length, snout-vent length etc.) and released at the point of capture. Elliott traps were closed during the day and then opened in the late afternoon when pitfall and funnel traps were rechecked. Traps were set for 3 nights at each site during each trip.

Bat detectors

Two bat detectors (a SongMeter SM2BAT+ and a SongMeter SM3BAT) were deployed at ten sites encompassing the three survey areas. The bat detectors were used to identify the bat species in each habitat type and to determine if the threatened species, bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus*) and ghost bat (*Macroderma gigas*) were present. Bat detectors were placed at each trap site for one night, except in May 2017 when a detector was set at SQ2 for two nights and for no nights at SQ3. To target the bare-rumped sheath-tailed bat, detectors were placed in woodland or forest habitat, placed several metres above the ground where vegetation permitted, orientated upwards or towards waterholes/dams or watercourses (as per Department of the Environment, Water, Heritage and the Arts, 2010). Echolocation calls recorded were identified for each species when possible or assigned to a species group when echolocation call structure overlapped and individual species could not be identified. Bats were identified from the recordings by bat expert, Dennis Matthews.

Secondary sign surveys

Searches for secondary sign of fauna species (e.g. tracks and scats) were undertaken within a 200 m x 200 m quadrat at each site twice a day for three days when traps were checked and set.

Area search

Area searches for direct observation of flora and fauna species were undertaken at each of the trapping sites and camera sites while vegetation surveys were being undertaken and opportunistically while checking and setting traps.

Motion-sensing camera surveys

Motion-sensing cameras were deployed at four sites in each survey area to increase the chance of recording species not detected by other methods. Cameras were set to take pictures when triggered by movement. Camera traps were baited with peanut butter and oats. 4 cameras were set ~1 m above the ground facing vertically (i.e. pointing at the ground), and all other were set facing horizontally. Cameras were set for between four and five days.

Spotlighting

Spotlighting was undertaken at 12 sites within the survey areas. At each site, a walkover was undertaken while searching for eye-shine or movement of animals with a torch. Spotlighting was undertaken for approximately 20 minutes at each site. Leaf litter was searched during surveys targeting the yellow-snouted gecko (*Lucasium occultum*).

Table 2.1. Type of survey undertaken to target fauna species listed as threatened under the EPBC Act and TPWC Act potentially occurring within the survey areas

Species	Habitat search	Trapping	Bat detector	Secondary sign survey	Area search	Motion-sensing camera	Spotlighting	Call playback
Red goshawk	X				X			
Gouldian finch	X				X			
Grey falcon	X				X			
Partridge pigeon	X				X			
Australian painted snipe	X				X			
Masked owl	X						X	X
Fawn antechinus	X	X				X	X	
Northern quoll	X	X		X		X	X	
Ghost bat	X		X					
Black-footed tree-rat	X	X		X		X	X	
Northern brush-tailed phascogale	X	X				X	X	
Pale field-rat	X	X				X	X	
Bare-rumped sheath-tailed bat	X		X					
Yellow-snouted gecko	X						X	
Merten's water monitor	X	X			X	X		
Mitchell's water monitor	X	X			X	X		
Floodplain monitor	X	X			X	X		

Call-playback

Call-playback was undertaken for masked owls following the method of Ward (2010), whereby:

- i) the call of the masked owl is broadcast.
- ii) for the first five minutes after the broadcast, surveyors listen for calls of masked owls and watch for silhouettes of birds flying in the area around the speaker without a spotlight.
- iii) in the second five minutes surveyors keep listening for owl calls but use a spotlight to look for owls in the trees around the site.
- iv) when spotlighting, the surveyors do an initial scan of all the nearby trees, then spend the rest of the five minutes doing a more-careful search of the trees for owls and small mammals (potential prey).

Incidental observations

Incidental observations of fauna species were recorded at all times and all habitats during the field surveys.

2.2.3 Other

GPS locations and extent of weed infestations were recorded. Where possible, GPS locations of large mature trees of potential cultural significance were taken.

2.2.4 Limitations of the surveys

Records obtained from the NT Fauna and Flora Atlases display records from areas which have been surveyed previously. The lack of records at a locality commonly may represent a lack of survey effort as opposed to the absence of various species in the area.

Only casual attempt was made to identify any trapped invertebrates to group, genus or species level. No targeted survey for invertebrates was undertaken during the on-ground survey, as this was not a part of the scope of works.

LES has attempted to carry out surveys at an appropriate spatial scale for the proposed development. While this will increase the chances of obtaining sufficient data required to detect the presence of threatened species, it cannot be guaranteed that the species lists are complete. As a result, this report includes a likelihood of occurrence for threatened species based on habitat present in the leases (see section 3.9.2 and section 3.10.2)

Surveys were aimed at detecting appropriate landscapes and assessing the potential presence of threatened species within the survey areas. Population surveys for abundance and density were not conducted within the survey areas and surrounds.

3 EXISTING ENVIRONMENT

3.1 Climate

The Toms Gully, Rustlers Roost and Quest 29 survey areas (the Proposal area) have a tropical monsoonal climate, with distinct wet and dry seasons. The closest Australian Bureau of Meteorology climate station to the Proposal area with consistent records is Darwin Airport approximately 85 km to the north-west. Average annual rainfall is 1727.5 mm, with approximately 90% occurring between November and April (Figure 3-1). Average temperatures vary little over the year, with average maximum temperatures being above 30°C in all months of the year and average minimum temperatures ranging from 19.3°C in July to 25.3°C in November and December (Figure 3-1).

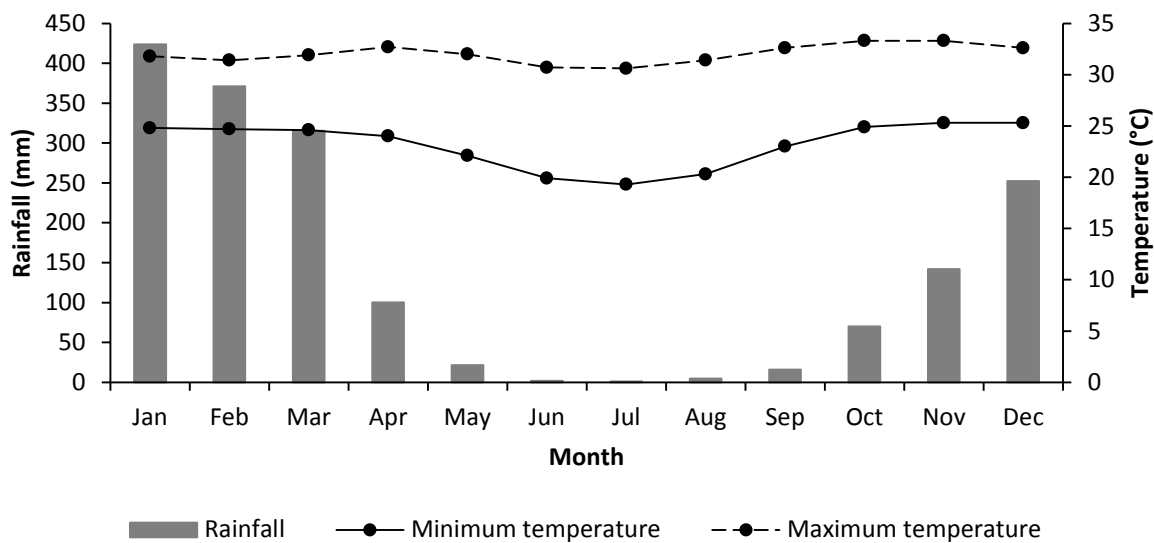


Figure 3-1: Monthly average rainfall and average minimum and maximum temperature at Darwin Airport based on data from the Bureau of Meteorology’s Climate Data Online (Bureau of Meteorology, 2016).

3.2 Bioregion

The Interim Biogeographic Regionalisation of Australia (IBRA) provides a division of Australia into geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information (Environment Australia, 2000). Toms Gully, Rustlers Roost and Quest 29 lie within the Pine Creek bioregion (Figure 3-2).

The Pine Creek Bioregion consists mainly of rugged ridges and undulating plains with eucalypt woodlands and patches of monsoon forest (Bastin & ACRIS Management Committee, 2008). Land use types in the bioregion include aboriginal lands, conservation, pastoralism, rural freehold, horticulture and mining (Bastin & ACRIS Management Committee, 2008). The Pine Creek bioregion is characterised by extensive and high frequency fire (Bastin & ACRIS Management Committee, 2008).

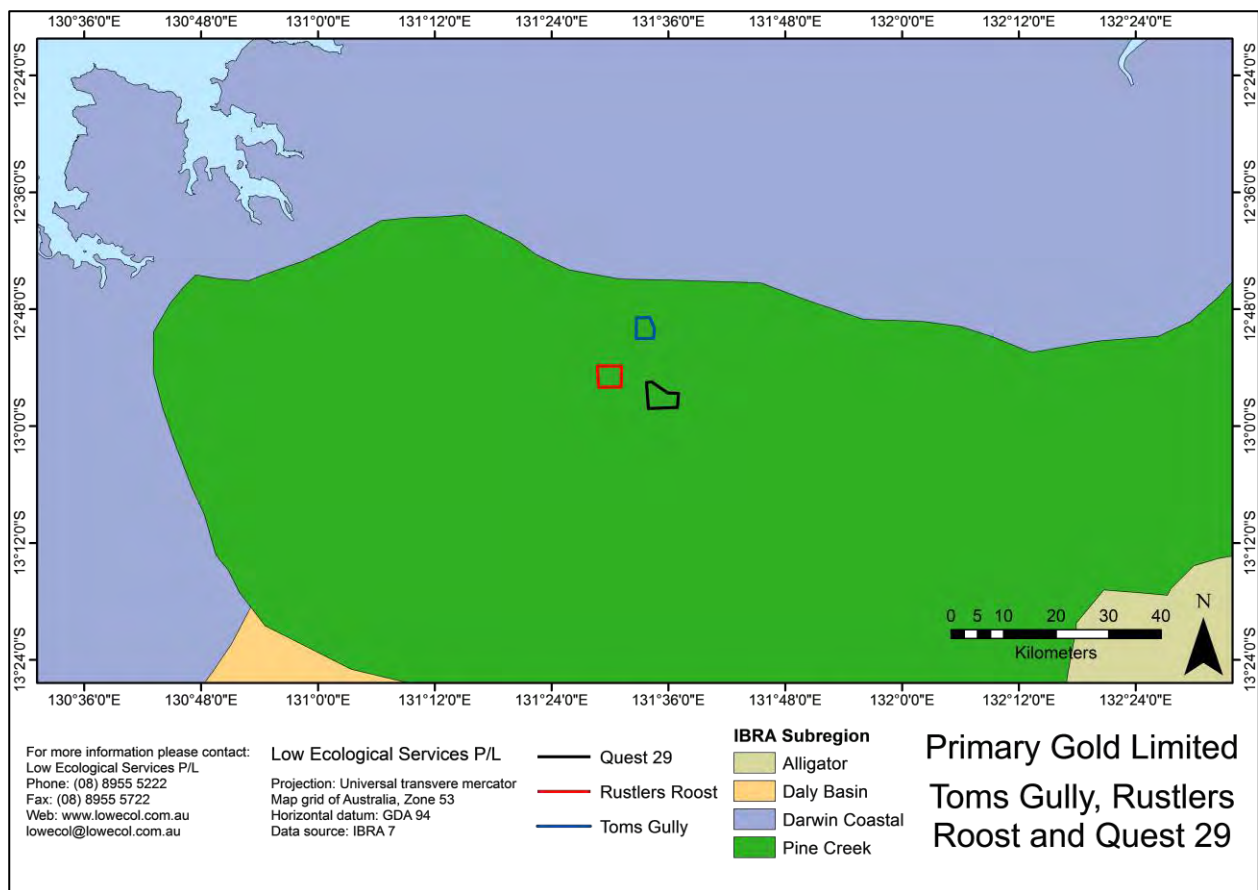


Figure 3-2: Interim Biogeographic Regionalisation for Australia (IBRA) bioregions at Toms Gully, Rustlers Roost and Quest 29 survey areas and the surrounding area (Department of Sustainability, Environment, Water, Population and Communities, 2012a).

3.3 Geology

The geological units of the survey areas are described in Table 3.1 and mapped in Figure 3-3. The Toms Gully area consists of geological units P2, P3 and g5. The Rustlers Roost area consists of geological units P3 and P4. The Quest 29 area consists of geological units P3, P4 and g5.

Table 3.1: Geological units present within Toms Gully, Rustlers Roost and Quest 29 as described by Ahmad (2000)

Map unit	Rock type	Description
P2	Sedimentary	Sandstone, shale
P3	Sedimentary	Greywacke, shale, siltstone, tuff, phyllite, chert, carbonaceous shale, banded iron formation (BIF), dolostone
P4	Sedimentary	Greywacke, shale, siltstone, sandstone
g5	Plutonic	Granite

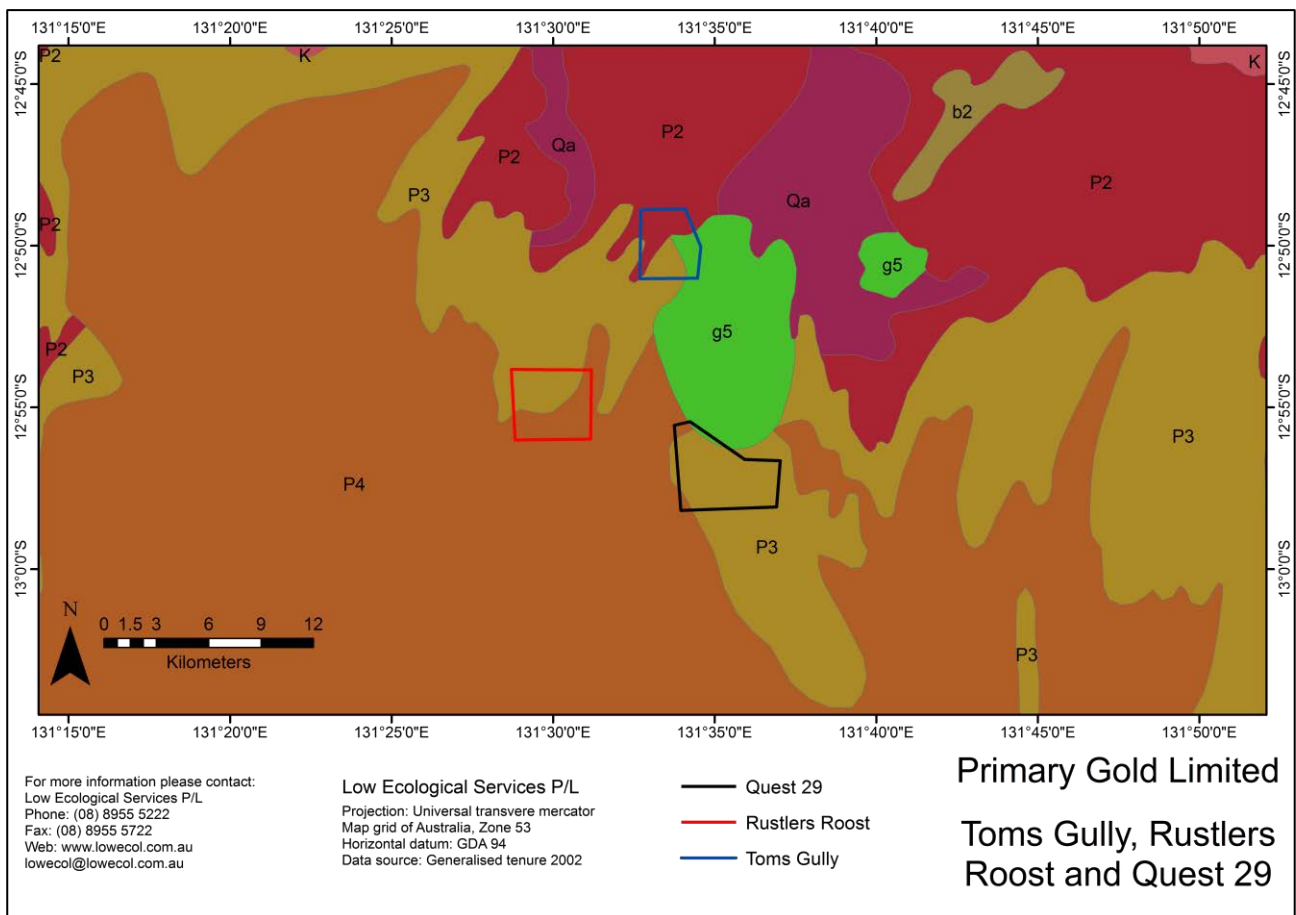


Figure 3-3: The Geological Map of the Northern Territory (Ahmad 2000) within and surrounding Toms Gully, Rustlers Roost and Quest 29. Geological units within the three areas are described in Table 3.2.

3.4 Soils

Soil types in the lease areas have been mapped using the Atlas of Australian Soils (mapped by Bureau of Rural Sciences after Commonwealth Scientific and Industrial Research Organisation, 1991; described by Northcote et al., 1968). However, because the currently accepted classification system is the Australian Soil Classification (ASC) (Isbell & National Committee on Soil and Terrain, 2016) a conversion from the Atlas of Australian Soils to Australian Soil Classification was developed by (Ashton & McKenzie, 2001). Soil units within Toms Gully, Rustlers Roost and Quest 29 include LK22 and Tb134. Soil unit Wd13 is also within Toms Gully. The soil units are mapped in relation to the survey areas in Figure 3-4 and described along with the ASC conversion in Table 3.2.

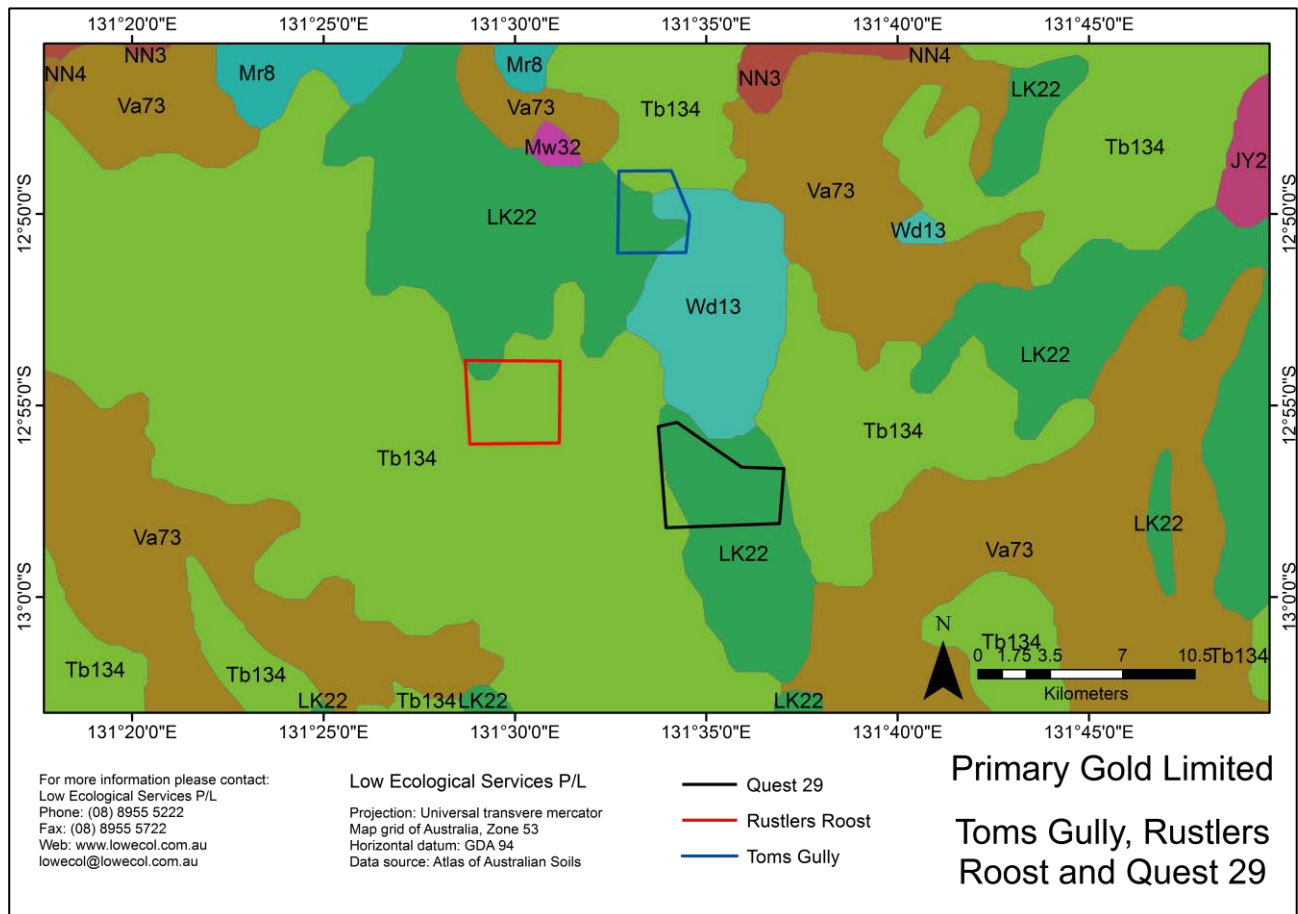


Figure 3-4. The Digital Atlas of Australian Soils within and surrounding Toms Gully, Rustlers Roost and Quest 29. Geological units within the three areas are described in Table 3.2.

Table 3.2: Description of soil types, including Australian Soils Atlas Description by Northcote et al. (1968) and Australian Soil Classification conversion by Ashton & McKenzie (2001)

Map unit	Australian Soils Atlas Description	ASC Conversion
Tb134	Strongly undulating to hilly lands on greywacke, siltstones, and sandstones with rock outcrops, and interspersed with gently sloping to flat-floored valleys of variable size and extent. Soil dominance varies markedly between the valleys and the hilly portions. Chief soils of the basal hill slopes and the valleys are hard acidic, and also neutral, yellow mottled soils, sometimes with yellow duplex soils with bleached A₂ horizons and usually in association with yellow and grey earths. Chief soils on the hill slopes are shallow stony and gravelly loams and sands such as red duplex soils, yellow duplex soils, texture contrast soils, and yellow earths. Small areas of other soils, such as (Gn2.1), occur on andesites and dolerite sills.	Sodosol: Soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is sodic and not strongly acidic. Hydrosols and soils with strongly subplastic upper B2 horizons are excluded.
Wd13	Undulating to rolling and hilly terrain on granites; many rock outcrops and tors on crests and upper slopes: chief soils are sandy acidic yellow mottled soils (Dy5.81) with (Dy4.81) and (Dr4.81) on the undulating to rolling areas. Associated are (KS-Dy5.81) and (Dy5.81) containing ironstone gravels on gently undulating to flat portions, and gritty and gravelly sands (Uc4.12) and possible (Uc5.2) on crests and upper slopes. The (Uc) soils are dominant in some localities.	Tenosol: Soils with generally only weak pedologic organisation apart from the A horizons. Encompasses a diverse range of soils that do not fit the requirements of any other soil orders and generally with one or more of the following: - A peaty horizon. - A lumose, melacic or melanitic horizon, or conspicuously bleached A2 horizon, which overlays a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite or unconsolidated mineral materials. - A horizons which meet all the conditions for a peaty, humose, melacic or melanitic horizon except the depth requirement, and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. - A1 horizons which have a more than weak development of structure and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. - An A2 horizon which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. - Either a tenic B horizon, or a B2 horizon with 15% clay (SL) or less, or a transitional horizon (C/B) occurring in fissures in the parent rock or saprolite which contains between 10 and 50% of B horizon material (including pedogenic carbonate). - A ferric or bauxitic horizon >0.2 m thick. - A calcareous horizon >0.2 m thick.
LK22	Hilly to steep hilly ranges and strike ridges mainly on greywacke, siltstones and some sandstones; a surface stone cover is common; rock outcrops are frequent; chief soils of the	Tenosol

Map unit	Australian Soils Atlas Description	ASC Conversion
	hill slopes are shallow stony and gravelly loams (Um4.1), (Um1.4) and sand (Uc4.1) and (Uc2.12). Associated are variable areas of stony and gravelly (D) soils such as (Dr2.21), (K-Dy2.21), and (Dr2.51). Other soils include yellow earths such as (Gn2.24), (Gn2.34), and (Gn2.74), and red earths such as (Gn2.1) on dolerite sills and andesites.	

3.5 Land units

Land unit mapping of the area by Fett & Hall (1983) is available at a scale of 1:25,000. Land units in the Toms Gully, Rustlers Roost and Quest 29 survey areas are described in Table 3.3 and mapped in Figure 3-5.

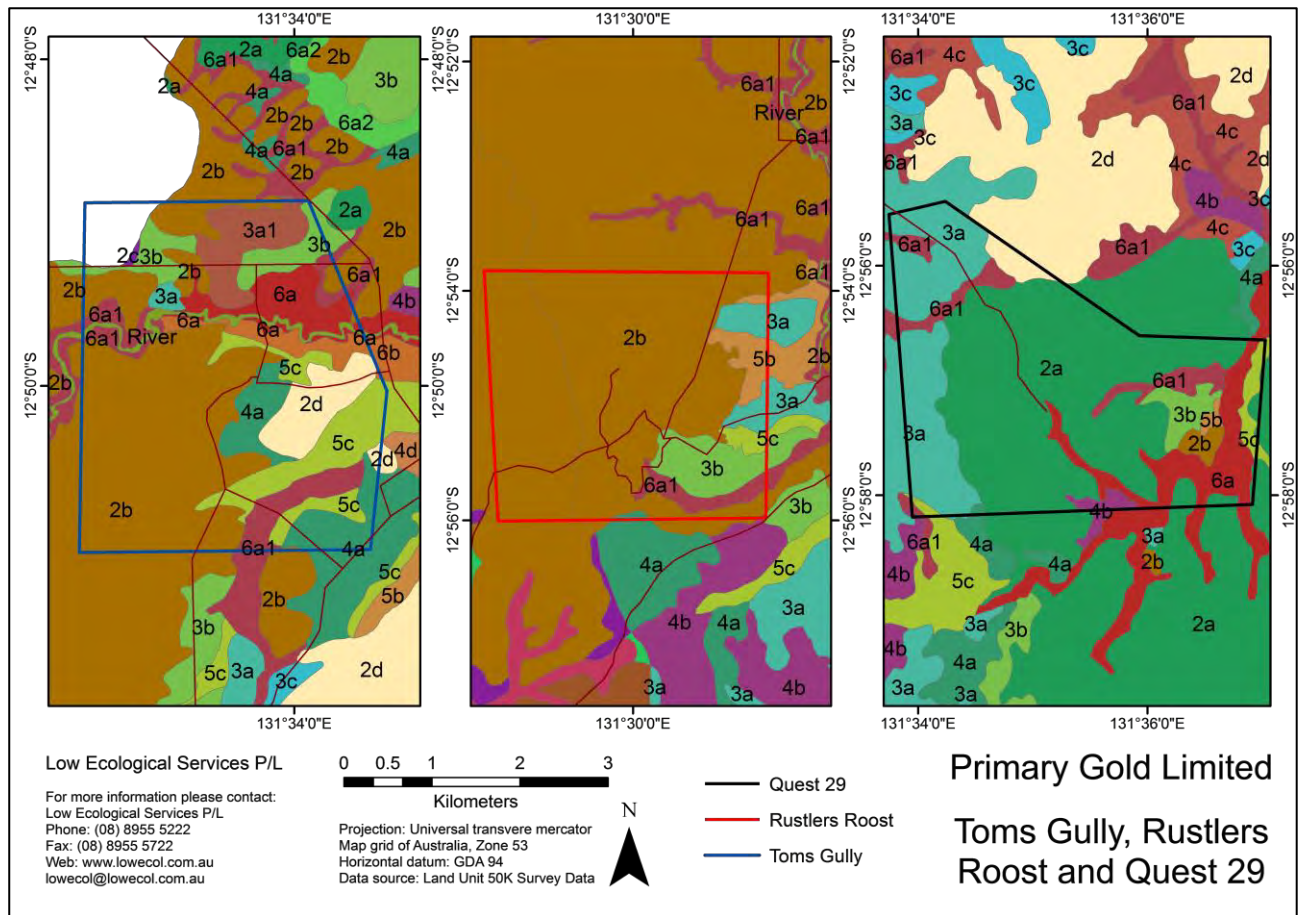


Figure 3-5: Land unit mapping for Toms Gully, Rustlers Roost and Quest 29 (Fett & Hall, 1983). Descriptions of each land system are provided in Table 3.3.

Table 3.3: Description of land units within Toms Gully (T), Rustlers Roost (R) and Quest 29 (Q) as described by Fett & Hall (1983).

Land Unit	Site	Landform	Soil description	Vegetation
2a	Q	Rugged terrain associated with siltstones and greywacke of Burrells Creek formation and Upper Proterozoic dolomites and sandstones; slopes >10%; surface stone and outcrop extensive	Very shallow stony lithosols (rudosols)	<i>Corymbia polysciada</i> , <i>Eucalyptus miniata</i> , <i>Corymbia dichromophloia</i> and <i>Erythrophleum chlorostachys</i> woodland/low open woodland with a <i>Chrysopogon fallax</i> , <i>Triodia bitextura</i> , <i>Heteropogon triticeus</i> mixed spp. tussock grass understorey
2b	R, Q, T	Low hills and strike ridges; ridges same lithologies as 2a; relief between 5-50 m; slope gradients between 5-20%; extensive surface stone outcrop of siltstone and greywacke; 5-60 % surface gravel and stone in some areas	Shallow stony and gravelly lithosols, and mottled yellow earths (Kandosols)	<i>Corymbia polysciada</i> ; <i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Corymbia dichromophloia</i> and <i>Erythrophleum chlorostachys</i> woodland/low open woodland with a <i>Chrysopogon fallax</i> , <i>Triodia bitextura</i> <i>Heteropogon triticeus</i> mixed spp. tussock grass understorey
2c	T	Hillslopes; slope 1-5%; occasional outcrop of siltstone and greywacke; 20-60% surface gravel	Moderately deep gravelly red and yellow earths (kandosols)	<i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Erythrophleum chlorostachys</i> and <i>Corymbia bleeseri</i> open woodland/woodland
2d	T	Granite hills with steep slopes; extensive boulders and outcrop; relief up to 120 m	Very little soil material, areas of coarse shallow sand between stone outcrops (rudosols)	<i>Corymbia polysciada</i> , <i>Eucalyptus tetradonta</i> , <i>Corymbia foelscheana</i> , <i>Eucalyptus miniata</i> and <i>Erythrophleum chlorostachys</i> woodland/open woodland
3a	R, Q, T	Low erosional rises; rounded crests and upper slopes <5%; 1-15 m relief; occasional outcrop; 30-100% surface gravel	Gravelly yellow brown and yellow lithosols up to 1 m deep overlying friable weathered siltstone and greywacke (Kandosols)	<i>Corymbia clavigera</i> , <i>Erythrophleum chlorostachys</i> , <i>Corymbia foelscheana</i> and <i>Calytrix</i> spp. low woodland; minor <i>Eucalyptus tectifera</i> and <i>Corymbia bleeseri</i> woodland; mixed spp. tussock grassy understorey
3a1	T	Undulating terrain slopes less than 5%	Deep sandy red earths; minor red earthy sands (kandosols)	<i>Eucalyptus tetradonta</i> and <i>Eucalyptus miniata</i> woodland to open forest
3b	R, Q, T	Erosional slopes 1-4%; sometimes below 3a, 2b and 2c; slopes <5% in some areas; 0-100% surface gravel	Shallow gravelly yellow, yellow brown and grey lithosols and gravelly yellow and brown earths (kandosols)	<i>Corymbia grandifolia</i> , <i>Corymbia polysciada</i> , <i>Corymbia foelscheana</i> , <i>Erythrophleum chlorostachys</i> , <i>Calytrix</i> spp. and <i>Buchanania obovata</i> woodland/low woodland; minor <i>Eucalyptus miniata</i> , <i>Eucalyptus tectifera</i> and <i>Corymbia bleeseri</i> woodland
4a	R, Q, T	Colluvial slopes between 3a and 3b; occasionally below 2b in southern areas; slopes <5%; up to 500 m wide; relief 10 m	Shallow to moderately deep yellow earths; indistinct mottling in B horizon; scattered low termitaria (kandosols)	<i>Erythrophleum chlorostachys</i> , <i>Eucalyptus miniata</i> mixed species woodland with <i>Sorghum plumosum</i> , <i>Themeda triandra</i> , <i>Chrysopogon fallax</i> and <i>Heteropogon triticeus</i> tussock grass understorey

Land Unit	Site	Landform	Soil description	Vegetation
4b	Q	Colluvial slopes below 3b and 4a above alluvial areas; slopes <2%; commonly 200 m to 800 m wide; relief <5m	Moderately deep to deep yellow; distinct mottling in sub-soil; minor debil-debil; scattered large termitaria; waterlogged for short periods (hydrosols)	<i>Corymbia polycarpa</i> , <i>Corymbia grandifolia</i> , <i>Vitex glabrata</i> and <i>Lophostemon lactifluus</i> woodland with <i>Sorghum plumosum</i> , <i>Themeda triandra</i> , <i>Chrysopogon fallax</i> and <i>Eriachne burkittii</i> tussock grass understorey
5b	R, Q	Alluvial plains up to 3 km wide; negligible slope	Mottled yellow duplex (solodic) soils; shallow, hard setting and pulverulent A horizon over a dense, mottled B horizon, well developed debil debil (hydrosols).	<i>Corymbia polycarpa</i> , <i>Corymbia bella</i> and <i>Corymbia grandifolia</i> open woodland/woodland; minor <i>Melaleuca</i> spp., <i>Eriachne burkittii</i> , <i>Chrysopogon setifolius</i> and <i>Themeda triandra</i> mixed tussock grassy understorey
5c	R, Q, T	Alluvial plains up to 3 km wide; negligible slope	Mottled yellow duplex (solodic) soils; shallow, hard setting and pulverulent A horizon over a dense, mottled B horizon, well developed debil debil, minor grey non-cracking clays on Mary floodplain (hydrosols)	<i>Eriachne burkittii</i> , <i>Chrysopogon setifolius</i> mixed spp. tussock grassland with sedges
6a	Q, T	Rivers and major creeks with associated narrow leaves; channels incised up to 6 m	Alluvial yellow and red earths on levees, deep, gradational-textured profiles (hydrosols)	Mixed species open forest
6a1	R, Q, T	Drainage lines in rugged terrain or narrow drainage depressions in hilly terrain; narrow (<200 m); normally incised to <2 m; 0.5-1% slope in some areas	Yellow earths; moderately deep and usually sandy in upper reaches; weakly developed solodics in lower reaches towards major alluvials; or gravelly shallow lithosols and grey earths (hydrosols)	<i>Corymbia polycarpa</i> , <i>Corymbia grandifolia</i> , <i>Corymbia bella</i> , <i>Eucalyptus bigalerita</i> , <i>Lophostemon lactifluus</i> and <i>Melaleuca</i> spp. open woodland/woodland/open forest with <i>Arundinella nepalensis</i> , <i>Eriachne burkittii</i> , <i>Mnesithea</i> sp. mixed species tussock grass understorey
River	T	Water body	Hydrosol soils	-

3.6 Vegetation types

Vegetation in the lease areas has been mapped at a scale of 1: 100 000 in the Vegetation Survey of the Northern Territory (Wilson, et al., 1990). There are three vegetation types occurring within the survey areas and these are mapped in Figure 3-6 and described in Table 3.4.

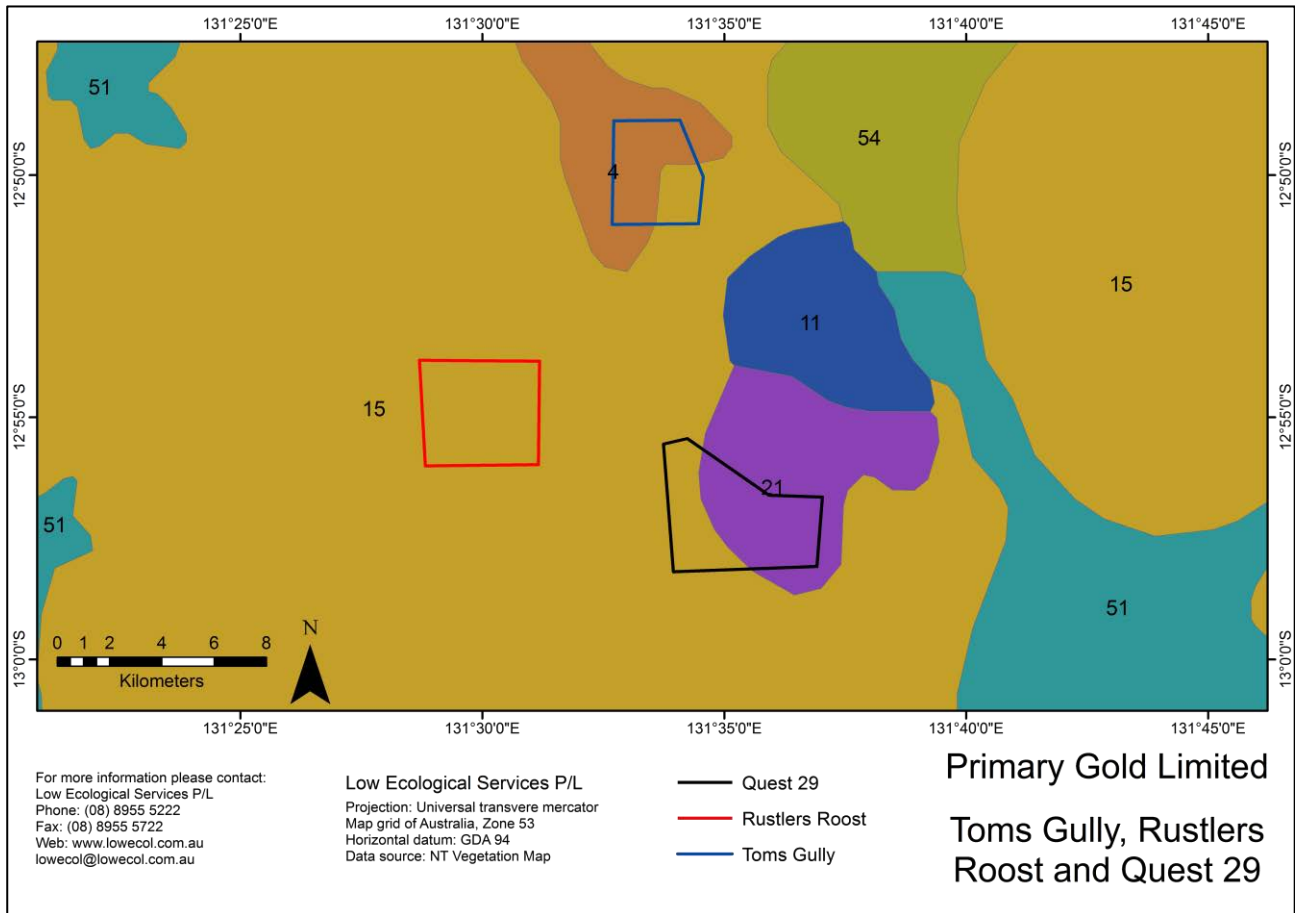


Figure 3-6: Vegetation types within Toms Gully, Rustlers Roost and Quest 29 mapped by Wilson et al. (1990). Vegetation types are described in Table 3.4.

Table 3.4: Description of vegetation types within Toms Gully (T), Rustlers Roost (R) and Quest 29 (Q) as mapped by Wilson et al. (1990)

Vegetation unit	Sites	Broad vegetation classification	Structural formation	Fine vegetation description
4	T	Eucalyptus with grass understorey	Open forest	<i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Eucalyptus nesophila</i> open-forest with <i>Sorghum</i> grassland understorey
15	T, R, Q	Eucalyptus with grass understorey	Woodlands	<i>Eucalyptus tectifera</i> , <i>Eucalyptus latifolia</i> woodland with <i>Sorghum</i> grassland understorey
21	Q	Eucalyptus with grass understorey	Low woodlands	<i>Eucalyptus tintinnans</i> low woodland with <i>Sorghum</i> grassland understorey

3.7 Sites of Conservation Significance

Sites of Conservation significance (SoCS) are 67 sites identified as the most important sites for biodiversity that need further protecting in the Northern Territory. Sites of Botanical Significance (SoBS) are defined as area that have botanical features distinguishing them from the surrounding landscape, and that are important for general plant conservation and for specifically mentioned species (White, et al., 2000a). The Mary River coastal floodplain SoCS is adjacent to and very slightly overlaps with the Toms Gully survey area (Figure 3-7). There are no SoBS within 20 km of the survey areas.

The Toms Gully survey borders the Mary River coastal floodplain SoCS (Figure 3-7). The Mary River coastal floodplain is unusual in that it lacks a single channel through the floodplain to the ocean (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The main land use in this SoCS is pastoral, with other uses including conservation, recreation, tourism and mining (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The Mary River coastal floodplain consists of a mosaic of wet and dry habitats that support large populations of waterbirds and a major breeding area for fish species such as Barramundi (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The Mary River system is suffering degradation as a result of impact from introduced species and fire (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The Mary River costal floodplain SoCS is of international significance for threatened species and wildlife aggregations, national (but possibly international) significance for wetlands and regional significance for its flora (Department of Natural Resources, Environment, the Arts and Sport, n.d.).

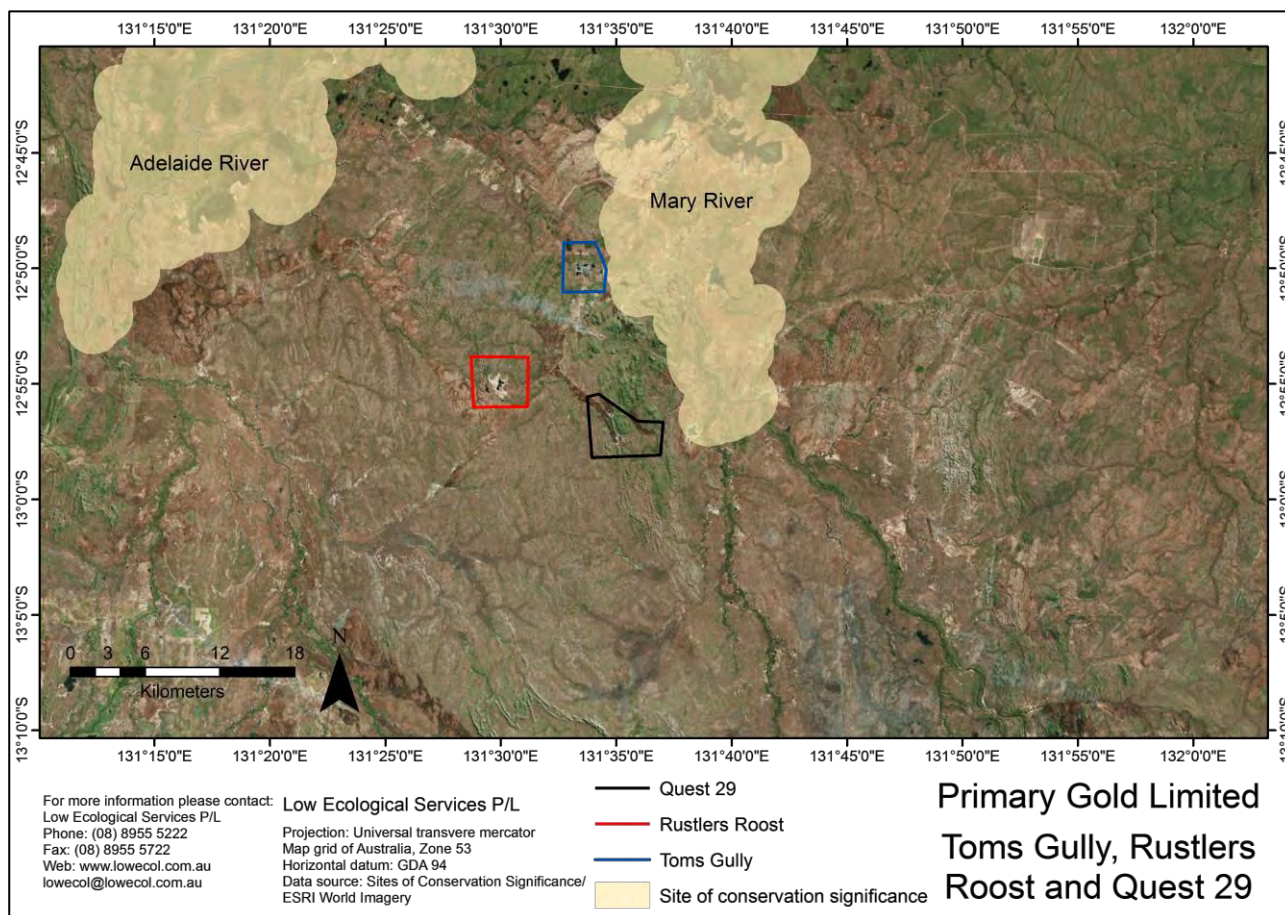


Figure 3-7: Sites of conservation significance in the area surrounding Toms Gully, Rustlers Roost and Quest 29 survey areas.

3.8 Fire history

Mapping obtained from the North Australia Fire Information website (North Australia and Rangelands Fire Information, 2016) indicates that fire generally occurs within the survey areas on an annual basis (Table 3.5, Figure 3-8).

Table 3.5: Fires occurring in the survey areas between 2011 and 2016, with the area (km²) and percentage of the survey areas burnt (%) during those years.

Survey area		2011		2012		2013		2014		2015		2016	
Name	Total area	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
Toms Gully	12.27	2.81	22.9	3.43	27.95	1.15	9.37	3.17	25.8	0.95	7.74	6.86	55.91
Rustlers Roost	17.4	10.5	60.5	10.04	57.7	7.12	40.9	11.2	64.5	15.4	88.7	15.9	91.38
Quest 29	20.66	0	0	11.21	54.26	0	0	0	0	9.74	47.1	16	77.54

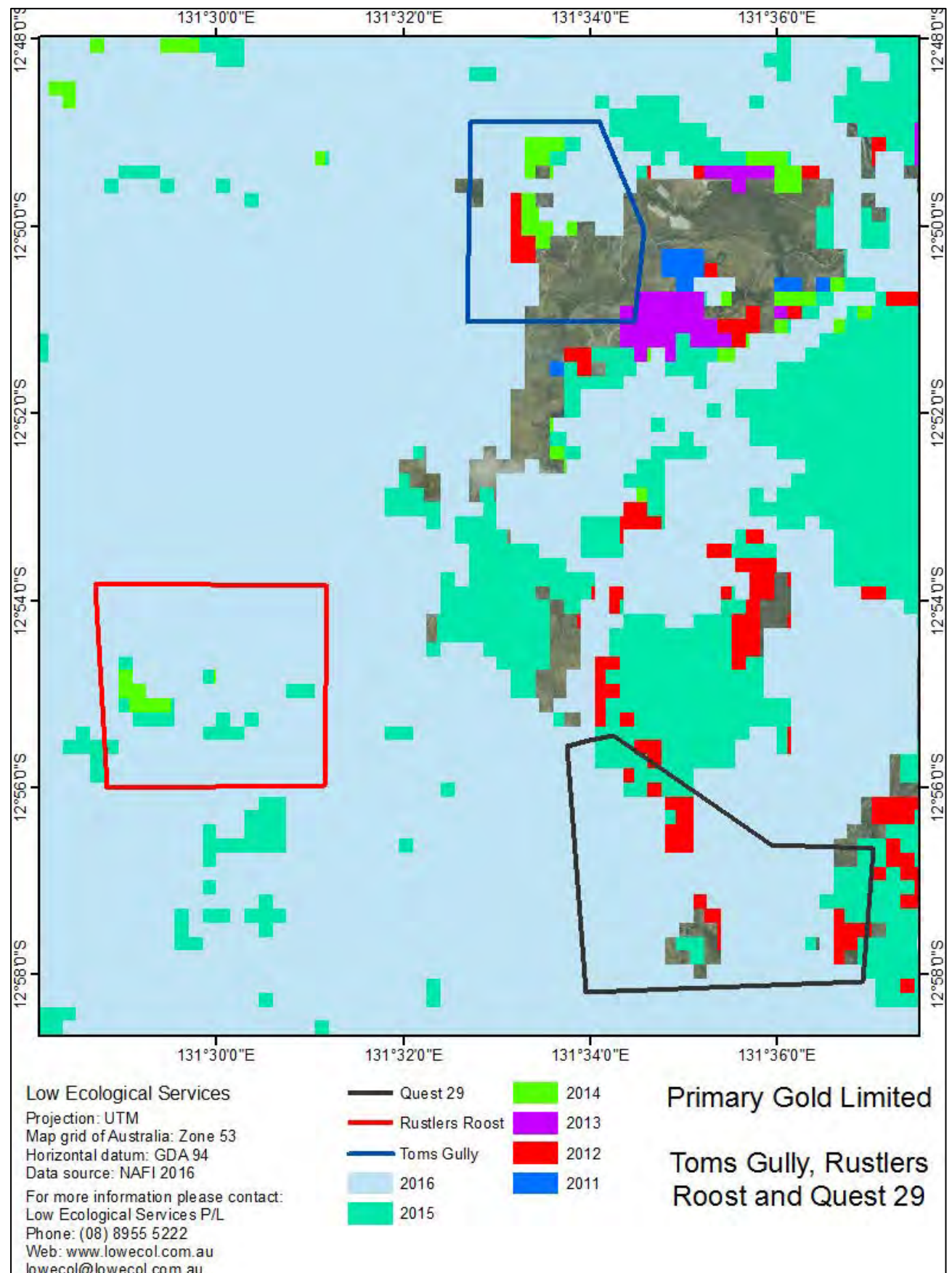


Figure 3-8: Fire history for the years 2011 – 2016 in the Toms Gully, Rustlers Roost and Quest 29 survey areas (North Australia and Rangelands Fire Information, 2016)

3.9 Flora

3.9.1 Flora records

The NT Flora Atlas identified 5944 records of 813 flora species within 20 km of the survey areas.

3.9.2 Threatened Flora Species

Twenty-six species of conservation significance were identified by the EPBC PMST or TWPC Act as occurring or potentially occurring within a 20 km radius of the survey areas. The EPBC PMST identified two endangered flora species, *Helicteres macrothrix* and *Stylidium ensatum*, and one vulnerable flora species, *Goodenia quadrifida*, as potentially occurring within 20 km of the survey areas. Interrogation of the NT Flora Atlas identified records of *H. macrothrix* and *G. quadrifida* within the same search area, along with records of *Schoutenia ovata*, which is listed as vulnerable under the TPWC Act. Further descriptions of these threatened species and assessment of their likelihood of occurrence are provided below. Twenty-one data deficient and three near threatened species were identified by the NT Flora Atlas as occurring within 20 km of the survey areas (Figure 3-9; Table 3.6).

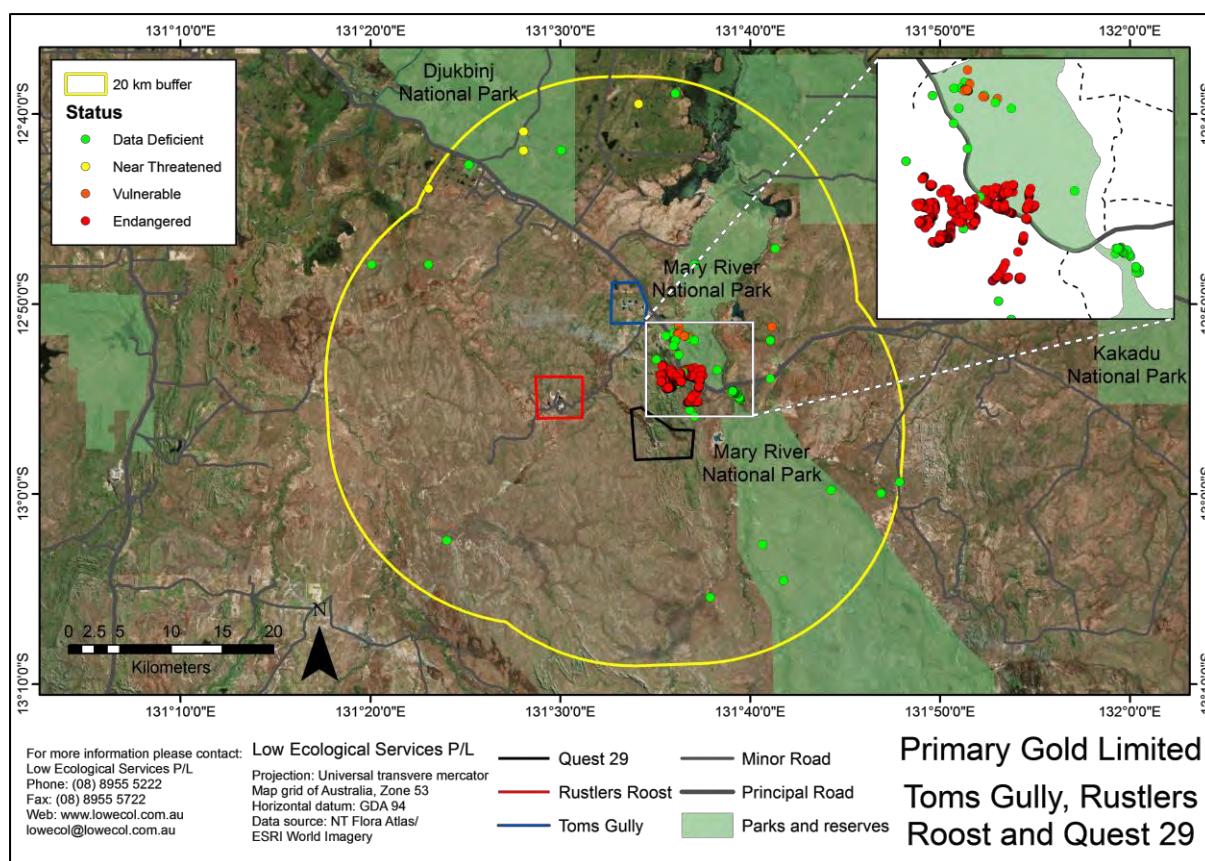


Figure 3-9: Location of records of flora species of conservation significance listed under the TPWC Act with records in the NT Flora Atlas within 20 km of Toms Gully, Rustlers Roost and Quest 29

Table 3.6: Flora species of conservation significance identified by the EPBC PMST and/or the TPWC act as occurring or potentially occurring within a 20 km radius of the survey areas. En: endangered, Vu: vulnerable, DD: data deficient, NT: near threatened

Family	Scientific Name	Status		PMST	NT Flora Atlas	Likelihood of occurrence
		TPWC	EPBC			
Alismataceae	<i>Butomopsis latifolia</i>	DD			X	
Cleomaceae	<i>Cleome bundeica</i>	DD			X	
Cyperaceae	<i>Fimbristylis dipsacea</i>	DD			X	
Droseraceae	<i>Drosera fulva</i>	DD			X	
Fabaceae	<i>Alysicarpus brownii</i>	DD			X	
Fabaceae	<i>Chamaecrista nomame grandiflora</i>	DD			X	
Fabaceae	<i>Crotalaria quinquefolia</i>	NT			X	
Fabaceae	<i>Zornia muelleriana muelleriana</i>	DD			X	
Goodeniaceae	<i>Goodenia quadrifida</i>	DD	Vu	X	X	Moderate
Lamiaceae	<i>Callicarpa brevistyla</i>	DD			X	
Linderniaceae	<i>Lindernia</i> sp. Mount Bunday	DD			X	
Malvaceae	<i>Helicteres macrothrix</i>	En	En	X	X	High
Malvaceae	<i>Hibiscus vitifolius vitifolius</i>	DD			X	
Malvaceae	<i>Schoutenia ovata</i>	Vu			X	High
Malvaceae	<i>Sida subcordata</i>	DD			X	
Menyanthaceae	<i>Nymphoides subacuta</i>	NT			X	
Orchidaceae	<i>Didymoplexis pallens</i>	DD			X	
Poaceae	<i>Echinochloa dietrichiana</i>	DD			X	
Poaceae	<i>Microchloa indica</i>	DD			X	
Poaceae	<i>Eragrostis concinna</i>	DD			X	
Poaceae	<i>Eragrostis ecarinata</i>	DD			X	
Poaceae	<i>Eriachne squarrosa</i>	DD			X	
Podostemaceae	<i>Malaccotristicha australis</i>	DD			X	
Rutaceae	<i>Citrus gracilis</i>	NT			X	
Santalaceae	<i>Viscum whitei flexicaule</i>	DD			X	
Stylidiaceae	<i>Stylidium ensatum</i>		En	X		Low

Goodenia quadrifida

Goodenia quadrifida is known only from Hardy Creek within the Mary River floodplain and the upper Adelaide River, where it grows on cracking clay plains. *Goodenia quadrifida* is an annual herb with branches to 30 cm long. It has sessile, linear or narrowly oblanceolate leaves, 2-8 cm long and 0.2-0.5 cm wide, which are hairy when young and become glabrous with age. Flowers are purplish, conspicuously hairy and solitary in axils, with pedicels 1-4 cm long. Flowering and fruiting occur from March to May (Northern Territory Herbarium, 2013).

There are no cracking clay soils known from within the survey areas. However, little is known about the species and there are records from 15 km north-west of Rustlers Roost. Therefore, there is a moderate likelihood that this species occurs within the survey areas.

Helicteres macrothrix

Helicteres macrothrix grows in *E. tectifera*, *E. miniata* or *E. tetradonta* woodland on clayey soils derived from siltstone or more sandy soils derived from syenite. *Helicteres macrothrix* is an erect, multi-stemmed subshrub, with annual above-ground parts and a perennial woody rootstock. The leaves are ovate, or occasionally elliptic or broadly ovate, 5-17 cm long and 4-11 cm wide, with serrate to dentate margins. Flowers are mauve-pink, and occur in an axillary cymose inflorescence. The lower three petals are woolly-hairy, and the upper pair are smooth. *Helicteres macrothrix* flowers between November and March and fruits between January and March (Northern Territory Herbarium, 2013)

There is suitable habitat within the survey areas and records of the species from within 2.5 km of Quest 29. Therefore, there is a high likelihood that this species occurs within the survey areas.

Schoutenia ovata

Schoutenia ovata is a tree to 10 m height with grey, flaky bark. The branchlets, petioles, leaf under-surface, calyx and capsule are densely hairy. The leaves are glossy above, three-veined at the base, elliptic to obovate, 25-98 mm long, 17-50 mm wide and reportedly deciduous. The leaf margin is entire to irregularly lobed in the upper half. Flowers are arranged in a racemose inflorescence up to 20 mm long. The petals of the flowers are often absent or reduced, up to 4.5 mm long, and the sepals are pale yellow and about 7.5 mm long. *Schoutenia ovata* flowers in February to March and fruits in May (Northern Territory Herbarium, 2013).

Schoutenia ovata grows in semi-deciduous vine thicket on syenite and limestone outcrops. *Schoutenia ovata* has been recorded approximately 2.5 km south-east of Toms Gully. There are also granitic outcrops (land unit 2d) in the eastern section of the Toms Gully survey area and the north-eastern section of the Quest 29 survey area (Figure 3-5), which is the same land unit that *S. ovata* has been previously recorded in. Therefore, there is a high likelihood that this species occurs within land unit 2d in the survey areas.

Stylidium ensatum

Stylidium ensatum is an annual herb to 22cm tall with broad sessile leaves on a short basal stem. The flowers are pink, with both upper and lower petals bilobed at the apex. *Stylidium ensatum* flowers and fruits from June to August (Northern Territory Herbarium, 2013).

Stylidium ensatum grows on poorly drained grassy flats that stay wet into the dry season. It is often found with *Eriachne burkitii*, *Pandanus* spp., *Osbeckia* spp. and *Fimbristylis furva* (Northern Territory Herbarium, 2013). The closest record of *S. ensatum* to the survey areas is 60 km north-west of Toms Gully. There is potential habitat for this species within land unit 5c, which occurs in the eastern sections of all three areas. However, it is unclear how long these areas stay inundated past the end of the wet season. There is a low likelihood that this species occurs within the survey areas.

3.9.3 Threatened Ecological Communities

No threatened ecological communities were identified within 20 km of the lease areas.

3.9.4 Introduced and weed species

Weeds of National Significance are declared based on invasiveness, potential for spread and environmental, social and economic impacts. Strategic plans for WoNS are developed as a result of their declaration, which define responsibilities and identifies strategies and actions to control the species. Landholders and managers are ultimately responsible for managing WoNS, and the state/territory government is responsible for overall legislation and administration (Department of Sustainability, Environment, Water, Population and Communities, 2012).

In the NT, a plant is declared a weed if it has been identified for control, eradication or prevention of entry into the NT. All landholders, land managers and land users must comply with the declaration classification. Based on the risk of harm they could cause and how difficult they are to control, weeds are placed into the following classes:

- Class A – to be eradicated
- Class B – growth and spread to be controlled
- Class C – not to be introduced into the NT

Forty-seven introduced flora species were identified as occurring or potentially occurring within 20 km of the survey areas by the EPBC PMST, NT Weeds public database or both (Table 3.7). Nine of these species are WoNS and are described in further detail below, including information on identification and habitat. Other weeds known to occur in the Pine Creek bioregion are *Barleria prionitis*, cabomba (*Cabomba caroliniana*), creeping lantana (*Lantana montevidensis*), giant rats-tail grass (*Sporobolus natalensis* and *S. pyramidalis*), grader grass (*Themeda quadrivalvis*), *Senna tora* and snake weed (*Stachytarpheta* spp.) (Bastin & ACRIS Management Committee, 2008).

Table 3.7: Introduced flora and weed species identified by the desktop study and/or recorded on surveys to date including if the species is a WoNS and the class it is declared under in the NT within the survey areas.

Species name	Common name	Status			PMST	NT Flora Atlas
		NT	EPBC	WoNS		
<i>Aeschynomene villosa</i>						X
<i>Ageratum conyzoides</i>						X
<i>Alysicarpus ovalifolius</i>						X
<i>Andropogon gayanus</i>	Gamba grass	B	Inv	X	X	X
<i>Brachiaria mutica</i>	Para grass		Inv		X	
<i>Calopogonium mucunoides</i>	Calopo					X
<i>Celosia argentea</i>						X
<i>Cenchrus ciliaris</i>	Buffel grass		Inv		X	
<i>Cenchrus pedicellatus</i>	Mission grass					X
<i>Centrosema pascuorum</i>						X
<i>Cynodon dactylon</i>	Couch grass					X

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Species name	Common name	Status			PMST	NT Flora Atlas
		NT	EPBC	WoNS		
<i>Cynodon radiatus</i>						X
<i>Digitaria bicornis</i>						X
<i>Digitaria ciliaris</i>						X
<i>Digitaria violascens</i>						X
<i>Eichhornia crassipes</i>	Water hyacinth	A, C	Inv	X	X	
<i>Eragrostis pilosa</i>	Soft lovegrass					X
<i>Evolvulus nummularis</i>						X
<i>Gomphrena celosioides</i>						X
<i>Heliotropium indicum</i>						X
<i>Hibiscus sabdariffa</i>						X
<i>Hymenachne amplexicaulis</i>	Olive hymenachne	B, C	Inv	X	X	X
<i>Mesophaerum suaveolens</i>	Hyptis	B, C				X
<i>Jatropha gossypifolia</i>	Bellyache bush	A	Inv	X	X	
<i>Lantana camara</i>	Lantana	B, C	Inv	X	X	
<i>Macroptilium lathyroides semierectum</i>	Phasey bean					X
<i>Malachra fasciata lineariloba</i>						X
<i>Malvastrum americanum</i>						X
<i>Mimosa pigra</i>	Mimosa	B	Inv	X	X	X
<i>Mitracarpus hirtus</i>						X
<i>Murdannia nudiflora</i>						X
<i>Parkinsonia aculeata</i>	Parkinsonia	B, C	Inv	X	X	
<i>Paspalum dilatatum</i>						X
<i>Passiflora foetida</i>						X
<i>Pennisetum polystachion</i>	Mission grass	B, C	Inv		X	
<i>Salvinia molesta</i>	Salvinia	B, C	Inv	X	X	
<i>Scoparia dulcis</i>						X
<i>Senna obtusifolia</i>	Sicklepod	B				X
<i>Senna occidentalis</i>	Coffee senna	B				X
<i>Sida acuta</i>	Spinyhead sida	B				X
<i>Sida cordifolia</i>	Flannel weed	B				X
<i>Stylosanthes scabra</i>						X
<i>Tridax procumbens</i>						X
<i>Triumfetta pentandra</i>						X
<i>Triumfetta rhomboidea</i>						X
<i>Vachellia nilotica</i>	Prickly acacia	A, C	Inv	X	X	
<i>Xanthium strumarium</i>	Noogoora burr	B, C				X

Gamba grass (*Andropogon gayanus*)

Gamba grass is a perennial tussock grass that grows up to 70 cm diameter and 4 m tall. The leaf blades are up to 60 cm long and 1.5-5 cm wide with a prominent white midrib. The flowering stems have up to six groups of 2-18 loosely branched primary branches. The flower spikelets are arranged in pairs, with one spikelet sessile and the other stalked. The seeds of gamba grass are light brown to brownish-black, 2-3 mm long and 1 mm wide (DSEWPac, 2013a).

Gamba grass mostly grows in pastures and along roads, but can be invasive in other habitats such as savanna. Gamba grass invasion leads to dramatically increased fire intensity. More intense fires are harder to control and can result in a reduction in the woody component of a vegetation community. Gamba grass seed is dispersed by wind or water, and can also be spread during hay transport or in mud attached to vehicles and machinery. Gamba grass can be controlled by herbicide application of young and regrowing plants before seed maturity (DSEWPac, 2013a).

Water hyacinth (*Eichornia crassipes*)

Water hyacinth is an erect, free-floating, aquatic perennial herb from 10 cm to 1 m in height. It has black to purple feathery roots up to 1 m long. The leaves radiate from the base of the plant in a cluster or rosette. The leaf blade is glossy green, finely striated, flat, thick, ovate or circular to rounded-oblong and up to 25 cm across, and has a spongy leaf stalk. The flower spike is up to 20 cm long with few to many crowded sky-blue to bluish purple-lavender, lilac –blue, lilac-mauve, pale-violet or sometimes white flowers that are 3-7 cm across (DSEWPac, 2011a).

Water hyacinth grows on still or slow-flowing freshwater areas. It can obstruct waterways, reduce water quality, affect fish communities and harbour mosquitoes. Water hyacinth spreads vegetatively by stolons rooting at the nodes to produce new plants, which happens most rapidly in nutrient rich water. Seeds are dispersed by water, and may remain dormant in the mud for 15 years or more. Seeds and vegetative material can also be dispersed by birds, movement of mud or sediment, contaminated boats and boating equipment and discarded pond refuse (DSEWPac, 2011a).

Hymenachne (*Hymenachne amplexicaulis*)

Hymenachne is a perennial grass, usually growing to 1-2.5 m tall, but occasionally to 3.5 m tall. Its above ground stems are upright or semi-upright from a creeping base or floating on shallow water, are up to 12 mm or more thick and regularly produce roots at the joints. The leaf blades are 10-45 cm long and 2-6 cm wide, hairy or hairless and partially enclose the stem, and are large and spreading. The inflorescence is elongated, dense and spike like, and is 10 -50 cm long and 8-20 mm wide (DSEWPac, 2013b).

Hymenachne occurs in swamps, wetlands, seasonally flooded areas, waterways, riverbanks, drainage channels and other water bodies in wetter tropical and sub-tropical environments. Hymenachne can block waterways, potentially causing flooding and threatening drinking water, block drainage and irrigation channels in cropping areas, displace native plants and increase the density of vegetation, which can alter habitat suitability for biodiversity. Hymenachne can reproduce by seed or vegetatively, with spread being attributed to flooding, mud attached to animals and vehicles, in contaminated agricultural produce and by birds (DSEWPac, 2013b).

Bellyache bush (*Jatropha gossypifolia*)

Bellyache bush is a shrub or small tree 1-3 m tall. Older stems of bellyache bush are relatively thick and contain a watery or soapy sap. Younger stems and growing points are purplish in colour and have a dense covering of hairs. The leaves are alternately arranged, purplish and covered in sticky hairs when immature, bright or dark green as they are, 4.5-10 cm long and 5-13 cm wide and have three or five deep lobes. The flowers are arranged in clusters with 2-8 female and 27-54 male flowers in each cluster. The flowers are deep purple to bright red. The fruit is slightly three lobed and faintly hairy (DSEWPac, 2011b).

Bellyache bush occurs in degraded pastures, open woodlands, monsoon vine forests, grasslands, waterways, coastal foreshores, roadsides, disturbed sites, waste areas and old or abandoned gardens. It occurs mainly in drier tropical environments, but also sometimes in sub-tropical and semi-arid regions. Bellyache bush can form dense thickets, which reduces the productivity of pastures, displaces native vegetation, and may reduce biodiversity, preventing the regeneration of trees and shrubs. Bellyache bush reproduces by seed and vegetatively. Seeds may be dispersed in water and mud, and by ants (DSEWPac, 2011b).

Lantana (*Lantana camara*)

Lantana is a sprawling or climbing shrub or vine 1-3 m high, sometimes to 6 m high in favourable conditions. The stems and branches often have recurved prickles and sometimes glands or glandular hairs. The leaves are in opposite pairs, are ovate to oblong-ovate, often covered with coarse hairs on the upper surface, strongly aromatic and 4-10 cm long and 3-6 cm wide. The inflorescence consists of 20-40 flowers ranging from yellow, orange-yellow, deep orange, deep red, pink, rose-pink to white (DSEWPac, 2011c).

Lantana occurs in disturbed sites such as roadsides, cultivated pastures and fence lines on rich organic soils and well-drained clay and basalt soils. Lantana forms dense thickets, which changes the structure of native bushland and pasture, increases fuel loads and adversely affects the species richness of soil biodiversity. Lantana can reproduce vegetatively and by seed, which can be spread by animals (DSEWPac, 2011c).

Mimosa (*Mimosa pigra*)

Mimosa is a shrub 5-6 m tall with touch sensitive compound leaves 12-22 cm long with up to 45 pairs of leaflets. Mimosa has thorns 5-12 mm long scattered along the stems and branches. The flower heads are round, 10-20 mm diameter and comprised of about 100 pink or mauve flowers. The seed pods are flat, 30-120 mm long, 7-14 mm wide and densely hairy (DSEWPac, 2011d).

Mimosa occurs in moist areas such as riverbanks, coastal plains and floodplains, particularly in humid and sub-humid tropical regions. Mimosa produces copious amounts of seed, which are dispersed by water, humans, animals, mud on vehicles and movement of contaminated soils. Mimosa forms dense monoculture stands, replacing all native vegetation. The invasion of mimosa threatens productive industry and cultural and conservation values of wetlands, including nationally and internationally significant wetlands, where it reduces biodiversity by out-competing native plants and reducing habitat suitability for native fauna (DSEWPac, 2011d).

Parkinsonia (*Parkinsonia aculeata*)

Parkinsonia is a shrub or tree to 8-10 m tall with 5 mm long thorns on its stems. The compound leaves of parkinsonia are up to 300 mm long with numerous green leaflets 4-10 mm long. There are sharp spines 5-15 mm long at the leaf base. The flowers are predominantly yellow and up to 20 mm diameter. The fruit is an elongated pod 3-13 cm long and 3.5 mm wide and narrows at both ends (DSEWPac, 2011e).

Parkinsonia occurs mainly on seasonally flooded sites in pastures, roadsides, grasslands, open woodland and rangelands, and also around dams, bores, stream banks and floodplains on sand to clay soils. Parkinsonia produces abundant seed, which is dispersed by moving water, and on unclean machinery. Parkinsonia can form dense thickets, which can impede access, dam watercourses, cause erosion, lower water tables and provide refuges for feral animals such as pigs (DSEWPac, 2011e).

Salvinia (*Salvinia molesta*)

Salvinia is a free-floating aquatic fern, which forms a thick mat of vegetation. The fronds of salvinia are arranged along the stem in three, with two fronds being leaf like and the third frond being root-like and submerged in the water. The leaf-like fronds are round in shape, 4-40 mm long and 7-25 mm wide, covered in hairs pale green to greenish brown and folded along the mid-rib. The root-like fronds are up to 30 cm long and covered with fine brown hairs (DSEWPac, 2011f).

Salvinia occurs in still or slow-moving water bodies with high nutrient levels. Salvinia modifies aquatic fauna habitats, excludes light and reduces oxygen levels leading to reduced water quality, impeded water flow, and increased mosquito abundance (DSEWPac, 2011f).

Prickly acacia (*Vachellia nilotica*)

Prickly acacia is a thorny shrub or spreading tree, which grows to 4-7 m high and occasionally to 10m. Young trees have bark with a tinge of orange and/or green, and usually have long white straight spines 10-50 mm long in pairs at the base of each leaf. Older trees have dark, rough bark and lose most of their thorns. Prickly acacia has compound leaves 30-40 mm long, with 10-25 pairs of leaflets along their length. Flowerheads are globular, golden-yellow, about 10 mm diameter and in groups of 2-6 in the leaf axils. The seed pods are a distinguishing feature, being grey-green, covered in fine hairs, 100-200 mm long and having deep constrictions between the seeds to give them a necklace like appearance.

Prickly acacia occurs on cracking clay soils with high water holding capacity, but can also occur on sandy soils in areas of higher rainfall. It grows best around waterways and on seasonally inundated floodplains with 350-1500 mm of annual rainfall. Established stands of prickly acacia form impenetrable dense thorny thickets, reducing primary productivity, interfering with stock mustering and access to water, and changing the structure and composition of grasslands which impacts the overall ecology of the system. Prickly acacia reproduces only by seeds, which are dispersed by flowing water and consumption by cattle (DSEWPac, 2011g).

3.10 Fauna

3.10.1 Fauna records

The NT Fauna Atlas identified 14,929 records of 386 fauna taxa identified to species level and a further 18 fauna taxa identified to genus level within 20 km of the survey areas. The majority of these records are along the Kakadu Hwy and in the low lying areas nearer the Mary River that have been used as quarries.

3.10.2 Fauna species of conservation significance

The EPBC PMST identified 32 fauna species listed as threatened under the EPBC Act as occurring or potentially occurring within 20 km of lease areas. Four are listed as critically endangered, 13 as endangered and 25 as vulnerable. Of these species, six occur in marine habitats and will not be discussed further. These species are humpback whale (*Megaptera novaehollandiae*), Loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), Hawksbill turtle (*Eretmochelys imbricate*) and olive ridley turtle (*Lepidochelys olivacea*). Records of four species listed as endangered and four species listed as vulnerable under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. The NT Fauna Atlas also identified records of 14 species listed as threatened under the TPWC Act within a 20 km radius of the survey areas (Figure 3-10). One of these species is listed as critically endangered, one as endangered and 12 as vulnerable.

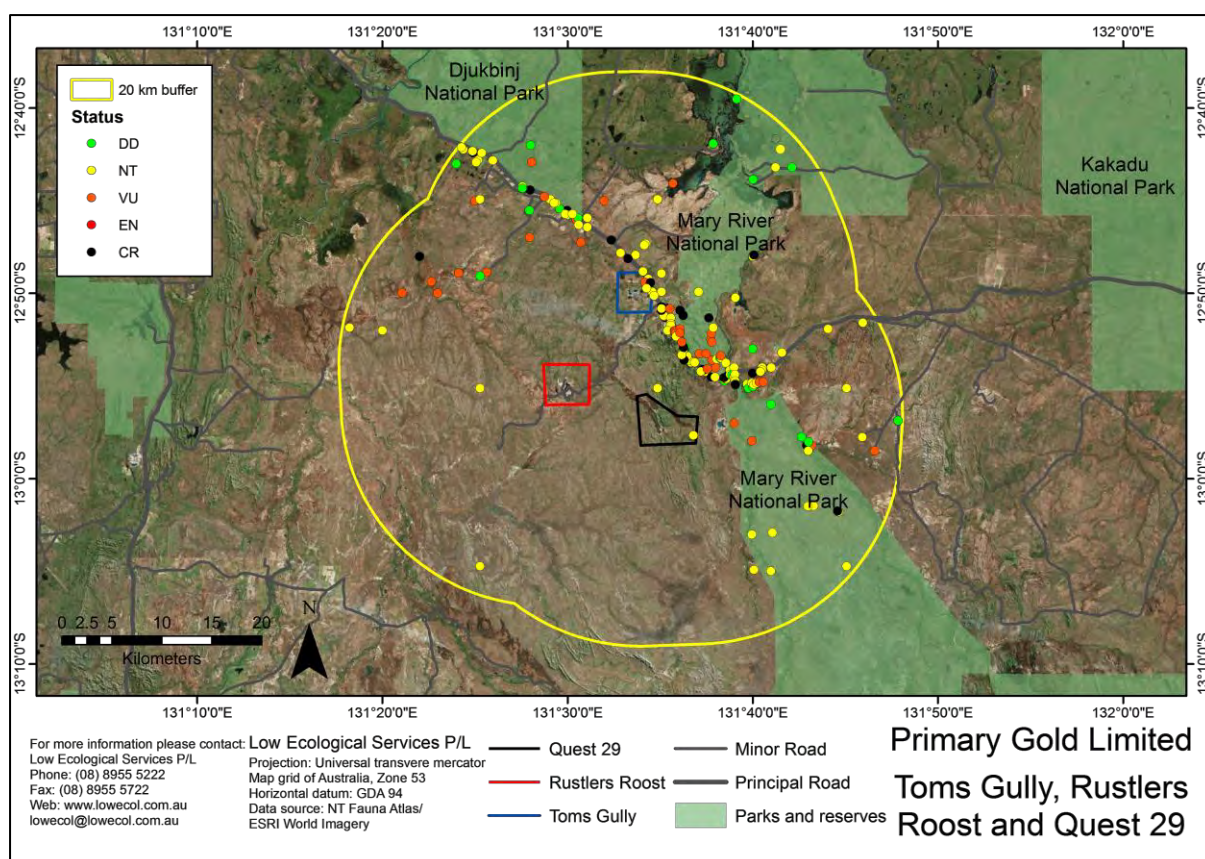


Figure 3-10: Location of records of fauna species of conservation significance listed under the TPWC Act with records in the NT Flora Atlas within 20 km of Toms Gully, Rustlers Roost and Quest 29

Bird species of conservation significance

Twenty-five bird species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring or potentially occurring within a 20 km radius of the survey areas (Table 3.8). Eleven of these species are listed as threatened under the EPBC Act; two as critically endangered, four as endangered and five as vulnerable. Five of these species listed as threatened under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of ten bird species listed as threatened under the TPWC Act, nine as vulnerable and one as endangered, were also identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of a further 13 species listed as near threatened and one species listed as data deficient under the TPWC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. All NT Fauna Atlas records within 20km of the survey areas are mapped in Figure 3-10. Further information on relevant to assessment of likelihood of occurrence of threatened bird species in the survey areas is discussed below.

Curlew sandpiper (*Calidris ferruginea*) – The curlew sandpiper is a small to medium sized shorebird that is present in Australia during the non-breeding season from late August to April and is listed as vulnerable under the TPWC Act and critically endangered under the EPBC Act (Department of the Environment, 2017). In Australia, the curlew sandpiper inhabits coastal and brackish lagoons, intertidal mud and sand flats, estuaries, saltmarshes and occasionally inland freshwater wetlands (Ward, 2012). The closest record of this species to the survey areas is 37 km north-west of Toms Gully. There is a moderate likelihood that this species will be present in the survey areas.

Table 3.8: Bird species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within a 20 km radius of the survey areas and likelihood of occurrence of threatened species. En: endangered, Vu: vulnerable, DD: data deficient, NT: near threatened

Species name	Common name	Status		PMST	NT Fauna Atlas	Likelihood of occurrence in Proposal area
		TPWC	EPBC			
<i>Acrocephalus australis</i>	Australian reed-warbler	NT			X	
<i>Amaurornis moluccana</i>	Pale-vented bush-hen	NT			X	
<i>Ardeotis australis</i>	Australian bustard	NT			X	
<i>Arenaria interpres</i>	Ruddy turnstone	NT			X	
<i>Burhinus grallarius</i>	Bush stone-curlew	NT			X	High
<i>Calidris ferruginea</i>	Curlew sandpiper	Vu	Cr	X		Mod
<i>Charadrius leschenaultii</i>	Great sand plover	Vu	Vu		X	Low
<i>Charadrius mongolus</i>	Lesser sand plover	Vu	En		X	Low
<i>Dromaius novaehollandiae</i>	Emu	NT			X	
<i>Epthianura crocea tunneyi</i>	Alligator Rivers yellow chat	En	En	X		Mod
<i>Erythrotriorchis radiatus</i>	Red goshawk	Vu	Vu	X	X	High
<i>Erythrura gouldiae</i>	Gouldian finch	Vu	En	X	X	High
<i>Falco hypoleucos</i>	Grey falcon	Vu			X	High
<i>Falcunculus frontatus whitei</i>	Crested shrike-tit (northern)	NT	Vu	X		Low

Species name	Common name	Status		PMST	NT Fauna Atlas	Likelihood of occurrence in Proposal area
		TPWC	EPBC			
<i>Geophaps smithii smithii</i>	Partridge pigeon (eastern)	Vu	Vu	X	X	High
<i>Limosa limosa</i>	Black-tailed godwit	NT			X	
<i>Lonchura flaviprymna</i>	Yellow-rumped mannikin	NT			X	High
<i>Lophoictinia isura</i>	Square-tailed kite	NT			X	
<i>Numenius madagascariensis</i>	Eastern curlew	Vu	Cr	X		Low
<i>Numenius phaeopus</i>	Whimbrel	NT			X	
<i>Poecilodryas cerviniventris</i>	Buff-sided robin	NT			X	
<i>Rostratula australis</i>	Australian painted snipe	Vu	En	X		Mod
<i>Tringa brevipes</i>	Grey-tailed tattler	NT			X	
<i>Turnix castanotus</i>	Chestnut-backed button-quail	DD			X	
<i>Tyto novaehollandiae kimberli</i>	Masked owl (northern)	Vu	Vu	X		Mod

Great sand plover (*Charadrius leschenaultii*) – The great sand plover is a small to medium sized shorebird that is present in Australia from July to mid to late April and is listed as vulnerable under the TPWC Act and EPBC Act (Department of the Environment, 2017). In Australia, the great sand plover inhabits sandy beaches and sheltered mudflats, and also occasionally inland saline wetlands close to the coast (Ward, 2016). The closest record of this species to the survey areas is 18 km north-east of Quest 29. Given this species is found mainly in coastal areas and saline wetlands and these habitats are not present in the survey areas, there is a low likelihood that this species will be present in the survey areas.

Lesser sand plover (*Charadrius mongolus*) – The lesser sand plover is a small to medium sized shorebird that is present in Australia between September and May and is listed as vulnerable under the TPWC Act and endangered under the EPBC Act (Department of the Environment, 2017). In Australia, the lesser sand plover inhabits sheltered mudflats, sandy beaches, estuaries and mangroves, and occasionally inland saline wetlands close to the coast. The closest record of this species to the survey areas is 18 km north-east of Quest 29. Given this species is found mainly in coastal areas and saline wetlands and these habitats are not present in the survey areas, there is a low likelihood that this species will be present in the survey areas.

Alligator Rivers yellow chat (*Epthianura crocea tunneyi*) – The Alligator Rivers yellow chat is a small bird that is restricted to a small number of sites on the floodplains from the Adelaide River to the East Alligator River (Woinarski & Armstrong, 2006). It is listed as endangered under the TPWC Act and EPBC Act. Most records of this subspecies are from floodplain depressions and channels, concentrating around wetter areas at the end of the dry season (Woinarski & Armstrong, 2006). The closest record of this species to the survey areas is 34 km north-west of Toms Gully. Given the

potentially suitable habitat for this species in the survey areas, there is a moderate likelihood that the Alligator Rivers yellow chat is present in the survey areas.

Red goshawk (*Erythrorhynchus radiatus*) – The red goshawk is a large reddish-brown hawk with conspicuous dark streaks from chin to belly and barring on the underwing and tail (Woinarski, 2006b). It is listed as vulnerable under the TPWC Act and EPBC Act. It occurs across much of northern Australia where it generally occurs in tall open eucalypt forest and riparian areas characteristic of higher rainfall areas (Woinarski, 2006b). The closest record of the red goshawk to the survey areas is 6.5 km east of Toms Gully. Given the large territory size of this species (up to 200 km²; Woinarski, 2006) and the relatively close proximity of prior records, there is a high likelihood that this species occurs in the survey areas.

Gouldian finch (*Erythrura gouldiae*) – The Gouldian finch is an easily recognised colourful finch that is restricted to isolated areas of tropical savannas in the NT and the Kimberley (Department of Environment and Natural Resources, 2017). It is listed as vulnerable under the TPWC Act and endangered under the EPBC Act. In the late wet season and dry season (February to October) the Gouldian finch inhabits wooded hills containing a group of eucalypts called snappy or salmon gums, with hollows for nesting sites (Department of Environment and Natural Resources, 2017). In the wet season, *E. gouldiae* inhabits lowland drainages to feed on seeds on perennial grasses (Department of Environment and Natural Resources, 2017). The closest record of Gouldian finches to the survey areas is 1.5 km south-east of Toms Gully. Given the proximity of prior records and potentially suitable habitat in the survey areas, there is a high likelihood that the Gouldian finch is present in the survey areas.

Grey falcon (*Falco hypoleucos*) – The grey falcon is a medium-sized pale falcon found in low densities across all Australian mainland states and territories, mainly in the arid and semi-arid zone but with records up to Darwin in the NT (Ward, 2012b). It is listed as vulnerable under the TPWC Act. The grey falcon generally inhabits lightly-timbered lowland plains, typically on inland drainage systems (Ward, 2012b). They use the nests of other species, and prefer those in the tallest tree along watercourses (Ward, 2012b). The closest record of a grey falcon to the survey areas is 13 km north-west of Rustlers Roost. Given the proximity of prior records and the potentially suitable habitat there is a high likelihood that this species occurs within the survey areas.

Crested shrike-tit (northern) (*Falcunculus frontatus whitei*) – The crested shrike-tit is a distinctive medium-sized bird that occurs between the south-west Kimberley east to Borroloola and north into north-east Arnhem Land (Woinarski & Ward, 2012). It is listed as near threatened under the TPWC Act and vulnerable under the EPBC Act. This subspecies inhabits a range of eucalypt and melaleuca woodlands, from relatively wet to strongly seasonal areas in Arnhem Land to semi-arid woodland in the southern Victoria River District (Woinarski & Ward, 2012). The closest record of a crested shrike-tit to the survey areas is 85 km north-east of Toms Gully. Despite the potentially suitable habitat, the distance to the closest known record of the species suggests that there is a low likelihood that the crested shrike-tit occurs in the survey areas.

Partridge pigeon (*Geophaps smithii smithii*) – The partridge pigeon is a medium-sized ground dwelling pigeon listed as vulnerable under both the TPWC Act and EPBC Act (Woinarski, 2006a). It is distributed across the Top End NT and Kimberley but has disappeared from the lower rainfall parts of its range (Woinarski, 2006a). The partridge pigeon mainly inhabits lowland eucalypt open forest and woodland with grassy understorey (Woinarski, 2006a). The partridge pigeon is largely sedentary,

but may make localised movements up to 5-10 km in response to seasonal variations in resource availability. This species has been recorded within the Toms Gully survey area, therefore there is a high likelihood of it occurring in the survey areas.

Eastern curlew (*Numenius madagascariensis*) – The eastern curlew is a very large shorebird that is a non-breeding migrant in Australia for the austral summer (Ward, 2012c). It is listed as vulnerable under the TPWC Act and critically endangered under the EPBC Act. The species has been recorded along the coast and offshore islands of the NT, and is most common in mangrove areas but can also be found on intertidal flats and saltmarshes (Ward, 2012c). The closest record of this species to the survey areas is 28 km north-west of Toms Gully. Given that this species inhabits coastal areas there is a low likelihood that it occurs within the survey areas.

Australian painted snipe (*Rostratula australis*) – The Australian painted snipe is a wading bird that is found throughout Australia, though mostly recorded in south-east Australia (Taylor, et al., 2013). It is listed as vulnerable under the TPWC Act and endangered under the EPBC Act. The species inhabits shallow, vegetated, freshwater swamps, claypans or inundated grassland (Taylor, et al., 2013). The closest record of an Australian painted snipe to the survey areas is 57 km north-west of Rustlers Roost. Due to potentially suitable habitat, there is a moderate likelihood that the Australian painted snipe will occur within the survey areas.

Masked owl (northern) (*Tyto novaehollandiae kimberli*) – The masked owl is a large dark owl occurring on the north Australian mainland (Woinarski & Ward, 2012). It is listed as vulnerable under the TPWC Act and EPBC Act. The species occurs mainly in tall open eucalypt forest, but also roosts in monsoon rainforests and forages in more open vegetation types including grasslands (Woinarski & Ward, 2012). The closest record of this species to the survey areas is 35 km north-west of Toms Gully. As there is potentially suitable habitat for the masked owl present in the survey areas there is a moderate likelihood that this species is present in the survey areas.

Mammal species of conservation significance

Seventeen mammal species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring within a 20 km radius of the survey areas (Table 3.9). Nine of these species are listed as threatened under the EPBC Act; one as critically endangered, three as endangered and five as vulnerable. Three of these species listed as threatened under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of seven mammal species listed as threatened under the TPWC Act; one as critically endangered, three as endangered and five as vulnerable, were also identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of a further six species listed as near threatened and three species listed as data deficient under the TPWC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. All NT Fauna Atlas records of conservation significant mammals within 20km of the survey areas are mapped in Figure 3-10. Further information relevant to assessment of likelihood of occurrence of threatened mammal species in the survey areas is provided below.

Table 3.9: Mammal species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within the lease areas and likelihood of occurrence of threatened species. Vu: vulnerable, En: endangered, Cr: critically endangered, DD: data deficient, NT: near threatened.

Species name	Common name	Status		PMST	NT Fauna Atlas	Likelihood of occurrence
		TPWC	EPBC			
<i>Antechinus bellus</i>	Fawn antechinus	En	Vu	X	X	High
<i>Conilurus penicillatus</i>	Brush-tailed rabbit-rat	En	Vu	X		Low
<i>Dasyurus hallucatus</i>	Northern quoll	Cr	En	X	X	Mod
<i>Isodon macrourus</i>	Northern brown bandicoot	NT			X	
<i>Macroderma gigas</i>	Ghost bat	NT	Vu	X		Mod
<i>Mesembriomys gouldii gouldii</i>	Black-footed tree-rat	Vu	En	X	X	High
<i>Onychogalea unguifera</i>	Northern nailtail wallaby	NT			X	
<i>Petrogale concinna canescens</i>	Nabarlek (Top End)	Vu	En	X		Low
<i>Phascogale pirata</i>	Northern brush-tailed phascogale	En	Vu	X		Mod
<i>Pseudomys nanus</i>	Western chestnut mouse	NT			X	
<i>Rattus tunneyi</i>	Pale field-rat	Vu			X	High
<i>Rhinioncteris aurantia</i>	Orange leaf-nosed bat	NT			X	High
<i>Saccolaimus saccolaimus nudiclunatus</i>	Bare-rumped sheath-tailed bat	DD	Cr	X		Mod
<i>Sminthopsis bindi</i>	Kakadu dunnart	DD			X	
<i>Sminthopsis virginiae</i>	Red-cheeked dunnart	DD			X	High
<i>Trichosurus vulpecula arnhemensis</i>	Common brushtail possum (Top End)	NT			X	
<i>Xeromys myoides</i>	Water mouse	DD	Vu	X		Low

Fawn antechinus (*Antechinus bellus*) – The fawn antechinus is a small dasyurid marsupial found in the savannah woodland and tall open forest on the Top End NT (Young, 2012). It is listed as endangered under the TPWC Act and vulnerable under the EPBC Act. The closest record of *A. bellus* to the survey areas is 3.5 km south-east of Toms Gully. Given the proximity of prior records, and the presence of potentially suitable habitat, there is a high likelihood that the fawn antechinus occurs within the survey areas.

Brush-tailed rabbit-rat (*Conilurus penicillatus*) – The brush-tailed rabbit-rat is a moderate-sized, partly arboreal rat, only known to currently persist in the NT on the Cobourg Peninsula, Bathurst, Melville and Inglis Islands, and Groote Eylandt (Woinarski & Hill, 2012). It is listed as endangered under the TPWC Act and vulnerable under the EPBC Act. The preferred habitat of the species is eucalypt tall-open forest, but, at least on the Cobourg Peninsula, it also occurs on coastal grasslands (Woinarski & Hill, 2012). The closest record of this species is 30 km south-west of Quest 29, however this was before 1971. Given the high survey effort for this species in recent years and associated observed declines in populations (see Woinarski & Hill, (2012)), and a lack of records within the immediate area surrounding the survey areas, there is a low likelihood that the brush-tailed rabbit-rat occurs within the survey areas.

Northern quoll (*Dasyurus hallucatus*) – The northern quoll is a distinctive carnivorous marsupial, about the size of a small cat, occurring across much of northern Australia (Woinarski & Hill, 2012b). It is listed as critically endangered under the TPWC Act and endangered under the EPBC Act. The northern quoll occurs in a wide range of habitats (Woinarski & Hill, 2012b). It was once common in many eucalypt open forests, but now the northern quoll is most commonly found in rocky areas (Woinarski & Hill, 2012b). There are records of the northern quoll within Toms Gully. Given this and suitable habitat being present in the survey areas, but also taking into account recent broad-scale declines in its distribution and abundance (Woinarski & Hill, 2012b), there is a moderate likelihood of the northern quoll being present in the survey areas.

Ghost bat (*Macroderma gigas*) – The ghost bat is a large species of bat, currently distributed across northern Australia (Ward & Milne, 2016). It is listed as near threatened under the TPWC Act and vulnerable under the EPBC Act. The distribution is influenced by the availability of suitable caves and mines for roost sites, with one of the largest colonies occurring in gold mine workings at Pine Creek NT (Ward & Milne, 2016). The closest record of the ghost bat to the survey areas is 38 km south of Quest 29. There is the potential for caves to be present in the rocky areas within the survey areas, therefore there is a moderate likelihood that the ghost bat is present.

Black-footed tree-rat (*Mesembriomys gouldii gouldii*) – The black-footed tree-rat is one of the largest rodents in Australia and is found in the Top End NT (Hill, 2012). The species inhabits tropical woodlands and open forests in coastal areas, sheltering in tree hollows and pandanus stands during the day (Hill, 2012). The closest record of the black-footed tree-rat is 5 km north of Quest 29. Given the proximity of prior records and potentially suitable habitat in the area, there is a high likelihood that this species occurs in the survey areas.

Nabarlek (Top End) (*Petrogale concinna canescens*) – The nabarlek is a very small rock-wallaby that has been recorded in scattered populations from the Arafura Swamp in the east to the Daly River catchment in the west (Ward & Woinarski, 2012). The species is restricted to rocky sandstone or granite areas, especially on steep slopes, with large boulders, caves and crevices, and may move to forage in adjacent flat areas (Ward & Woinarski, 2012). The closest record of the nabarlek is 61 km south-east of Quest 29. Given the proximity of prior records, there is a low likelihood that the nabarlek is present in the survey areas.

Northern brush-tailed phascogale (*Phascogale pirata*) – The northern brush-tailed phascogale is a mid-sized carnivorous marsupial restricted to the Top End NT (Woinarski & Ward, 2012b). Little is known about the ecology of the northern brush-tailed phascogale, but most records are from tall open forest dominated by *E. miniata* and *E. tertodonta* (Woinarski & Ward, 2012b). The closest record of this the northern brush-tailed phascogale to the survey areas is 53.5 km south-west of Rustlers Roost. Given the potentially suitable habitat in the survey areas, but taking into account proximity to prior records, there is a moderate likelihood that the northern brush-tailed phascogale occurs in the survey areas.

Pale field-rat (*Rattus tunneyi*) – The pale field-rat is a medium sized rodent found in higher rainfall areas of northern Australia (Young & Hill, 2012). It is listed as vulnerable under the TPWC Act. The pale field-rat inhabits dense vegetation along creeks (Young & Hill, 2012). The closest record of the species is 3.5 km south-east of Toms Gully. Given the potentially suitable habitat and the proximity of prior records, there is a high likelihood that this species is present in the survey areas.

Bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus nudicluniatatus*) – The bare-rumped sheath-tailed bat is a large, high-flying, insectivorous bat distributed across north-eastern Australia, including Top End NT (Milne & Woinarski, 2006). It is listed as data deficient under the TPWC Act and critically endangered under the EPBC Act. The species has been recorded in open pandanus woodland and eucalypt tall open forests (Milne & Woinarski, 2006). The closest record of the bare-rumped sheath-tailed bat to the survey areas is 60 km north-west of Rustlers Roost. Given the difficulty associated with recording the species and potentially suitable habitat, there is a moderate likelihood that the bare-rumped sheath-tailed bat occurs within the survey areas.

Water mouse (*Xeromys myoides*) – The water mouse is a small rodent known from just ten records from northern Arnhem Land in the east to the Daly River in the west (Woinarski, 2006c). It is listed as data deficient under the TPWC Act and vulnerable under the EPBC Act. The water mouse inhabits mangrove forests, freshwater swamps and floodplain saline grasslands (Woinarski, 2006c). The closest record of the water mouse to the survey areas is 107 km north-east of Rustlers Roost. However this record was prior to 1970 (Woinarski, 2006c). Given the proximity of prior records, there is a low likelihood that the water mouse is present in the survey areas.

Reptile species of conservation significance

Thirteen reptile species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring within a 20 km radius of the survey areas (Table 3.10). Two of these species are listed as threatened under the EPBC Act; one as endangered and one as vulnerable. Two of these reptile species listed as threatened under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of five reptile species listed as threatened under the TPWC Act, all as vulnerable, were also identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of a further two species listed as near threatened and six species listed as data deficient under the TPWC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. All NT Fauna Atlas records of conservation significant reptiles within 20km of the survey areas are mapped in Figure 3-10. Further information relevant to assessment of likelihood of occurrence of threatened reptile species in the survey areas is provided below.

Plains death adder (*Acanthophis hawkei*) – The plains death adder has a disjointed distribution on the floodplains of the Adelaide, Mary and Alligator Rivers, and the Barkly Tableland (Ward & Phillips, 2012). It is listed as vulnerable under the TPWC Act and EPBC Act. The plains death adder inhabits flat, treeless, cracking soil plains of northern Australia (Ward & Phillips, 2012). The closest record of the plains death adder to the survey areas is 23 km north-west of Toms Gully. As any potentially suitable habitat is likely to be limited in extent in the survey areas, there is a low likelihood of the plains death adder occurring.

Yellow-snouted gecko (*Lucasium occultum*) – The yellow-snouted gecko is a small ground-dwelling gecko known from north-west Kakadu, the Wildman River portion of the Mary River National Park and Annaburroo Station (Beggs, et al., 2012). It is listed as vulnerable under the TPWC Act and endangered under the EPBC Act. All records have been from areas with well-developed leaf litter and grasses in open forests dominated by *E. miniata* and *E. tetradonta*, typically with red sandy-loam soils. The closest record of the yellow-snouted gecko to the survey areas is 27 km north-east of Toms Gully. As very little is known of the ecology of this species, and there is potentially suitable habitat, there is a moderate likelihood that the yellow-snouted gecko occurs within the survey areas.

Table 3.10: Reptile species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within 20km of the lease areas and likelihood of occurrence of threatened species. Vu: vulnerable, DD: data deficient, NT: near threatened.

Species name	Common name	Status		PMST	NT Fauna Atlas	Likelihood of occurrence
		TPWC	EPBC			
<i>Acanthopis hawkei</i>	Plains death adder	Vu	Vu	X		Low
<i>Demansia olivacea</i>	Olive whip snake	DD			X	
<i>Dendrelaphis punctulatus</i>	Green tree snake	DD			X	
<i>Lucasium occultum</i>	Yellow-snouted gecko	Vu	En	X		Mod
<i>Pseudechis australis</i>	King brown snake	NT			X	
<i>Tiliqua scincoides</i>	Common blue-tongued lizard	DD			X	
<i>Varanus baritji</i>	Black-spotted ridge-tailed monitor	DD			X	
<i>Varanus glebopalma</i>	Long-tailed rock monitor	DD			X	
<i>Varanus mertensi</i>	Mertens' water monitor	Vu			X	High
<i>Varanus mitchelli</i>	Mitchell's water monitor	Vu			X	High
<i>Varanus panoptes</i>	Floodplain monitor	Vu			X	High
<i>Varanus primordius</i>	Northern ridge-tailed monitor	NT			X	
<i>Varanus scalaris</i>	Spotted tree monitor	DD			X	

Mertern's water monitor (*Varanus mertensi*) – The Merten's water monitor is a medium- to large-sized semi-aquatic monitor found across far north Australia from the Kimberly to the west side of Cape York Peninsula (Ward, et al., 2006). It is listed as vulnerable under the TPWC Act. The Merten's water monitor inhabits coastal and inland waters in all river systems of the Top End (Ward, et al., 2006). The closest record of the Merten's water monitor to the survey areas is 3.5 km south-east of Toms Gully. Given the presence of potentially suitable habitat, there is a high likelihood that the Merten's water monitor occurs within the survey areas.

Mitchell's water monitor (*Varanus mitchelli*) – Mitchell's water monitor is a slender medium-sized monitor found across the Kimberley and the Top End, and an isolated population in north-western Queensland (Ward, 2012d). It is listed as vulnerable under the TPWC Act. Mitchell's water monitor inhabits margins of watercourses, swamps and lagoons (Ward, 2012d). The closest record of Mitchell's water monitor to the survey areas is 3.5 km south-east of Toms Gully. Given the presence of potentially suitable habitat, there is a high likelihood that Mitchell's water monitor occurs in the survey areas.

Floodplain monitor (*Varanus panoptes*) – The floodplain monitor is a large, heavy-built terrestrial monitor with a broad geographic range across far northern Australia (Ward, et al., 2012b). It is listed as vulnerable under the TPWC Act. The floodplain monitor occurs in a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands (Ward, et al., 2012b). There are records of the floodplain monitor in Toms Gully. Therefore, there is a high likelihood that the floodplain monitor occurs within the survey areas.

Fish and shark species of conservation significance

Five fish and shark species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring within a 20 km radius of the survey areas (Table 3.11). All of these species are listed as threatened under both the EPBC Act and TPWC Act. Records of one of these species, *Pristis pristis* (largetooth sawfish), were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Further information relevant to assessment of likelihood of occurrence of threatened reptile species in the survey areas is provided below.

Table 3.11: Fish and shark species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within the lease areas and likelihood of occurrence of threatened species. Vu: vulnerable, En: endangered, Cr: critically endangered

Species name	Common name	Status		PMST	NT Fauna Atlas	Likelihood of occurrence
		TPWC	EPBC			
<i>Glyphis garricki</i>	Northern river shark	En	En	X		Low
<i>Glyphis glyphis</i>	Speartooth shark	Vu	Cr	X		Low
<i>Pristis clavata</i>	Dwarf sawfish	Vu	Vu	X		Low
<i>Pristis pristis</i>	Largetooth sawfish	Vu	Vu	X	X	Low
<i>Pristis zijsron</i>	Green sawfish	Vu	Vu	X		Low

Northern river shark (*Glyphis garricki*) – The northern river shark is known from the Adelaide, and east and south Alligator River systems in the NT, and the Kimberley coast and King Sound in WA (Ward & Larson, 2012a). It is listed as endangered under both the TPWC Act and EPBC Act. There is little known about the ecology of the northern river shark but it is probably restricted to shallow, brackish reaches of large rivers. The closest record of this the northern river shark to the survey areas is 30 km west of Rustlers Roost. Given the absence of potentially suitable habitat, there is a low likelihood that this species occurs within the survey areas.

Speartooth shark (*Glyphis glyphis*) – The speartooth shark is a medium-sized whaler shark that is known to occur in the eastern Gulf of Carpentaria, Cape York Peninsula and the Alligator Rivers region across to the Adelaide River NT (Ward & Larson, 2012b). It is listed as vulnerable under the TPWC Act and critically endangered under the EPBC Act. The speartooth shark has been recorded in brackish waters in the NT (Ward & Larson, 2012b). The closest record of the speartooth shark to the survey areas is 27 km north-west of Toms Gully. Given that there are no brackish habitats, there is a low likelihood that this species occurs in the survey areas.

Dwarf sawfish (*Pristis clavata*) – The dwarf sawfish is a small, robust shark-like sawfish occurring in shallow waters in coastal and estuarine areas of tropical Australia, extending some distance up rivers almost into fresh water (Larson, et al., 2012). It is listed as vulnerable under both the TPWC Act and EPBC Act. The closest record of the dwarf sawfish to the survey areas is 95 km north-west of Toms Gully. Given the lack of suitable habitat, there is a low likelihood that this species will occur in the survey areas.

Largetooth sawfish (*Pristis pristis (microdon)*) – The largetooth sawfish is a medium-sized sawfish known from several drainages in northern Australia from Western Australia to Queensland (Larson, et al., 2006). It is listed as vulnerable under both the TPWC Act and EPBC Act. The largetooth sawfish

prefers muddy bottoms of freshwater areas and upper reaches of estuaries. The largetooth sawfish is anadromous and is thought to spend its first 3-4 years in freshwaters before moving into estuarine and marine environments (Larson, et al., 2006). The closest record of the largetooth sawfish to the survey areas is 12.5 km north-west of Rustlers Roost. The creeks running through the survey areas are relatively small, and probably do not provide habitat for an animal as large as the largetooth sawfish. Therefore, there is a low likelihood that the largetooth sawfish occurs within the survey areas.

Green sawfish (*Pristis zijsron*) – The green sawfish is a large, robust shark-like sawfish found in Australian tropical waters (Stirrat, et al., 2006). In the NT, specimens have been collected in Darwin Harbour and other evidence of occurrence in Garig Gunak Barlu National Park and in the Arafura Sea around Groote Eylandt (Stirrat, et al., 2006). It is listed as vulnerable under the TPWC Act. The green sawfish occurs in areas with a muddy substrate, and throughout its range has been reported to inhabit marine inshore waters, estuaries, lagoons and freshwater, but mainly marine and estuarine areas (Stirrat, et al., 2006). The closest record of the green sawfish to the survey areas is 95 km north-west of Toms Gully. Given that the green sawfish is found mainly in coastal and estuarine areas, there is a low likelihood that this species occurs within the survey areas.

3.10.3 Migratory species

The EPBC PMST and NT Fauna Atlas identified 45 migratory species as occurring or potentially occurring within 20 km of the survey areas (Table 3.12).

Table 3.12: Fauna species listed as migratory under the EPBC Act as identified by the PMST and the NT Fauna Atlas as occurring or having potentially suitable habitat within the Area of Interest, their conservation status, observation during the on-ground survey, listing under international agreements and likelihood of occurrence (Likelihood) in the lease areas.

Mi: Migratory; Ma: Marine, J: Japan-Australia Migratory Bird Agreement; C: China-Australia Migratory Bird Agreement; R: Republic of Korea-Australia Migratory Bird Agreement; B: Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals)

Scientific name	Common name	EPBC	PMST	NT Fauna Atlas	International agreement
<i>Acrocephalus orientalis</i>	Oriental reed-warbler	MiMa	X		J, C, B
<i>Actitis (Tringa) hypoleucos</i>	Common sandpiper	MiMa		X	J, C, R, B
<i>Anoxypristis cuspidata</i>	Narrow sawfish	MiMa	X		B
<i>Apus pacificus</i>	Fork-tailed swift	MiMa	X	X	J, C, R
<i>Arenaria interpres</i>	Ruddy turnstone	MiMa		X	J, C, R, B
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MiMa		X	J, C, R, B
<i>Calidris ferruginea</i>	Curlew sandpiper	MiMa	X		J, C, R, B
<i>Caretta caretta</i>	Loggerhead turtle	MiMa	X		B
<i>Cecropis daurica</i> (<i>Hirundo daurica</i>)	Red-rumped swallow	MiMa	X		J, C, R
<i>Charadrius leschenaultii</i>	Great sand plover	MiMa		X	J, C, R, B
<i>Charadrius mongolus</i>	Lesser sand plover	MiMa		X	J, C, R, B
<i>Charadrius veredus</i>	Oriental plover	MiMa	X		J, C, R, B
<i>Chelonia midas</i>	Green turtle	MiMa	X		B

Scientific name	Common name	EPBC	PMST	NT Fauna Atlas	International agreement
<i>Crocodylus porosus</i>	Saltwater crocodile	MiMa	X	X	B
<i>Cuculus optatus</i>	Oriental cuckoo	MiMa	X	X	J, C, R
<i>Dermochelys coricea</i>	Leatherback turtle	MiMa	X		B
<i>Eremochelys imbricata</i>	Hawksbill turtle	MiMa	X		B
<i>Glareola maldivarum</i>	Oriental pratincole	MiMa	X		J, C, R
<i>Hirundo rustica</i>	Barn swallow	MiMa	X		J, C, R
<i>Hydroprogne (Sterna) caspia</i>	Caspian tern	MiMa		X	J
<i>Lepidochelys olivacea</i>	Olive ridley turtle	MiMa	X		B
<i>Limosa limosa</i>	Black-tailed godwit	MiMa		X	J, C, R, B
<i>Manta alfredi</i>	Reef manta ray	MiMa	X		B
<i>Manta birostris</i>	Giant manta ray	MiMa	X		B
<i>Megaptera novaeangliae</i>	Humpback whale	MiMa	X		B
<i>Motacilla cinerea</i>	Grey wagtail	MiMa	X		J, C, R
<i>Motacilla flava</i>	Yellow wagtail	MiMa	X		J, C, R
<i>Natator depressus</i>	Flatback turtle	MiMa	X		B
<i>Numenius madagascariensis</i>	Eastern curlew	MiMa	X		J, C, R, B
<i>Numenius phaeopus</i>	Whimbrel	MiMa		X	J, C, R, B
<i>Pandion haliaetus</i>	Osprey	MiMa	X		B
<i>Plegadis falcinellus</i>	Glossy ibis	MiMa		X	B
<i>Pluvialis fulva</i>	Pacific golden plover	MiMa		X	J, C, R, B
<i>Pristis clavata</i>	Dwarf sawfish	Mi	X		B
<i>Pristis pristis</i>	Largetooth sawfish	Mi	X		B
<i>Pristis zijsron</i>	Green sawfish	MiMa	X		B
<i>Rhipidura rufifrons</i>	Rufous fantail	MiMa	X		B
<i>Sousa chinensis</i>	Indo-Pacific humpback dolphin	Mi	X		B
<i>Sterna hirundo</i>	Common tern	MiMa		X	J, C, R
<i>Sternula albifrons</i>	Little tern	MiMa		X	J, C, R, B
<i>Tringa (Heteroscelus) brevipes</i>	Grey-tailed tattler	MiMa		X	J, C, R, B
<i>Tringa glareola</i>	Wood sandpiper	MiMa		X	J, C, R, B
<i>Tringa nebularia</i>	Common greenshank	MiMa	X	X	J, C, R, B
<i>Tringa stagnatilis</i>	Marsh sandpiper	MiMa		X	J, C, R, B
<i>Xenus cinereus</i>	Terek sandpiper	MiMa		X	J, C, R, B

3.10.4 Introduced fauna species

Thirteen introduced fauna species were identified by the EPBC PMST as occurring or potentially occurring within 20 km of the survey areas (Table 3.13). Nine introduced fauna species were identified by the NT Fauna Atlas within 20 km of the survey areas (Table 3.13).

Table 3.13: Introduced fauna species identified as occurring or potentially occurring within 20 km of the survey areas by the EPBC PMST, NT Fauna Atlas and observation during the on-ground survey.

Scientific name	Common name	PMST	NT Fauna Atlas	On-ground
<i>Bos Taurus</i>	Cattle	X	X	X
<i>Bubalus bubalis</i>	Swamp buffalo	X	X	X
<i>Canis lupis familiaris</i>	Domestic dog	X		
<i>Columba livia</i>	Rock dove	X	X	
<i>Equus asinus</i>	Donkey	X	X	
<i>Equus caballus</i>	Horse	X		
<i>Felis catus</i>	Cat	X	X	X
<i>Hemidactylus frenatus</i>	Asian house gecko	X	X	
<i>Indotyphlops braminus</i>	Flower-pot blind snake	X	X	
<i>Mus musculus</i>	House mouse	X		X
<i>Rattus rattus</i>	Black rat	X		
<i>Rhinella marina</i>	Cane toad	X	X	X
<i>Sus scrofa</i>	Pig	X	X	X

3.11 State and Territory Reserves

The PMST identified five Territory reserves in the area surrounding Toms Gully. These are Mary River National Park (4km from Toms Gully processing plant), Leaning Tree Lagoon (20km), Harrison Dam Conservation Area (31km), Adelaide River Foreshore Conservation Area (39km) and Djukbinj National Park (62km).

4 FIELD SURVEY RESULTS

4.1 Survey Conditions

The surveys were conducted at the end of the dry season (1st – 7th November 2016) and at the start of the dry season (4th – 10th May 2017). Climatic conditions during the late dry season survey were warm and humid. Rainfall in the month preceding the November 2016 survey was higher than average, with 122.8mm of rain recorded at the Middle Point Rangers weather station located 33 km north-west of the survey sites compared to an average of 57.1 mm (BoM, 2017). Rainfall in the month preceding the May 2017 survey was also higher than average, with 300.5 mm recorded at the Middle Point Rangers weather station, compared to an average of 282 mm (BoM, 2017). Maximum temperatures at the Middle Point weather station during the November 2016 on-ground survey were between 35.5° C and 38.7° C and minimum temperatures were between 23.6° C and 24.9° C (BoM, 2017). Maximum temperatures at the Middle Point weather station during the May 2017 on-ground survey were between 33.4° C and 34.6° C and minimum temperatures were between 17.5° C and 22.6° C (BoM, 2017).

4.2 Survey Locations

Surveying was targeted towards habitat types that may support threatened species listed under the EPBC and TPWC Acts that were identified by the NT EPA and the desktop survey as occurring or potentially occurring within the study areas. Coordinates for each site are provided in Appendix 1.

4.3 Flora Species

More flora species were recorded in all survey areas during the post-wet season survey (May 2017: $n = 186$) than the late dry season survey (November 2016: $n = 102$; Figure 4-1), which was likely due to the higher soil moisture available from wet season rainfall. More flora species was recorded in the Toms Gully survey area during both surveys (November 2016: $n = 62$; May 2017: $n = 115$) compared to Rustlers Roost (November 2016: $n = 42$; May 2017: $n = 95$) and Quest 29 (November 2016: $n = 44$; May 2017: $n = 85$; Figure 4-1).

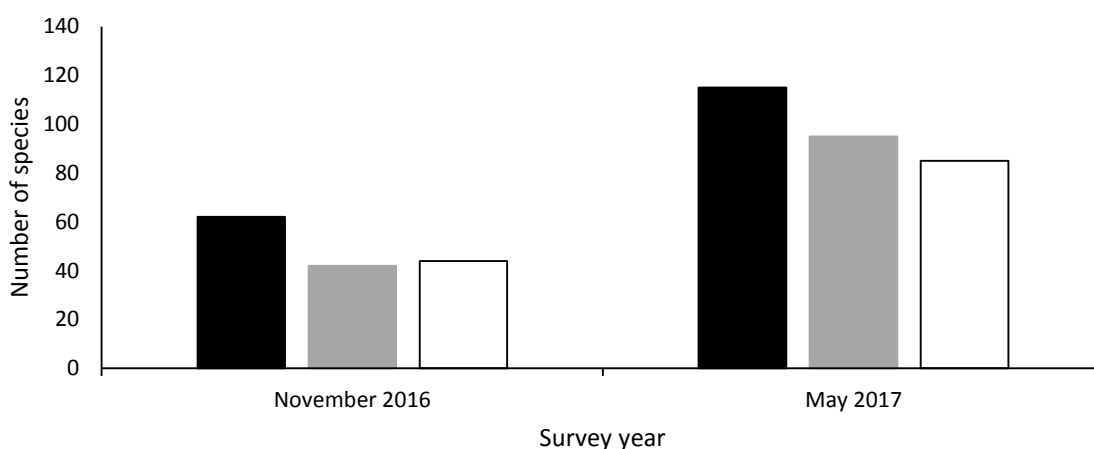


Figure 4-1: Number of flora species identified in Toms Gully (black bars), Rustlers Roost (grey bars) and Quest 29 (white bars) during the November 2016 and May 2017 on-ground surveys

There were 102 flora species from 34 families identified during the November 2016 on-ground survey (Appendix 2). No species of conservation significance and eight introduced species were recorded. An additional 20 specimens were collected but could not be identified to species level due to a lack of seed heads, fruit or flowers. All additional specimens were identified to genus level. There were 62 flora species identified in the Toms Gully survey area, with an additional 14 specimens that could not be identified to species level. There were 42 flora species identified in the Rustlers Roost survey area, with an additional seven specimens that could not be identified to species level. There were 44 flora species identified in the Quest 29 survey area, with an additional four that could not be identified to species level.

There were 186 flora species from 47 families recorded during the May 2017 on-ground survey (Appendix 3). Thirty-four flora specimens could not be identified to species level due to a lack of seed heads, flowers or fruit. All but one specimen was identified to genus level. There were 115 flora species recorded in the Toms Gully survey area and an additional 20 specimens that could not be identified to species level. There were 95 flora species identified in the Rustlers Roost survey area, with an additional 18 specimens that could not be identified to species level. There were 85 flora species identified in the Quest 29 survey area, with an additional 12 that could not be identified to species level.

4.3.1 Conservation Significant Flora

No flora species of conservation significance were recorded in the study areas during either the November 2016 or May 2017 surveys of the Toms Gully, Rustlers Roost or Quest 29 survey areas despite targeted survey effort. Several flora species could not be identified to species level; however all were determined not to be a threatened species outlined in the desktop survey due to their genus, description or and/or location.

4.3.2 Introduced Flora Species

A total of eight introduced flora species were recorded during November 2016 survey, four of which are listed weeds federally or in the Northern Territory. *Andropogon gayanus* (Gamba Grass) and *Mesophaerum suaveolens* (Hyptis) were the most widespread (Table 4.1; Figure 4-2; Figure 4-3). Four introduced flora species were recorded in the Toms Gully survey area. Two introduced flora species were found at study sites in the Rustlers Roost area. Incidentally, *Mimosa pigra* was also recorded next to the old heap leach in Rustlers Roost. Four introduced flora species were recorded in the Quest 29 region. Four introduced flora species recorded during the November 2016 survey are listed weeds in the NT and three are listed WoNS (Table 4.1).

There were 17 introduced flora species recorded during the May 2017 survey of Toms Gully, Rustlers Roost and Quest 29. *Andropogon gayanus*, *C. mucunoides*, *M. suaveolens*, *P. pedicellatus* and *T. rhomboidea* were the most widespread (Table 4.1; Figure 4-2; Figure 4-3). Nine species were recorded in the Toms Gully and Quest 29 survey areas. Four species were recorded in the Rustlers Roost area. Six introduced flora species recorded during the May 2017 survey are listed as class B and C weeds in the NT, including two species listed as WoNS (Table 4.1; Figure 4-2; Figure 4-3).

Table 4.1. Introduced flora species identified in the lease areas, including NT and WoNS status.

Species name	Common name	Status		Site	
		NT	WoNS	Nov-16	May-17
<i>Andropogon gayanus</i>	Gamba grass	B, C	X	ST1, ST4, WRD, CT3, CQ4.2	ST1, CT2, CT3, CR2
<i>Calopogonium mucunoides</i>	Calopo				ST1, CT1, CT3, CQ1, CQ4.2
<i>Crotalaria goreensis</i>					CQ4.2
<i>Cynodon dactylon</i>	Couch grass			CQ2	
<i>Cynodon radiatus</i>					SQ1, SQ3
<i>Heliotropium indicum</i>				ST2	
<i>Hibiscus sabdariffa</i>					CT1, CT4
<i>Hymenachne amplexicaulis</i>	Olive hymenachne	B,C	X	CT4, SR1	CR1
<i>Leucaena leucocephala</i>					CQ2
<i>Mesophaerum suaveolens</i>	Hyptis	B, C		ST2, ST3, WRD, CT1, CT2, CQ2, CQ4.2	ST2, ST3, CT1, CT2, CT3, CT4, SR2, SR4, CR1, CR3, SQ2, SQ3, CQ2, CQ4.2
<i>Mimosa pigra</i>	Mimosa	B, C	X	Incidental Rustlers Roost	
<i>Passiflora foetida</i>					ST1
<i>Pennisetum pedicellatus</i>	Mission grass (annual)				ST1, ST2, ST3, CT1, CT3, SR2, CQ4.2
<i>Pennisetum polystachion</i>	Mission grass (perennial)	B, C			SQ3
<i>Pennisetum</i> sp.				CQ4.2	CQ1
<i>Sida acuta</i>	Spinyhead sida	B, C			CT1, CT4,
<i>Stylosanthes viscosa</i>	Stylo			SR2	CT3, CQ4.2
<i>Trimfetta rhomboidea</i>	Triumfetta				SQ1, SQ3, CQ2, CQ4.2
<i>Triumfetta</i> sp.	Triumfetta				CR1
<i>Xanthium strumarium</i>	Ngoora burr	B, C			ST1

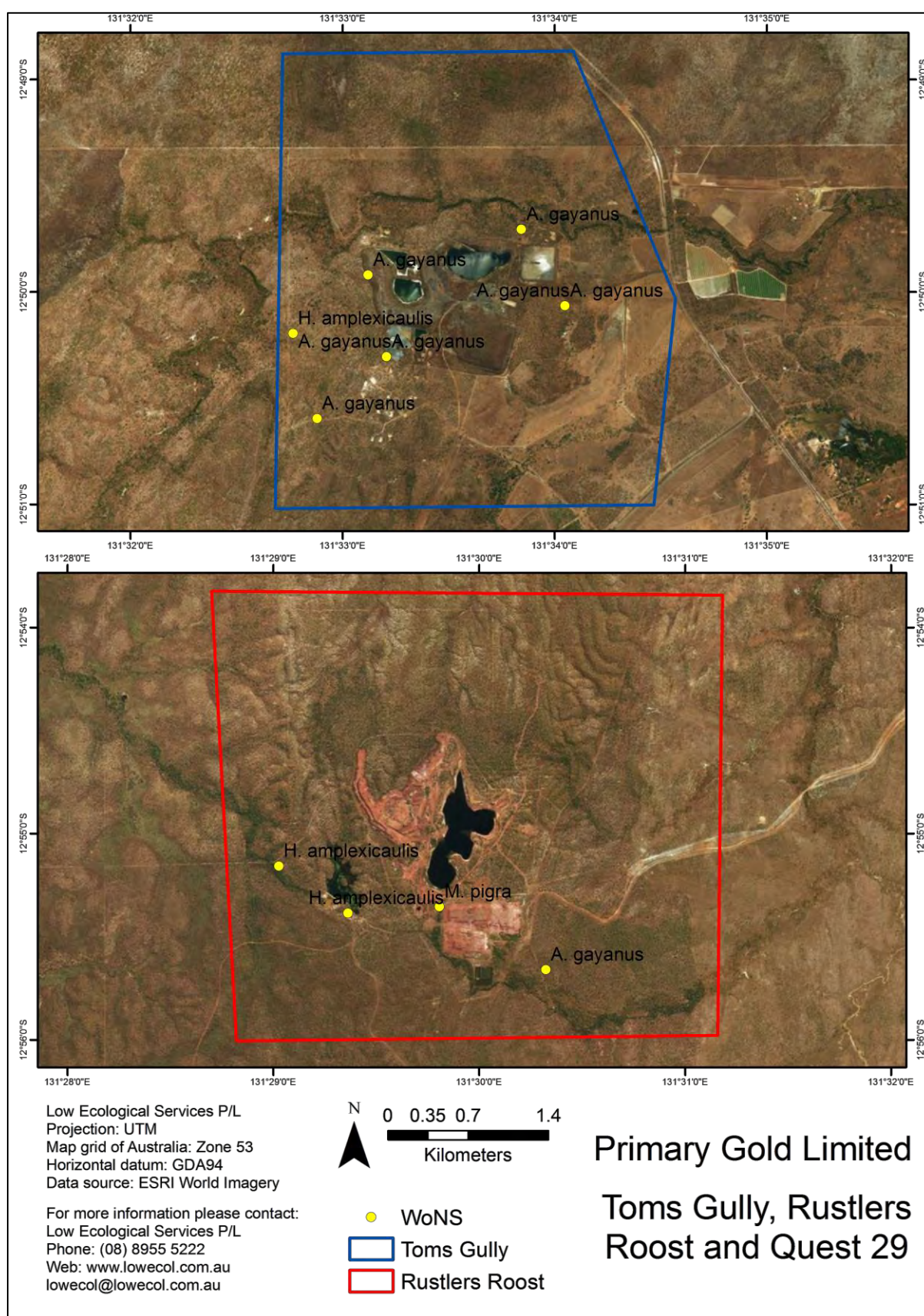


Figure 4-2: Location of WoNS recorded during the November 2016 and May 2017 surveys of the Toms Gully, Rustlers Roost and Quest 29 survey areas. Note that these species are also class B and class C weeds in the Northern Territory.

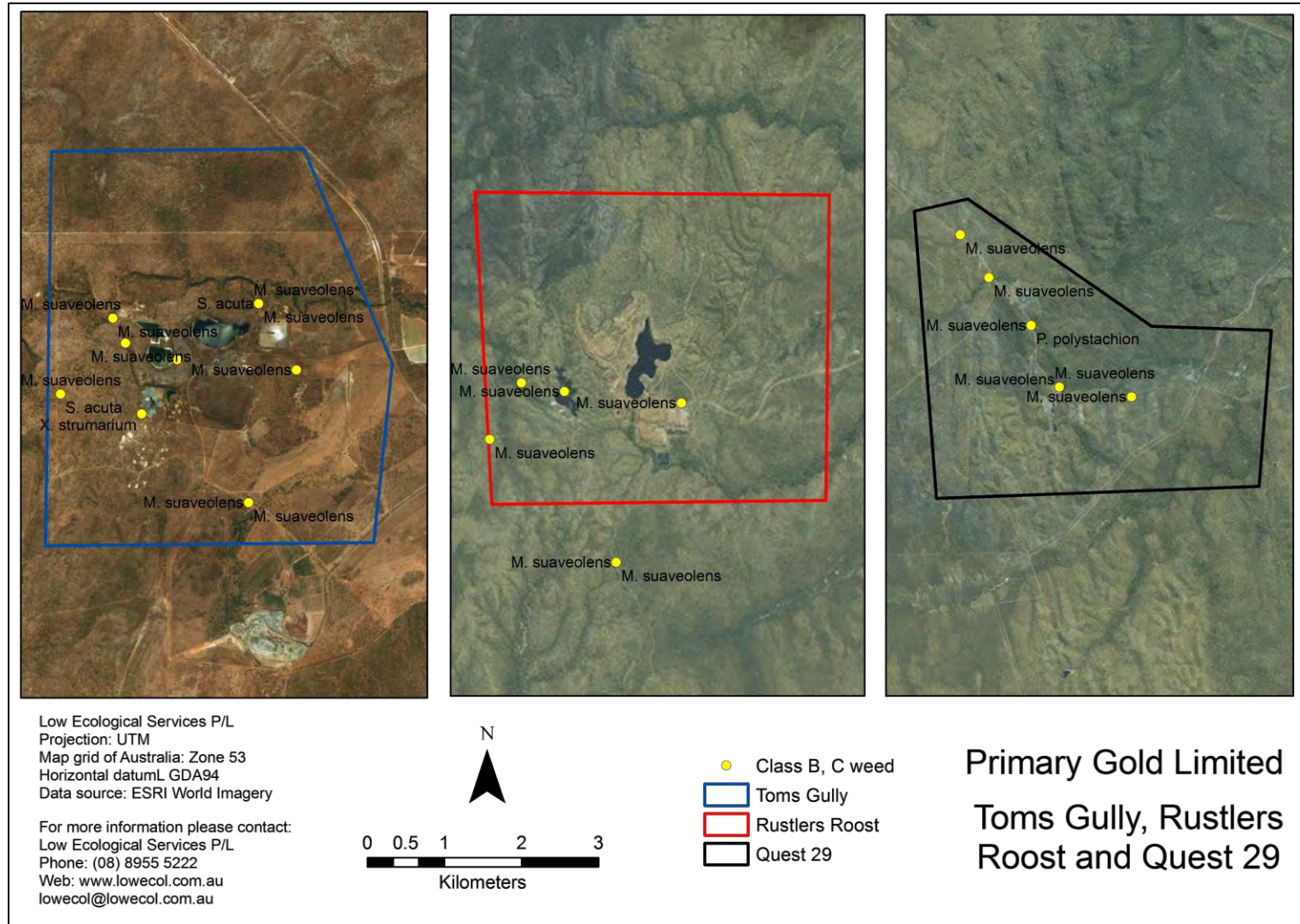


Figure 4-3: Location of weeds classified in the Northern Territory as class B and C recorded during the November 2016 and May 2017 surveys of the Toms Gully, Rustlers Roost and Quest 29 survey areas.

4.4 Habitat types the survey area

Nine habitats were identified during the on-ground survey. These habitat types are described in detail in the table below (Table 4.2).

Table 4.2: Habitat types identified during the on-ground survey of the lease and proposed drilling areas.

Habitat	Survey sites	Description	Photograph
Waste Rock Dump	TGWD1	Rocky slope of waste rock dump with an open forest vegetation community of <i>Eucalyptus camaldulensis</i> to 15 metres in height over <i>Acacia holosericea</i> with an understorey of <i>Petalostigma pubescens</i>, <i>Andropogon gayanus</i> (weed), <i>Mesophaerum suaveolens</i> (weed) and <i>Eriachne sp.</i> Soils were mixed with quartzite and siltstone rocks to 20 cm in size. Non-dominant species: <i>Cochlospermum fraseri</i>, <i>Owenia vernicosa</i>, <i>Pterocaulon serrulatum</i>	
Rocky Slope	CamT3.2	Large boulder and outcrop slope with open forest of <i>Eucalyptus miniata</i>, <i>Erythrophleum chlorostachys</i>, <i>Corymbia polycarpa</i> and <i>Ficus platypoda</i> with a maximum height of 25 metres. The mid-story contained <i>Cochlospermum fraseri</i>, <i>Brachychiton megaphyllus</i>, <i>Petalostigma pubescens</i>, <i>P. quadriloculare</i>, <i>Acacia holosericea</i>, <i>Buchanania obovata</i> and <i>Ampelocissus acesosa</i>. The understorey was dominated by the weed species <i>Andropogon gayanus</i>, <i>Pennisetum pedicellatus</i> and <i>Mesophaerum suaveolens</i> with density increasing closer to the station track. Soils were shallow loam with boulders to 2 metres in size and widespread outcrop. Non-dominant species: <i>Buchanania obovata</i>, <i>Erythrina verperitilio</i>, <i>Livistona inermis</i>, <i>Galactia megaphylla</i>, <i>Calopogonium mucunoides</i>, <i>Alstonia actinophylla</i>, <i>Livistona inermis</i>, <i>Stylosanthes viscosa</i>, <i>Ficus scobina</i>, <i>Eragrostis schultzei</i>, <i>Heteropogon contortus</i>, <i>Grevillea pteridifolia</i>, <i>Gardenia megasperma</i>	

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Habitat	Survey sites	Description	Photograph
Major Creek Line	ST2	Creek line with tall open-forest along banks consisting of and overstorey of <i>C. polycarpa</i> and <i>E. tectifera</i> with a mid-storey of <i>Bambusa arnhemica</i>, <i>Barringtonia acutangula</i>, <i>Acacia auriculiformis</i> and <i>Melaleuca dealbata</i> to 30 metres in height. The lower stories included a community of <i>Pandanus aquaticus</i>, <i>Petalostigma pubescens</i>, <i>Aristida macroclada</i>, <i>Eriachne</i> sp. and <i>Mesophaerum suaveolens</i> (weed). Non-dominant species: <i>Planchonia careya</i>, <i>Petalostigma quadriloculare</i>, <i>Mnesithea rottboellioides</i>, <i>Melaleuca viridiflora</i>, <i>Erythrophleum chlorostachys</i>, <i>Lophostemon lactifluus</i>, <i>Brachychiton megaphyllus</i>, <i>Ampelocissus acetosa</i>, <i>Grewia retusifolia</i>, <i>Heliotropium indicum</i> (introduced), <i>Glinus oppositifolius</i>, <i>Drosera darwiniensis</i>, <i>Eriachne</i> sp. <i>Brunonia</i> sp.	
Lowland Woodland	SR2, ST1, CamT4	Lowland woodland of <i>Corymbia polycarpa</i> +/- <i>Lophostemon lactifluus</i>/<i>Erythrophleum chlorostachys</i>/<i>Eucalyptus miniata</i>/ <i>E. tectifera</i>/ <i>E. camaldulensis</i> to 18m in height, over <i>Buchanania obovata</i> and <i>Acacia holosericea</i> +/- <i>Petalostigma pubescens</i>/ <i>Melaleuca viridiflora</i> /<i>Ficus opposita</i>/ <i>Cochlospermum fraseri</i>/<i>Hibiscus sabdariffa</i>/<i>Mesophaerum suaveolens</i> (weed) and an understory of <i>Themeda triandra</i> +/- <i>Aristida pruinosa</i>/<i>Andropogon gayanus</i> (weed)/<i>Cynodon dactylon</i> (introduced) during the late dry season, and <i>Eriachne</i> spp./<i>Sorghum plumosum</i>/<i>Heteropogon contortus</i>/<i>Fimbristylis</i> sp. post-wet season. Soils were moderately deep grey silty loams or deep clay loams with siltstone rocks up to 20 cm in size. Non-dominant species: <i>Eucalyptus clavigera</i>, <i>Corymbia alba</i>, <i>E. tetradonta</i>, <i>Corymbia bleeseri</i> <i>Melaleuca nervosa</i>, <i>Barringtonia acutangula</i>, <i>Terminalia ferdinandiana</i>, <i>Petalostigma quadriloculare</i>, <i>Lophostemon lactifluus</i>, <i>Brachychiton megaphyllus</i>, <i>Ampelocissus acetosa</i>, <i>Grevillea mimosoides</i>, <i>Cajanus acutifolius</i>, <i>Clerodendrum tatei</i>, <i>Eragrostis schultzei</i>, <i>Eriachne burkittii</i>, <i>Eriachne ciliate</i>, <i>Gycine</i> sp., <i>Polymeria ambigua</i>, <i>Sida spinosa</i>, <i>Spermaeoce</i> sp., <i>Stylosanthes viscosa</i> (introduced), <i>Coldenia procumbens</i>, <i>Pterocaulon serrulatum</i>, <i>Euphorbia</i> sp., <i>Fimbristylis</i> sp., <i>Mesophaerum suaveolens</i> (weed), <i>Hymenachne amplexicaulis</i> (weed), <i>Goodenia armstrongiana</i>, <i>Hibbertia lepidota</i>, <i>Panicum mindanaense</i>/seminudum, <i>Pennisetum pedicellatus</i> (weed), <i>Pseudopogonatherum contortum</i>, <i>Spermocoe</i> sp., <i>Stemodia lythrifolia</i>	

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Habitat	Survey sites	Description	Photograph
Seasonally inundated plain	CamT2, CamQ2	Open forest of <i>Lophostemon lactifluus</i> and some <i>Erythrophleum chlorostachys</i> +/- <i>Miliusa traceyi</i>/<i>Ficus virens</i> var. <i>virens</i>/<i>Corymbia bella</i>/<i>C. polycarpa</i>/<i>C. bleeseri</i> over a moderately dense mid-storey of +/- <i>Melaleuca viridiflora</i>/<i>Pandanus spiralis</i>/<i>Melaleuca nervosa</i>/<i>Acacia lamprocarpa</i>/<i>Bauhinia malabarica</i>/<i>Gardenia megasperma</i>/<i>Buchanania obovata</i> and a sparse ground layer of <i>Mesophaerum suaveolens</i> (weed) +/- <i>Imperata cylindrica</i>/<i>Cynodon dactylon</i> (weed)/ <i>Abrus precatorius</i> during the late dry season and +/- <i>Calopogonium mucunoides</i>, <i>Andropogon gayanus</i>, <i>Mesophaerum suaveolens</i>/<i>Eriachne trisetata</i> post-wet season. Soils were deep, grey-dark brown sandy loams and loamy clays with rock cover up to 60cm in size (CamQ2) or absent (CamT2). Non-dominant species: <i>Acacia auriculiformis</i>, <i>Bridelia tomentosa</i>, <i>Planchonia careya</i>, <i>Xanthostemon paradoxus</i>, <i>Galactia megalophylla</i>, <i>Xyris complanata</i>, <i>Tinospora smilacina</i>, <i>Planchonia careya</i>	
Open woodland on slope	SQ01, SQ02, CamQ01	Open woodland of <i>Corymbia dichromophloia</i> and <i>Erythrophleum chlorostachys</i> +/- <i>C. bleeseri</i>/<i>Eucalyptus tintinnans</i>/<i>C. terminalis</i>/<i>E. confertiflora</i>/<i>C. setosa</i>/<i>E. tectifera</i> up to 20 metres in height over a midstorey with +/- <i>Planchonia careya</i>/<i>Cochlospermum fraseri</i>/<i>Terminalia ferdinandiana</i>/<i>Buchanania obovata</i>/<i>Xanthostemon paradoxus</i>/<i>Grevillea decurrens</i>/<i>Petalostigma quadriloculare</i> and ground layer of one or more of the following: <i>Eriachne</i> sp., <i>Chrysopogon fallax</i>, annual sorghum and <i>Sorghum plumosum</i> during the late-dry season and <i>Goodenia armstrongiana</i>/<i>Paspalum scrobiculatum</i>/<i>Microstachys chaemelea</i>/<i>C. latifolius</i>/<i>Eriachne obtusa</i>/<i>Buchnera linearis</i> post-wet season. Soils were shallow (<10cm) to moderately deep (10-40 cm) silty loams with siltstone rock cover up in 60 cm in size. Sites SQ02 and CamQ01 had a larger rock size covering the slope and as a result a less diverse floral assemblage than SQ01. Non-dominant species: <i>C. clavigera</i>, <i>Ficus aculeata</i>, <i>Lophostemon lactifluus</i> (at bottom of slope), <i>Brachychiton megaphyllus</i>, <i>Waltheria indica</i>, <i>Galactia megaphylla</i>, <i>Plectranthus scultellarioides</i>, <i>Ampelocissus acetosa</i>, <i>Aristida</i> sp., <i>Pseudopogonatherum contortum</i>, <i>Spermocoe</i> sp.	

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Habitat	Survey sites	Description	Photograph
Creek Floodplain	CamT1, CamR1	<i>Corymbia polycarpa</i>, <i>Erythrophleum chlorostachys</i> and +/- <i>Melaleuca argentea</i>/<i>Eucalyptus bigalerita</i>/<i>Eucalyptus miniata</i> up to 20 m in height over +/- <i>Melaleuca viridiflora</i>, <i>Ficus scobina</i>, <i>Terminalia microcarpa</i>, <i>Mesophaerum suaveolens</i> (weed), <i>Livistona humilis</i>, <i>Acacia lamprocarpa</i>, <i>Senna obtusifolia</i> and a ground layer of <i>Ampelocissus acetosa</i>, <i>Imperata cylindrical</i> during the late dry season and <i>A. acetosa</i>, <i>Sida acuta</i> (weed), <i>Aristida</i> sp., <i>M. suaveolens</i> and <i>Heteropogon contortus</i> in the post-wet season. Soils were deep, silty loams with no rock cover Non-dominant species: <i>Ziziphus oenoplia</i>, <i>Triumfetta petandra/rhomboihea</i>, <i>Mnesithea formosa</i>	
Woodland on Slope	ST4, SR1, SR3, SR4, CamR2, CamQ3, SQ3, SQ4, CamR4	Woodland of +/- <i>Eucalyptus miniata</i>, <i>Corymbia bleeseri</i>, <i>Erythrophleum chlorostachys</i>, <i>E. tectifera</i>, <i>Xanthostemon paradoxus</i>, <i>E. tetradonta</i>, <i>C. dichromophloia</i>, <i>E. tintinnans</i>, <i>C. polycarpa</i> and <i>E. confertiflora</i> up to 18 metres in height, a mid-storey of +/- <i>Buchanania obovata</i>/<i>Livistona inermis</i>/<i>Livistona humilis</i>/<i>Terminalia ferdinandiana</i>/<i>Grevillea</i> spp./ <i>Petalostigma pubescens</i>, <i>P. quadriloculare</i> and a ground layer of +/- <i>Triodia bitextura</i>/ <i>Grevillea pteridifolia</i>/<i>Tephrosia humifusa</i> /<i>Sauropus glauceus</i>/<i>Eragrostis</i> sp./<i>Eriachne avenacea</i>/ <i>E. mucronate</i>/annual <i>Sorghum</i> during the late dry season and +/- <i>Chrysopogon latifolius</i>, <i>Buchnera linearis</i>, <i>Stylidium</i> sp., <i>Panicum mindanaense/seminudum</i>, <i>Sorghum plumosum</i>, <i>Heteropogon triteus</i>, <i>Ampelocissus acetosa</i>, <i>Eriachne obtusa</i>, <i>Achizachyrium pseudeulalia</i>, <i>Mnesithea rottboeloides</i>, <i>Mesophaerum suaveolens</i> (weed) and <i>Eriachne schultzei</i> in the post-wet season. Soils were moderately deep, grey silty loams, grey-brown sandy loams and clay loams with sandstone stones to 20cm and isolated large boulders at ST1. Non-dominant species: <i>Eucalyptus clavigera</i>, <i>Petalostigma quadriloculare</i>, <i>Cochlospermum fraseri</i>, <i>Planchonia careya</i>, <i>Drosera darwiniensis</i>, <i>Jacquermontia</i> sp., <i>Galactia megalophylla</i>, <i>Evolvulus alsinoides</i>, <i>Tephrosia porecta</i>, <i>Euphorbia muelleri</i>, <i>Marsdenia viridiflora</i>, <i>Acacia lamprocarpa</i>, <i>Sida acuta</i> (weed), <i>Ficus scobina</i>, <i>Ficus aculeata</i>, <i>Scleria sphacelata</i>, <i>Alloteropsis</i>	

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Habitat	Survey sites	Description	Photograph
		<i>semialata</i> , <i>Themeda triandra</i> , <i>Petalostigma pubescens</i> , <i>P. quadriloculare</i> , <i>Cartonema spicatum</i> , <i>Corymbia clavigera</i> , <i>Euphorbia drummondii</i> , <i>Goodenia armstrongiana</i> , <i>Grevillea armstrongiana</i> , <i>Hibbertia lepidota</i> , <i>Lobelia diocia</i> , <i>Stemodia lythrifolia</i> ,	
Dam-side Low Open Forest	CamR3	Low open forest of <i>Corymbia polysciada</i>, <i>Eucalyptus tintinnans</i>, <i>C. dichromophloia</i>, <i>E. miniata</i> and <i>Erythrophleum chlorostachys</i> up to 10 metres in height over <i>Xanthostemon paradoxus</i>, <i>E. bigalerita</i>, <i>Acacia holosericea</i>, <i>A. lamprocarpa</i> and <i>Antidesma ghaesembilla</i> with a ground layer of <i>Fimbristylis</i> sp. and water lilies on the dam in the late-dry season and <i>Petalostigma quadriloculare</i>, <i>Scleria sphacelata</i> and <i>Eriachne burkittii</i> in the post-wet season. Soils were brown-grey sandy loam with sandstone and quartzite rocks to 60cm in size. Non-dominant species: <i>Alloteropsis semialata</i>, <i>Aristida macroclada</i>, <i>Buchanania obovata</i>, <i>Calytrix exstipulata</i>, <i>Livistona inermis</i>, <i>Lobelia diocia</i>, <i>Ludwigia perennis</i>, <i>Melaleuca leucadendra</i>, <i>Mesophaerum suaveolens</i>, <i>Thecanthes punicea</i>	

4.5 Fauna

There was a higher number of fauna species recorded during the November 2016 survey ($n = 139$) than during the May 2017 survey ($n = 121$). A greater number of fauna species was recorded in the Rustlers Roost area than in the Toms Gully or Quest 29 areas during the late dry season (November 2016) on-ground survey. The same number of species ($n = 77$) was recorded in the Toms Gully and Rustlers Roost survey areas during the May 2017 on-ground survey, which was greater than the number of species recorded in the Quest 29 survey area ($n = 54$). Overall, birds made up the majority of species recorded in all survey areas during both survey times, with numbers being similar over areas and times, with the exception of Rustlers Roost during November 2016 (Figure 4-4). This may be due to a higher number of transient species in the area at this time. Similar number of amphibian (November 2016: $n = 12$ vs. May 2017: $n = 9$), mammal (November 2016: $n = 20$ vs. May 2017: $n = 19$) and arthropod species (November 2016: $n = 3$ vs. May 2017: $n = 1$) were recorded between November 2016 and May 2017. There were fewer reptile species recorded during the May 2017 survey ($n = 9$) than the November 2016 survey ($n = 15$), which may have been due to the cooler climatic conditions at the time of the May 2017 survey. There was a noticeably higher number of mammal species in the Toms Gully survey area during the November 2016 survey ($n = 16$), and this was due to a greater number of bat species being recorded in this area during this time.

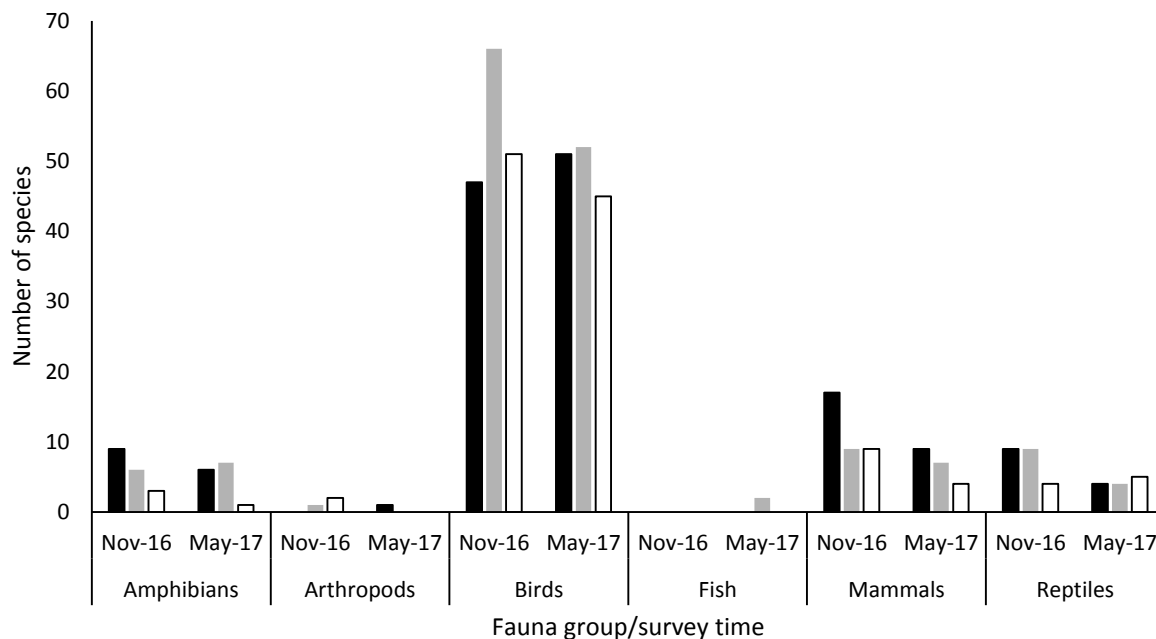


Figure 4-4: Number of species in each fauna group recorded during the November 2016 and May 2017 on-ground surveys at Toms Gully (black bars), Rustlers Roost (grey bars) and Quest 29 (white bars)

One hundred and thirty-nine fauna species were recorded during the November 2016 on-ground surveys of Toms Gully, Rustlers Roost and Quest 29. This included 89 bird species, 20 mammal species, 15 reptile species, 12 amphibian species and three arthropod species. Seventy-one species were recorded in the Toms Gully survey area; 47 bird species, 17 mammal species, nine reptile species and nine amphibian species. Ninety-one species were recorded in the Rustlers Roost area; 66

bird species, nine mammal species, nine reptile species, six amphibian species and one arthropod species. Sixty-nine fauna species were recorded in the Quest 29 survey area; 51 birds, nine mammals, four reptiles, three amphibians and two arthropods. A copy of the bat identification report provided by Dennis Matthews can be found in Appendix 6.

One hundred and twenty-one fauna species were recorded and identified to species level during the May 2017 on-ground surveys of Toms Gully, Rustlers Roost and Quest 29. This included nine amphibians, one arthropod, 82 bird species, 19 mammals and nine reptiles. Seventy-seven species were recorded in the Toms Gully survey area; six amphibians, one arthropod, 58 birds, 16 mammals and five reptiles. Seventy-seven fauna species were recorded in the Rustlers Roost survey areas; seven amphibians, 51 birds, 14 mammals and five reptiles. Fifty-four fauna species were recorded in the Quest 29 survey area; one amphibian, 42 birds, six mammals and five reptiles.

4.5.1 Fauna species of conservation significance

Threatened fauna

No threatened fauna species listed under the TPWC Act or EPBC Act were recorded during the November 2016 on-ground survey of Toms Gully, Rustlers Roost and Quest 29.

One species listed as vulnerable under the TPWC Act were recorded during the May 2017 on-ground survey. Merten's water monitor (*Varanus mertensi*), listed as vulnerable under the TPWC Act, was recorded at SR1. This species is not listed under the EPBC Act.

Despite targeted survey effort for threatened species identified by the NT Fauna Atlas and PMST (see section 2.2 for a description of the methods employed for each identified threatened species), no other threatened species were identified during the November 2016 or May 2017 on-ground surveys.

Near threatened and data deficient fauna

No fauna species listed as migratory were recorded during the November 2016 on-ground survey. Three species listed as near-threatened under the TPWC Act were recorded during the November 2016 on-ground survey. The orange leaf-nosed bat (*Rhinionictis aurantia*) was recorded at ST3 and ST4 in the Toms Gully survey area. The Arnhem sheath-tailed bat (*Taphozous kapalgensis*) was recorded at ST1, ST2 and ST4 in the Toms Gully survey area. The bush-stone curlew was recorded incidentally throughout the Toms Gully survey area. Two species listed as data deficient under the TPWC Act, the red-cheeked dunnart and the black-spotted ridge-tailed monitor, were recorded in the Rustlers Roost survey area during the November 2016 on-ground survey. The red-cheeked dunnart was recorded at SR4 and the black-spotted ridge-tailed monitor was recorded at SR3.

Four species of listed as near threatened under the TPWC Act were recorded during the May 2017 on-ground survey. The yellow-rumped mannikin (*Lonchura flaviprymna*) was recorded incidentally within the Toms Gully survey area (latitude: -12.837966, longitude: 131.555858). The bush-stone curlew was recorded at CamT3 in the Toms Gully survey area. The Arnhem sheath-tailed bat was recorded at SR1 in the Rustlers Roost survey area. The orange leaf-nosed bat was recorded at SR1 in the Rustlers Roost survey area and ST2 in the Toms Gully survey area. No data deficient species were recorded during the May 2017 on-ground survey.

4.5.2 Introduced fauna

Seven introduced fauna species were recorded during surveys of Toms Gully, Rustlers Roost and Quest 29 during the November 2016 on-ground survey. These were cat, cattle, water buffalo, cane toad, horse, house mouse and pig. Cattle were recorded in Rustlers Roost. Water buffalo were recorded at Annie's Dam in Rustlers Roost. Cane toads were ubiquitous throughout all three survey areas. Horses and house mouse were recorded in Toms Gully. Pigs were recorded incidentally in all three survey areas. Cats were recorded incidentally throughout the survey areas.

Four introduced fauna species were recorded during the May 2017 on-ground surveys of the Toms Gully, Rustlers Roost and Quest 29 areas. These were cane toad, cattle, horse and pig. Cane toads were recorded at ST2, ST3 and CamT3 in Toms Gully, SR1 and SR2 in Rustlers Roost and SQ2 in Quest 29. Cattle were recorded at CamT4 in Toms Gully and CamR2 in Rustlers Roost. Horses were recorded at ST3 in Toms Gully. Pigs were recorded at CR1 in Rustlers Roost and CamQ4.2 in Quest 29.

5 CONCLUSION

The NT EPA identified 11 threatened species potentially occurring within the Toms Gully survey area. These were the yellow-snouted gecko, a sub-shrub *H. macrothrix*, black-footed tree-rat, bare-rumped sheath-tailed bat, northern quoll, fawn antechinus, pale field-rat, partridge pigeon, floodplain monitor, Mitchell's water monitor and Merten's water monitor. Survey effort during on-ground surveys of the Toms Gully, Rustlers Roost and Quest 29 areas was targeted towards these species and identifying habitats and introduced flora and fauna species.

No flora species of conservation significance were recorded in the on-ground surveys. A total of 20 introduced flora species were recorded, with three, *A. gayanus*, *H. amplexicaulis* and *M. pigra*, being Weeds of National Significance (WoNS) and listed as Class B and C weeds in the NT. An additional four introduced flora species, *M. suaveolens*, *P. polystachion*, *S. acuta* and *X. strumarium*, are listed as Class B and C weeds in the NT. The growth and spread of Class B weeds is to be controlled and Class C weeds are not to be introduced into the NT. Strategic plans are available for WoNS with the landholder being ultimately responsible for their implementation. Furthermore, several of the introduced species recorded during the on-ground surveys are recognised as threats to biodiversity under the Key Threatening Process 'Ecosystem degradation, habitat loss and species decline due to invasion of northern Australia by introduced gamba grass (*Andropogon gayanus*), para grass (*Urochloa mutica*), olive hymenachne (*Hymenachne amplexicaulis*), mission grass (*Cenchrus polystachios* syn. *Pennisetum polystachion*) and annual mission grass (*Cenchrus pedicellatus* syn. *Pennisetum pedicellatum*). This Key Threatening Process has an associated Threat Abatement Plan.

There were nine habitat types defined in the Toms Gully, Rustlers Roost and Quest 29 survey areas, with woodland on slope, open woodland on slope and lowland woodland being the most common. The remaining habitat areas surveyed included waste rock dump (WRD), a major creekline, a seasonally inundated plain, a creek floodplain and a low open forest on the side of a dam.

One threatened species, Merten's water monitor, was recorded during the on-ground surveys. Four species listed as near threatened under the TPWC Act, orange leaf-nosed bat, Arnhem sheath-tailed bat, yellow-rumped manikin and bush-stone curlew, were recorded during the on-ground surveys. Two species listed as data deficient under the TPWC Act, red-cheeked dunnart and black-spotted ridge-tailed monitor, were recorded in the Rustlers Roost survey area during the November 2016 on-ground survey. No data deficient species were recorded during the May 2017 on-ground survey.

A description of Merten's water monitor and the species habitat requirements can be found in section 3.10.2. This species was recorded in woodland on slope habitat in Rustlers Roost. The NT Fauna Atlas indicates that this Merten's water monitor has a widespread distribution, and that this record is not likely to indicate the presence of an important population of the species. Due to the localised scale of the proposed operations, it is not likely that they will negatively affect the conservation status of Merten's water monitor.

The black-spotted ridge-tailed monitor was recorded at SR3 in woodland on slope habitat. This is 9.5 km south-west of the nearest record of the species, in Mary River National Park. NT Fauna Atlas records of the black-spotted ridge-tailed monitor indicate that this species is widespread. Due to the localised scale of the proposed operations, it is not likely that they will have a negative effect on the conservation status of this species.

The red-cheeked dunnart was recorded at SR4 in the woodland on slope habitat. This is 13 km west of the nearest record of the species in Mary River National Park. Potential impacts on this species from operations include vehicle impact and habitat clearance. NT Fauna Atlas records of the red-cheeked dunnart indicate that this species is widespread in the region. Therefore, due to the localised scale of the operations, it is unlikely that they will negatively affect the conservation status of this species.

The yellow-rumped mannikin was recorded incidentally within the Toms Gully survey area at a small dam adjacent to the tailings dam. This area was dominated by *A. holosericea* and *A. gyanus*. The closest record of this species to the Toms Gully survey area is 10.5 km south-east in land unit 2b; low hills and strike ridges with woodland vegetation. Yellow-rumped mannikins occur in tropical grasslands and adjacent grassy woodlands (Menkhorst, et al., 2017). They are generally sedentary, but there is some evidence for seasonal dispersal (Menkhorst, et al., 2017). NT Fauna Atlas records indicate that this species is widespread in the region. Therefore, given the localised scale of the proposed operations, it is unlikely that they will have a negative impact on the conservation status of the yellow-rumped mannikin.

The bush-stone curlew was recorded at CamT3.2 in rocky slope habitat, as well during spotlighting and incidentally within the Toms Gully survey area. The bush-stone curlew is mainly nocturnal, nests on bare ground and inhabits a wide range of habitats including open woodland, dry watercourses with fallen branches, leaf litter and sparse grasses, and sandplain with spinifex and mallee (Pizzey & Knight, 2012). The closest NT Fauna Atlas record of the bush stone-curlew to CamT3.2 is 1.8 km east in land unit 6a; rivers and major levees with associated narrow levees and a mixed species open forest. There are >10 records within a 10 km radius of the three survey areas. This species is likely to be common within the survey areas. Impacts resulting from proposed operations will likely be related to vehicle impact and habitat clearance. However, given the localised scale of the proposed operations and the widespread distribution of the bush stone-curlew in the region, it is unlikely that operations will negatively impact the conservation status of this species.

The Arnhem sheath-tailed bat (*Taphozous kapalgensis*) was recorded at ST1, ST2 and ST4 in the Toms Gully survey area and SR1 in the Rustlers Roost survey area. ST4 and SR1 are within woodland on slope habitat next to Annie's Dam. ST1 is within lowland woodland habitat. ST2 is within a major creekline. The closest NT Fauna Atlas of the Arnhem sheath-tailed bat is 55 km north-east of the Toms Gully survey area in woodland habitat next to a tributary of the West Alligator River. This species has been recorded in most coastal environments (floodplains, mangroves and patchy monsoon forest) and adjacent woodland areas, as well as in areas adjacent to sandstone escarpment (Milne, et al., 2003). Given that the Arnhem sheath-tailed bat was recorded at four sites in the survey areas, it is likely that the species is locally common and resident in the area. Given the localised scale of the proposed operations there is a low likelihood that operations will negatively affect the conservation status of this species.

The orange leaf-nosed bat (*Rhinonictis aurantia*) was recorded at SR1 in the Rustlers Roost survey area and ST2 in the Toms Gully survey area. SR1 is within woodland on slope habitat and ST2 is within a major creekline. The closest NT Fauna Atlas record of the orange-leaf nosed bat to the Toms Gully survey area is 4 km south-east in land unit 4c; plains with open forest. The NT Fauna Atlas records indicate that this species is common in the local area. Given the localised scale of the

proposed operations there is a low likelihood that operations will negatively affect the conservation status of this species.

While survey effort was targeted toward detecting flora and fauna species of conservation significance, there is still a chance that some species are present in the survey areas but were not recorded. The two species of particular concern highlighted by the NT EPA were the yellow-snouted gecko and the sub-shrub *H. macrothrix*.

Spotlighting efforts targeting the yellow-snouted gecko was undertaken over six nights during each survey (i.e. six nights in November 2016 and six nights in May 2017 totalling 12 nights). Searches for habitat suitable for the yellow-snouted gecko were also undertaken during the day while travelling through the survey areas. The yellow-snouted gecko has been recorded in areas with well-developed leaf litter and grasses in open forests with red sandy-loam soils. Red sandy loam soils were not recorded in the survey areas. Therefore, survey effort was targeted towards those sites with woodland vegetation and well-developed leaf litter. Despite survey efforts, the yellow-snouted gecko was not recorded in the survey areas during either on-ground survey period. Therefore, there is a low residual likelihood that the yellow-snouted gecko occurs in the survey areas, and proposed operations are not likely to have a significant impact on a population of the species or the conservation status of the species.

All survey sites were searched intensively for *H. macrothrix*, and any plants that looked similar were collected for further identification by the NT Herbarium. None of these specimens were identified as *H. macrothrix*. All were identified as *H. darwinensis*, which is listed as least concern under the TPWC Act. Given the presence of suitable habitat and the close proximity to previous records, there is still a moderate likelihood that this species occurs in the survey areas, but was not detected during on-ground surveys. It is recommended that identification sheets are provided to personnel working on site and that any plants suspected to be *H. macrothrix* are recorded. Proposed operations will occur in a previously disturbed area, and further disturbance will be localised. Therefore, proposed operations are not expected to have a significant impact on a population of *H. macrothrix*.

Camera traps, cage traps, spotlighting and searches for suitable habitat were undertaken for the black-footed tree rat. Specifically, signs of scratching on trees and eaten fruit that may indicate the presence of the species were looked for. These signs were not found, and black-footed tree rats were not camera- or live-trapped, and were not found during spotlighting despite there being potentially suitable habitat in the survey areas. Therefore, there remains a low likelihood that the black-footed tree rat occurs within the survey areas, and proposed operations are not expected to have a significant impact on a population of this species.

Habitat searches were undertaken to look for habitat suitable for the bare-rumped sheath-tail bat. This species is considered to be an obligate hollow-roosting species, with potential habitat including woodlands and forests from coastal to adjacent inland areas in the Top End (Milne, et al., 2009). All survey sites consisted of potentially suitable habitat for the bare-rumped sheath-tailed bat and detectors were deployed at sites thought to be suitable for 12 nights for each of the two detectors. Despite these targeted survey efforts, this species was not recorded during either the November 2016 or May 2017 on-ground surveys. It is difficult to distinguish the calls of the bare-rumped sheath-tailed bat with several the sympatric species *Chaerophon jobensis*, *Mormopterus beccarii* and *S. flaviventris*. All three of these species were identified during the on-ground surveys; *C. jobensis* and *S. flaviventris* in all three survey areas, and *M. beccarii* in Toms Gully and Quest 29. Therefore,

there is still a moderate likelihood that the bare-rumped sheath-tailed bat is present in the survey areas. As proposed operations are within previously disturbed areas, and any further disturbance will be localised it is not expected that there will be a significant impact on a population of this species. Further survey effort should involve setting up mistnets over isolated waterholes and creeklines, and in woodland or forest as high as possible (preferably >8 m above the ground) near the tree canopy (Department of the Environment, Water, Heritage and the Arts, 2010).

Survey effort for the northern quoll involved searches for suitable habitat, live- and camera-trapping, search for secondary sign and spotlighting. Only one site in the survey areas (Cam T3.2) was identified as being suitable habitat for the northern quoll. A camera-trap was placed at this site, but did not detect northern quolls and no secondary sign was apparent. This species was not recorded in any survey area during either the November 2016 or May 2017 on-ground surveys despite these targeted efforts. Given the low availability of habitat in the survey areas, and the lack of sign that the northern quoll was present during on-ground surveys, there is a low likelihood that this species is present. As the northern quoll is not likely to be present in the survey areas, the proposal is not likely to have a significant impact on a population of the species.

Habitat searches, live- and camera-trapping and spotlighting were undertaken to investigate the presence of the fawn antechinus and pale field rat. The fawn antechinus occurs in savanna woodland and tall open forest. These habitat types are widespread through the survey areas (Table 4.2). Despite targeted survey effort, the fawn antechinus was not recorded during either November 2016 or May 2017, but the species has been recorded 3.5 km south-east of Toms Gully. This species has undergone widespread declines across the Top End in the last decade (Young, 2012), after this record was taken. Therefore there remains a low-moderate likelihood that the fawn antechinus occurs within the survey areas. The main factors thought to be associated with the decline of the fawn antechinus in the top end are predation by feral cats and inappropriate fire regimes (Young, 2012). The proposed operations are not likely to increase the impacts of these threats. Therefore, if the fawn antechinus occurred in the survey areas, it is not likely that proposed operations would have a significant impact on an important population of the species.

The pale field rat occurs in dense vegetation along creeklines. Vegetation along creeklines was not very dense during the November 2016 and May 2017 on-ground surveys and thought not to be optimal for *R. tunneyi*. However, density of vegetation may differ between years due to differences in climatic conditions or grazing pressure and there is still a moderate likelihood that *R. tunneyi* will be present in the survey areas if vegetation density increases along creeklines. The pale field rat has been recorded 3.5 km south-east of Toms Gully in the past. The decline of the pale field rat in the NT is thought to be associated with inappropriate fire regimes and predation by feral cats. The proposed operations are not likely to increase the impacts of these threats on the pale field rat. Therefore, there the proposed operations are not likely to have a significant impact on an important population of the species.

Searches for suitable habitat were undertaken for the Gouldian finch and partridge pigeon. Further area searches were undertaken for these species in potentially suitable habitat. The Gouldian finch inhabits wooded hills in the late wet and dry season, and lowland drainage during the wet season. This species has been particularly associated with *E. brevifolia* and *E. tintinnans* in the NT and *C. dichromophloia* and *E. miniata* in Western Australia (Brazill-Boast, et al., 2016; Tidemann, et al., 1992). Despite targeted survey effort and potentially suitable habitat being present in the area,

Gouldian finches were not recorded during either the November 2016 or May 2017 on-ground survey, but have been recorded 1.5 km south-east of Toms Gully in the past. There is a high possibility that this species could occur in the survey areas in future as potentially suitable habitat exists, and groups are known to be mobile depending on habitat suitability. The greatest threat to this species is thought to be altered availability of food resources caused by understorey change from pastoralism and/or changed fire regimes. The proposed operations are not likely to increase the impacts of this threatening process on the Gouldian Finch. Therefore, for this reason and the high likelihood that this species will occur irregularly in the area, the proposed operations are not likely to have a significant impact on a population of this species.

The partridge pigeon occurs in lowland eucalypt open forest and woodland with grassy understorey. These habitats are present throughout the survey areas, particularly Rustlers Roost. The partridge pigeon was not recorded during either the November 2016 or May 2017 on-ground survey, but has been recorded within the Toms Gully survey area in the past. As this species can move up to 5-10 km in response to changes in resource availability, and due to potentially suitable habitat occurring within the survey areas and the past record of the species in Toms Gully there remains a high likelihood that the partridge pigeon could occur in the survey areas in the future. The main threats to the partridge pigeon are thought to be predation by feral cats, loss of water sources, the interactive impacts of invasive plant species and changes in fire regimes and the clearance of suitable habitat (Woinarski, 2006). The proposed operations are not likely to increase the impact of these threats on the partridge pigeon. Therefore it is not expected that the proposed operations will have a significant impact on an important population of this species.

Searches for suitable habitat, live- and camera-trapping and area searches were undertaken for the floodplain monitor and Mitchell's water monitor. Inland, the floodplain monitor inhabits waters in all river systems and Mitchell's water monitor inhabits floodplains, grasslands and woodlands. Watercourses through the survey area are ephemeral and standing water is in dams and mine pits. Therefore, there is limited habitat available for the floodplain monitor. There are floodplains, grasslands and woodlands throughout the survey areas; however, despite targeted survey effort Mitchell's water monitor was not recorded during either the November 2016 or May 2017 on-ground survey. However, Mitchell's water monitor has been recorded within 3.5 km of Toms Gully in the past. Due to the proximity of prior records and potentially suitable habitat occurring within the survey areas, there remains a high likelihood that Mitchell's water monitor will occur within the study areas in the future. The greatest threat to the persistence of this Mitchell's water monitor is the presence of cane toads across the species range (Ward, 2012). This threat is not likely to be exacerbated by the proposed operations. Therefore, it is not expected that the proposed operations will have a significant impact on an important population of Mitchell's water monitor.

Seven introduced fauna species were recorded during the November 2016 and May 2017 on-ground surveys of Toms Gully, Rustlers Roost and Quest 29; cattle, water buffalo, cane toad, horse, house mouse, pig and cat. The impacts of three of these species are listed Key Threatening Processes and all have associated Threat Abatement Plans.

- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs
- The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo marinus*)

As discussed in section 2.2.4, there are limitations to the survey methodologies used and threatened species identified by the EPBC PMST and NT Flora and Fauna Atlases may be present in the area despite not being detected during on-ground surveys. However, best endeavours were taken to maximise the chance of identifying threatened species in the survey areas. As discussed above, the proposed operations will occur in a previously disturbed area, and any further disturbance will be localised. The proposed operations are also not likely to increase the impacts of threatening processes on threatened species that are known or could potentially occur in the survey areas. Therefore, although accidental individual mortality of native species may occur during the life of the project, the proposed operations are not likely to have a significant impact on a population of a threatened species or the conservation status of the species.

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7 APPENDICES

Appendix 1. Location of sites, in GDA94 co-ordinate system, surveyed during the November 2016 on-ground survey by LES

Survey area	Site	Latitude	Longitude
Toms Gully	ST1	- 12.83841	131.55345
	ST2	- 12.82973	131.55084
	ST3	- 12.84643	131.56313
	ST4	- 12.84327	131.54800
	CamT1	- 12.82841	131.56405
	CamT2	- 12.82270	131.55667
	CamT3	- 12.84048	131.57201
	CamT3.2	- 12.83443	131.56747
	CamT4	- 12.83659	131.54611
Rustlers Roost	SR1	- 12.92310	131.48938
	SR2	- 12.92165	131.50247
	SR3	- 12.94020	131.49487
	SR3.2	- 12.908632	131.49252
	SR4	- 12.92588	131.48011
	CamR1	- 12.91929	131.48378
	CamR2	- 12.92767	131.50539
	CamR3	- 12.92029	131.48883
	CamR4	- 12.93206	131.49067
Quest 29	SQ1	- 12.95495	131.60526
	SQ2	- 12.95428	131.59575
	SQ3	- 12.94336	131.58037
	SQ4	- 12.92755	131.56660
	CamQ1	- 12.96330	131.59821
	CamQ2	- 12.95277	131.58470
	CamQ3	- 12.93757	131.57472
	CamQ4	- 12.92947	131.56952

Appendix 2: Flora list from the November 2016 on-ground survey of the Toms Gully, Rustlers Roost and Quest 29 survey areas from trapping sites and camera sites and the waste rock dump in Toms Gully (WRD)

Family	Scientific name	Toms Gully									Rustlers Roost								Quest 29							
		Cameras				Trapping					Cameras				Trapping				Cameras				Trapping			
		T1	T2	T3	T4	T1	T2	T3	T4	WRD	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4.2	Q1	Q2	Q3	Q4
Fabaceae	<i>Acacia lampocarpa</i>												X													
Fabaceae	<i>Acacia</i> sp.				X																					
Fabaceae	<i>Acacia auriculiformis</i>		X				X																			
Fabaceae	<i>Acacia holosericea</i>					X				X	X		X		X	X										
Fabaceae	<i>Abrus precatorious</i>																			X						
Poaceae	<i>Alloteropsis semialata</i>																				X					
Vitaceae	<i>Ampelocissus acetosa</i>	X				X	X		X														X			
Poaceae	<i>Andropogon gayanus*</i>			X		X			X	X												X				
Phyllanthaceae	<i>Antidesma ghaesembilla</i>												X													
Apocynaceae	<i>Apocynaceae</i>						X																			
Poaceae	<i>Aristida latifolia</i>										X															
Poaceae	<i>Aristida pruinosa</i>														X											
Poaceae	<i>Aristida</i> sp.						X																X			
Poaceae	<i>Bambusa arnhemica</i>						X																			
Lecythidaceae	<i>Barringtonia acutangula</i>				X		X																			
Poaceae	<i>Bothriochloa blahii</i>								X																	
Malvaceae	<i>Brachychiton megaphyllus</i>			X	X		X		X										X				X			
Phyllanthaceae	<i>Bridelia tomentosa</i>		X																							
Goodeniaceae	<i>Brunonia</i> sp.						X																			
Acanthaceae	<i>Brunoniella</i> sp.					X																				
Anacardiaceae	<i>Buchanania obovata</i>			X	X	X					X	X				X	X	X	X						X	X

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Family	Scientific name	Toms Gully									Rustlers Roost								Quest 29							
		Cameras				Trapping					Cameras				Trapping				Cameras				Trapping			
		T1	T2	T3	T4	T1	T2	T3	T4	WRD	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4.2	Q1	Q2	Q3	Q4
Fabaceae	<i>Cajanus acutifolius</i>								X						X											
Boraginaceae	<i>Coldenia procumbens</i>				X																					
Poaceae	<i>Pennisetum polystachios/pedicillatus*</i>																				X					
Poaceae	<i>Chrysopogon fallax</i>																X						X			
Lamiaceae	<i>Clerodendrum tatei</i>								X						X											
Rubiaceae	<i>Coelospermum reticulatum</i>													X												
Bixaceae	<i>Cochlospermum fraseri</i>			X	X	X				X					X				X					X		X
Myrtaceae	<i>Corymbia alba</i>																									
Myrtaceae	<i>Corymbia bleeseri</i>				X				X							X	X				X		X		X	
Myrtaceae	<i>Corymbia dichromophloia</i>												X	X	X					X		X	X			
Myrtaceae	<i>Corymbia ferruginea</i>								X																	
Myrtaceae	<i>Corymbia polycarpa</i>	X		X		X		X			X				X						X					X
Myrtaceae	<i>Corymbia polysciada</i>												X													
Myrtaceae	<i>Corymbia terminalis</i>																	X								
Poaceae	<i>Cynodon dactylon*</i>																		X							
Droseraceae	<i>Drosera darwiniensis</i>						X									X										
Cyperaceae	<i>Eleocharis</i> sp.								X																	
Poaceae	<i>Eragrostis cumingii</i>																				X					
Poaceae	<i>Eragrostis</i> sp.														X					X						X
Poaceae	<i>Eriachne avenacea</i>																									X
Poaceae	<i>Eriachne burkittii</i>												X		X											

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Family	Scientific name	Toms Gully									Rustlers Roost								Quest 29							
		Cameras				Trapping					Cameras				Trapping				Cameras				Trapping			
		T1	T2	T3	T4	T1	T2	T3	T4	WRD	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4.2	Q1	Q2	Q3	Q4
Poaceae	<i>Eriachne mucronata</i>																									
Poaceae	<i>Eriachne</i> sp.						X			X																
Fabaceae	<i>Erythrina vespertilio</i>			X																						
Fabaceae	<i>Erythrophleum chlorostachys</i>		X	X			X		X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Myrtaceae	<i>Eucalyptus bigalerita</i>	X																				X				
Myrtaceae	<i>Eucalyptus camaldulensis</i>					X				X																
Myrtaceae	<i>Eucalyptus clavigera</i>				X											X										
Myrtaceae	<i>Eucalyptus dichromophloia</i>								X																	
Myrtaceae	<i>Eucalyptus miniata</i>			X	X				X		X	X		X	X	X	X	X			X				X	X
Myrtaceae	<i>Eucalyptus tectifica</i>				X	X						X											X		X	X
Myrtaceae	<i>Eucalyptus tetradonta</i>				X				X																	
Myrtaceae	<i>Eucalyptus tintinnans</i>														X									X		
Euphorbiaceae	<i>Euphorbiaceae</i>																				X					
Euphorbiaceae	<i>Euphorbia muelleri</i>											X			X											
Euphorbiaceae	<i>Euphorbia</i> sp.				X				X																	
Convolvulaceae	<i>Evovulus alsinoides</i>																									X
Santalaceae	<i>Exocarpus latifolius</i>																									
Moraceae	<i>Ficus aculeata</i>																						X			
Moraceae	<i>Ficus opposita</i>					X																				
Moraceae	<i>Ficus scobina</i>	X							X																	
Moraceae	<i>Ficus virens</i> var. <i>virens</i>																			X						
Moraceae	<i>Ficus</i> sp.			X																						

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Family	Scientific name	Toms Gully									Rustlers Roost								Quest 29							
		Cameras				Trapping					Cameras				Trapping				Cameras				Trapping			
		T1	T2	T3	T4	T1	T2	T3	T4	WRD	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4.2	Q1	Q2	Q3	Q4
Cyperaceae	<i>Fimbristylis</i> sp.				X										X											
Fabaceae	<i>Flemingia parviflora</i>																				X				X	
Fabaceae	<i>Galactia megalophylla</i>		X	X													X						X			
Molluginaceae	<i>Glinus oppositifolius</i>						X																			
Phyllanthaceae	<i>Glochidion xerocarpum</i>										X				X											
Poaceae	<i>Glycine</i> sp.															X										
Goodeniaceae	<i>Goodenia armstrongiana</i>					X																				
Proteaceae	<i>Grevillea mimosoides</i>					X																			X	X
Proteaceae	<i>Grevillea pteridifolia</i>																								X	
Malvaceae	<i>Grewia retusifolia</i>						X																			
Malvaceae	<i>Helicteres darwinensis</i>					X																				
Boraginaceae	<i>Heliotropium indicum</i> *						X																			
Dilleniaceae	<i>Hibbertia brevipedunculata</i>					X			X						X											
Malvaceae	<i>Hibiscus zonatus</i>														X											
Poaceae	<i>Hymenachne amplexicaulis</i> *				X										X											
Lamiaceae	<i>Mesophaerum suaveolens</i> *	X	X				X	X		X										X		X				
Poaceae	<i>Imperata cylindrica</i>	X	X																							
Convolvulaceae	<i>Jaquermontia</i> sp.																				X	X				
Areaceae	<i>Livistona inermis</i>			X					X						X			X								
Myrtaceae	<i>Lophostemon lactifluus</i>		X		X	X	X														X		X			
Myrtaceae	<i>Lophostemon</i> sp.							X																		
Myrtaceae	<i>Melaleuca</i> sp.														X											

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Family	Scientific name	Toms Gully										Rustlers Roost								Quest 29							
		Cameras				Trapping						Cameras				Trapping				Cameras				Trapping			
		T1	T2	T3	T4	T1	T2	T3	T4	WRD	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4.2	Q1	Q2	Q3	Q4	
Myrtaceae	Melaleuca argenticia	X																									
Myrtaceae	Melaleuca dealbata						X																				
Myrtaceae	Melaleuca nervosa		X			X																					
Myrtaceae	Melaleuca viridiflora	X	X				X	X												X							
Annonaceae	Miliusa traceyi					X													X		X						
Poaceae	Mnesithea rottboellioides						X																				
Fabaceae	Neptunia sp.					X																					
Meliaceae	Owenia vernicosa									X																	
Pandanaceae	Pandanus aquaticus						X	X													X						
Pandanaceae	Pandanus spiralis		X								X																
Picrodendraceae	Petalostigma pubescens			X			X			X											X						
Picrodendraceae	Petalostigma quadriloculare					X	X				X				X						X						
Lecythidaceae	Planchonia careya		X				X				X			X					X				X	X			
Convolvulaceae	Polymeria ambigua														X						X						
Asteraceae	Pterocaulon serrulatum				X					X																	
Euphorbiaceae	Sauropus glauceus								X											X							
Cyperaceae	Scleria sphacelata													X													
Malvaceae	Sida sp.														X												
Poaceae	Sorghum plumosum																	X				X					
Poaceae	Sorghum sp. (Annual sorghum)							X				X				X	X										
Rubiaceae	Spermaeoce sp.														X												

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Family	Scientific name	Toms Gully									Rustlers Roost								Quest 29							
		Cameras				Trapping					Cameras				Trapping				Cameras				Trapping			
		T1	T2	T3	T4	T1	T2	T3	T4	WRD	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4.2	Q1	Q2	Q3	Q4
Fabaceae	<i>Stylosanthes viscosa</i> *															X										
Fabaceae	<i>Tephrosia</i> sp.							X																		
Fabaceae	<i>Tephrosia humifusa</i>																				X					
Fabaceae	<i>Tephrosia polyzyga</i>													X												
Fabaceae	<i>Tephrosia porecta</i>											X														
Combretaceae	<i>Terminalia ferdinandiana</i>					X					X						X	X			X	X	X			
Combretaceae	<i>Terminalia microcarpa</i>	X																								
Thelypteridaceae	<i>Thelypteridaceae</i>													X												
Poaceae	<i>Themeda triandra</i>					X										X										X
Menispermaceae	<i>Tinospora smilacina</i>		X																							
Poaceae	<i>Triodia bitextura</i>																X									
Fabaceae	<i>Vachellia valida</i>																							X		
Malvaceae	<i>Waltheria indica</i>																				X	X				
Myrtaceae	<i>Xanthostemon paradoxus</i>		X								X				X		X									
Xyridaceae	<i>Xyris complanata</i>		X																							

Appendix 3: Flora list from the May 2017 on-ground survey of the Toms Gully, Rustlers Roost and Quest 29 survey areas from trapping sites and camera sites.
***introduced species**

Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Fabaceae	<i>Acacia auriculiformis</i>		X																						
Fabaceae	<i>Acacia hemignosta</i>												X												
Fabaceae	<i>Acacia holosericea</i>	X						X		X	X					X									
Fabaceae	<i>Acacia lamprocarpa</i>			X						X		X		X		X	X						X		
Poaceae	<i>Alloteropsis semialata</i>	X			X																		X		
Apocynaceae	<i>Alstonia actinophylla</i>	X					X	X												X					
Fabaceae	<i>Alysicarpus schomburgkii</i>												X												
Amaranthaceae	<i>Ameranthus</i> sp.								X																
Vitaceae	<i>Ampelocissus acetosa</i>	X	X		X	X	X						X	X	X					X					
Poaceae	<i>Andropogon gayanus</i> *	X					X	X							X										
Poaceae	<i>Aristida latifolia</i>		X							X	X														X
Poaceae	<i>Aristida macroclada</i>															X									
Poaceae	<i>Aristida pruinosa</i>								X																
Poaceae	<i>Aristida</i> sp.													X											
Poaceae	<i>Bambusa arnhemica</i>		X																						
Proteaceae	<i>Banksia dentata</i>		X																						
Lecythidaceae	<i>Barringtonia acutangula</i>		X			X																			
Fabaceae	<i>Bauhinia malabarica</i>																						X		X
Asteraceae	<i>Blumea saxatilis</i>										X														
Malvaceae	<i>Brachychiton megaphyllus</i>	X			X			X					X												

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Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Phyllanthaceae	<i>Bridelia tomentosa</i>																			X					
Ancardiaceae	<i>Buchanania obovata</i>	X			X		X	X	X	X	X		X	X	X	X	X	X		X	X	X		X	
Orobanchaceae	<i>Buchnera linearis</i>				X		X		X			X			X		X	X	X		X	X			X
Fabaceae	<i>Calopogonium mucunoides*</i>			X		X		X			X												X		X
Myrtaceae	<i>Calytrix exstipulata</i>		X								X					X									
Commelinaceae	<i>Canarium australianum</i>																								X
Commelinaceae	<i>Cartonema spicatum</i>	X													X		X				X				
Fabaceae	<i>Chamaecrista absus</i>								X																
Fabaceae	<i>Chamaecrista</i> or <i>Aeschynomene</i>			X																					
Poaceae	<i>Chrysopogon latifolius</i>				X		X					X	X		X		X	X	X		X				X
Lamiaceae	<i>Clerodendrum tatei</i>									X															
Bixaceae	<i>Cochlospermum fraseri</i>	X	X		X			X	X	X			X	X			X		X			X		X	
Commelinaceae	<i>Commelina ensifolia</i>							X																	
Myrtaceae	<i>Corymbia bella</i>			X																			X		
Myrtaceae	<i>Corymbia bleeseri</i>				X		X		X			X					X			X		X		X	
Myrtaceae	<i>Corymbia clavigera</i>												X		X			X		X		X			
Myrtaceae	<i>Corymbia dichromophloia</i>		X		X				X			X					X	X						X	
Myrtaceae	<i>Corymbia foelscheana</i>																			X					
Myrtaceae	<i>Corymbia polycarpa</i>	X	X	X		X	X		X		X		X	X							X				X
Myrtaceae	<i>Corymbia polycarpa/terminalis</i>																	X			X				

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Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Myrtaceae	<i>Corymbia setosa</i>																		X						
Myrtaceae	<i>Corymbia</i> sp.										X														
Fabaceae	<i>Crotalaria goreensis</i> *																								X
Asteraceae	<i>Cyanthillium cinereum</i>							X					X												
Fabaceae	<i>Cyclocarpa stellaris</i>						X																		
Poaceae	<i>Cynodon radiatus</i> *																	X		X					
Cyperaceae	<i>Cyperus iria</i>								X	X	X														
Cyperaceae	<i>Cyperus</i> sp.									X															X
Fabaceae	<i>Desmodium</i> sp.												X												
Poaceae	<i>Dichanthium</i> sp.										X														
Bignoniaceae	<i>Dolichandrone filiformis</i>												X												
Droseraceae	<i>Drosera</i> sp.						X														X				
Fabaceae	<i>Dunbaria singuliflora</i>								X	X															
Poaceae	<i>Ectrosia leporina</i>	X																							
Elaeocarpaceae	<i>Elaeocarpus arnhemicus</i>												X							X					
Cyperaceae	<i>Eleocharis</i> sp.										X														
Poaceae	<i>Eragrostis schultzei</i>	X			X		X	X	X	X	X														
Poaceae	<i>Eriachne aristidea</i>																				X				
Poaceae	<i>Eriachne avenacea</i>									X	X	X													
Poaceae	<i>Eriachne burkittii</i>			X			X		X	X	X					X									X
Poaceae	<i>Eriachne ciliata</i>	X							X																
Poaceae	<i>Eriachne obtusa</i>														X							X			

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Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Poaceae	<i>Eriachne schultiziana</i>						X														X				
Poaceae	<i>Eriachne</i> sp.	X							X											X					
Poaceae	<i>Eriachne triseta</i>						X																		
Eriocaulaceae	<i>Eriocaulon</i> sp.						X			X															
Fabaceae	<i>Erythrophleum chlorostachys</i>		X		X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X
Myrtaceae	<i>Eucalyptus bigalerita</i>		X			X					X														
Myrtaceae	<i>Eucalyptus camaldulensis</i>	X																							
Myrtaceae	<i>Eucalyptus miniata</i>				X			X	X	X		X		X	X	X	X			X				X	
Myrtaceae	<i>Eucalyptus</i> sp.	X							X					X	X										
Myrtaceae	<i>Eucalyptus tectifca</i>	X	X												X			X	X					X	
Myrtaceae	<i>Eucalyptus tetradonta</i>				X																				X
Myrtaceae	<i>Eucalyptus tintinnans</i>				X					X	X	X	X			X	X		X		X	X			
Myrtaceae	<i>Eucalytpus alba</i>						X																		
Euphorbiaceae	<i>Euphorbia drummondii</i>	X										X								X					
Euphorbiaceae	<i>Euphorbia</i> sp.								X																
Euphorbiaceae	<i>Euphorbia wheeleri</i>															X									X
Moraceae	<i>Ficus aculeata</i>	X		X			X													X					X
Moraceae	<i>Ficus platypoda</i>							X																	
Moraceae	<i>Ficus scobina</i>		X			X	X	X							X					X					
Moraceae	<i>Ficus virens</i>																					X			
Cyperaceae	<i>Fimbristylis littoralis</i>										X														

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		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Cyperaceae	<i>Fimbristylis</i> sp.								X																X
Fabaceae	<i>Flemingia parviflora</i>	X																							
Fabaceae	<i>Flemingia</i> sp.		X					X																	
Fabaceae	<i>Flemingia</i> sp. <i>sericea</i>																			X					
Phyllanthaceae	<i>Flueggea virosa</i>																			X					
Fabaceae	<i>Galactia megalophylla</i>				X							X	X					X	X		X			X	
Fabaceae	<i>Galactia tenuiflora</i>														X										
Rubiaceae	<i>Gardenia megasperma</i>						X	X																	
Amaranthaceae	<i>Gomphrena canescens</i>	X	X												X										
Goodeniaceae	<i>Goodenia armstrongiana</i>	X									X		X		X		X	X	X	X	X				
Goodeniaceae	<i>Goodenia leiosperma</i>																			X					
Goodeniaceae	<i>Goodenia</i> sp.	X																		X				X	
Proteaceae	<i>Grevillea decurrens</i>						X					X	X		X							X			
Proteaceae	<i>Grevillea dimidiata</i>												X												
Proteaceae	<i>Grevillea dryandri</i> ssp. <i>dryandri</i>																				X				
Proteaceae	<i>Grevillea mimosoides</i>	X							X	X															
Proteaceae	<i>Grevillea pluricaulis</i>											X													
Proteaceae	<i>Grevillea pteridifolia</i>							X													X				
Proteaceae	<i>Grevillea</i> sp.					X																			
Malvaceae	<i>Grewia retusifolia</i>						X																		
Apocynaceae	<i>Gymnanthera oblonga</i>					X																			

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Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Haemodoraceae	<i>Haemodorum coccineum</i>											X													
Malvaceae	<i>Helicteres darwinensis</i>													X											
Malvaceae	<i>Helicteres isora</i>	X																				X			
Boraginaceae	<i>Heliotropium ventricosum</i>														X										
Poaceae	<i>Heteropogon contortus</i>							X																	
Poaceae	<i>Heteropogon sp.</i>												X												
Poaceae	<i>Heteropogon triticeus</i>		X										X				X								
Dilleniaceae	<i>Hibbertia lepidota</i>	X	X						X	X		X	X		X		X	X	X	X				X	
Malvaceae	<i>Hibiscus meraukensis</i>		X						X												X				
Malvaceae	<i>Hibiscus sabdariffa*</i>						X		X																
Poaceae	<i>Hymenachne amplexicaulis*</i>												X												
Fabaceae	<i>Indigofera linifolia</i>				X																				
Convolvulaceae	<i>Ipomoea abrupta</i>						X																		
Convolvulaceae	<i>Ipomoea eriocarpa</i>												X						X						
Convolvulaceae	<i>Ipomoea sp.</i>							X										X					X		
Poaceae	<i>Ischaemum rugosum</i>									X															
Poaceae	<i>Iseilema vaginiflorum</i>		X																						
Convolvulaceae	<i>Jacquemontia browniana</i>																		X						
Vitaceae	<i>Leea rubra</i>																								X
Fabaceae	<i>Leucaena leucocephala*</i>																					X			
Plantaginaceae	<i>Limnophila fragrans</i>									X		X													

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		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Lindsaeaceae	<i>Lindsaea ensifolia</i>													X											
Arecaceae	<i>Livistona humilis</i>						X				X	X	X	X											
Arecaceae	<i>Livistona inermis</i>				X			X		X						X									
Campanulaceae	<i>Lobelia dioica</i>	X	X							X		X	X			X	X				X				
Myrtaceae	<i>Lophostemon grandiflorus</i>		X	X											X										
Myrtaceae	<i>Lophostemon lactifluus</i>						X																	X	
Onagraceae	<i>Ludwigia hyssopifolia</i>			X																				X	
Onagraceae	<i>Ludwigia octovalvis</i>									X				X								X			
Onagraceae	<i>Ludwigia perennis</i>						X				X					X									
Apocynaceae	<i>Marsdenia viridiflora</i>				X					X															
Myrtaceae	<i>Melaleuca argentea</i>		X			X																			
Myrtaceae	<i>Melaleuca leucadendra</i>															X									
Myrtaceae	<i>Melaleuca</i> sp.																					X			
Myrtaceae	<i>Melaleuca viridiflora</i>	X		X		X	X															X			
Myrtaceae	<i>Melaleuca nervosa</i>																					X			
Malvaceae	<i>Melochia corchorifolia</i>			X																					
Convovulaceae	<i>Merremia gemella</i>					X																			
Lamiaceae	<i>Mesosphaerum suaveolens*</i>		X	X		X	X	X	X		X		X	X		X			X	X			X	X	
Euphorbiaceae	<i>Microstachys chaemaelea</i>																	X			X				
Poaceae	<i>Mnesithea formosa</i>				X																				
Poaceae	<i>Mnesithea rottboelioides</i>					X	X							X						X					

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Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Menyanthaceae	<i>Nymphoides quadriloba</i>									X															
Rubiaceae	<i>Oldenlandia galioides</i>									X															
Pandanaceae	<i>Pandanus aquaticus</i>		X	X																					X
Pandanaceae	<i>Pandanus spiralis</i>						X																		
Poaceae	<i>Panicum mindanaense/seminudum</i>	X	X		X				X		X														X
Poaceae	<i>Panicum sp.</i>								X																
Poaceae	<i>Panicum trachyrachis</i>			X																					
Poaceae	<i>Paspalum scrobiculatum</i>		X								X														
Passifloraceae	<i>Passiflora foetida</i> *	X																							
Poaceae	<i>Pennisetum pedicellatus</i> *	X	X	X		X		X			X														X
Poaceae	<i>Pennisetum polystachion</i> *																			X					
Poaceae	<i>Pennisetum sp.*</i>													X											
Picrodendraceae	<i>Petalostigma pubescens</i>	X	X				X											X		X				X	
Picrodendraceae	<i>Petalostigma quadriloculare</i>				X			X		X	X	X	X		X	X	X	X	X	X	X	X		X	
Phyllanthaceae	<i>Phyllanthus flagellaris</i>				X																				
Phyllanthaceae	<i>Phyllanthus minutiflorus</i>									X	X			X											X
Phyllanthaceae	<i>Phyllanthus sp.</i>								X		X					X									
Solanaceae	<i>Physalis sp.</i>							X																	
Lecythidaceae	<i>Planchonia careya</i>						X											X	X				X		
Lamiaceae	<i>Plectranthus scutellarioides</i>				X			X														X			

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		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Caryophyllaceae	<i>Polycarpaea longiflora</i>																	X							
Caryophyllaceae	<i>Polycarpaea violacea</i>														X										
Polygalaceae	<i>Polygala exsuarrosa</i>																X								
Polygalaceae	<i>Polygala sp.</i>		X														X								
Poaceae	<i>Pseudopogonatherum contortum</i>	X			X						X							X	X						
Poaceae	<i>Pseudoraphis spinescens</i>									X															
Asteraceae	<i>Pterocaulon serrulatum</i>	X																		X					
Amaranthaceae	<i>Ptilotus corymbosus</i>																	X							
Fabaceae	<i>Pycnospora lutescens</i>												X												
Cyperaceae	<i>Rhynchospora sp.</i>										X														
Poaceae	<i>Sacciolepis indica</i>						X				X														
Poaceae	<i>Sacciolepis myosuroides</i>										X														
Poaceae	<i>Schizachyrium pseudeulalia</i>	X																						X	
Cyperaceae	<i>Scleria pygmaea</i>						X																		
Cyperaceae	<i>Scleria sphacelata</i>				X						X					X									
Poaceae	<i>Sehima nervosum</i>								X																
Fabaceae	<i>Senna obtusifolia*</i>	X		X		X																			
Poaceae	<i>Setaria oplismenoides</i>							X																	
Malvaceae	<i>Sida acuta*</i>					X			X																
Malvaceae	<i>Sida cardifolia</i>		X																						
Malvaceae	<i>Sida sp.</i>												X												

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Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Malvaceae	<i>Sida spinosa</i>	X		X							X														
Poaceae	<i>Sorghum intrans</i>									X															
Poaceae	<i>Sorghum plumosum</i>	X		X					X			X								X					
Poaceae	<i>Sorghum sp.</i>																X								
Poaceae	<i>Sorghum stipodeum/intrans</i>											X													
Rubiaceae	<i>Spermacoce sp.</i>	X	X		X				X	X	X				X				X		X	X			
Asteraceae	<i>Sphaeromorphaea littoralis</i>												X												
Plantaginaceae	<i>Stemodia lythrifolia</i>				X			X	X	X	X							X						X	
Stylidiaceae	<i>Stylidium sp.</i>																	X			X				
Fabaceae	<i>Stylosanthes viscosa*</i>							X																	X
Fabaceae	<i>Swainsona sp.</i>								X																
Fabaceae	<i>Tephrosia bifacialis</i>											X													
Fabaceae	<i>Tephrosia nematophylla</i>																	X							
Fabaceae	<i>Tephrosia polyzyga</i>											X													
Combretaceae	<i>Terminalia ferdinandiana</i>																	X	X	X	X	X		X	
Combretaceae	<i>Terminalia microcarpa</i>					X																			
Combretaceae	<i>Terminalia platyphylla</i>			X																					
Combretaceae	<i>Terminalia pterocarya</i>												X												
Thymelaeaceae	<i>Thecanthes punicea</i>															X	X								
Poaceae	<i>Themeda triandra</i>	X													X						X			X	
Malvaceae	<i>Thespesia thespesioides</i>		X																						

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Family	Scientific name	Toms Gully								Rustlers Roost								Quest 29							
		Trapping				Cameras				Trapping				Cameras				Trapping				Cameras			
		T1	T2	T3	T4	T1	T2	T3	T4	R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4.2
Menispermaceae	<i>Tinospora smilacina</i>																						X		
Cannabaceae	<i>Trema tomentosa</i> var. <i>aspera</i>							X																	
Poaceae	<i>Triodia bitextura</i>																			X					
Poaceae	<i>Triraphis mollis</i>								X																
Malvaceae	<i>Triumfetta pentandra</i> or <i>rhomboidea</i> *													X											
Malvaceae	<i>Triumfetta rhomboidea</i> *																	X		X			X		X
Lamiaceae	<i>Vitex acuminata</i>						X																		
Malvaceae	<i>Waltheria indica</i>		X																						
Asteraceae	<i>Xanthium strumarium</i> *	X																							
Myrtaceae	<i>Xanthostemon paradoxus</i>									X			X			X	X		X			X			
Rhamnaceae	<i>Ziziphus oenopolia</i>													X											
Poaceae	Poaceae sp.	X	X											X					X						

APPENDIX 4. Fauna list from the November 2016 on-ground survey of the Toms Gully survey area from trapping sites (ST1, ST2, ST3 and ST4), camera sites (CT1, CT2, CT3.2 and CT4), tailings dam (Dam) mine pit (Pit), waste rock dump (WRD) and incidental observations (Inc.)

Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
Amphibian	-	Frog		X														
	<i>Rhinella marina</i>	Cane toad	X	X	X	X				X			X				X	
	<i>Cyclorana australis</i>	Giant frog				X					X		X				X	
	<i>Cyclorana longipes</i>	Long-footed frog				X												
	<i>Litoria caerulea</i>	Green tree-frog				X								X				
	<i>Litoria inermis</i>	Peters' frog											X					
	<i>Litoria nasuta</i>	Rocket frog												X				
	<i>Litoria rothii</i>	Roth's tree-frog				X							X	X			X	
	<i>Litoria sp.</i>			X														
	<i>Litoria watjulumensis</i>	Wotjulum frog									X							
	<i>Platyplectrum ornatum</i>	Ornate burrowing frog		X														
Bird	<i>Aprosmictus erythropterus</i>	Red-winged parrot	X	X		X												
	<i>Aquila audax</i>	Wedge-tailed eagle														X		
	<i>Ardea alba</i>	Great egret	X	X					X									
	<i>Ardea ibis</i>	Cattle egret			X													
	<i>Burhinus grallarius</i>	Bush stone-curlew									X	X					X	
	<i>Cacatua galerita</i>	Sulphur-crested cockatoo			X												X	
	<i>Cacatua sanguinea</i>	Little corella	X															
	<i>Cacomantis variolosus</i>	Brush cuckoo	X					X	X									
	<i>Calyptrorhynchus banksii</i>	Red-tailed black cockatoo		X					X									
	<i>Centropus phasianinus</i>	Pheasant coucal	X	X	X			X								X		X
	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo		X														
	<i>Chlamydera nuchalis</i>	Great bowerbird			X													

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Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
Bird	<i>Cisticola exilis</i>	Golden-headed cisticola							X									
	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	X															
	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike			X			X										
	<i>Dacelo leachii</i>	Blue-winged kookaburra	X	X	X		X		X									
	<i>Ducula bicolor</i>	Pied imperial pigeon	X															
	<i>Egretta novaehollandiae</i>	White-faced heron	X															
	<i>Ephippiorhynchus asiaticus</i>	Black-necked stork						X							X	X		
	<i>Eudynamys scolopacea</i>	Common koel			X													
	<i>Eurystomus orientalis</i>	Dollarbird	X		X	X		X										
	<i>Geopelia humeralis</i>	Bar-shouldered dove		X	X													
	<i>Geopelia placida</i>	Peaceful dove	X	X	X				X									
	<i>Gerygone olivacea</i>	White-throated gerygone			X													
	<i>Grallina cyanoleuca</i>	Magpie-lark	X															
	<i>Haliastur sphenurus</i>	Whistling kite		X	X			X										
	<i>Heteronotia bynoei</i>	Bynoe's gecko				X												
	<i>Lalage sueurii</i>	White-winged triller							X									
	<i>Lichenostomus unicolor</i>	White-gaped honeyeater	X	X	X			X										
	<i>Lichmera indistincta</i>	Brown honeyeater			X				X									
	<i>Melithreptus albogularis</i>	White-throated honeyeater	X					X										
	<i>Merops ornatus</i>	Rainbow bee-eater			X			X	X							X		
	<i>Milvus migrans</i>	Black kite			X													
	<i>Myzomela obscura</i>	Dusky honeyeater			X													
	<i>Oriolus flavocinctus</i>	Yellow oriole	X															
	<i>Pachycephala rufiventris</i>	Rufous whistler	X					X										

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Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
	<i>Pardalotus striatus</i>	Striated pardalote							X									
Bird	<i>Philemon sp.</i>	Friabird				X												
	<i>Poephila personata</i>	Masked finch			X				X									
	<i>Psitteuteles versicolor</i>	Varied lorikeet	X	X		X	X		X									X
	<i>Rhipidura leucophrys</i>	Willie wagtail							X									
	<i>Scythrops novaehollandiae</i>	Channel-billed cuckoo			X													
	<i>Smicrornis brevirostris</i>	Weebill						X										
	<i>Sphecotheres viridis</i>	Figbird		X		X												
	<i>Tadorna radjah</i>	Radjah shelduck	X															
	<i>Threskiornis spinicollis</i>	Straw-necked ibis		X	X				X									
	<i>Todiramphus macleayii</i>	Forest kingfisher			X													
	<i>Trichoglossus haematodus</i>	Rainbow lorikeet		X	X													X
Mammal	<i>Canis lupus</i>	Dingo						X										
	<i>Equus caballus</i>	Horse			X													
	<i>Macropus agilis</i>	Agile wallaby				X			X									
	<i>Macropus antilopinus</i>	Antilopine wallaroo	X			X											X	
	<i>Mus musculus</i>	House mouse			X													
	<i>Sus scrofa</i>	Pig		X														
Reptile	-	Gecko									X							
	<i>Carlia amax</i>	Carlia sp.		X														
	<i>Carlia gracilis</i>	Slender rainbow skink		X														
	<i>Carlia munda</i>	Striped rainbow skink				X												
	<i>Carlia sp.</i>			X	X													
	<i>Crocodylus johnstoni</i>	Freshwater crocodile		X														

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Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
	<i>Cryptoblepharus cygnatus</i>	Swanson's snake-eyed skink	X															
	<i>Delma tinctoria</i>	Excitable delma				X							X					
Reptile	<i>Diporiphora magna</i>	Yellow-sided two-lined dragon				X							X					
	<i>Liasis olivaceus</i>	Olive python								X								
	<i>Lophognathus gilberti</i>	Gilbert's dragon		X														

APPENDIX 5. Fauna list from the May 2017 on-ground survey of the Toms Gully survey area from trapping sites (ST1, ST2, ST3 and ST4), camera sites (CT1, CT2, CT3.2 and CT4) and incidental observations (Inc.)

Group	Scientific name	Common name	ST1	ST2	ST3	ST04	CT1	CT2	CT3	CT4	Inc.
Amphibian	<i>Limnodynastes convexiusculus</i>	Marbled frog			X				X		
	<i>Litoria caerulea</i>	Green tree frog							X		X
	<i>Litoria nasuta</i>	Rocket frog							X		X
	<i>Litoria rubella</i>	Little red tree frog			X						X
	<i>Northern laughing frog</i>	Litoria rothii		X					X		
	<i>Notaden sp.</i>	Spadefoot			X						
	<i>Rhinella marina</i>	Cane toad		X	X				X		
Arthropod	<i>Cressida cressida</i>	Butterfly							X		
Bird	<i>Aprosmictus erythropterus</i>	Red-winged parrot	X	X	X	X					
	<i>Ardea/Egretta sp.</i>	Egret sp.									X
	<i>Artamus minor</i>	Little woodswallow	X						X		
	<i>Burhinus grallarius</i>	Bush-stone curlew							X		
	<i>Cacatua galerita</i>	Sulphur-crested cockatoo	X		X						X
	<i>Cacatua sanguinea</i>	Little corella		X	X						
	<i>Cacomantis pallidus</i>	Pallid cuckoo					X				
	<i>Calyptrornis banksii macrorhynchus</i>	Red-tailed black cockatoo		X	X					X	X
	<i>Centropus phasianinus</i>	Pheasant coucal	X	X			X				X
	<i>Ceyx pusilla</i>	Little kingfisher					X				
	<i>Chrysococcyx basalis</i>	Horsfield's bronze cuckoo	X		X		X				
	<i>Chrysococcyx minutillus</i>	Little bronze cuckoo			X						
	<i>Chrysococcyx osculans</i>	Black-eared cuckoo			X						
	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	X								
	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike	X			X					

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Group	Scientific name	Common name	ST1	ST2	ST3	ST04	CT1	CT2	CT3	CT4	Inc.
Bird	<i>Corvus orru</i>	Torresian crow			X						
	<i>Dacelo leachii</i>	Blue-winged kookaburra		X	X						X
	<i>Dicrurus bracteatus</i>	Spangled drongo	X		X						
	<i>Falco subniger</i>	Black falcon									X
	<i>Geopelia humeralis</i>	Bar-shouldered dove	X	X	X	X	X	X		X	X
	<i>Geopelia striata</i>	Peaceful dove	X	X	X	X	X		X	X	X
	<i>Grallina cyanoleuca</i>	Magpie lark		X	X						
	<i>Haliastur sphenurus</i>	Whistling kite			X	X			X		
	<i>Lalage sueurii</i>	White-winged triller	X								
	<i>Lichmera indistincta</i>	Brown honeyeater	X								X
	<i>Lonchura castaneothorax</i>	Chestnut breasted mannikin									X
	<i>Lonchura flaviprymma</i>	Yellow rumped mannikin									X
	<i>Melithreptus albogularis</i>	White-throated honeyeater			X					X	
	<i>Merops ornatus</i>	Rainbow bee-eater	X	X		X	X		X		X
	<i>Milvus migrans</i>	Black kite						X			
	<i>Myiagra alecto</i>	Shining flycatcher	X								
	<i>Neochmia phaeton</i>	Crimson finch									X
	<i>Ninox connivens</i>	Barking owl		X							
	<i>Pachycephala rufiventris</i>	Rufous whistler	X						X	X	
	<i>Pardalotus striatus</i>	Striated pardalote	X						X	X	
	<i>Phalacrocorax carbo novaehollandiae</i>	Black cormorant		X							
	<i>Philemon citreogularis</i>	Little friarbird		X	X						X
	<i>Philemon sp.</i>	Friarbird									X
	<i>Poephila acuticauda</i>	Long-tailed finch	X								

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Group	Scientific name	Common name	ST1	ST2	ST3	ST04	CT1	CT2	CT3	CT4	Inc.
Bird	<i>Pomatostomus temporalis</i>	Grey-crowned babbler									X
	<i>Psitteteles versicolor</i>	Varied lorikeet	X								
	<i>Ptilonorhynchus nuchalis</i>	Great bowerbird									X
	<i>Ramsayornis fasciatus</i>	Bar-breasted honeyeater									X
	<i>Rhipidura leucophrys</i>	Willie wagtail	X	X	X						
	<i>Scythrops novaehollandiae</i>	Channel-billed cuckoo				X					
	<i>Smicronis brevirostris</i>	Weebill	X			X	X			X	
	<i>Stomiopera unicolor</i>	White-gaped honeyeater		X							
	<i>Tadorna radjah</i>	Radjah shelduck		X	X						
	<i>Todiramphus macleayii</i>	Forest kingfisher		X	X						
	<i>Trichoglossus haematodus</i>	Red-collared lorikeet	X	X	X						
Mammal	<i>Bos taurus</i>	Cattle								X	
	<i>Canis lupis dingo</i>	Dingo								X	
	<i>Canis sp.</i>	Dingo/dog							X		
	<i>Chaerephon jobensis</i>	Northern freetail bat	X	X							
	<i>Chalinolobus gouldii</i>	Gould's wattled bat	X	X							
	<i>Equus caballus</i>	Horse			X						
	<i>Isodon macrourus</i>	Northern brown bandicoot	X								
	<i>Macropodidae</i>	Macropod								X	
	<i>Mormopterus beccarii</i>	Beccari's free-tailed bat	X								
	<i>Notamacropus agilis</i>	Agile wallaby			X					X	X
	<i>Nyctophilus sp.</i>	(blank)	X	X	X						
	<i>Osphranter antilopinus</i>	Antilopine wallaroo	X								
Mammal	<i>Pipistrellus westralis</i> or <i>Miniopterus</i>	Northern pipistrelle or Northern bent-	X	X							

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Group	Scientific name	Common name	ST1	ST2	ST3	ST04	CT1	CT2	CT3	CT4	Inc.
	<i>oriana oriana</i>	winged bat									
	<i>Planigale maculata</i>	Common planigale			X						
	<i>Pteropus alecto</i>	Black flying-fox			X						
	<i>Rhinonictis aurantia</i>	Orange leaf-nosed bat		X							
	<i>Saccolaimus flaviventris</i>	Yellow-bellied sheath-tailed bat	X	X							
	<i>Scotorepens greyii</i> or <i>S. sanborni</i> or <i>Chalinolobus nigrogriseus</i>	Little broad-nosed bat or Northern broad-nosed bat or Hoary wattled bat	X	X							
	<i>Tachyglossus aculeatus</i>	Short-beaked echidna							X		
	<i>Taphozous georgianus</i>	Common sheath-tailed bat	X								
Reptile	<i>Carlia amax</i>	Bauxite rainbow-skink		X							
	<i>Carlia</i> sp.	Skink	X								
	<i>Ctenophorus caudicinctus</i>	Ring-tailed dragon	X								
	<i>Ctenotus robustus</i>	Robust ctenotus				X					
	<i>Gehyra australis</i>	Northern dtella							X		
	<i>Liasis olivaceus</i>	Olive python									X

APPENDIX 6. Fauna list from the November 2016 on-ground survey of the Rustlers Roost survey area from trapping sites (SR1, SR2, SR3 and SR4), camera sites (CR1, CR2, CR3 and CR4), Annie's Dam (Dam) and incidental observations (Inc.)

Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
Amphibian	<i>Rhinella marina</i>	Cane toad	X	X							
	<i>Litoria bicolor</i>	Northern dwarf tree-frog					X				
	<i>Litoria caerulea</i>	Green tree-frog	X		X		X			X	X
	<i>Litoria rothii</i>	Roth's tree-frog					X				
	<i>Litoria rubella</i>	Red tree-frog								X	
	<i>Litoria tornieri</i>	Tornier's frog					X				
Arthropod	-	Centipede				X					
	<i>Danaus affinis</i>	Black and white tiger								X	
Bird	<i>Anhinga melanogaster</i>	Darter								X	
	<i>Aprosmictus erythropterus</i>	Red-winged parrot			X						
	<i>Aquila audax</i>	Wedge-tailed eagle									X
	<i>Ardea alba</i>	Great egret								X	
	<i>Ardea ibis</i>	Cattle egret								X	
	<i>Ardea picata</i>	Pied heron								X	
	<i>Artamus leucorhynchus</i>	White-breasted woodswallow								X	
	<i>Artamus minor</i>	Little woodswallow								X	
	<i>Cacatua galerita</i>	Sulphur-crested cockatoo				X					
	<i>Cacatua sanguinea</i>	Little corella									X
	<i>Cacomantis variolosus</i>	Brush cuckoo	X		X	X	X	X		X	
	<i>Calyptorhynchus banksii</i>	Red-tailed black-cockatoo			X	X		X		X	
	<i>Centropus phasianinus</i>	Pheasant coucal		X	X					X	
	<i>Certhionyx pectoralis</i>	Banded honeyeater					X	X			
	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo							X		

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
	<i>Cisticola exilis</i>	Golden-headed cisticola		X							
Bird	<i>Climacteris melanura</i>	Black-tailed treecreeper						X		X	
	<i>Colluricincla harmonica</i>	Grey shrike-thrush	X	X							
	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	X					X		X	
	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike	X		X			X	X		
	<i>Corvus orru</i>	Torresian crow			X					X	
	<i>Dacelo leachii</i>	Blue-winged kookaburra	X					X		X	X
	<i>Dendrocygna arcuata</i>	Wandering whistling-duck								X	
	<i>Dendrocygna eytoni</i>	Plumed whistling-duck								X	
	<i>Dicaeum hirundinaceum</i>	Mistletoebird					X				
	<i>Eudynamys scolopacea</i>	Common koel								X	
	<i>Eurystomus orientalis</i>	Dollarbird	X			X		X		X	
	<i>Falco berigora</i>	Brown falcon					X	X			X
	<i>Geopelia humeralis</i>	Bar-shouldered dove					X			X	
	<i>Geopelia placida</i>	Peaceful dove	X				X	X		X	
	<i>Gerygone sp.</i>	Gerygone									X
	<i>Grallina cyanoleuca</i>	Magpie-lark	X					X		X	X
	<i>Haliastur sphenurus</i>	Whistling kite					X	X		X	X
	<i>Hamirostra melanosternon</i>	Black-breasted buzzard								X	
	<i>Irediparra gallinacea</i>	Comb-crested jacana								X	
	<i>Lalage sueurii</i>	White-winged triller								X	
	<i>Lichenostomus unicolor</i>	White-gaped honeyeater					X				
	<i>Lichmera indistincta</i>	Brown honeyeater				X					
	<i>Malurus melanocephalus</i>	Red-backed fairy-wren	X			X	X				

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
Bird	<i>Melithreptus albogularis</i>	White-throated honeyeater				X	X	X			
	<i>Merops ornatus</i>	Rainbow bee-eater				X	X			X	
	<i>Milvus migrans</i>	Black kite						X		X	
	<i>Myiagra rubecula</i>	Leaden flycatcher						X			
	<i>Neochmia phaeton</i>	Crimson finch					X			X	
	<i>Oriolus flavocinctus</i>	Yellow oriole					X				
	<i>Pachycephala lanioides</i>	White-breasted whistler	X								
	<i>Pachycephala rufiventris</i>	Rufous whistler	X	X	X	X	X	X	X	X	
	<i>Pardalotus striatus</i>	Striated pardalote			X						
	<i>Phalacrocorax melanoleucos</i>	Little pied cormorant								X	
	<i>Phalacrocorax sulcirostris</i>	Little black cormorant								X	
	<i>Philemon buceroides</i>	Helmeted friarbird			X						
	<i>Philemon citreogularis</i>	Little friarbird				X			X	X	
	<i>Philemon sp.</i>	Friarbird				X					
	<i>Platalea regia</i>	Royal spoonbill								X	
	<i>Podargus strigoides</i>	Tawny frogmouth						X		X	
	<i>Poephila acuticauda</i>	Long-tailed finch	X						X	X	X
	<i>Poephila personata</i>	Masked finch	X					X		X	
	<i>Pomatostomus temporalis</i>	Grey-crowned babbler	X			X					
	<i>Psittuteutes versicolor</i>	Varied lorikeet					X	X	X	X	
	<i>Rhipidura leucophrys</i>	Willie wagtail	X	X	X		X			X	X
	<i>Smicrornis brevirostris</i>	Weebill							X		
	<i>Tachybaptus novaehollandiae</i>	Australian grebe								X	
	<i>Tadorna radjah</i>	Radjah shelduck								X	

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
	<i>Taeniopygia bichenovii</i>	Double-barred finch					X				
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis								X	
	<i>Todiramphus sanctus</i>	Sacred kingfisher								X	
Bird	<i>Trichoglossus haematodus</i>	Rainbow lorikeet	X				X				
	<i>Vanellus miles</i>	Masked lapwing								X	
Mammal	<i>Bos taurus</i>	Cattle						X		X	
	<i>Bubalus bubalis</i>	Water buffalo								X	
	<i>Canis lupus</i>	Dingo									X
	<i>Macropus agilis</i>	Agile wallaby					X				X
	<i>Macropus antilopinus</i>	Antilopine wallaroo									X
	<i>Sminthopsis virginiae</i>	Red-cheeked dunnart				X					
	<i>Sus scrofa</i>	Pig								X	
Reptile	-	Skink			X						
	<i>Crocodylus johnstoni</i>	Freshwater crocodile								X	
	<i>Diporiphora magna</i>	Yellow-sided two-lined dragon			X	X					
	<i>Gehyra nana</i>	Northern spotted rock dtella				X					
	<i>Liasis olivaceus</i>	Olive python				X	X				
	<i>Lophognathus gilberti</i>	Gilbert's dragon			X		X				
	<i>Menetia alanae</i>	Top End dwarf skink		X	X						
	<i>Menetia sp.</i>			X							
	<i>Morethia storri</i>	Storr's snake-eyed skink				X					
	<i>Strophurus ciliaris</i>	Spiny-tailed gecko				X					
	<i>Varanus baritji</i>	Black-spotted ridge-tailed monitor			X						

APPENDIX 7. Fauna list from the May 2017 on-ground survey of the Rustlers Roost survey area from trapping sites (SR1, SR2, SR3 and SR4), camera sites (CR1, CR2, CR3 and CR4), Annie's Dam (Dam) and incidental observations (Inc.)

Group	Scientific name	Common name	SR1	SR2	SR3	SR4	SR3.2	CR1	CR2	CR3	CR3.2	CR4	Dam	Inc.
Amphibian	<i>Limnodynastes convexiusculus</i>	Marbled frog		X										
Amphibian	<i>Litoria bicolor</i>	Northern dwarf tree frog	X											
Amphibian	<i>Litoria nasuta</i>	Rocket frog		X										
Amphibian	<i>Litoria pallida</i>	Pale frog		X										
Amphibian	<i>Litoria rubella</i>	Little red tree frog		X										
Amphibian	<i>Rhinella marina</i>	Cane toad	X	X										
Amphibian	<i>Uperoleia inundata</i>	Floodplain toadlet		X										
Bird	<i>Aprosmictus erythropterus</i>	Red-winged parrot		X					X					
Bird	<i>Ardea intermedia</i>	Intermediate egret											X	
Bird	<i>Ardea pacifica</i>	White-necked heron	X					X			X			
Bird	<i>Ardea/Egretta</i> sp.	Egret sp.				X		X						
Bird	<i>Artamus leucorhynchus</i>	White-breasted woodswallow				X								
Bird	<i>Artamus minor</i>	Little woodswallow				X							X	
Bird	<i>Cacatua galerita</i>	Sulphur-crested cockatoo						X						X
Bird	<i>Calyptorhynchus banksii macrorhynchus</i>	Red-tailed black cockatoo		X			X							
Bird	<i>Centropus phasianinus</i>	Pheasant coucal		X										
Bird	<i>Colluricincla harmonica</i>	Grey shrike-thrush								X	X			
Bird	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike							X					
Bird	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike	X				X							
Bird	<i>Corvus orru</i>	Torresian crow	X											
Bird	<i>Dacelo leachii</i>	Blue-winged kookaburra		X				X			X			
Bird	<i>Dendrocygna eytoni</i>	Plumed whistling duck											X	
Bird	<i>Egretta alba</i>	Great egret	X					X						

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	SR3.2	CR1	CR2	CR3	CR3.2	CR4	Dam	Inc.
Bird	<i>Eolophus roseicapillus</i>	Galah											X	
Bird	<i>Ephippiorynchus asiaticus</i>	Black-necked stork	X					X						
Bird	<i>Eurystomus orientalis</i>	Dollarbird	X											
Bird	<i>Geopelia humeralis</i>	Bar-shouldered dove	X	X			X	X		X			X	
Bird	<i>Geopelia striata</i>	Peaceful dove	X	X		X	X	X	X			X		
Bird	<i>Grallina cyanoleuca</i>	Magpie lark	X	X			X	X		X				X
Bird	<i>Haliastur sphenurus</i>	Whistling kite						X					X	
Bird	<i>Hamirostra melanosternon</i>	Black-breasted buzzard												X
Bird	<i>Irediparra gallinacea</i>	Comb-crested jacana									X		X	
Bird	<i>Lalage sueurii</i>	White-winged triller						X	X					
Bird	<i>Lichmera indistincta</i>	Brown honeyeater	X	X		X	X	X						
Bird	<i>Malurus melanocephalus</i>	Red-backed fairy wren		X			X		X					
Bird	<i>Megalurus timoriensis</i>	Tawny grassbird												X
Bird	<i>Melithreptus albogularis</i>	White-throated honeyeater		X			X						X	
Bird	<i>Melithreptus gularis</i>	Black-chinned honeyeater		X										
Bird	<i>Merops ornatus</i>	Rainbow bee-eater	X							X			X	
Bird	<i>Milvus migrans</i>	Black kite												X
Bird	<i>Myiagra nana</i>	Paperbark flycatcher											X	
Bird	<i>Neochmia phaeton</i>	Crimson finch						X						
Bird	<i>Nycticorax caledonicus</i>	Nankeen night heron						X						
Bird	<i>Pachycephala rufiventris</i>	Rufous whistler					X							
Bird	<i>Pardalotus striatus</i>	Striated pardalote	X	X										
Bird	<i>Phalacrocorax varius</i>	Pied cormorant											X	
Bird	<i>Philemon citreogularis</i>	Little friarbird						X						

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	SR3.2	CR1	CR2	CR3	CR3.2	CR4	Dam	Inc.
Bird	<i>Poephila acuticauda</i>	Long-tailed finch	X								X			
Bird	<i>Poephila personata</i>	Masked finch					X						X	
Bird	<i>Pomatostomus temporalis</i>	Grey-crowned babbler	X								X		X	
Bird	<i>Ptilonorynchus nuchalis</i>	Great bowerbird											X	
Bird	<i>Ptilotula flavescens</i>	Yellow-tinted honeyeater						X						
Bird	<i>Purnella albifrons</i>	White-fronted honeyeater		X				X						
Bird	<i>Rhipidura leucophrys</i>	Willie wagtail	X	X			X				X		X	
Bird	<i>Rhipidura rufiventris</i>	Northern fantail						X						
Bird	<i>Smicrornis brevirostris</i>	Weebill		X		X	X							
Bird	<i>Stizoptera bichenovii</i>	Double-barred finch		X										
Bird	<i>Threskiornis spinicollis</i>	Straw-necked ibis						X						
Bird	<i>Vanellus miles</i>	Masked lapwing	X										X	
Mammal	<i>Bos taurus</i>	Cattle							X					
Mammal	<i>Canis lupis dingo</i>	Dingo				X								
Mammal	<i>Chaerophon jobensis</i>	Northern free-tailed bat	X			X								
Mammal	<i>Chalinolobus gouldii</i>	Gould's wattled bat	X											
Mammal	<i>Hyposideros ater</i>	Dusky leaf-nosed bat		X										
Mammal	<i>Macropodidae</i>	Macropod								X				
Mammal	<i>Notamacropus agilis</i>	Agile wallaby								X				
Mammal	<i>Nyctophilus</i> sp.	Bat	X		X	X								
Mammal	<i>Osphranter antilopinus</i>	Antilopine wallaroo												X
Mammal	<i>Pipistrellus westralis</i> or <i>Miniopterus orianae orianae</i>	Northern pipistrelle or Northern bent-winged bat	X			X								
Mammal	<i>Rhinonictis aurantia</i>	Orange leaf-nosed bat	X											

Primary Gold Limited – Toms Gully, Rustlers Roost and Quest 29
Flora and Fauna Survey Report

Group	Scientific name	Common name	SR1	SR2	SR3	SR4	SR3.2	CR1	CR2	CR3	CR3.2	CR4	Dam	Inc.
Mammal	<i>Saccolaimus flaviventris</i>	Yellow-bellied sheath-tailed bat	X			X								
Mammal	<i>Scotorepens greyii</i> or <i>S.sanborni</i> or <i>Chalinolobus nigrogriseus</i>	Little broad-nosed bat or Northern broad-nosed bat or Hoary wattled bat	X			X								
Mammal	<i>Sus scrofa</i>	Pig						X						
Mammal	<i>Tachyglossus aculeatus</i>	Short-beaked echidna	X											
Mammal	<i>Taphozous georgianus</i>	Common sheath-tailed bat	X											
Mammal	<i>Taphozous kapalgensis</i>	Arnhem sheath-tailed bat	X											
Mammal	<i>Vespadelus caurinus</i>	Northern cave bat	X											
Reptile	<i>Carlia amax</i>	Bauxite rainbow-skink		X										
Reptile	<i>Ctenotus robustus</i>	Robust ctenotus					X							
Reptile	<i>Ctenotus</i> sp.	Ctenotus	X											
Reptile	<i>Egernia</i> sp./ <i>Ctenotus robustus</i>	Skink	X											
Reptile	<i>Gehyra australis</i>	Northern dtella				X								
Reptile	<i>Lophognathus gilberti</i>	Gilbert's dragon									X			
Reptile	<i>Varanus mertensi</i>	Merten's water monitor	X											

APPENDIX 8. Fauna list from the November 2016 on-ground survey of the Quest 29 survey area from trapping sites (SQ1, SQ2, SQ3 and SQ4), camera sites (CQ1, CQ2, CQ3 and CQ4.2), stock dam (Dam) and incidental observations (Inc.)

Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ4.2	CQ2	CQ3	Dam	Inc
Amphibian	<i>Rhinella marina</i>	Cane toad	X	X	X	X					
	<i>Litoria caerulea</i>	Green tree-frog				X			X		
	<i>Litoria rubella</i>	Red tree-frog							X		
Arthropod	<i>Danaus chrysippus</i>	Plain tiger							X		
	<i>Junonia orithya</i>	Blue argus							X		
Bird	<i>Aprosmictus erythropterus</i>	Red-winged parrot		X	X			X			X
	<i>Aquila audax</i>	Wedge-tailed eagle				X					
	<i>Ardea intermedia</i>	Intermediate egret	X								
	<i>Cacatua galerita</i>	Sulphur-crested cockatoo	X		X				X		
	<i>Cacatua sanguinea</i>	Little corella					X		X		
	<i>Cacomantis variolosus</i>	Brush cuckoo				X			X		
	<i>Calyptorhynchus banksii</i>	Red-tailed black cockataoo	X		X	X					
	<i>Centropus phasianinus</i>	Pheasant coucal				X					X
	<i>Certhionyx pectoralis</i>	Banded honeyeater					X				
	<i>Chlamydera nuchalis</i>	Great bowerbird		X		X		X			X
	<i>Conopophila rufogularis</i>	Rufous-throated honeyeater	X							X	
	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike				X		X		X	
	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike	X			X	X	X	X		
	<i>Coracina tenuirostris</i>	Cicadabird	X								
	<i>Corvus orru</i>	Torresian crow							X		
	<i>Coturnix ypsilophora</i>	Brown quail					X				
	<i>Dacelo leachii</i>	Blue-winged kookaburra		X		X	X		X		X
	<i>Ducula bicolor</i>	Pied imperial pigeon					X	X	X		

Primary Gold Limited – Toms Gully, Rustlers Roost and Quest 29
Flora and Fauna Survey Report

Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ4.2	CQ2	CQ3	Dam	Inc
	<i>Eudynamys scolopacea</i>	Common koel			X		X	X			
Bird	<i>Eurystomus orientalis</i>	Dollarbird	X		X	X	X	X	X		X
	<i>Geopelia humeralis</i>	Bar-shouldered dove			X	X		X	X		
	<i>Geopelia placida</i>	Peaceful dove	X		X	X	X			X	
	<i>Grallina cyanoleuca</i>	Magpie-lark	X				X	X			
	<i>Haliastur sphenurus</i>	Whistling kite	X	X	X					X	X
	<i>Hamirostra melanosternon</i>	Black-breasted buzzard									X
	<i>Hieraaetus morphnoides</i>	Little eagle			X						
	<i>Lichenostomus flavescens</i>	Yellow-tinted honeyeater					X				
	<i>Lichenostomus unicolor</i>	White-gaped honeyeater					X	X	X		
	<i>Lichmera indistincta</i>	Brown honeyeater				X					
	<i>Melithreptus albogularis</i>	White-throated honeyeater			X	X	X	X	X		
	<i>Merops ornatus</i>	Rainbow bee-eater							X		
	<i>Microeca flavigaster</i>	Lemon-bellied flycatcher					X				
	<i>Milvus migrans</i>	Black kite							X		X
	<i>Myiagra rubecula</i>	Leaden flycatcher					X			X	
	<i>Myzomela obscura</i>	Dusky honeyeater				X	X		X		
	<i>Oriolus flavocinctus</i>	Yellow oriole						X	X		
	<i>Pachycephala lanioides</i>	White-breasted whistler			X						
	<i>Pachycephala rufiventris</i>	Rufous whistler			X	X	X	X	X	X	
	<i>Philemon buceroides</i>	Helmeted friarbird			X			X	X		
	<i>Philemon citreogularis</i>	Little friarbird		X	X					X	
	<i>Phylidonyris albifrons</i>	White-fronted honeyeater								X	
	<i>Platycercus venustus</i>	Northern rosella			X						

Primary Gold Limited – Toms Gully, Rustlers Roost and Quest 29
Flora and Fauna Survey Report

Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ4.2	CQ2	CQ3	Dam	Inc
	<i>Poephila acuticauda</i>	Long-tailed finch								X	
	<i>Poephila personata</i>	Masked finch				X	X			X	
Bird	<i>Pomatostomus temporalis</i>	Grey-crowned babbler						X			
	<i>Psitteuteles versicolor</i>	Varied lorikeet				X			X		
	<i>Rhipidura leucophrys</i>	Willie wagtail			X				X		
	<i>Rhipidura rufiventris</i>	Northern fantail						X			
	<i>Taeniopygia bichenovii</i>	Double-barred finch		X						X	
	<i>Threskiornis spinicollis</i>	Straw-necked ibis	X								
	<i>Trichoglossus haematodus</i>	Rainbow lorikeet	X								
Mammal	<i>Macropus agilis</i>	Agile wallaby	X		X						
	<i>Macropus antilopinus</i>	Antilopine wallaroo			X				X		X
	<i>Sus scrofa</i>	Pig	X	X	X			X	X		
Reptile	<i>Carlia gracilis</i>	Slender rainbow skink	X								
	<i>Diporiphora magna</i>	Yellow-sided two-lined dragon	X								
	<i>Heteronotia bynoei</i>	Bynoe's gecko									X
	<i>Lophognathus gilberti</i>	Gilbert's dragon									X
	Skink sp.			X							

APPENDIX 9. Fauna list from the May 2017 on-ground survey of the Quest 29 survey area from trapping sites (SQ1, SQ2, SQ3 and SQ4), camera sites (CQ1, CQ2, CQ3 and CQ4.2) and incidental observations (Inc.)

Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ1	CQ2	CQ3	CQ4	CQ4.2	Inc.
Amphibian	Rhinella marina	Cane toad		X								
Bird	Aprosmictus erythropterus	Red-winged parrot	X									
Bird	Cacatua galerita	Sulphur-crested cockatoo		X				X				
Bird	Cacatua sanguinea	Little corella					X					
Bird	Cacomantis variolosus	Brush cuckoo							X			
Bird	Calyptorynchus banksii macrorhynchus	Red-tailed black cockatoo	X	X			X					
Bird	Centropus phasianinus	Pheasant coucal			X							
Bird	Chrysococcyx basalis	Horsfield's bronze cuckoo							X			
Bird	Colluricincla harmonica	Grey shrike-thrush						X				
Bird	Coracina papuensis	White-bellied cuckoo-shrike	X	X			X	X				
Bird	Corvus orru	Torresian crow		X								X
Bird	Cracticus nigrogularis	Pied butcherbird			X							
Bird	Dacelo leachii	Blue-winged kookaburra	X					X				
Bird	Dicrurus bracteatus	Spangled drongo	X					X				
Bird	Entomyzon cyanotis	Blue-faced honeyeater										X
Bird	Eolophus roseicapillus	Galah					X					
Bird	Eurystomus orientalis	Dollarbird										X
Bird	Falco berigora	Brown falcon	X									
Bird	Falco sp.	Falcon					X					
Bird	Geopelia humeralis	Bar-shouldered dove	X	X	X			X		X		
Bird	Geopelia striata	Peaceful dove	X	X	X	X	X	X				
Bird	Haliastur sphenurus	Whistling kite		X								
Bird	Lichmera indistincta	Brown honeyeater	X	X	X	X	X					

Primary Gold Limited – Toms Gully, Rustlers Roost and Quest 29
Flora and Fauna Survey Report

Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ1	CQ2	CQ3	CQ4	CQ4.2	Inc.
Bird	Megalurus timoriensis	Tawny grassbird										X
Bird	Melithreptus albogularis	White-throated honeyeater		X								
Bird	Merops ornatus	Rainbow bee-eater				X						
Bird	Microeca flavigaster	Lemon-bellied flycatcher						X				
Bird	Milvus migrans	Black kite		X								X
Bird	Myiagra ruficollis	Broad-billed flycatcher						X				
Bird	Oriolus flacocinctus	Yellow oriole						X				
Bird	Pachycephala rufiventris	Rufous whistler	X	X	X			X				
Bird	Pardalotus striatus	Striated pardalote				X		X		X		X
Bird	Philemon citreogularis	Little friarbird			X							
Bird	Philemon sp.	Friarbird				X		X				
Bird	Podargus strigoides	Tawny frogmouth			X							
Bird	Pomatostomus temporalis	Grey-crowned babbler						X				
Bird	Psitteuteles versicolor	Varied lorikeet	X									
Bird	Purnella albifrons	White-fronted honeyeater										X
Bird	Ramsayornis fasciatus	Bar-breasted honeyeater				X						
Bird	Rhipidura leucophrys	Willie wagtail	X					X				
Bird	Rhipidura rufiventris	Northern fantail		X				X				
Bird	Scythrops novaehollandiae	Channel-billed cuckoo	X									
Bird	Smicrornis brevirostris	Weebill	X	X		X			X	X		
Bird	Stomiopera unicolor	White-gaped honeyeater						X				
Bird	Trichoglossus haematodus	Red-collared lorikeet	X		X	X	X					
Mammal	Canis lupus dingo	Dingo					X					
Mammal	Chaerephon jobensis	Northern free-tailed bat		X		X						

Primary Gold Limited – Toms Gully, Rustlers Roost and Quest 29
Flora and Fauna Survey Report

Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ1	CQ2	CQ3	CQ4	CQ4.2	Inc.
Mammal	Macropodidae	Macropod									X	
Mammal	Notamacropus agilis	Agile wallaby					X	X			X	
Mammal	Nyctophilus sp.	Bat		X		X						
Mammal	Pipistrellus westralis or Miniopterus orianae orianae	Northern pipistrelle or Northern bent-winged bat	X	X		X						
Mammal	Saccolaimus flaviventris	Yellow-bellied sheath-tailed bat		X		X						
Mammal	Scotorepens greyii or S.sanborni or Chalinolobus nigrogriseus	Little broad-nosed bat or Northern broad-nosed bat or Hoary wattled bat		X		X						
Mammal	Sus scrofa	Pig									X	
Mammal	Taphozous georgianus	Common sheath-tailed bat		X								
Reptile	Carlia munda	Shaded-litter rainbow-skink	X									
Reptile	Ctenophorus caudicinctus	Ring-tailed dragon				X						
Reptile	Ctenotus robustus	Robust ctenotus	X		X	X						
Reptile	Diporiphora albilabris	White-lipped two-lined dragon			X	X						
Reptile	Lophognathus gilberti	Gilbert's dragon			X							

APPENDIX 10. Echolocation call identification report by Dennis Matthews for calls recorded during the November 2016 on-ground survey

Echolocation call identification report

Client: Bill Low Ecological Services

Contact: Nicola Hanrahan

Date: 9/3/2017

Project: Mary River – North Australia

Important information about the call identifications presented in this report.

Echolocation call analysis is complex and many species cannot be identified by call alone. It is highly recommended for most surveys that echolocation call recording be accompanied by trapping. Call analysis normally shows the specific species that need to be trapped for confirmation of that species in the study area.

Call analysis is affected by many factors, these include the suite of species present, the quality of calls recorded (equipment settings, microphone quality, background noise from wind, insects, echoes), the quality of the reference call database for the region and the experience of the analyst.

The time taken to identify calls depends on the above and the needs of the client. Deriving a simple species inventory for each detector night is much quicker than attempting to identify every call for each detector night.

In many projects, a very low proportion of all calls recorded may be of sufficient quality to allow identification. It is a sign of the competence of the analyst to reject calls based on poor quality.

The identifications in this report are based on a combination of manual and automated methods using either reference calls from the region or from species calls recorded outside the region if they are likely to represent the calls from species in the survey region. Any doubt on species' identifications is always explained.

Species identified per night is at a very high standard and is only identified if I am sure that a species occurs in the recordings for that night. For the table data the proportion of calls (files) identified in this report is very high but with a lower reliability. That is to say that once I am sure of a species presents I lower the standard to best identify as many files as possible. This lowering is hard to put a value on but would be higher than 80% confidence. This is to allow for data on Bat Passes per night as represented in the Results Table.

This data in no way represents abundance of species per night. The bat detector microphone will record a bat file when it is loud enough to trigger the electronics. The volume of space sampled by the microphone varies, due to loudness of the call, frequency of the call, temperature and humidity. Additionally one bat may feed around a detector many times or not. Additionally the detection of Anabat detectors varies between detectors due to the sensitivity setting – there is no information as to the calibration of the Detectors.

There is NO abundance data from a Anabat Detector.

This report includes the recommendations set out in the reporting standards for echolocation call analysis developed by the Australasian Bat Society.

Dennis Matthews – dennis.matthews@bigpond.com - 0885621555

Data

Species likely to be present in the area

Chaerephon jobensis
Chalinolobus gouldii
Chalinolobus nigrogriseus
Hipposideros ater
Hipposideros stenotis
Macroderma gigas
Miniopterus orianae orianae
Myotis macropus
Mormopterus beccarii
Mormopterus cobourgiana
Nyctophilus arnhemensis
Nyctophilus daedalus
Nyctophilus geoffroyi
Nyctophilus walkeri
Pipistrellus adamsi
Pipistrellus westralis
Rhinonicteris aurantia
Saccolaimus flaviventris
Saccolaimus saccolaimus
Scotorepens greyii
Taphozous georgianus
Taphozous kapalgensis
Vespadelus caurinus
Vespadelus finlaysoni

Species that do not echolocate that are in the area (Blossum bats and Fuitbats)

Macroglossus minimus
Pteropus alecto
Pteropus scapulatus

A good list... but Bat detectors cannot separate all these species. In the Table the species groups are listed.

Results

Species found to be present (there were over 15,000 bat files (these were created from Wac files into 10 second Anabat files)

	CHGO	CHJO	MOBE?	NYSP	RHAU	SAFL	TAGE	TAKA	VECA	Species 1		Species9
Q02												
5/11/16		X	X	X			X		X	X		
Q04												
5/11/16				X						X		
R01												
3/11/16				X								
R02												
1/1/00				X						X		
2/11/16										X		
R03												
4/11/16										X		
R04												
6/11/16										X		
T01												
3/11/16		X		X		X		X	X	X		X
T02												
1/11/16	X	X		X		X				X		X
2/11/16	X	X		X				X		X		
T03												
6/11/16		X		X	X	X	X		X	X		X
T04												
4/11/16	X	X	X	X	X	X	X	X	X	X		X

Species 1 – *Scotorepens greyii* (or *S. sanborni*) or *Chalinolobus nigrogriseus*

Species 9 – *Pipistrellus westralis* or *Miniopterus orianae orianae*

NYSP – *Nyctophilus* species includes *Nyctophilus arnhemensis* or *Nyctophilus daedalus* or *Nyctophilus geoffroyi* or *Nyctophilus walkeri*

Identification

The calls were manually scanned in AnalookW and compared with known reference calls for the region held by myself and Damian Milne’s “Key to the Bats of the Top End of the

Northern Territory”. The identification is my responsibility. A species inventory was tabulated for each detector night.

Comments

Species 1 dominates the calls with possibly more than 65% of all calls.

Chaerephon jobensis was the second most common call followed by *Saccolaimus flaviventris*.

Taphozous kapalgensis calls were not well recorded, but I am confident that the species was present on the sites recorded in the table.

Nyctophilus species cannot be separated at this stage with a bat detector, these calls could represent any number of these species. About 5% of calls were *Nyctophilus* species.

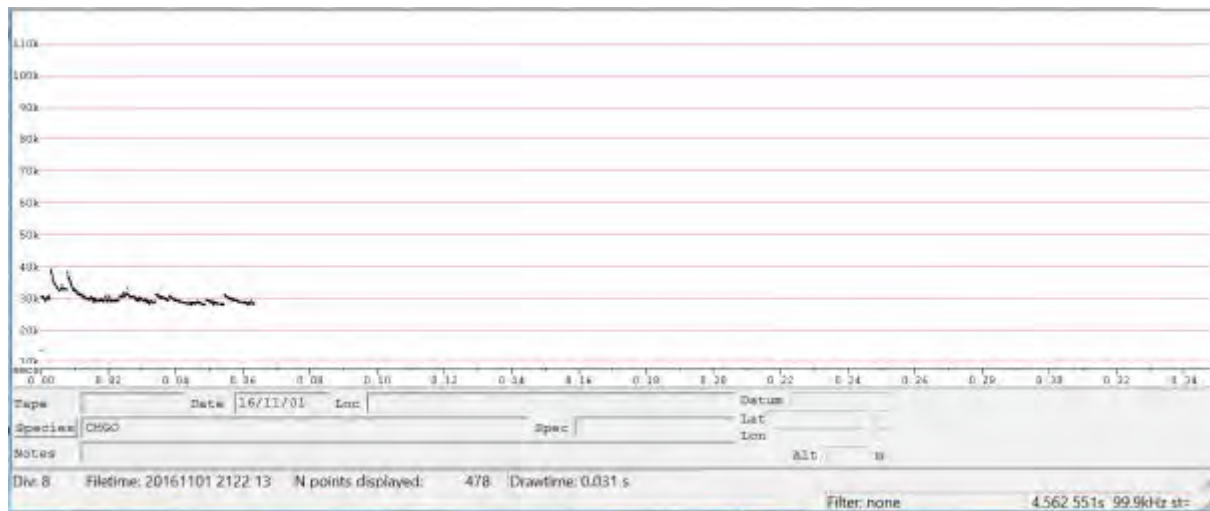
All other species were recorded by less than 5% of the total calls.

Mormopterus beccarii, has a “?” on the table, this species is of a lower reliability in the identification, but was still included as a separate species.

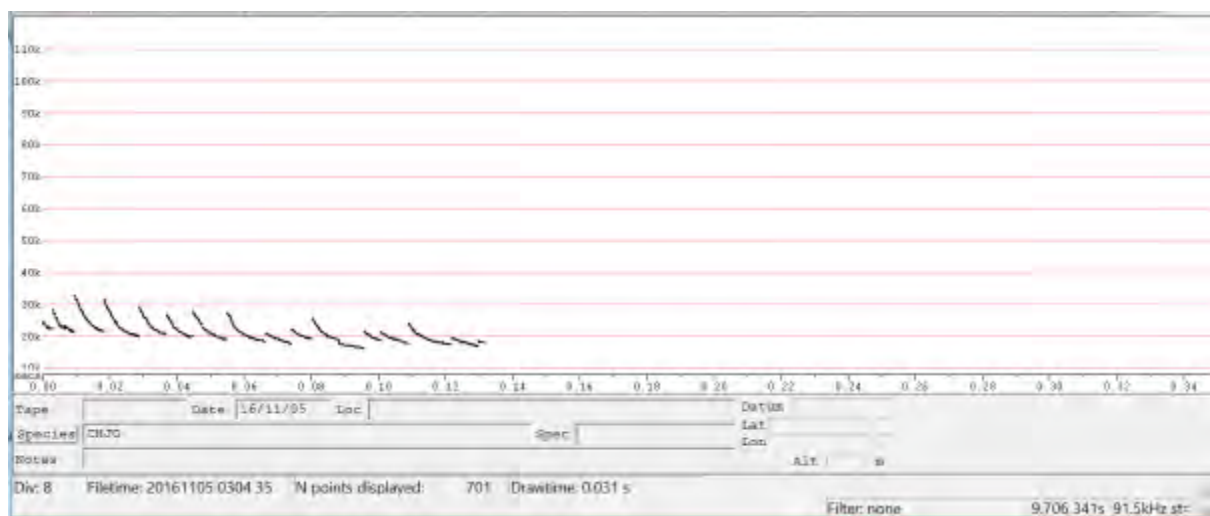
All the issues of species Id can only be resolved by trapping, with so many species overlapping in calls in the Top End, this report is the best I can do from calls alone.

SAMPLPE ANABAT FILES

Chalinolobus gouldii

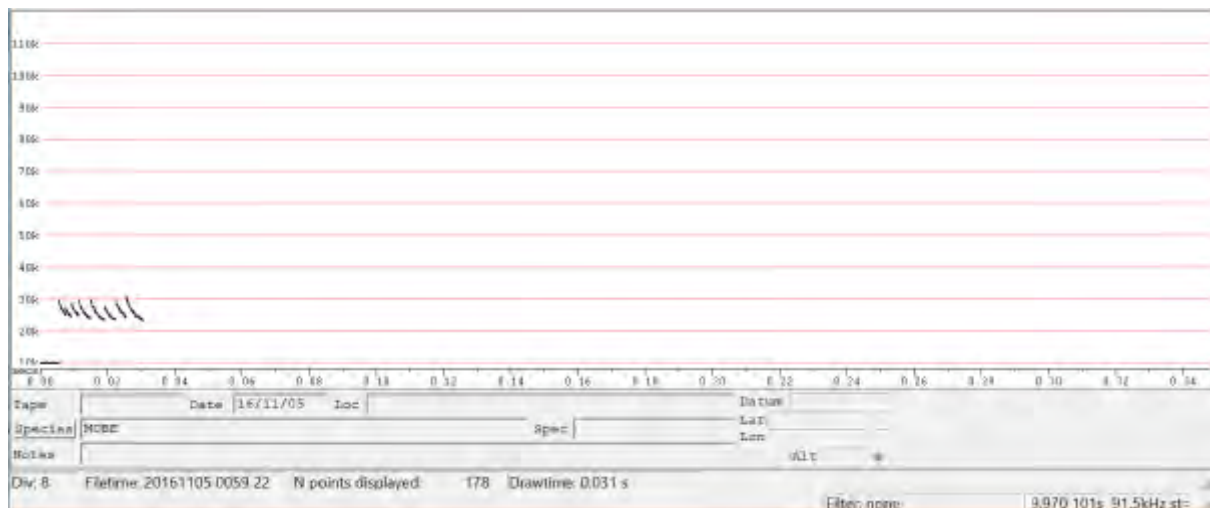


Chalinolobus jobensis

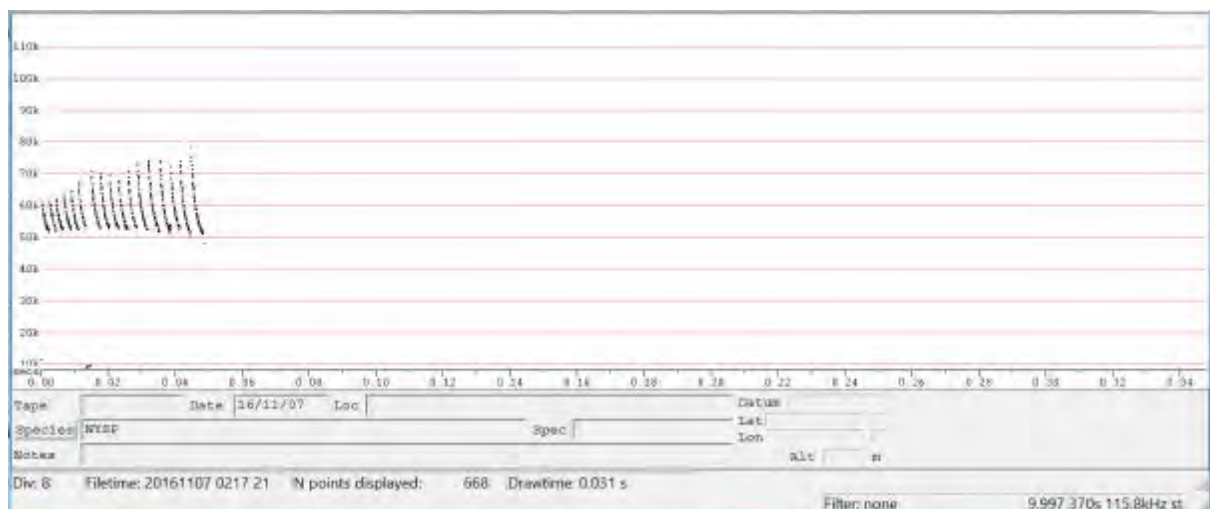


Mormopterus beccarii

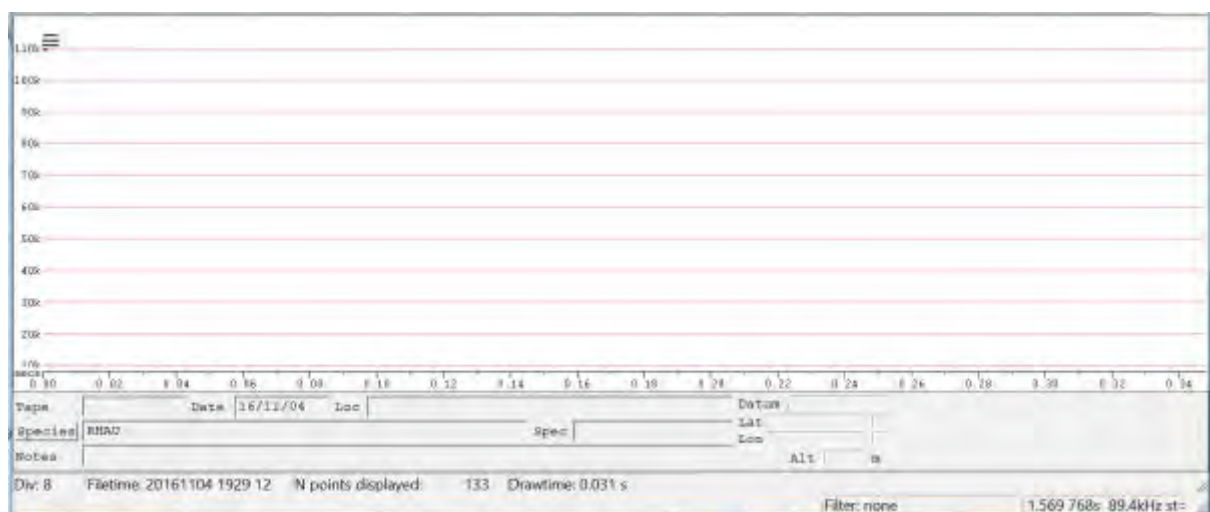
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Nyctophilus species

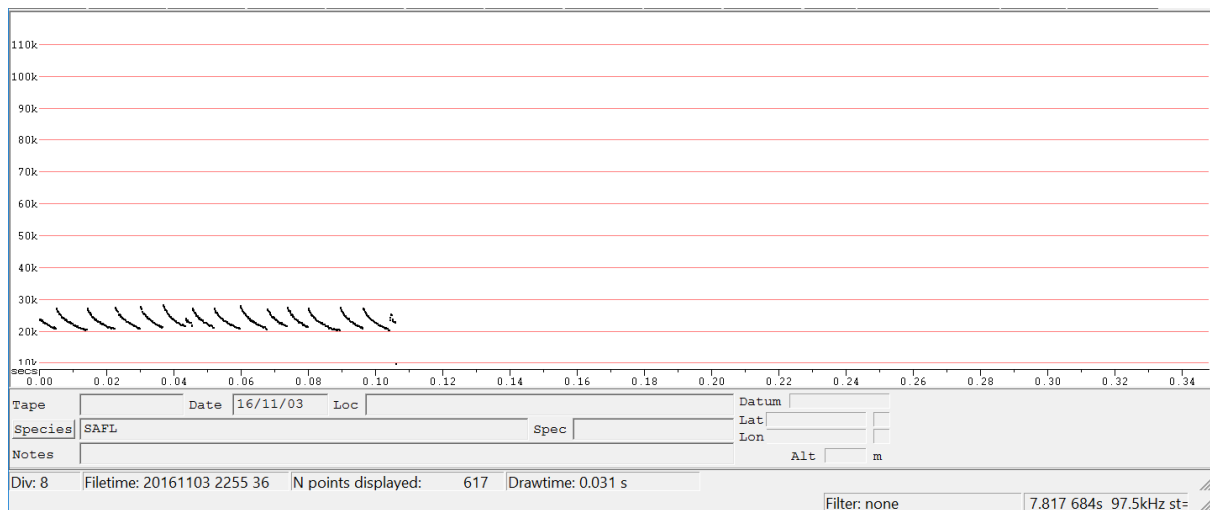


Rhinonicteris aurantius

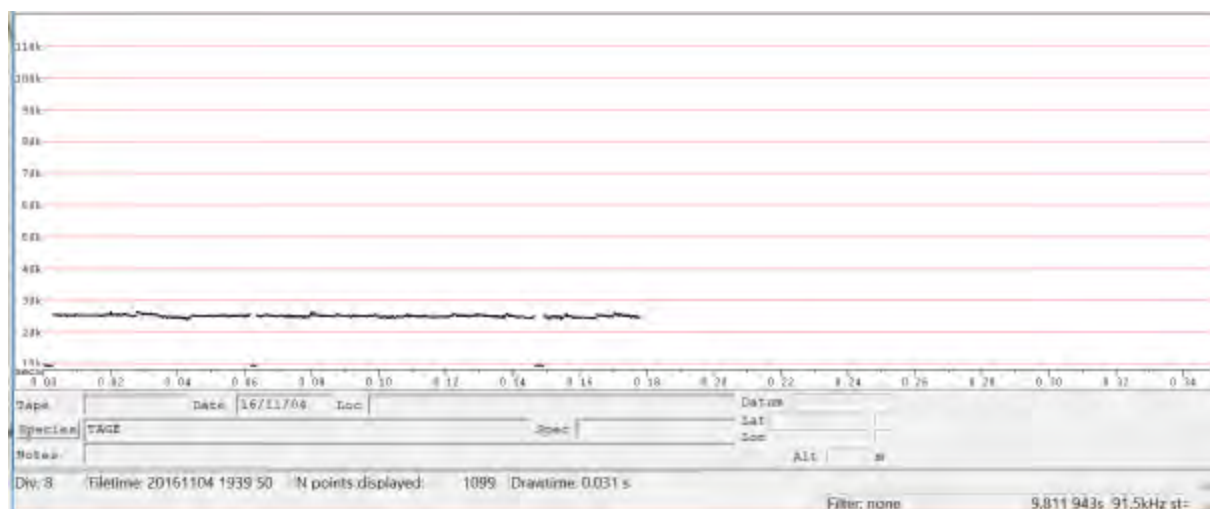


Saccolaimus flaviventris

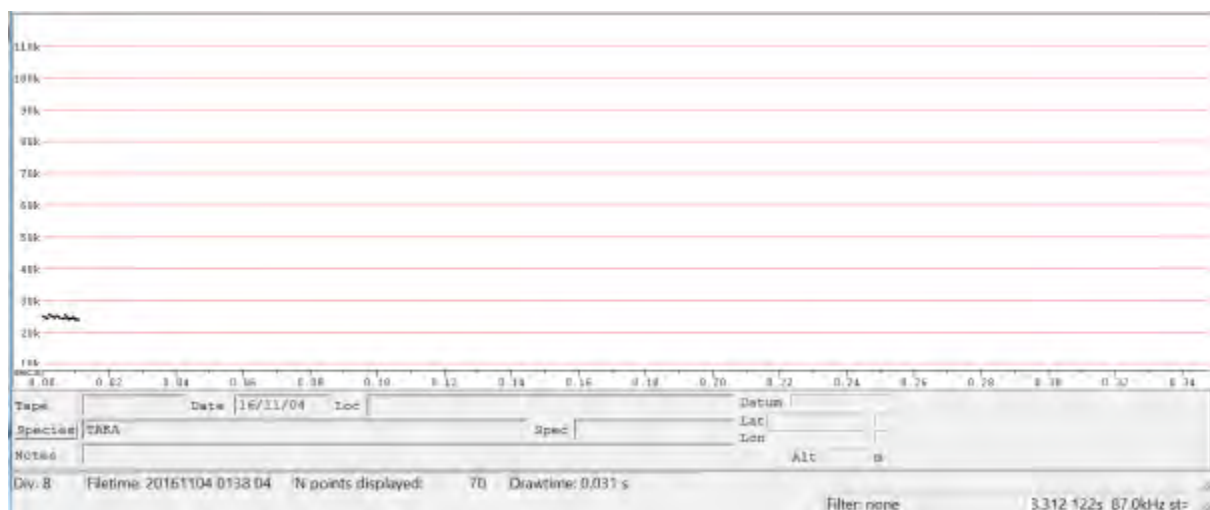
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Tapozous kapalgensis

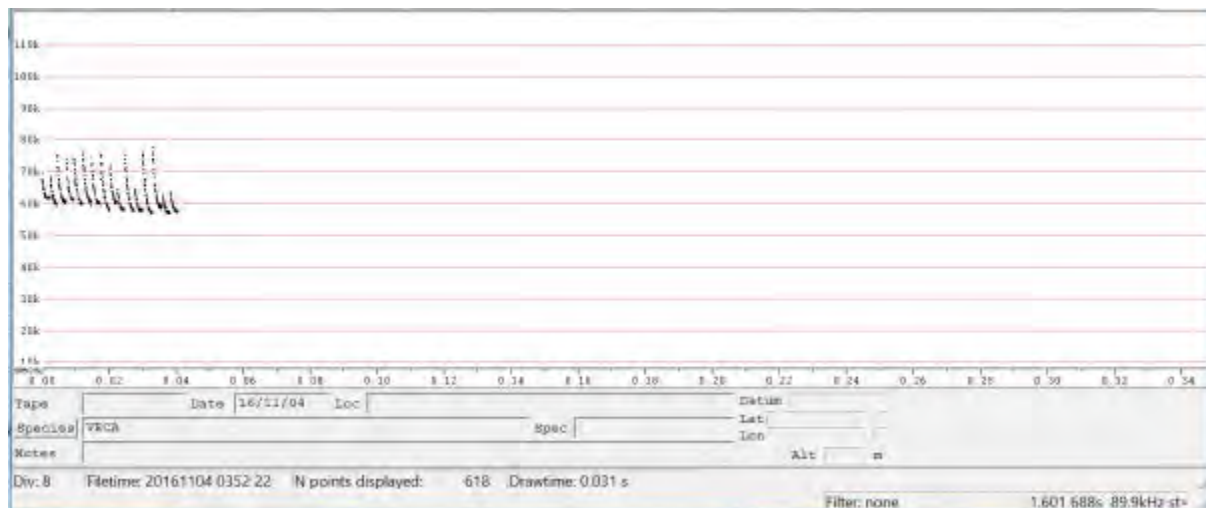


Tapozous kapalgensis

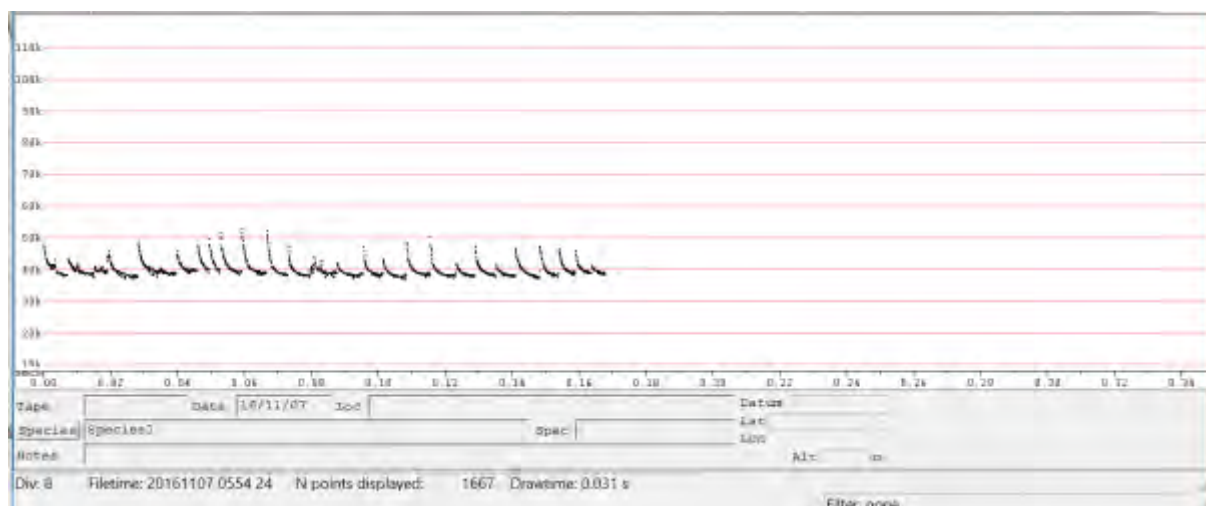


Vespadelus caurinus

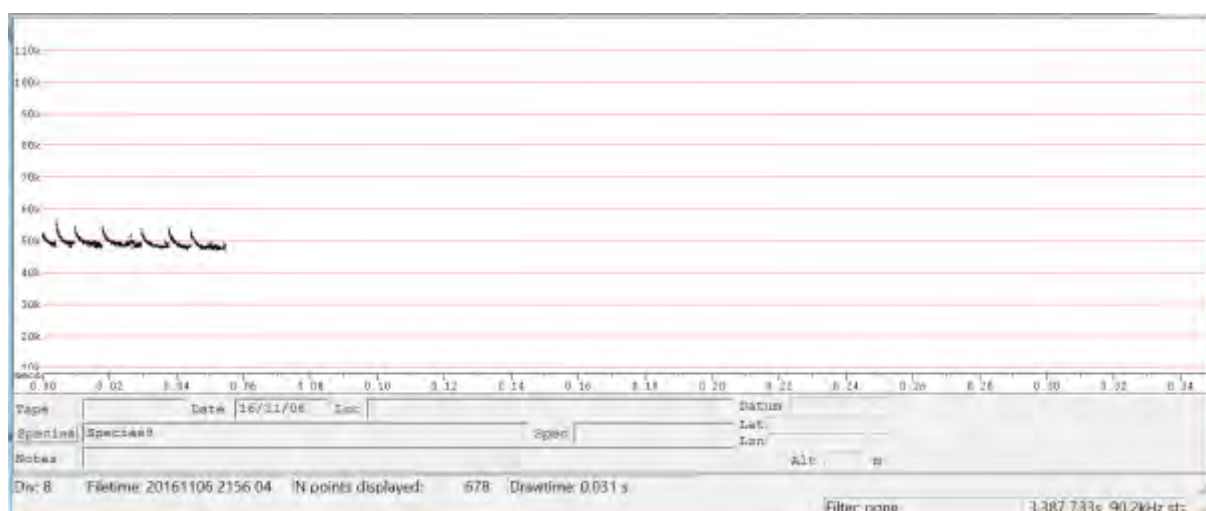
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Flora and Fauna Survey Report



Species1



Species9



APPENDIX 11. Echolocation call identification report by Dennis Matthews for calls recorded during the May 2017 on-ground survey

Echolocation call identification report

Client: Bill Low Ecological Services

Contact: Nicola Hanrahan

Date 23/6/2017

Project: Mary River and Hayes Creek – North Australia

Important information about the call identifications presented in this report.

Echolocation call analysis is complex and many species cannot be identified by call alone. It is highly recommended for most surveys that echolocation call recording be accompanied by trapping. Call analysis normally shows the specific species that need to be trapped for confirmation of that species in the study area.

Call analysis is affected by many factors, these include the suite of species present, the quality of calls recorded (equipment settings, microphone quality, background noise from wind, insects, echoes), the quality of the reference call database for the region and the experience of the analyst.

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Species identified per night is at a very high standard and is only identified if I am sure that a species occurs in the recordings for that night. For the table data the proportion of calls (files) identified in this report is very high but with a lower reliability. That is to say that

once I am sure of a species presents I lower the standard to best identify as many files as possible. This lowering is hard to put a value on but would be higher than 80% confidence. This is to allow for data on Bat Passes per night as represented in the Results Table.

This data in no way represents abundance of species per night. The bat detector microphone will record a bat file when it is loud enough to trigger the electronics. The volume of space sampled by the microphone varies, due to loudness of the call, frequency of the call, temperature and humidity. Additionally one bat may feed around a detector many times or not. Additionally the detection of Anabat detectors varies between detectors due to the sensitivity setting – there is no information as to the calibration of the Detectors.

There is NO abundance data from a Anabat Detector.

This report includes the recommendations set out in the reporting standards for echolocation call analysis developed by the Australasian Bat Society.

Dennis Matthews – dennis.matthews@bigpond.com - 0885621555

Data

Species likely to be present in the area with Codes used in the table below

<i>Chaerephon jobensis</i>	CHJO
<i>Chalinolobus gouldii</i>	CHGO
<i>Chalinolobus nigrogriseus</i>	CHNI
<i>Hipposideros ater</i>	HIAT
<i>Hipposideros stenotis</i>	HIST
<i>Macroderma gigas</i>	MAGI
<i>Miniopterus orianae orianae</i>	MIOROR
<i>Myotis macropus</i>	MYMA
<i>Mormopterus beccarii</i>	MOBE
<i>Mormopterus cobourgiana</i>	MOCO
<i>Nyctophilus arnhemensis</i>	NYAR
<i>Nyctophilus daedalus</i>	NYDA
<i>Nyctophilus geoffroyi</i>	NYGE
<i>Nyctophilus walkeri</i>	NYWA
<i>Pipistrellus adamsi</i>	PIAD
<i>Pipistrellus westralis</i>	PIWE
<i>Rhinonicteris aurantia</i>	RHAU
<i>Saccolaimus flaviventris</i>	SAFL
<i>Saccolaimus saccolaimus</i>	SASA
<i>Scotorepens greyii</i>	SCGR
<i>Taphozous georgianus</i>	TAGE
<i>Taphozous kapalgensis</i>	TAKA
<i>Vespadelus caurinus</i>	VECA
<i>Vespadelus finlaysoni</i>	VEFI

Species that do not echolocate that are in the area (Blossum bats and Fuitbats)

Macroglossus minimus

Pteropus alecto

Pteropus scapulatus

A good list... but Bat detectors cannot separate all these species. In the Table the species groups are listed.

Results

Species found to be present (there were over 18,000 bat files)

	4/5/17	5/5/17	6/5/17	7/5/17	8/5/17	9/5/17	14/5/17	15/5/17	16/5/17	17/5/17
SM2_ZC										
NYSP			X			X		X		
Species9				X			X	X		
SM3_ZC										
CHGO	X	X	X							
CHJO	X	X	X	X	X	X				
MOBE		X								
NYSP	X	X	X	X	X	X				
RHAU	X		X							
SAFL	X	X	X	X	X	X				
Species1	X	X	X	X	X	X				
Species9	X	X	X	X	X	X				
TAGE		X	X	X						
TAKA			X							
VECA			X		X					

Species 1 – *Scotorepens greyii* (or *S. sanborni*) or *Chalinolobus nigrogriseus*

Species 9 – *Pipistrellus westralis* or *Miniopterus orianae orianae*

NYsp – *Nyctophilus* species includes *Nyctophilus arnhemensis* or *Nyctophilus daedalus* or *Nyctophilus geoffroyi* or *Nyctophilus walkeri*

Identification

The calls were manually scanned in AnalookW and compared with known reference calls for the region held by myself and Damian Milne's "Key to the Bats of the Top End of the Northern Territory". The identification is my responsibility. A species inventory was tabulated for each detector night.

Comments

I HAVE NOT CORRECTED THE DATES FOR THE BAT DETECTORS.

Species1 dominates the calls with possibly more than 30% of all calls. There could easily be 2 or the three species represented in the calls, but could not be separated.

Species9 was the second most common call, both species in this group could be represented in the calls, but can not be separated.

Taphozous kapalgensis calls were not well recorded, but I am confident that the species was present on the sites recorded in the table.

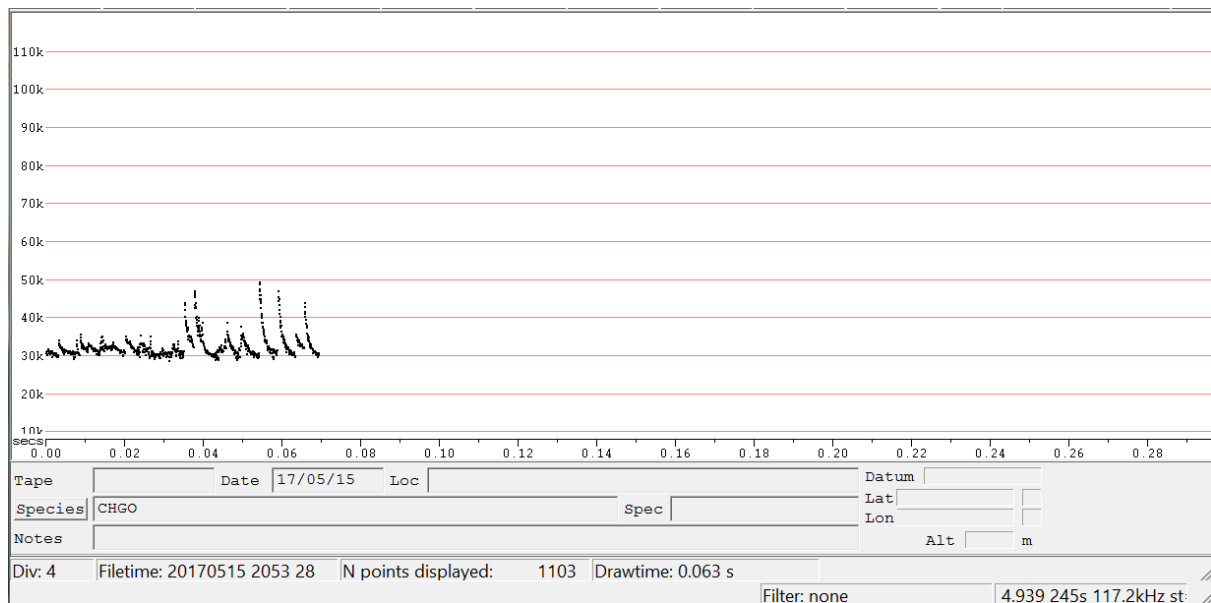
Nyctophilus species cannot be separated at this stage with a bat detector, these calls could represent any number of these species. Less than 5% of calls where *Nyctophilus* species.

All other species were recorded by less than 5% of the total calls.

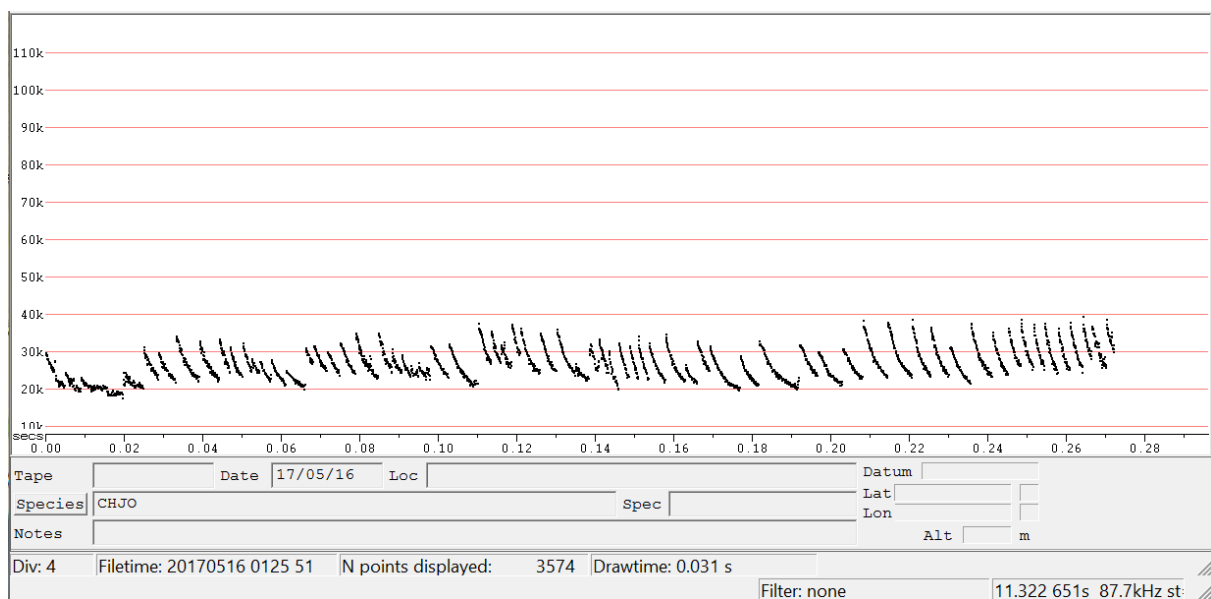
All the issues of species Id can only be resolved by trapping, with so many species overlapping in calls in the Top End, this report is the best I can do from calls alone. There were strange calls that I think are the issue of the SM3 and the conversion to ZCA files.

SAMPLER ANABAT FILES

Chalinolobus gouldii

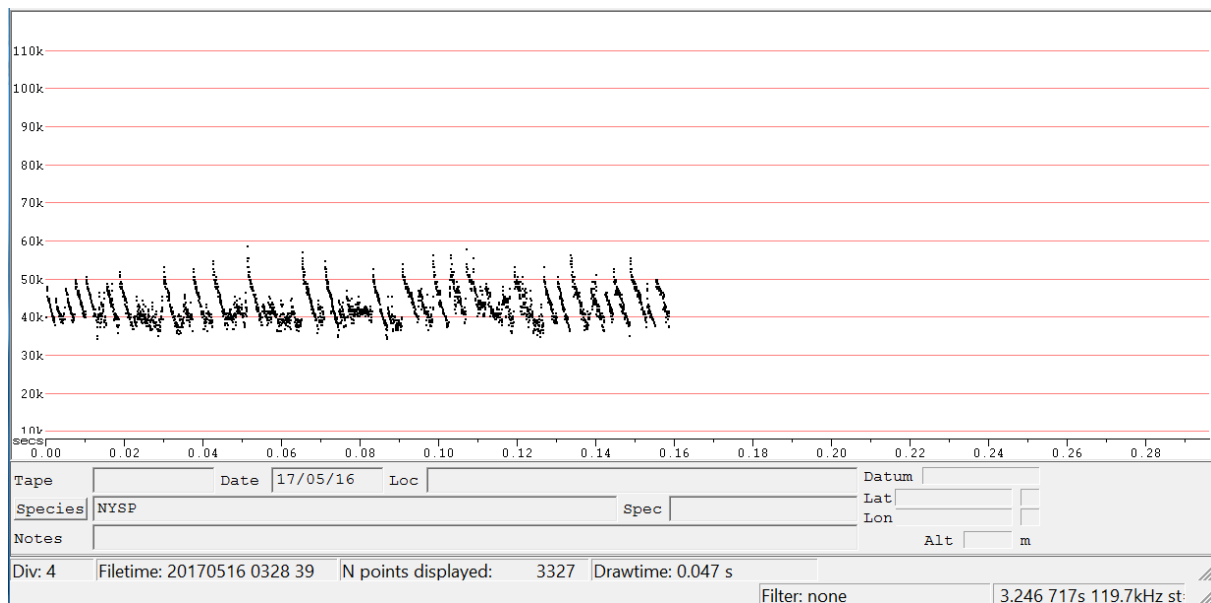


Chalinolobus jobensis

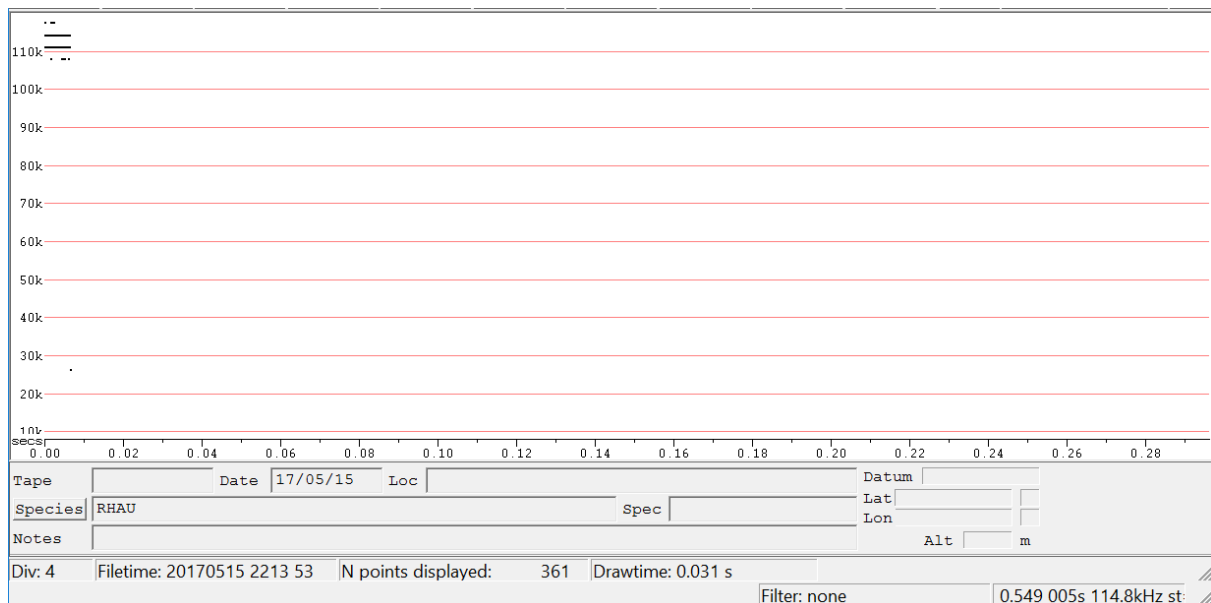


Nyctophilus species

Primary Gold Limited – Toms Gully, Rustlers Roost and Quest 29
Flora and Fauna Survey Report

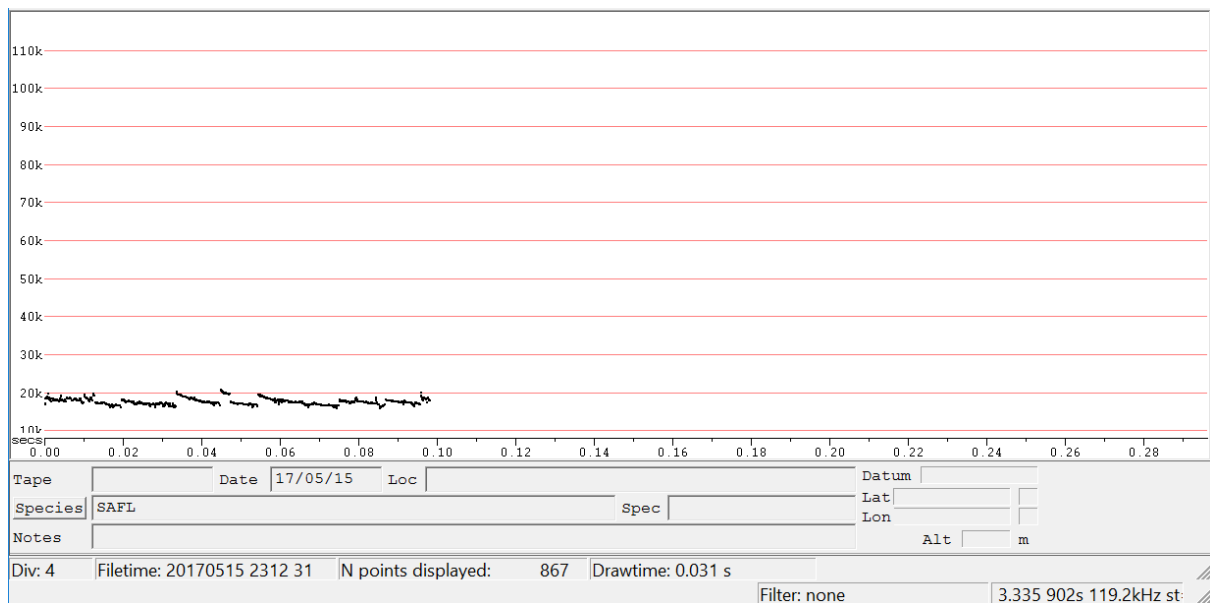


Rhinonictes aurantius

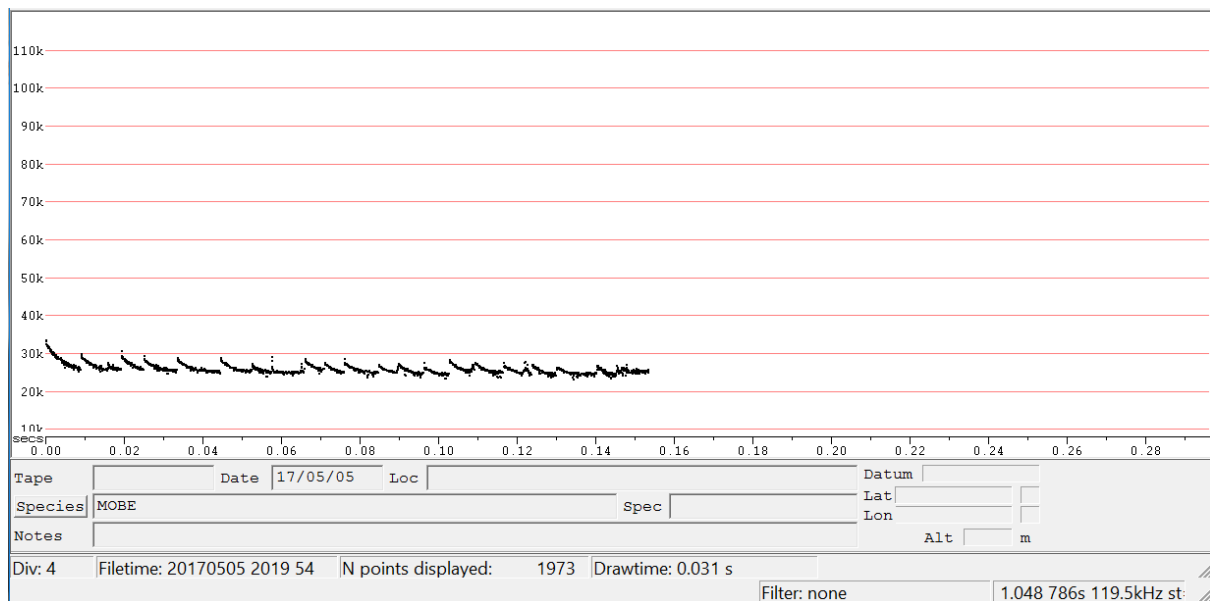


Saccolaimus flaviventris

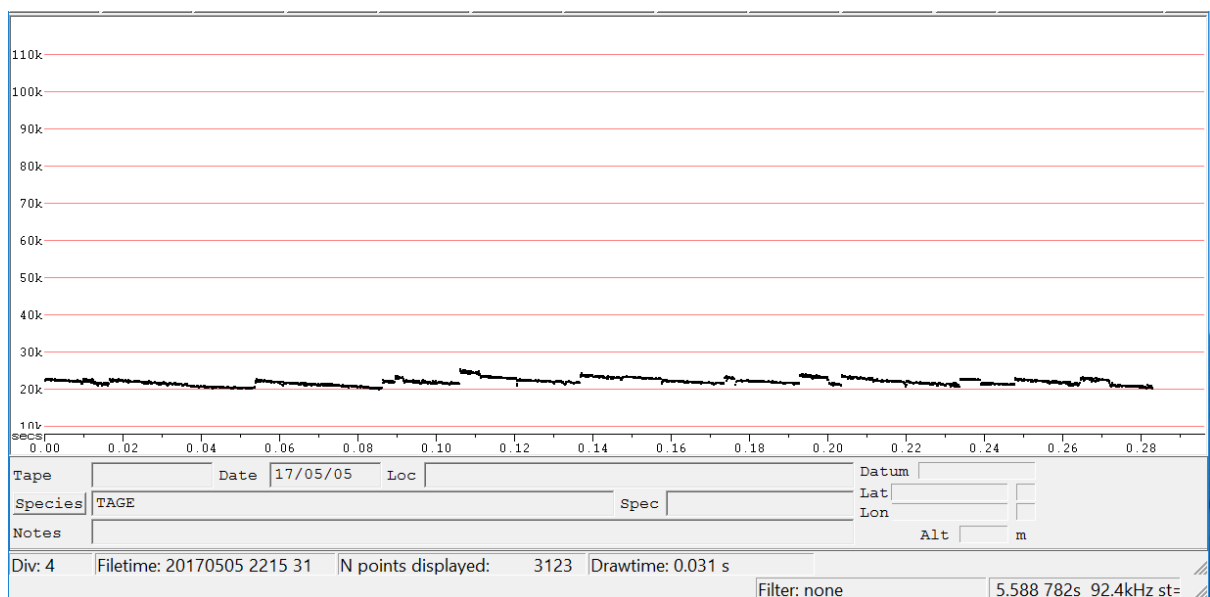
Primary Gold Limited – Toms Gully, Rustlers Roost and Quest 29
Flora and Fauna Survey Report



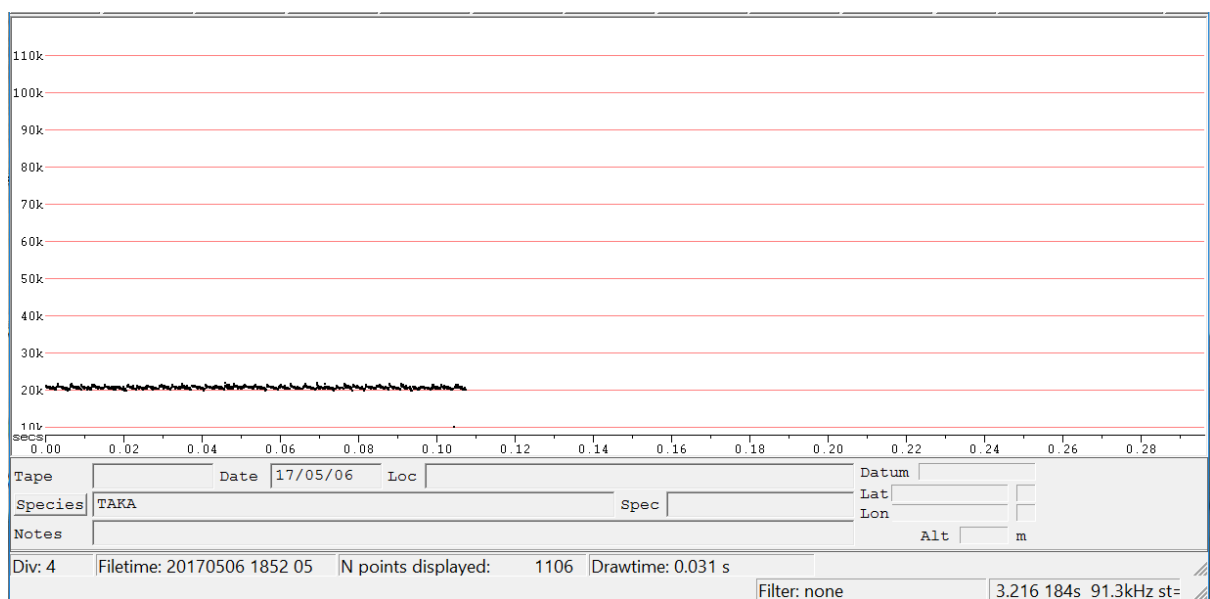
Mormopterus beccarii



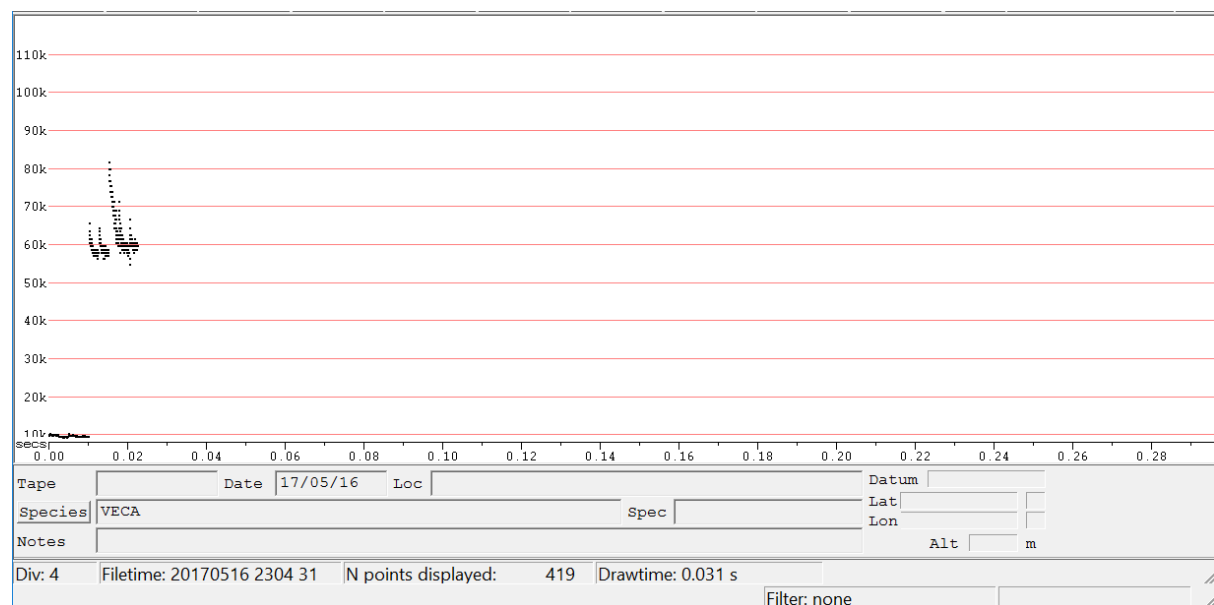
Taphozous georgianus



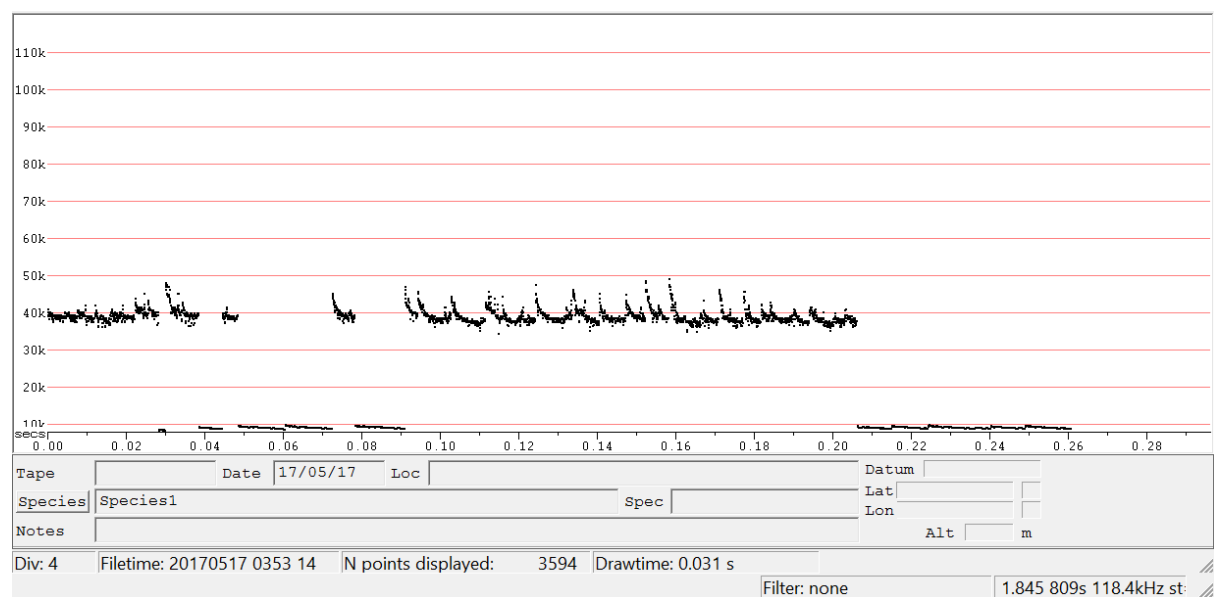
Taphozous kapalgensis



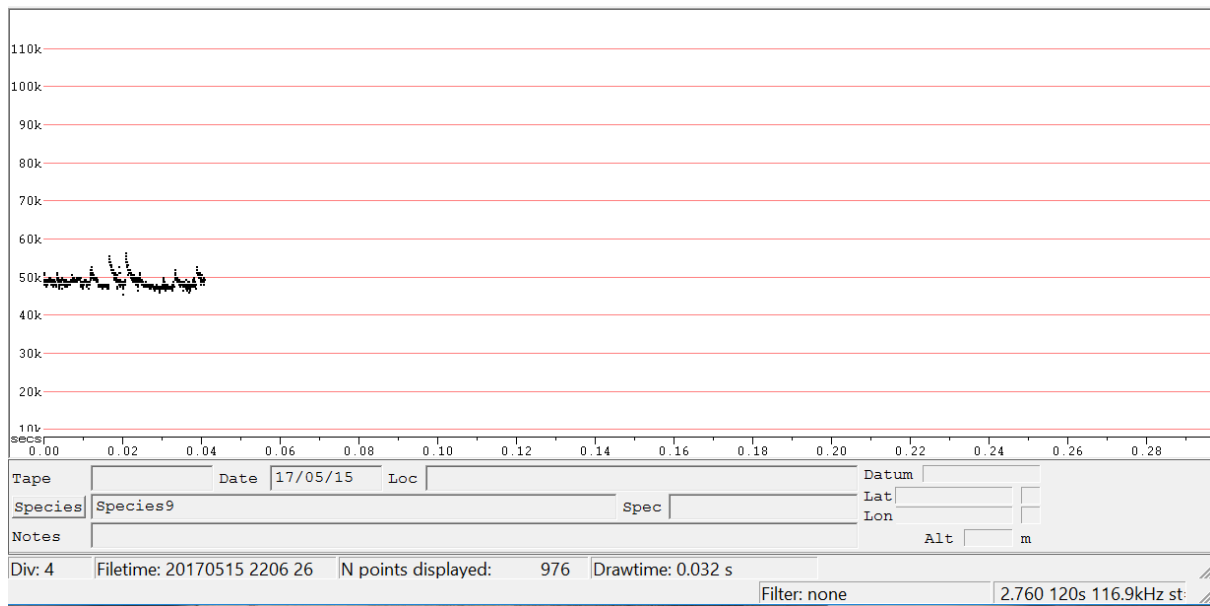
Vespadelus caurinus



Species1



Species9



Appendix K-2 - Flora and Fauna Report 2016



TOM'S GULLY, RUSTLER'S ROOST AND QUEST 29 Flora and Fauna Report

For

Primary Gold Limited

Prepared by: Low Ecological Services P/L

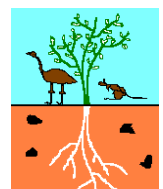
November 2016

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DOCUMENT CONTROL

DISCLAIMER

This document has been prepared by Low Ecological Services (LES) for Primary Gold Limited in accordance with an agreement with Primary Gold Limited. LES has prepared this document using the skill and care expected from professional scientists to provide factual and technical information and reasonable solutions to identified risks. It does not constitute legal advice.

ACKNOWLEDGEMENTS

LES acknowledges the assistance of Justin Robins and Josh Lowe from Primary Gold while onsite, Dennis Matthew for bat call identification, Nicholas Cuff at the Darwin Herbarium for plant identification and Garry for allowing access to their properties.

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Authors:	Lauren Young, Bill Low
Client:	Primary Gold Ltd
Name of Project:	Toms Gully, Rustlers Roost and Quest 29

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	Final	Reviewed by	Bill Low	Low Ecological Services P/L
		Submitted to	Justin Robins	Primary Gold Limited
		Reviewed by	Justin Robins	Primary Gold Limited

PREFACE

All information on proposed operations contained in this document has been supplied by Primary Gold Limited.

1 EXECUTIVE SUMMARY

Tom’s Gully, Rustlers Roost and Quest 29 are existing, non-operational mines located within the Old Mount Bundy and McKinlay River pastoral leases, approximately 90 km south-east of Darwin, Northern Territory (NT). The mines were operational for discontinuous periods from 1988 and have been in care and maintenance since 2007. Primary Gold Ltd (Primary Gold) acquired the existing mine sites in 2013 and is undergoing an EIS process via the NT EPA.

Primary Gold commissioned Low Ecological Services P/L (LES) to undertake an on-ground flora and fauna survey across areas defined by Primary Gold at Toms Gully, Rustlers Roost and Quest 29. A desktop assessment was undertaken to provide prior information of the existing environment within the survey areas and the likelihood that threatened species may occur in the areas. A number of threatened species were identified by the NT Environment Protection Authority (NT EPA) in the Toms Gully Environment Impact Statement as potentially occurring within the survey area and requested further information during contrasting seasons.

An on-site flora and fauna survey of the Toms Gully, Rustlers Roost and Quest 29 survey areas was undertaken from 1st – 7th November 2016 to assess fauna presence in the late dry season. This survey was designed to gain a detailed understanding of the environment of the survey areas, as well as to survey for species of conservation significance. Survey sites were chosen to incorporate the main habitat types in each area. Additionally, motion-sensing cameras and bat detectors were used to detect nocturnal or difficult to detect species.

The dry season survey of Toms Gully, Rustlers Roost and Quest 29 recorded nine habitats occurring within the survey area with woodland on slope, open woodland on slope and lowland woodland being the most common. There were 122 flora species from 34 families identified across nine habitat areas. No flora species of conservation significance were identified within the survey areas, in particular, targeted threatened species, *Helicteres macrothrix*, *Goodenia quadrifida* and *Schoutenia ovata* were not found in habitat deemed to be appropriate to those species. Eight introduced weedy species were recorded throughout the survey, including three declared Weeds of National Significance (WoNS). WoNS recorded within the survey sites included *Andropogon gayanus* (gamba grass), *Hymenachne amplexicaulis* (hymenachne) and *Mimosa pigra* (mimosa). Other weeds recorded included *Hyptis suaveolens* (hyptis) – an NT listed weed, *Cenchrus pedicellatum* (mission grass), *Heliotropium indicum* and *Stylosanthes viscosa*.

One hundred and thirty-nine fauna species were recorded during the on-ground surveys of Toms Gully, Rustlers Roost and Quest 29. This included 89 bird species, 20 mammal species, 15 reptile species, 12 amphibian species and three arthropod species. No threatened fauna species were recorded despite targeted survey effort for eleven potential threatened species identified by the NT Fauna Atlas and PMST.

No fauna species listed as migratory were recorded during the November 2016 on-ground survey. One species listed as near-threatened under the Territory Parks and Wildlife Conservation Act (TPWC) Act, *Rhinonycteris aurantia* (orange leaf-nosed bat), was recorded in the Toms Gully survey area. Additionally, two species listed as data deficient under the TPWC Act, *Sminthopsis virginiae* (red-cheeked dunnart) and *Varanus baritji* (black-spotted ridge-tailed monitor), were recorded in the Rustlers Roost survey area. Six introduced fauna species were recorded during surveys of Toms Gully, Rustlers Roost and Quest 29. These were cattle, water buffalo, cane toad, horse, house mouse and pig.

It is proposed that a late wet season survey is conducted to determine if any threatened species are present or detectable in the survey area seasonally.

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1 INTRODUCTION

1.1 Overview

Tom’s Gully, Rustlers Roost and Quest 29 are existing, non-operational mines located within the Old Mount Bundy and McKinlay River pastoral leases, approximately 90 km south-east of Darwin, Northern Territory (NT) (Figure 1). The mines were operational for discontinuous periods from 1988 and have been in care and maintenance since 2007. Primary Gold Ltd (Primary Gold) acquired the existing mine sites in 2013 and are proposing to conduct extensive drilling programs. Existing infrastructure at the sites includes open pits at all three sites, access roads, waste rock dumps (WRDs), tails storage facilities, evaporation dams, and drains and sumps. In addition, Toms Gully contains an underground mine, 22 Kv power reticulation, processing facility, maintenance shed and lay-down yards, stores shed and yards and administration offices.

1.2 Purpose of this report

Primary Gold commissioned Low Ecological Services P/L (LES) to undertake an on-ground flora and fauna survey across areas defined by Primary Gold at Toms Gully, Rustlers Roost and Quest 29 which will be used in the EIS process assessed by the NT EPA (Figure 1 and Figure 2). A desktop assessment was undertaken to provide prior information of the existing environment of the survey areas and the likelihood that threatened species may occur in the areas. A number of threatened fauna species were identified by the NT Environment Protection Authority (NT EPA) as potentially occurring on the Toms Gully site including:

- Yellow-snouted gecko (*Lucasium occultum*)
- *Helicteres macrothrix*
- Black-footed tree-rat (*Mesembriomys gouldii*)
- Bare-rumped sheath-tail bat (*Saccolaimus saccolaimus nudiclunatus*)
- Northern quoll (*Dasyurus hallucatus*)
- Fawn antechinus (*Antechinus bellus*)
- Pale field-rat (*Rattus tunneyi*)
- Gouldian finch (*Erythrura gouldiae*)
- Partridge pigeon (*Geophaps smithii smithii*)
- Floodplain monitor (*Varanus panoptes*)
- Merten’s water monitor (*Varanus mertensi*)
- Mitchell’s water monitor (*Varanus mitchelli*)

The on-ground survey was based on the findings of the desktop assessment, with targeted surveying for threatened species and incorporation of all major habitat types. Recording of weeds within the survey areas was also undertaken. Surveys were designed in line with the NT EPA “Guidelines for Assessment of Impacts on Terrestrial Biodiversity” and the “Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping”.

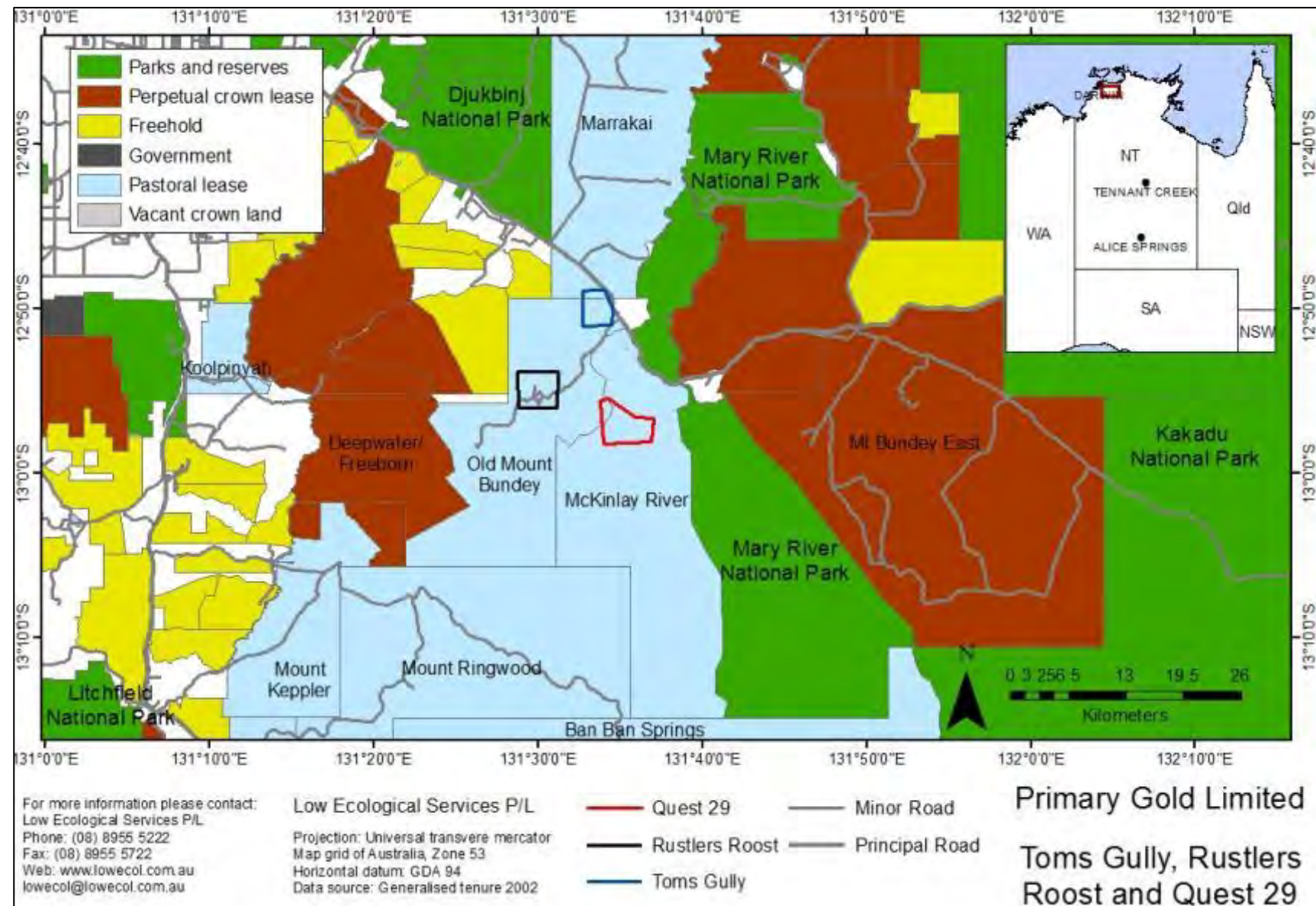


Figure 1: Location of the Toms Gully, Rustlers Roost and Quest 29 survey areas in relation to parks and reserves, crown lease, freehold land, pastoral lease and vacant crown land. Inset: location of the area within the Northern Territory.

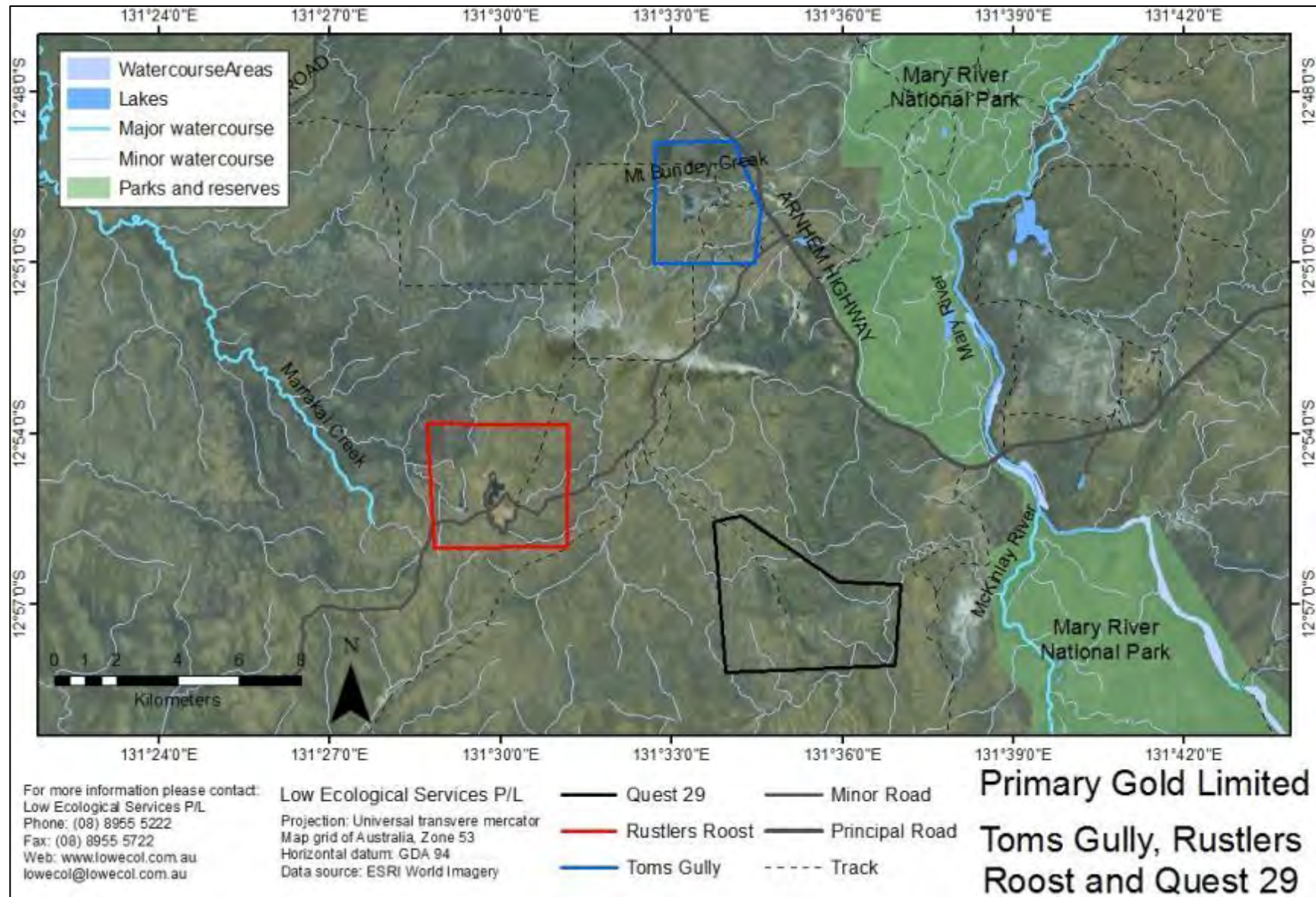


Figure 2: Location of Toms Gully, Rustlers Roost and Quest 29 in relation to watercourses, roads and Mary River National Park

1.3 Legislative context

1.3.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act is the Australian Government's key piece of environmental legislation which commenced on July 16, 2000. The objects of the EPBC Act are to provide for the protection of matters of national environmental significance (MNES) and to promote the conservation of biodiversity. The EPBC Act focuses Australian Government interests on the protection of MNES, with the states and territories having responsibility for matters of state and local significance. The EPBC Act identifies MNES as:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar wetlands).
- Threatened species and ecological communities;
- Migratory species.
- Commonwealth marine areas.
- Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development.

1.3.2 State legislation

Northern Territory Parks and Wildlife Conservation Act 2000

The NT *Parks and Wildlife Conservation Act 2000* (TPWC Act) is “an Act to make provision for and in relation to the establishment of Territory Parks and other Parks and Reserves, and the study, protection, conservation and sustainable utilisation of wildlife”. Under the TPWC Act, all threatened species are classed as protected wildlife. The Act includes ‘Principles of Management’, which require that a threatened species be managed in a manner that “maintains or increases their population or the extent of their distribution at or to a sustainable level.

Environmental Assessment Act 1982 (EA Act) and Environmental Assessment Administrative Procedures 1984

The EA Act and the Environmental Assessment Administrative Procedures 1984 is administered by the NT Environmental Protection Agency (EPA). The Act provides a framework for the assessment of potential environmental impacts of developments. The object of the Act is to ensure that matters affecting the environment to a significant extent are fully examined and taken into account in decisions by the Northern Territory Government. The assessment process also evaluates the effectiveness of the proposed safeguards to mitigate these impacts during construction and operational phases of the development.

Mining Management Act 2001

The *Mining Management Act 2001* (MM Act) is administered by the Department of Primary Industry and Resources (DPIR). The objectives of the MM Act are to ensure that mining in the NT is conducted in accordance with best practice standards for health, safety and the environment. Under the MM Act, an application for authorisation to carry out mining activities must include a Mining Management Plan (MMP).

Weeds Management Act 2001

The *Weeds Management Act 2001* is administered by the NT Department of Environment and Natural Resources (DENR). The objective of the Act is to prevent the spread of weeds in, into and out of the NT and to ensure that the management of weeds is an integral component of land management. The Act is linked to the *Northern Territory Weeds Management Strategy 1996-2005* which led to a series of Statutory Plans being developed for each declared weed. Declared weeds are grouped into three categories; Schedule A (weeds to be eradicated), Schedule B (Weeds which growth and spread must be controlled) and Schedule C (weeds not to be introduced to the Territory).

Other legislation that may be applicable to the proposed drilling includes:

General:

- *Mineral Titles Act 2016.*
- *Northern Territory Environmental Protection Authority Act 2012.*

Land Use:

- *Planning Act 2016.*
- *Aboriginal Land Act 2013.*
- *Crown Lands Act 2014.*
- *Soil Conservation and Land Utilization Act 2016.*
- *Bushfires Act 2014.*
- *Pastoral Land Act 2016.*

Cultural and Heritage:

- *Northern Territory Aboriginal Sacred Sites Act 2013.*
- *Heritage Act 2016.*

Water Quality and Biodiversity Conservation:

- *Water Act 2016.*
- *Biological Control Act 2016.*
- *Public and Environmental Health Act 2016.*
- *Weeds Management Act 2013.*

Air Quality, Noise and Waste Management:

- *Waste Management and Pollution Control Act 2016.*
- *Public and Environmental Health Act 2016.*

Safety and Environmental Compliance:

- *Work Health and Safety (National Uniform Legislation) Act 2016.*
- *Environmental Offences and Penalties Act 2011.*
- *Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2016.*
- *Dangerous Goods Act 2012.*

2 METHODOLOGY

2.1 Desktop review

Literature and database searches were undertaken to gain an understanding of the ecological context of the lease areas and to update assessments. Data collated from database searches provided information on the fauna and flora species known to occur in the region, particularly those of conservation significance. GIS mapping and a search of Australian Bureau of Meteorology (BoM) climate data were undertaken to provide an overview of the climate, soils, vegetation and habitats of the lease areas and surrounds. A literature review was performed to obtain an understanding of data available and validity thereof, within and surrounding the lease areas.

2.1.1 Database review

GIS mapping was undertaken using several data sources to provide an ecological context of the landscape, vegetation, habitats and climate of the lease areas. The sources include:

- Climate data online (BoM, 2016).
- Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway & Cresswell, 1995).
- Digital Atlas of Australian Soils (Northcote, 1968).
- NTVIS - NT Data Compilation for the National Vegetation Information System to determine vegetation communities present in the lease areas.
- Vegetation Survey of the Northern Territory Australia: Notes to accompany 1: 100, 000 Map Sheets (Wilson, et al., 1990).
- Report on the land units of the western section of Annaburroo Station (Fett & Hall 1983)
- Fire history from the North Australia and Rangelands Fire Information (2016)
- Aerial photographs and satellite imagery.

Database searches conducted provide lists of species of conservation significance that occur or are likely to occur within the vicinity of the survey areas. Species of conservation significance are those that are listed as such under the EPBC Act and/or TPWC Act.

The Commonwealth Government Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) identifies Matters of National Environmental Significance (MNES) that may occur in a given area. The PMST is based on predicted distributions of EPBC listed flora and fauna species and communities and/or their habitat, rather than known records. The PMST may predict the occurrence of a species or community in an area when there are no documented records from the area. A PMST search was conducted within a 20 km radius around the survey areas.

The NT Species Atlas which is maintained by the DENR and includes the NT Fauna Atlas, NT Flora Atlas, Sites of Conservation Significance (SoCS) and Sites of Botanical Significance (SoBS), The NT Fauna and Flora Atlas search provided a list of records of threatened, non-threatened and introduced fauna and flora species within a 20 km radius around the survey areas. A search of Sites of Conservation Significance (SoCS) and Sites of Botanical Significance (SoBS) was also undertaken to determine any SoCS or SoBS in the vicinity of the survey areas.

Geology, soil, land unit and vegetation mapping were studied to identify habitats present within the survey areas. This was then cross-referenced with information on threatened species habitat requirements obtained from the published literature and habitats in which mapped records occur, to determine if

threatened species habitat is present or likely to be present. Each species listed as threatened was then given a likelihood of occurrence in the lease areas of either low, moderate or high.

2.1.2 Literature review

A literature review provided information on the species occurring or potentially occurring within the lease areas and surrounds. Information was collated to assess the potential for species of conservation significance to occur within the lease areas and surrounds, and the likelihood that proposed operations would impact on these species of conservation significance. Sources of literature reviewed include:

- Species Profile and Threats Database (DoEb, 2015) for information about species listed in the EPBC Act – Information sheets, survey guidelines, recovery plans, and Threat Abatement Plans for Key Threatening Processes;
- Northern Territory Threatened Species fact sheets published by the Department of Land Resource Management (DENR); and
- Scientific literature (various referenced sources).

2.2 Field surveys

An on-site flora and fauna survey of the Toms Gully, Rustlers Roost and Quest 29 survey areas was undertaken from 1st – 7th November 2016. This survey was designed to gain a more detailed understanding of the environment of the survey areas, as well as to survey for species of conservation significance. Four sites in each survey area were chosen for detailed surveying and establishment of trapping grids (Figure 3). These sites were chosen to incorporate the main habitat types in each area. Additionally, motion-sensing cameras were set up at four sites in each survey area (Figure 3). Camera sites were chosen to replicate the habitat types of the trapping grids. Co-ordinates for the survey sites are provided in **Error! Reference source not found.**

2.2.1 Landscape, vegetation and flora surveys

A site description was carried out within a 50 m x 50 m quadrat at each of the nine survey sites. Site descriptions provided an overall snapshot of the landscape, geology, soil, dominant flora species and vegetation structure and density at each site. The presence of termite mounds, woody debris, impact from disturbance, weeds and current vegetation condition were also noted. Photographs were taken at each site representative of the landscape and vegetation community, facing north, south, east and west. Flora species lists were completed by doing a walkover of the quadrat. Voucher specimens were taken where plants could not be identified in the field. Voucher specimens were identified by botanists at the Northern Territory Herbarium, Darwin.

2.2.2 Fauna surveys

General survey methodology follows the NT EPA *Guidelines for Assessment of Impacts on Terrestrial Biodiversity* (NT EPA, 2013).

Survey methods used to determine the presence of threatened species follow those suggested in the *Survey Guidelines for Australia’s Threatened Mammals* (Department of Sustainability, Environment, Water, Population and Communities, 2011a) *Survey Guidelines for Australia’s Threatened Bats* (Department of the Environment, Water, Heritage and the Arts, 2010), *Survey Guidelines for Australia’s threatened reptiles* (Department of Sustainability, Environment, Water, Population and Communities, 2011) and *Survey Guidelines for Australia’s Threatened Birds* (Department of the Environment, Water, Heritage and the Arts,

2010). Targeted searches were conducted on-ground for threatened species that may occur within the appropriate habitat in the survey area as identified by the PMST and NT Flora and Fauna Atlases.

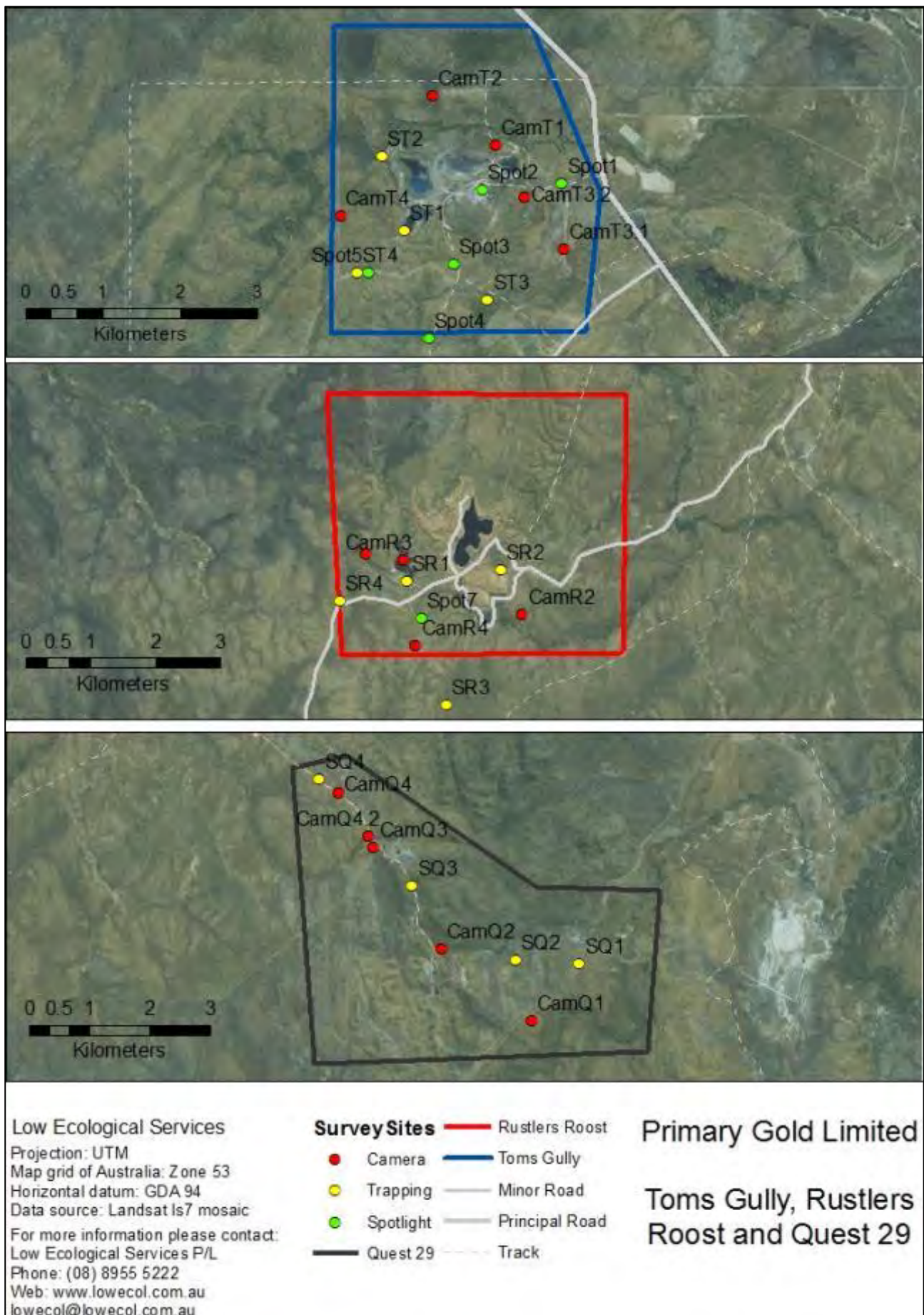


Figure 3: Location of camera, trapping and spotlight sites for surveys undertaken by LES of Quest 29, Rustlers Roost and Toms Gully

Targeted searches were conducted for the threatened species identified by the NT EPA (section 1.2). Surveys were also undertaken to target other species listed as threatened under the EPBC Act and TPWC Act identified by the PMST and NT Fauna Atlas as occurring or potentially occurring within the survey areas.

Table 1. Type of survey undertaken to target species listed as threatened under the EPBC Act and TPWC Act potentially occurring within the survey areas

Species	Habitat search	Trapping	Bat detector	Secondary sign survey	Area search	Motion-sensing camera	Spotlighting	Call playback
Red goshawk	X				X			
Gouldian finch	X				X			
Grey falcon	X				X			
Partridge pigeon	X				X			
Australian painted snipe	X				X			
Masked owl	X						X	X
Fawn antechinus	X	X						
Northern quoll	X			X		X		
Ghost bat	X		X					
Black-footed tree-rat	X	X		X		X	X	
Northern brush-tailed phascogale	X	X				X	X	
Pale field-rat	X	X				X	X	
Bare-rumped sheath-tailed bat	X		X					
Yellow-snouted gecko	X						X	
Merten’s water monitor	X	X			X			
Mitchell’s water monitor	X	X			X			
Floodplain monitor	X	X			X			

Habitat search

Searches for potentially suitable habitat for threatened species were undertaken while traversing the survey area.

Trapping

Elliott, cage and funnel traps were used at all sites. A grid of 25 Elliott traps at 10 m spacing was laid out at each of the trapping sites with a cage trap placed on the outside of each grid corner. Both cage and Elliott traps were baited with a mixture of peanut butter and oats. Four Funnel traps were placed randomly within the grid of Elliott traps, with two situated along a 10 m drift fence. When possible, pitfall traps were used, with a 10 m drift fence centred over the trap and two of the funnel traps placed at either end. Pitfall traps

were not used at all sites due to the difficulty of digging in the rocky substrate. For this reason, additional Elliott traps and funnel traps were used. Traps were checked each morning and animals processed (i.e. noting sex, reproductive status, body length, tail length, snout-vent length etc.) and removed at the point of capture. Elliott traps were closed during the day and then opened in late afternoon when pitfall and funnel traps were also checked.

Bat detectors

Two bat detectors, an SM2 and an SM3 were deployed at ten sites encompassing the three survey areas. The bat detectors were used to identify the bat species using each habitat and to determine if the threatened species, bare-rumped sheath-tailed bat and ghost bat were present. Echolocation calls recorded were identified for each species when possible and assigned to a species group when echolocation call structure overlapped. Bats were identified from the recordings by bat expert, Dennis Matthews.

Secondary sign surveys

Searches for secondary sign of fauna species (e.g. tracks and scats) were undertaken within a 250 m x 200 m quadrat at each site.

Area search

Area searches were undertaken at each of the trapping sites and camera sites while vegetation surveys were being undertaken and opportunistically while checking and setting traps.

Motion-sensing camera surveys

Motion-sensing cameras were deployed at four sites in each survey area to record shy or nocturnal species or verify species presence. Cameras were set to take pictures when triggered by movement. Camera traps were baited with peanut butter and oats. 4 cameras were set facing vertically, and all other were set facing horizontally.

Spotlighting

Spotlighting was undertaken at 12 sites within the survey areas. At each site, a walkover was undertaken while searching for eye-shine or movement of animals with a torch.

Call-playback

Call-playback was undertaken for masked owls following the method of Ward (2010), whereby:

- i) the call of the masked owl is broadcast
- ii) for the first five minutes after the broadcast, surveyors listen for calls of masked owls and watch for silhouettes of birds flying in the area around the speaker without a spotlight
- iii) in the second five minutes surveyors keep listening for owl calls but use a spotlight to look for owls in the trees around the site
- iv) when spotlighting, the surveyors do an initial scan of all the nearby trees, then spend the rest of the five minutes doing a more-careful search of the trees for owls and small mammals (potential prey)

Incidental observations

Incidental observations of fauna species were recorded at all times and all habitats during the field surveys.

2.2.3 Other

GPS locations and extent of weed infestations were recorded. Where possible, GPS locations of large mature trees of cultural significance were taken.

2.2.4 Limitations of the surveys

Records obtained from the NT Fauna and Flora Atlases display records from areas which have been surveyed previously. The lack of records at a locality commonly represents a lack of survey effort as opposed to the absence of various species in the area.

While invertebrates captured in traps were recorded, there are limited existing data and identification tools available for terrestrial invertebrates in the Top End. Therefore, only casual attempt was made to identify any trapped invertebrates to group, genus or species level. No targeted survey for invertebrates was undertaken during the on-ground survey, as this was not a part of the scope of works.

LES has attempted to carry out surveys at an appropriate spatial scale for the proposed development. While this will increase the chances of obtaining sufficient data required to detect the presence of threatened species, it cannot be guaranteed that the species lists are complete.

Surveys were aimed at detecting appropriate landscapes and assessing the potential presence of threatened species within the survey areas. Population surveys for abundance and density were not conducted within the survey areas and surrounds.

3 EXISTING ENVIRONMENT

3.1 Climate

The Proposal area has a tropical monsoonal climate, with distinct wet and dry seasons. The closest Australian Bureau of Meteorology climate station to the Proposal area with consistent records is Darwin Airport approximately 85 km north-west. Annual rainfall averages 1727.5 mm, with approximately 90% occurring between November and April (Figure 4). Average temperatures vary little over the year, with average maximum temperatures being above 30°C in all months of the year and average minimum temperatures ranging from 19.3°C in July to 25.3°C in November and December (Figure 4).

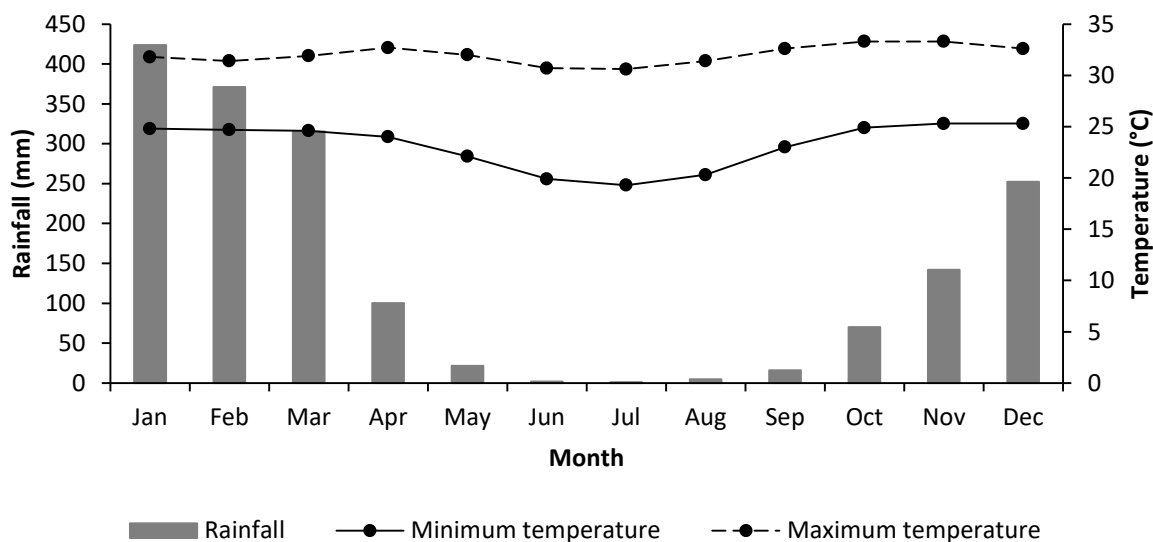


Figure 4: Monthly average rainfall and average minimum and maximum temperature at Darwin Airport based on data from the Bureau of Meteorology’s Climate Data Online (Bureau of Meteorology, 2016).

3.2 Bioregion

The Interim Biogeographic Regionalisation of Australia (IBRA) provides a division of Australia into geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information (Department of Sustainability, Environment, Water, Population and Communities, 2012a). Toms Gully, Rustlers Roost and Quest 29 lie within the Pine Creek bioregion (Figure 5).

The Pine Creek Bioregion consists mainly of rugged ridges and undulating plains with eucalypt woodlands and patches of monsoon forest (Bastin & ACRIS Management Committee, 2008). Land use types in the bioregion include aboriginal, conservation, pastoralism, rural freehold, horticulture and mining (Bastin & ACRIS Management Committee, 2008). The Pine Creek bioregion is characterised by extensive and high frequency fire (Bastin & ACRIS Management Committee, 2008).

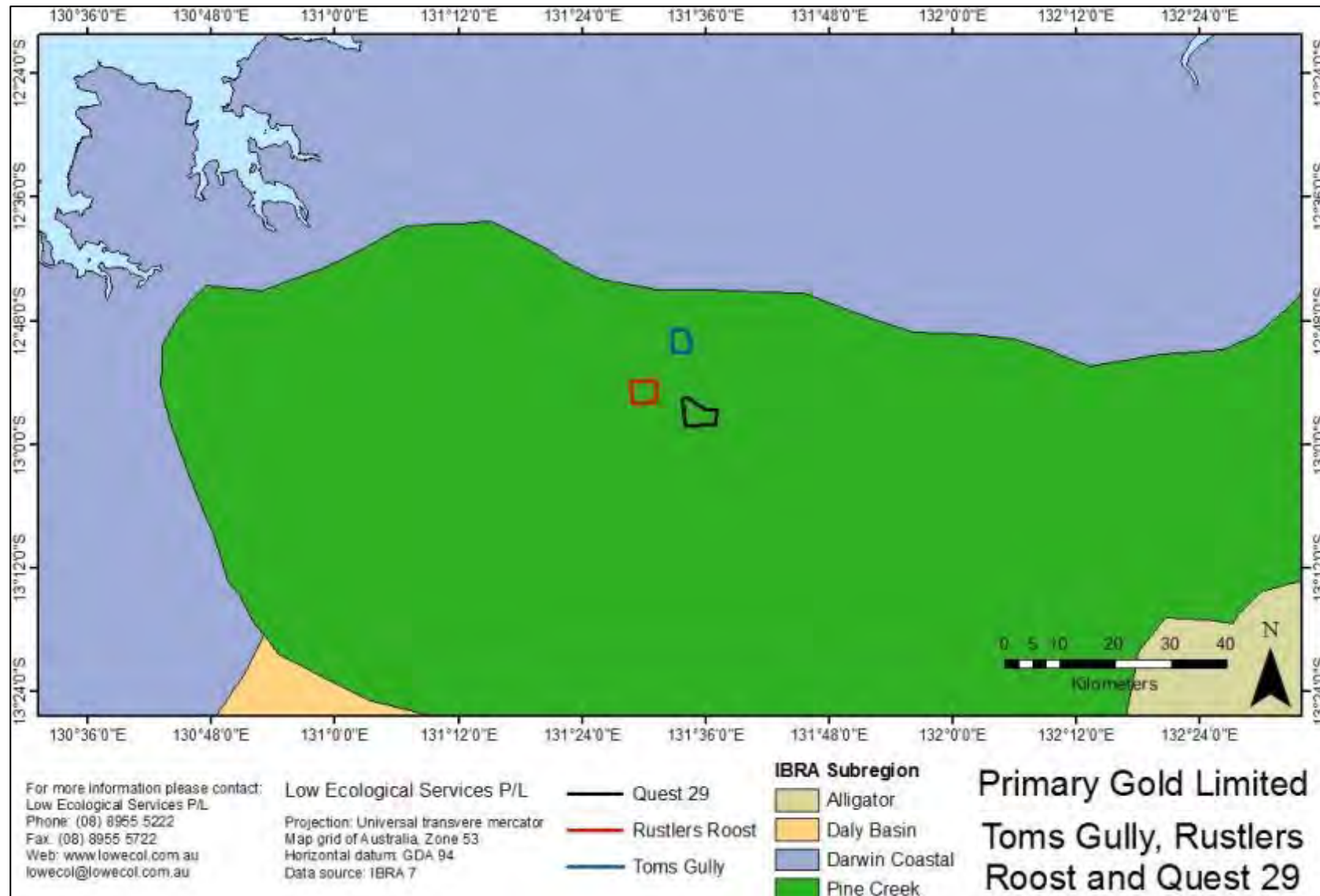


Figure 5: Interim Biogeographic Regionalisation for Australia (IBRA) bioregions in relation to Toms Gully, Rustlers Roost and Quest 29 (Department of Sustainability, Environment, Water, Population and Communities, 2012a).

3.3 Geology

The geological units of the survey areas are described in Table 2 and mapped in Figure 6. The Toms Gully area consists of geological units P2, P3 and g5. The Rustlers Roost area consists of geological units P3 and P4. The Quest 29 area consists of geological units P3, P4 and g5.

Table 2: Geological units present within Toms Gully, Rustlers Roost and Quest 29 as described by Ahmad (2000)

Map unit	Rock type	Description
P2	Sedimentary	Sandstone, shale
P3	Sedimentary	Greywacke, shale, siltstone, tuff, phyllite, chert, carbonaceous shale, banded iron formation (BIF), dolostone
P4	Sedimentary	Greywacke, shale, siltstone, sandstone
g5	Plutonic	Granite

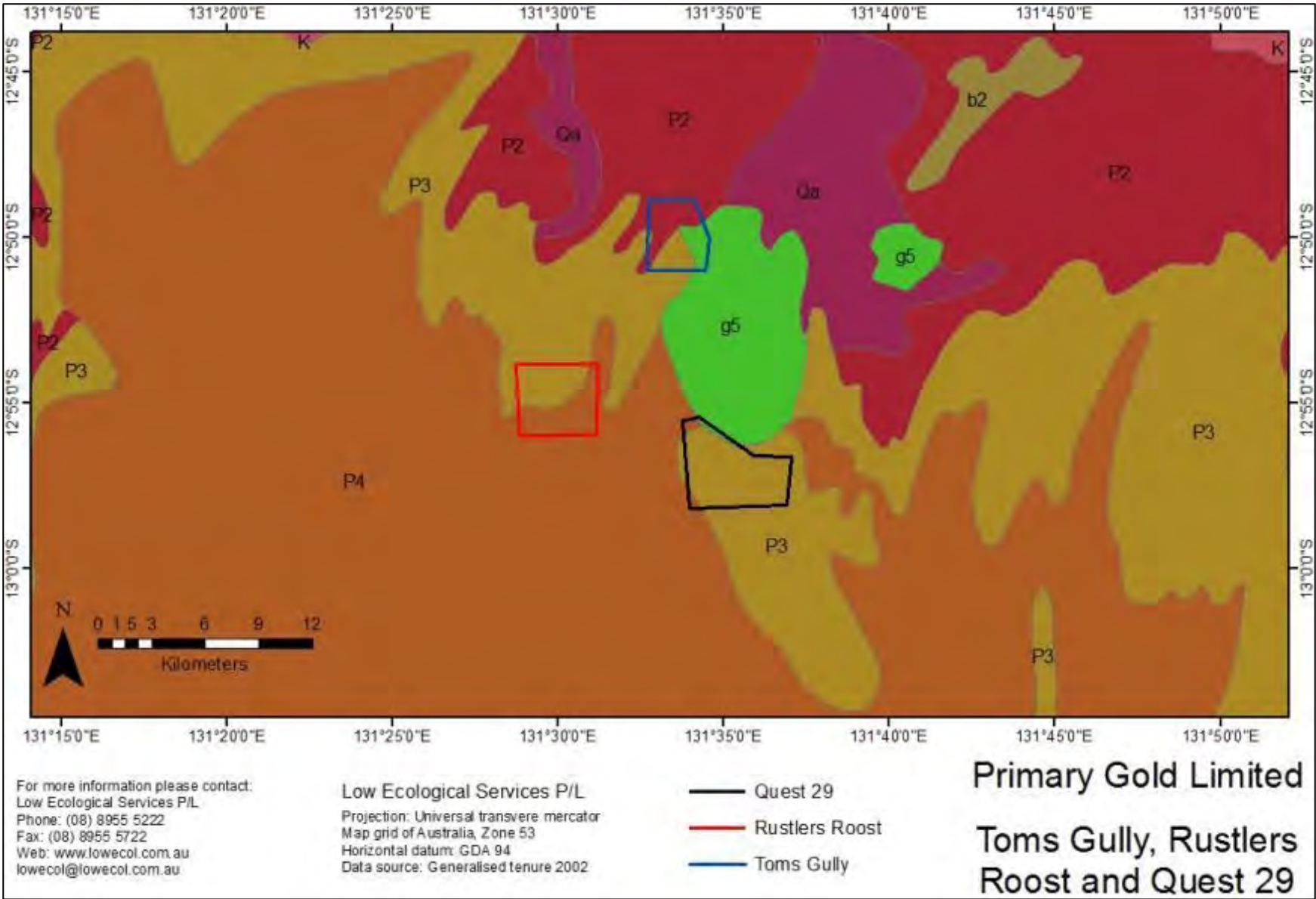


Figure 6: The Geological Map of the Northern Territory (Ahmad 2000) within and surrounding Toms Gully, Rustlers Roost and Quest 29. Geological units within the three areas are described in Table 3.

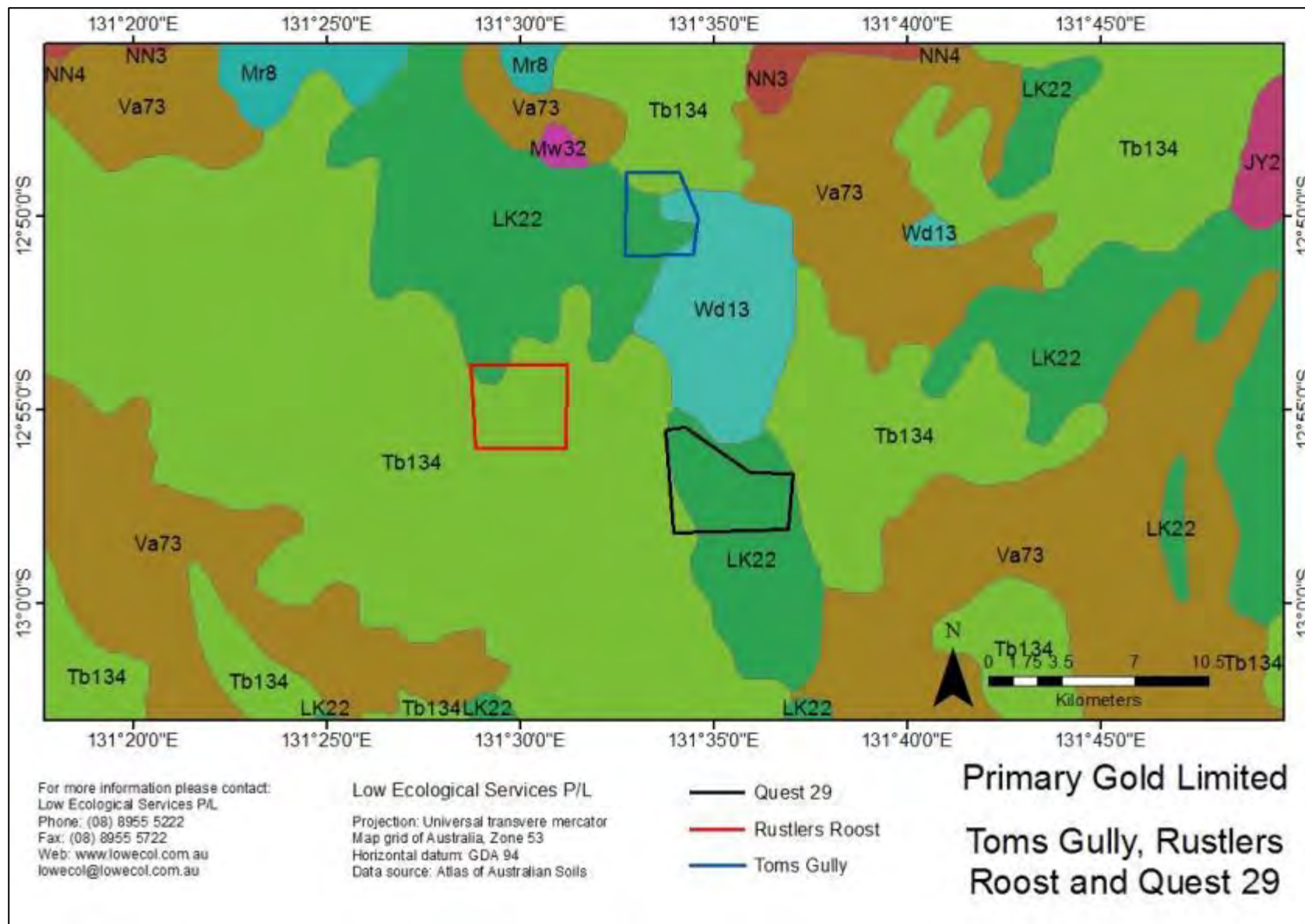
3.4 Soils

Soil types in the lease areas have been mapped using the Atlas of Australian Soils (mapped by Bureau of Rural Sciences after Commonwealth Scientific and Industrial Research Organisation, 1991; described by Northcote et al., 1968). However, because the currently accepted classification system is the Australian Soil Classification (ASC) (Isbell & National Committee on Soil and Terrain, 2016) a conversion from the Atlas of Australian Soils to Australian Soil Classification was developed by (Ashton & McKenzie, 2001). Soil units within Tom’s Gully, Rustlers Roost and Quest 29 include LK22 and Tb134. Soil unit Wd13 is also within Tom’s Gully. The soil units are described along with the ASC conversion in Table 3 and mapped in relation to the three areas in Figure 7.

Table 3: Description of soil types, including Australian Soils Atlas Description by Northcote et al. (1968) and Australian Soil Classification conversion by Ashton & McKenzie (2001)

Map unit	Australian Soils Atlas Description	ASC Conversion
Tb134	Strongly undulating to hilly lands on greywacke, siltstones, and sandstones with rock outcrops, and interspersed with gently sloping to flat-floored valleys of variable size and extent: soil dominance varies markedly between the valleys and the hilly portions. Chief soils of the basal hill slopes and the valleys are hard acidic, and also neutral, yellow mottled soils (Dy3.41 and Dy3.42), sometimes with (Dy3.43) and usually in association with yellow and grey earths such as (Gn2.24) and (Gn2.95). Chief soils of the hill slopes are shallow stony and gravelly loams (Um4.1), (Um1.4) and sands such as (Dr2.21), (K-Dy2.21), and (Dr2.51) and yellow earths such as (Gn2.34) and (Gn2.74). Small areas of other soils, such as (Gn2.1), occur on included andesites and dolerite sills.	Sodosol: Soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is sodic and not strongly acidic. Hydrosols and soils with strongly subplastic upper B2 horizons are excluded.
Wd13	Undulating to rolling and hilly terrain on granites; many rock outcrops and tors on crests and upper slopes: chief soils are sandy acidic yellow mottled soils (Dy5.81) with (Dy4.81) and (Dr4.81) on the undulating to rolling areas. Associated are (KS-Dy5.81) and (Dy5.81) containing ironstone gravels on gently undulating to flat portions, and gritty and gravelly sands (Uc4.12) and possible (Uc5.2) on crests and upper slopes. The (Uc) soils are dominant in some localities.	Tenosol: Soils with generally only weak pedologic organisation apart from the A horizons. Encompasses a diverse range of soils that do not fit the requirements of any other soil orders and generally with one or more of the following: i. A peaty horizon. ii. A lumose, melacic or melanic horizon, or conspicuously bleached A2 horizon, which overlays a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite or unconsolidated mineral materials. iii. A horizons which meet all the conditions for a peaty, humose, melacic or melanic horizon except the depth requirement, and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials. iv. A1 horizons which have a more than weak development of structure and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or

		decomposed rock or saprolite, or unconsolidated mineral materials.
		v. An A2 horizon which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
		vi. Either a tenic B horizon, or a B2 horizon with 15% clay (SL) or less, or a transitional horizon (C/B) occurring in fissures in the parent rock or saprolite which contains between 10 and 50% of B horizon material (including pedogenic carbonate).
		vii. A ferric or bauxitic horizon >0.2 m thick.
		viii. A calcareous horizon >0.2 m thick.
LK22	Hilly to steep hilly ranges and strike ridges mainly on greywacke, siltstones and some sandstones; a surface stone cover is common; rock outcrops are frequent; chief soils of the hill slopes are shallow stony and gravelly loams (Um4.1), (Um1.4) and sand (Uc4.1) and (Uc2.12). Associated are variable areas of stony and gravelly (D) soils such as (Dr2.21), (K-Dy2.21), and (Dr2.51). Other soils include yellow earths such as (Gn2.24), (Gn2.34), and (Gn2.74), and red earths such as (Gn2.1) on dolerite sills and andesites.	Tenosol



Figure

7.

3.5 Land units

Land unit mapping of the area by Fett & Hall (1983) is available at a scale of 1:25,000. Land units in the Toms Gully, Rustlers Roost and Quest 29 survey areas are described in Table 4 and mapped in Figure 8.

Table 4: Description of land units within Toms Gully (T), Rustlers Roost (R) and Quest 29 (Q) as described by Fett & Hall (1983).

Land Unit	Site	Landform	Soil description	Vegetation
2a	Q	Rugged terrain associated with siltstones and greywacke of Burrells Creek formation and Upper Proterozoic dolomites and sandstones; slopes >10%; surface stone and outcrop extensive	Very shallow stony lithosols (rudosols)	<i>Corymbia polysciada</i> , <i>Eucalyptus miniata</i> , <i>Corymbia dichromophloia</i> and <i>Erythrophleum chlorostachys</i> woodland/low open woodland with a <i>Chrysopogon fallax</i> , <i>Triodia bitextura</i> , <i>Heteropogon triticeus</i> mixed spp. tussock grass understorey
2b	R, Q, T	Low hills and strike ridges; ridges same lithologies as 2a; relief between 5-50 m; slope gradients between 5-20%; extensive surface stone outcrop of siltstone and greywacke; 5-60 % surface gravel and stone in some areas	Shallow stony and gravelly lithosols, and mottled yellow earths (Kandosols)	<i>Corymbia polysciada</i> ; <i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Corymbia dichromophloia</i> and <i>Erythrophleum chlorostachys</i> woodland/low open woodland with a <i>Chrysopogon fallax</i> , <i>Triodia bitextura</i> <i>Heteropogon triticeus</i> mixed spp. tussock grass understorey
2c	T	Hillslopes; slope 1-5%; occasional outcrop of siltstone and greywacke; 20-60% surface gravel	Moderately deep gravelly red and yellow earths (kandosols)	<i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Erythrophleum chlorostachys</i> and <i>Corymbia bleeseri</i> open woodland/woodland
2d	T	Granite hills with steep slopes; extensive boulders and outcrop; relief up to 120 m	Very little soil material, areas of coarse shallow sand between stone outcrops (rudosols)	<i>Corymbia polysciada</i> , <i>Eucalyptus tetradonta</i> , <i>Corymbia foelscheana</i> , <i>Eucalyptus miniata</i> and <i>Erythrophleum chlorostachys</i> woodland/open woodland
3a	R, Q, T	Low erosional rises; rounded crests and upper slopes <5%; 1-15 m relief; occasional outcrop; 30-100% surface gravel	Gravelly yellow brown and yellow lithosols up to 1 m deep overlying friable weathered siltstone and greywacke (Kandosols)	<i>Corymbia clavigera</i> , <i>Erythrophleum chlorostachys</i> , <i>Corymbia foelscheana</i> and <i>Calytrix</i> spp. low woodland; minor <i>Eucalyptus tectifica</i> and <i>Corymbia bleeseri</i> woodland; mixed spp. tussock grassy understorey
3a1	T	Undulating terrain slopes less than 5%	Deep sandy red earths; minor red earthy sands (kandosols)	<i>Eucalyptus tetradonta</i> and <i>Eucalyptus miniata</i> woodland to open forest
3b	R, Q, T	Erosional slopes 1-4%; sometimes below 3a, 2b and 2c; slopes <5% in some areas; 0-100% surface gravel	Shallow gravelly yellow, yellow brown and grey lithosols and gravelly yellow and brown earths (kandosols)	<i>Corymbia grandifolia</i> , <i>Corymbia polysciada</i> , <i>Corymbia foelscheana</i> , <i>Erythrophleum chlorostachys</i> , <i>Calytrix</i> spp. and <i>Buchanania obovata</i> woodland/low woodland; minor <i>Eucalyptus miniata</i> , <i>Eucalyptus tectifica</i> and <i>Corymbia bleeseri</i> woodland

Land Unit	Site	Landform	Soil description	Vegetation
4a	R, Q, T	Colluvial slopes between 3a and 3b; occasionally below 2b in southern areas; slopes <5%; up to 500 m wide; relief 10 m	Shallow to moderately deep yellow earths; indistinct mottling in B horizon; scattered low termitaria (kandosols)	<i>Erythrophleum chlorostachys</i> , <i>Eucalyptus miniata</i> mixed species woodland with <i>Sorghum plumosum</i> , <i>Themeda triandra</i> , <i>Chrysopogon fallax</i> and <i>Heteropogon triticeus</i> tussock grass understorey
4b	Q	Colluvial slopes below 3b and 4a above alluvial areas; slopes <2%; commonly 200 m to 800 m wide; relief <5m	Moderately deep to deep yellow; distinct mottling in sub-soil; minor debil debil; scattered large termitaria; waterlogged for short periods (hydrosols)	<i>Corymbia polycarpa</i> , <i>Corymbia grandifolia</i> , <i>Vitex glabrata</i> and <i>Lophostemon lactifluus</i> woodland with <i>Sorghum plumosum</i> , <i>Themeda triandra</i> , <i>Chrysopogon fallax</i> and <i>Eriachne burkittii</i> tussock grass understorey
5b	R, Q	Alluvial plains up to 3 km wide; negligible slope	Mottled yellow duplex (solodic) soils; shallow, hard setting and pulverulent A horizon over a dense, mottled B horizon, well developed debil debil (hydrosols).	<i>Corymbia polycarpa</i> , <i>Corymbia bella</i> and <i>Corymbia grandifolia</i> open woodland/woodland; minor <i>Melaleuca</i> spp., <i>Eriachne burkittii</i> , <i>Chrysopogon setifolius</i> and <i>Themeda triandra</i> mixed tussock grassy understorey
5c	R, Q, T	Alluvial plains up to 3 km wide; negligible slope	Mottled yellow duplex (solodic) soils; shallow, hard setting and pulverulent A horizon over a dense, mottled B horizon, well developed debil debil, minor grey non-cracking clays on Mary floodplain (hydrosols)	<i>Eriachne burkittii</i> , <i>Chrysopogon setifolius</i> mixed spp. tussock grassland with sedges
6a	Q, T	Rivers and major creeks with associated narrow leaves; channels incised up to 6 m	Alluvial yellow and red earths on levees, deep, gradational-textured profiles (hydrosols)	Mixed species open forest
6a1	R, Q, T	Drainage lines in rugged terrain or narrow drainage depressions in hilly terrain; narrow (<200 m); normally incised to <2 m; 0.5-1% slope in some areas	Yellow earths; moderately deep and usually sandy in upper reaches; weakly developed solodics in lower reaches towards major alluvials; or gravelly shallow lithosols and grey earths (hydrosols)	<i>Corymbia polycarpa</i> , <i>Corymbia grandifolia</i> , <i>Corymbia bella</i> , <i>Eucalyptus bigalerita</i> , <i>Lophostemon lactifluus</i> and <i>Melaleuca</i> spp. open woodland/woodland/open forest with <i>Arundinella nepalensis</i> , <i>Eriachne burkittii</i> , <i>Mnesithea</i> sp. mixed species tussock grass understorey
River	T	River		

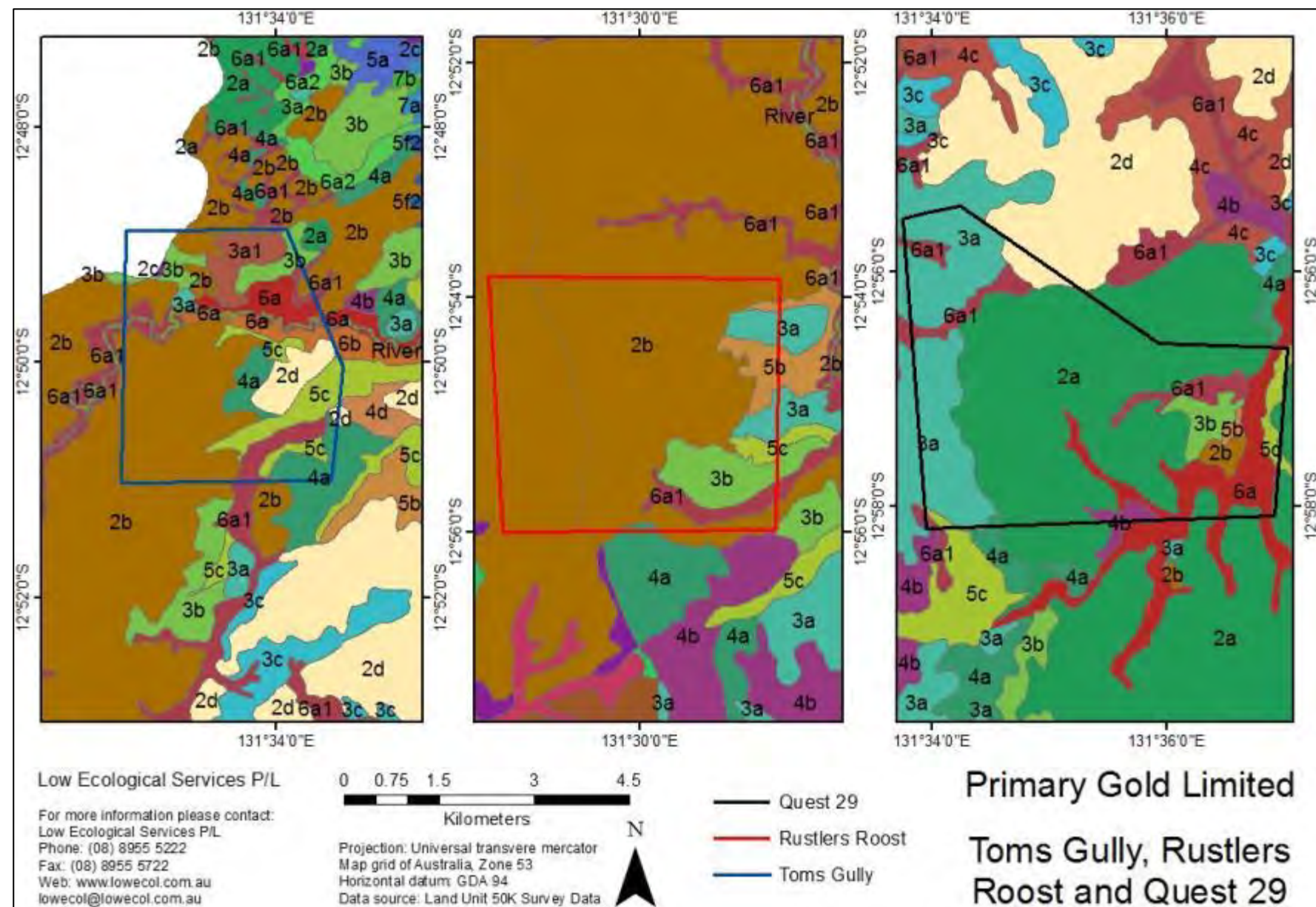


Figure 8: Land unit mapping for Toms Gully, Rustlers Roost and Quest 29 (Fett & Hall, 1983). Descriptions of each land system are provided in Table 4.

3.6 Vegetation types

Vegetation in the lease areas has been mapped at a scale of 1: 100 000 in the Vegetation Survey of the Northern Territory (Wilson, et al., 1990). There are three vegetation types occurring within the survey areas and these are described in Table 5 and mapped in Figure 9.

Table 5: Description of vegetation types within Toms Gully (T), Rustlers Roost (R) and Quest 29 (Q) as mapped by Wilson et al. (1990)

Vegetation unit	Sites	Broad vegetation classification	Structural formation	Fine vegetation description
4	T	Eucalyptus with grass understorey	Open forest	<i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Eucalyptus nesophila</i> open-forest with <i>Sorghum</i> grassland understorey
15	T, R, Q	Eucalyptus with grass understorey	Woodlands	<i>Eucalyptus tectifica</i> , <i>Eucalyptus latifolia</i> woodland with <i>Sorghum</i> grassland understorey
21	Q	Eucalyptus with grass understorey	Low woodlands	<i>Eucalyptus tintinnans</i> low woodland with <i>Sorghum</i> grassland understorey

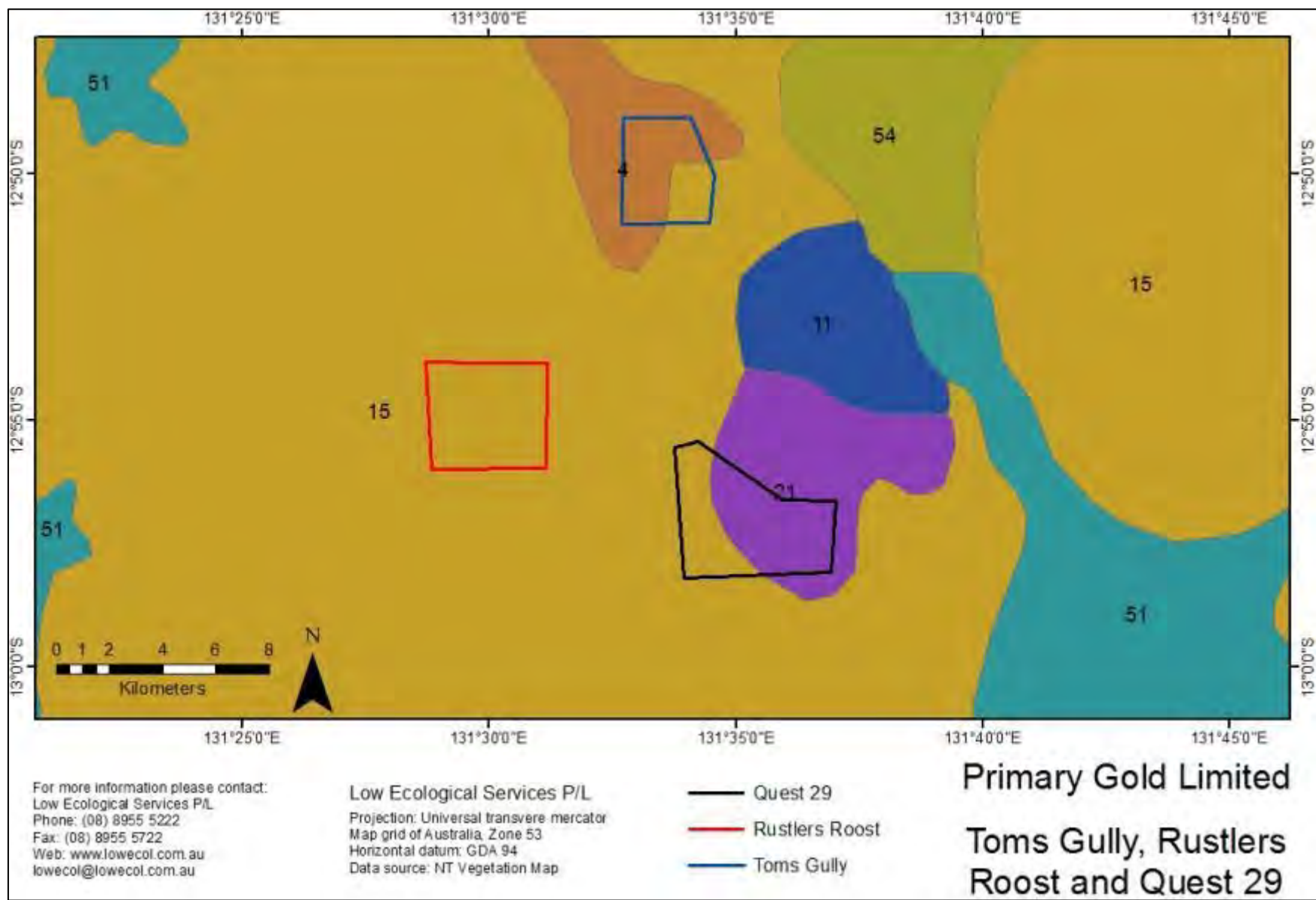


Figure 9: Vegetation types within Toms Gully, Rustlers Roost and Quest 29 mapped by Wilson et al. (1990). Vegetation types are described in Table 5.

3.7 Sites of Conservation Significance

Sites of Conservation significance (SoCS) are 67 sites identified as the most important sites for biodiversity that need further protecting in the Northern Territory. Sites of Botanical Significance (SoBS) are defined as area that have botanical features distinguishing them from the surrounding landscape, and that are important for general plant conservation and for specifically mentioned species (White, et al., 2000a). The Mary River coastal floodplain SoCS is adjacent to and very slightly within the survey areas (Figure 10). There are no SoBS within 20 km of the survey areas.

The Toms Gully survey area contains a very small area of the Mary River coastal floodplain SoCS (Figure 10). The Mary River coastal floodplain is unusual in that it lacks a single channel through the floodplain to the ocean (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The main land use in this SoCS is pastoral, with other uses including conservation, recreation, tourism and mining (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The Mary River coastal floodplain consists of a mosaic of wet and dry habitats that support large populations of waterbirds and a major breeding area for fish species such as Barramundi (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The Mary River system is suffering degradation as a result of impact from introduced species and fire (Department of Natural Resources, Environment, the Arts and Sport, n.d.). The Mary River costal floodplain SoCS is of international significance for threatened species and wildlife aggregations, national (but possibly international) significance for wetlands and regional significance for its flora (Department of Natural Resources, Environment, the Arts and Sport, n.d.).

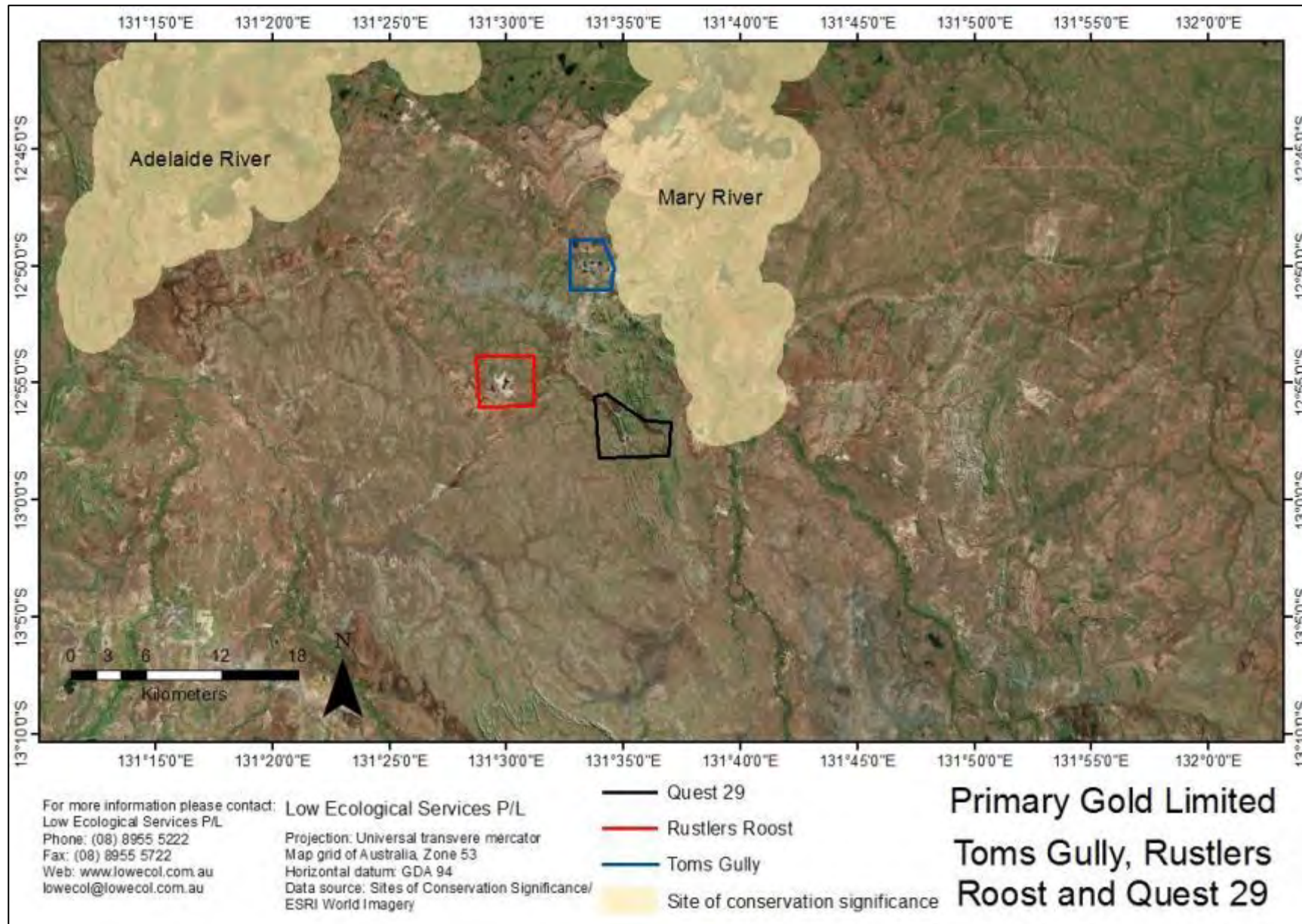


Figure 10: Sites of conservation significance in the area surrounding Toms Gully, Rustlers Roost and Quest 29.

3.8 Fire history

Mapping obtained from the North Australia Fire Information website (North Australia and Rangelands Fire Information, 2016) indicates that fire generally occurs within the survey areas on an annual basis (Table 6, Figure 11).

Table 6: Fires occurring in the survey areas between 2011 and 2016, with the area (km²) and percentage of the survey areas burnt (%) during those years.

Survey area		2011		2012		2013		2014		2015		2016	
Name	Total area	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
Toms Gully	12.27	2.81	22.9	3.43	27.95	1.15	9.37	3.17	25.8	0.95	7.74	6.86	55.91
Rustlers Roost	17.4	10.5	60.5	10.04	57.7	7.12	40.9	11.2	64.5	15.4	88.7	15.9	91.38
Quest 29	20.66	0	0	11.21	54.26	0	0	0	0	9.74	47.1	16	77.54

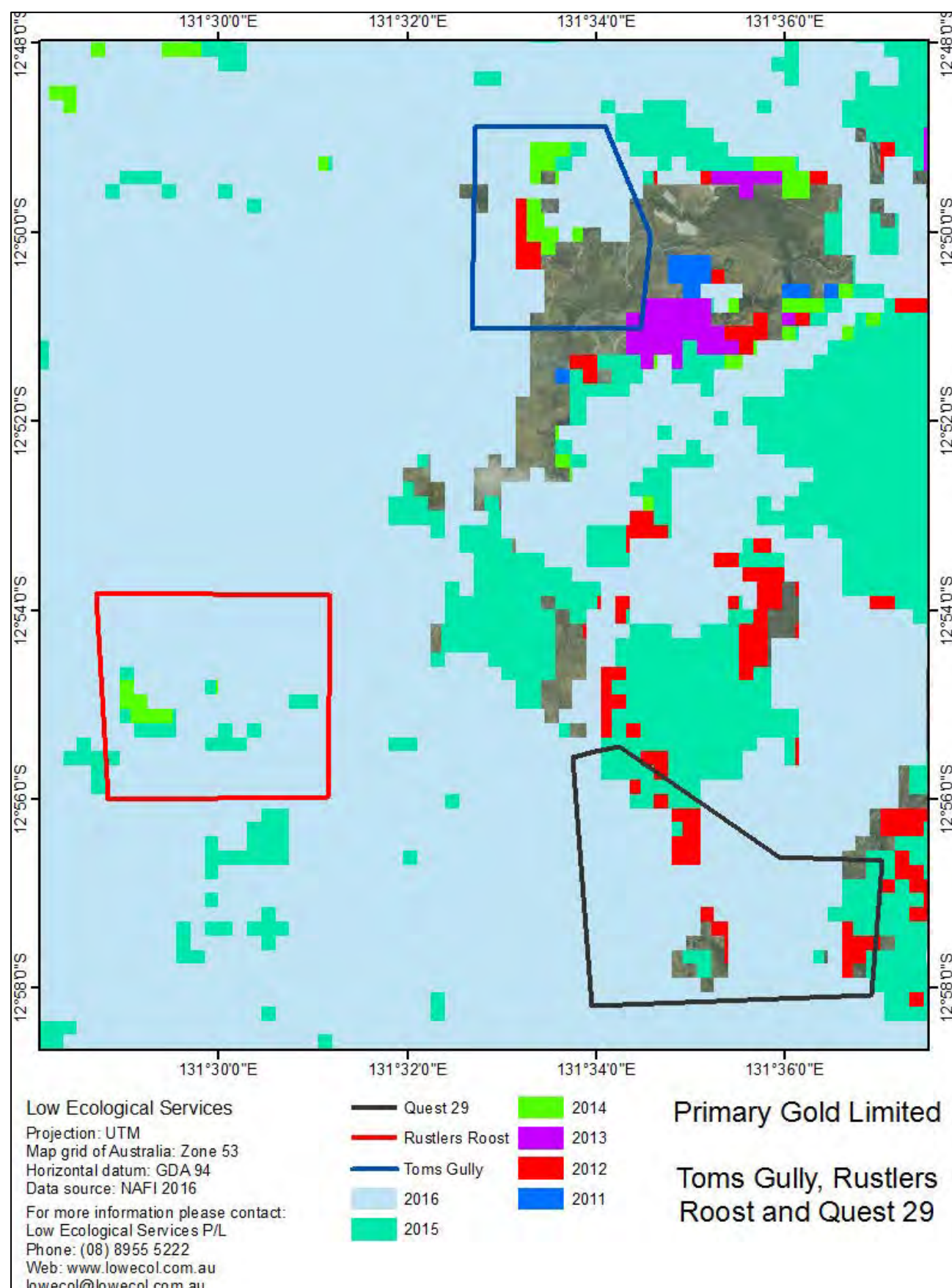


Figure 11: Fire history for the years 2011 – 2016 in the Toms Gully, Rustlers Roost and Quest 29 survey areas (North Australia and Rangelands Fire Information, 2016)

3.9 Flora

3.9.1 Flora records

The NT Flora Atlas identified 5944 records of 813 flora species within 20 km of the survey areas.

3.9.2 Threatened Flora Species

Twenty-six species of conservation significance were identified by the EPBC PMST or TWPC Act as occurring or potentially occurring within a 20 km radius of the survey areas (

Table 7Table 7). The EPBC PMST identified two endangered flora species, *Helicteres macrothrix* and *Stylidium ensatum*, and one vulnerable flora species, *Goodenia quadrifida*, as potentially occurring within 20 km of the survey areas. Interrogation of the NT Flora Atlas identified records of *H. macrothrix* and *G. quadrifida* within the same search area, along with records of *Schoutenia ovata*, which is listed as vulnerable under the TPWC Act. Further descriptions of these threatened species and assessment of their likelihood of occurrence are provided below. Twenty-one data deficient and three near threatened species were identified by the NT Flora Atlas as occurring within 20 km of the survey areas (Figure 12).

Goodenia quadrifida

Goodenia quadrifida is known only from Hardy Creek within the Mary River floodplain and the upper Adelaide River, where it grows on cracking clay plains (Northern Territory Herbarium, 2013). *Goodenia quadrifida* is an annual herb with branches to 30 cm long (Northern Territory Herbarium, 2013). It has sessile, linear or narrowly oblanceolate leaves, 2-8 cm long and 0.2-0.5 cm wide, which are hairy when young and become glabrous with age (Northern Territory Herbarium, 2013). Flowers are purplish, conspicuously hairy and solitary in axils, with pedicels 1-4 cm long (Northern Territory Herbarium, 2013). Flowering and fruiting occur from March to May (Northern Territory Herbarium, 2013).

There are no cracking clay soils known from within the survey areas. However little is known about the species and there are records from 15 km north-west of Rustlers Roost. Therefore, there is a moderate likelihood that this species occurs within the survey areas.

Helicteres macrothrix

Helicteres macrothrix grows in *E. tectifera*, *E. miniata* or *E. tetradonta* woodland on clayey soils derived from siltstone or more sandy soils derived from syenite (Northern Territory Herbarium, 2013). *Helicteres macrothrix* is an erect, multi-stemmed subshrub, with annual above-ground parts and a perennial woody rootstock (Northern Territory Herbarium, 2013). The leaves are ovate, or occasionally elliptic or broadly ovate, 5-17 cm long and 4-11 cm wide, with serrate to dentate margins (Northern Territory Herbarium, 2013). Flowers are mauve-pink, and occur in an axillary cymose inflorescence (Northern Territory Herbarium, 2013). The lower three petals are woolly-hairy, and the upper pair are smooth (Northern Territory Herbarium, 2013). *Helicteres macrothrix* flowers between November and March and fruits between January and March (Northern Territory Herbarium, 2013)

There is suitable habitat within the survey areas and records of the species from within 2.5 km of Quest 29. Therefore, there is a high likelihood that this species occurs within the surveys areas.

Table 7: Flora species of conservation significance identified by the EPBC PMST and/or the TPWC act as occurring or potentially occurring within a 20 km radius of the survey areas. En: endangered, Vu: vulnerable, DD: data deficient, NT: near threatened

Family	Scientific Name	Status			
		TPWC	EPBC	PMST	NT Flora Atlas
Alismataceae	<i>Butomopsis latifolia</i>	DD			X
Cleomaceae	<i>Cleome bundeica</i>	DD			X
Cyperaceae	<i>Fimbristylis dipsacea</i>	DD			X
Droseraceae	<i>Drosera fulva</i>	DD			X
Fabaceae	<i>Alysicarpus brownii</i>	DD			X
Fabaceae	<i>Chamaecrista nomame grandiflora</i>	DD			X
Fabaceae	<i>Crotalaria quinquefolia</i>	NT			X
Fabaceae	<i>Zornia muelleriana muelleriana</i>	DD			X
Goodeniaceae	<i>Goodenia quadrifida</i>	DD	Vu	X	X
Lamiaceae	<i>Callicarpa brevistyla</i>	DD			X
Linderniaceae	<i>Lindernia</i> sp. Mount Bunday	DD			X
Malvaceae	<i>Helicteres macrothrix</i>	En	En	X	X
Malvaceae	<i>Hibiscus vitifolius vitifolius</i>	DD			X
Malvaceae	<i>Schoutenia ovata</i>	Vu			X
Malvaceae	<i>Sida subcordata</i>	DD			X
Menyanthaceae	<i>Nymphoides subacuta</i>	NT			X
Orchidaceae	<i>Didymoplexis pallens</i>	DD			X
Poaceae	<i>Echinochloa dietrichiana</i>	DD			X
Poaceae	<i>Microchloa indica</i>	DD			X
Poaceae	<i>Eragrostis concinna</i>	DD			X
Poaceae	<i>Eragrostis ecarinata</i>	DD			X
Poaceae	<i>Eriachne squarrosa</i>	DD			X
Podostemaceae	<i>Malaccotristicha australis</i>	DD			X
Rutaceae	<i>Citrus gracilis</i>	NT			X
Santalaceae	<i>Viscum whitei flexicaule</i>	DD			X
Stylidiaceae	<i>Stylidium ensatum</i>		En	X	

Schoutenia ovata

Schoutenia ovata is a tree to 10 m height with grey, flaky bark (Northern Territory Herbarium, 2013). The branchlets, petioles, leaf under-surface, calyx and capsule are densely hairy (Northern Territory Herbarium, 2013). The leaves are glossy above, three-veined at the base, elliptic to obovate, 25-98 mm long, 17-50 mm wide and reportedly deciduous (Northern Territory Herbarium, 2013). The leaf margin is entire to irregularly lobed in the upper half (Northern Territory Herbarium, 2013). Flowers are arranged in a racemose inflorescence up to 20 mm long (Northern Territory Herbarium, 2013). The petals of the flowers are often absent or reduced, up to 4.5 mm long, and the sepals are pale

yellow and about 7.5 mm long (Northern Territory Herbarium, 2013). *Schoutenia ovata* flowers in February to March and fruits in May (Northern Territory Herbarium, 2013).

Schoutenia ovata grows in semi-deciduous vine thicket on syenite and limestone outcrops (Northern Territory Herbarium, 2013). *Schoutenia ovata* has been recorded approximately 2.5 km south-east of Toms Gully. There are also granitic outcrops (land unit 2d) in the eastern section of the Toms Gully survey area and the north-eastern section of the Quest 29 survey area (Figure 8), which is the same land unit that *S. ovata* has been previously recorded in. Therefore, there is a high likelihood that this species occurs within land unit 2d in the survey areas.

Stylidium ensatum

Stylidium ensatum is an annual herb to 22cm tall with broad sessile leaves on a short basal stem (Northern Territory Herbarium, 2013). The flowers are pink, with both upper and lower petals bilobed at the apex (Northern Territory Herbarium, 2013). *Stylidium ensatum* flowers and fruits from June to August (Northern Territory Herbarium, 2013).

Stylidium ensatum grows on poorly drained grassy flats that stay wet into the dry season. (Northern Territory Herbarium, 2013) It is often found with *Eriachne burkitii*, *Pandanus* spp., *Osbeckia* spp. and *Fimbristylis furva* (Northern Territory Herbarium, 2013). The closest record of *S. ensatum* to the survey areas is 60 km north-west of Toms Gully. There is potential habitat for this species within land unit 5c, which occurs in the eastern sections of all three section areas. However, it is unclear how long these areas stay inundated past the end of the wet season. There is a low likelihood that this species occurs within the survey areas.

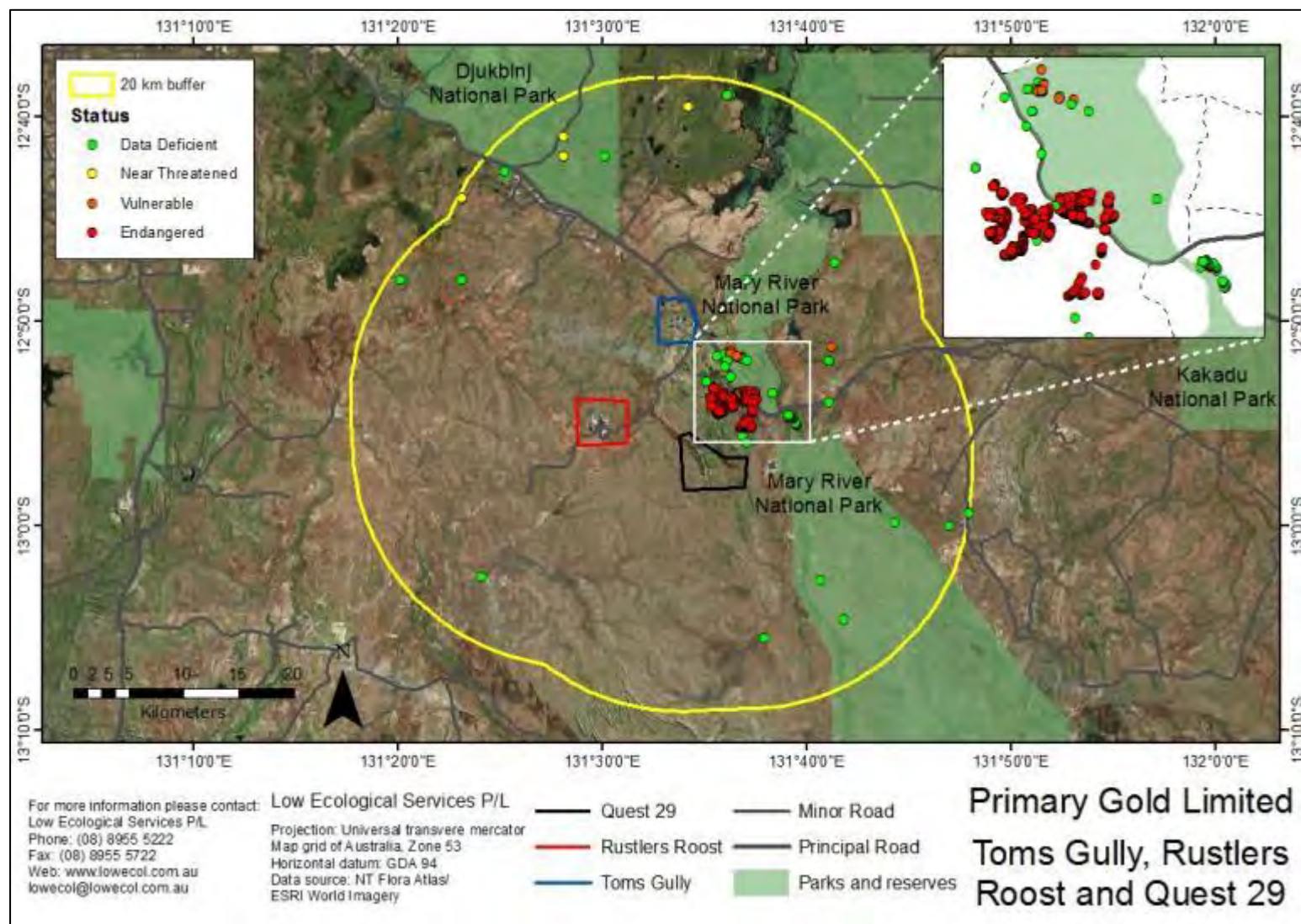


Figure 12: Location of records of flora species of conservation significance listed under the TPWC Act with records in the NT Flora Atlas within 20 km of Toms Gully, Rustlers Roost and Quest 29

3.9.3 Threatened Ecological Communities

No threatened ecological communities were identified within 20 km of the lease areas.

3.9.4 Introduced and weed species

WoNS are declared based on invasiveness, potential for spread and environmental, social and economic impacts. Strategic plans for WoNS are developed as a result of their declaration, which define responsibilities and identifies strategies and actions to control the species. Landholders and managers are ultimately responsible for managing WoNS, and the state/territory government is responsible for overall legislation and administration (Department of Sustainability, Environment, Water, Population and Communities, 2012).

In the NT, a plant is declared a weed if it has been identified for control, eradication or prevention of entry into the NT. All landholders, land managers and land users must comply with the declaration classification. Based on the risk of harm they could cause and how difficult they are to control, weeds are placed into the following classes:

- Class A – to be eradicated
- Class B – growth and spread to be controlled
- Class C – not to be introduced into the NT

Forty-seven introduced flora species were identified as occurring or potentially occurring within 20 km of the survey areas by the EPBC PMST, NT Weeds public database or both (Table 8). Nine of these species are WoNS and are described in further detail below, including information on identification and habitat. Other weeds known to occur in the Pine Creek bioregion are *Barleria prionitis*, cabomba (*Cabomba caroliniana*), creeping lantana (*Lantana montevidensis*), giant rats-tail grass (*Sporobolus natalensis* and *S. pyramidalis*), grader grass (*Themeda quadrivalvis*), *Senna tora* and snake weed (*Stachytarpheta* spp.) (Bastin & ACRIS Management Committee, 2008).

Table 8: Introduced flora and weed species identified by the desktop study and/or recorded on surveys to date including if the species is a WoNS and the class it is declared under in the NT within the survey areas.

Species name	Common name	Status				NT Fauna Atlas
		NT	EPBC	WoNS	PMST	
<i>Aeschynomene villosa</i>						X
<i>Ageratum conyzoides</i>						X
<i>Alysicarpus ovalifolius</i>						X
<i>Andropogon gayanus</i>	Gamba grass	B	Inv	X	X	X
<i>Brachiaria mutica</i>	Para grass		Inv		X	
<i>Calopogonium mucunoides</i>	Calopo					X
<i>Celosia argentea</i>						X
<i>Cenchrus ciliaris</i>	Buffel grass		Inv		X	
<i>Cenchrus pedicellatus</i>	Mission grass					X
<i>Centrosema pascuorum</i>						X
<i>Cynodon dactylon</i>	Couch grass					X

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Species name	Common name	Status				NT Fauna Atlas
		NT	EPBC	WoNS	PMST	
<i>Cynodon radiatus</i>						X
<i>Digitaria bicornis</i>						X
<i>Digitaria ciliaris</i>						X
<i>Digitaria violascens</i>						X
<i>Eichhornia crassipes</i>	Water hyacinth	A, C	Inv	X	X	
<i>Eragrostis pilosa</i>	Soft lovegrass					X
<i>Evolvulus nummularis</i>						X
<i>Gomphrena celosioides</i>						X
<i>Heliotropium indicum</i>						X
<i>Hibiscus sabdariffa</i>						X
<i>Hymenachne amplexicaulis</i>	Olive hymenachne	B, C	Inv	X	X	X
<i>Hyptis suaveolens</i>	Hyptis	B				X
<i>Jatropha gossypifolia</i>	Bellyache bush	A	Inv	X	X	
<i>Lantana camara</i>	Lantana	B, C	Inv	X	X	
<i>Macroptilium lathyroides semierectum</i>	Phasey bean					X
<i>Malachra fasciata lineariloba</i>						X
<i>Malvastrum americanum</i>						X
<i>Mimosa pigra</i>	Mimosa	B	Inv	X	X	X
<i>Mitracarpus hirtus</i>						X
<i>Murdannia nudiflora</i>						X
<i>Parkinsonia aculeata</i>	Parkinsonia	B, C	Inv	X	X	
<i>Paspalum dilatatum</i>						X
<i>Passiflora foetida</i>						X
<i>Pennisetum polystachios</i>	Mission grass	B, C	Inv		X	
<i>Salvinia molesta</i>	Salvinia	B, C	Inv	X	X	
<i>Scoparia dulcis</i>						X
<i>Senna obtusifolia</i>	Sicklepod	B				X
<i>Senna occidentalis</i>	Coffee senna	B				X
<i>Sida acuta</i>	Spinyhead sida	B				X
<i>Sida cordifolia</i>	Flannel weed	B				X
<i>Stylosanthes scabra</i>						X
<i>Tridax procumbens</i>						X
<i>Triumfetta pentandra</i>						X
<i>Triumfetta rhomboidea</i>						X
<i>Vachellia nilotica</i>	Prickly acacia	A, C	Inv	X	X	
<i>Xanthium strumarium</i>	Noogoora burr	B, C				X

Gamba grass (*Andropogon gayanus*)

Gamba grass is a perennial tussock grass that grows up to 70 cm diameter and 4 m tall (DSEWPaC, 2013a). The leaf blades are up to 60 cm long and 1.5-5 cm wide with a prominent white midrib (DSEWPaC, 2013a). The flowering stems have up to six groups of 2-18 loosely branched primary branches (DSEWPaC, 2013a). The flower spikelets are arranged in pairs, with one spikelet sessile and the other stalked (DSEWPaC, 2013a). The seeds of gamba grass are light brown to brownish-black, 2-3 mm long and 1 mm wide (DSEWPaC, 2013a).

Gamba grass mostly grows in pastures and along roads, but can be invasive in other habitats such as savanna (DSEWPaC, 2013a). Gamba grass invasion leads to dramatically increased fire intensity, which are harder to control and can result in a reduction in the woody component of a vegetation community (DSEWPaC, 2013a). Gamba grass seed is dispersed by wind or water, and can also be spread during hay transport or in mud attached to vehicles and machinery (DSEWPaC, 2013a). Gamba grass can be controlled by herbicide application of young and regrowing plants before seed maturity (DSEWPaC, 2013a).

Water hyacinth (*Eichornia crassipes*)

Water hyacinth is an erect, free-floating, aquatic perennial herb from 10 cm to 1 m in height (WoNS website). It has black to purple feathery roots up to 1 m long (DSEWPaC, 2011a). The leaves radiate from the base of the plant in a cluster or rosette (DSEWPaC, 2011a). The leaf blade is glossy green, finely striated, flat, thick, ovate or circular to rounded-oblong and up to 25 cm across, and has a spongy leaf stalk (DSEWPaC, 2011a). The flower spike is up to 20 cm long with few to many crowded sky-blue to bluish purple-lavender, lilac –blue, lilac-mauve, pale-violet or sometimes white flowers that are 3-7 cm across (DSEWPaC, 2011a).

Water hyacinth grows on still or slow-flowing freshwater areas (DSEWPaC, 2011a). It can obstruct waterways, reduce water quality, reduce fish production and harbour mosquitoes (DSEWPaC, 2011a). Water hyacinth spreads vegetatively by stolons rooting at the nodes to produce new plants, which happens most rapidly in nutrient rich water (DSEWPaC, 2011a). Seeds are dispersed by water, and may remain dormant in the mud for 15 years or more (DSEWPaC, 2011a). Seeds and vegetative material can also be dispersed by birds, movement of mud or sediment, contaminated boats and boating equipment and discarded pond refuse (DSEWPaC, 2011a).

Hymenachne (*Hymenachne amplexicaulis*)

Hymenachne is a perennial grass, usually growing to 1-2.5 m tall, but occasionally to 3.5 m tall. Its above ground stems are upright or semi-upright from a creeping base or floating on shallow water, are up to 12 mm or more thick and regularly produce roots at the joints (DSEWPaC, 2013b). The leaf blades are 10-45 cm long and 2-6 cm wide, hairy or hairless and partially enclose the stem, and are large and spreading (DSEWPaC, 2013b). The inflorescence is elongated, dense and spike like, and is 10 -50 cm long and 8-20 mm wide (DSEWPaC, 2013b).

Hymenachne occurs in swamps, wetlands, seasonally flooded areas, waterways, riverbanks, drainage channels and other water bodies in wetter tropical and sub-tropical environments (DSEWPaC, 2013b). Hymenachne can block waterways, potentially causing flooding and threatening drinking water, block drainage and irrigation channels in cropping areas, displace native plants and increase the density of vegetation, which can alter habitat suitability for biodiversity (DSEWPaC, 2013b).

Hymenachne can reproduce by seed or vegetatively, with spread being attributed to flooding, mud attached to animals and vehicles, in contaminated agricultural produce and by birds (DSEWPac, 2013b).

Bellyache bush (*Jatropha gossypifolia*)

Bellyache bush a shrub or small tree 1-3 m tall (DSEWPac, 2011b). Older stems of bellyache bush are relatively thick and contain a watery or soapy sap (DSEWPac, 2011b). Younger stems and growing points are purplish in colour and have a dense covering of hairs (DSEWPac, 2011b). The leaves are alternately arranged, purplish and covered in sticky hairs when immature, bright or dark green as they are, 4.5-10 cm long and 5-13 cm wide and have three or five deep lobes (DSEWPac, 2011b). The flowers are arranged in clusters with 2-8 female and 27-54 male flowers in each cluster (DSEWPac, 2011b). The flowers are deep purple to bright red (DSEWPac, 2011b). The fruit is slightly three lobed and faintly hairy (DSEWPac, 2011b).

Bellyache bush occurs in degraded pastures, open woodlands, monsoon vine forests, grasslands, waterways, coastal foreshores, roadsides, disturbed sites, waste areas and old or abandoned gardens (DSEWPac, 2011b). It occurs mainly in drier tropical environments, but also sometimes in sub-tropical and semi-arid regions (DSEWPac, 2011b). Bellyache bush can form dense thickets, which reduces the productivity of pastures, displaces native vegetation, and may reduce biodiversity, preventing the regeneration of trees and shrubs (DSEWPac, 2011b). Bellyache bush reproduces by seed and vegetatively (DSEWPac, 2011b). Seeds may be dispersed in water and mud, and by ants (DSEWPac, 2011b).

Lantana (*Lantana camara*)

Lantana is a sprawling or climbing shrub or vine 1-3 m high, sometimes to 6 m high in favourable conditions (DSEWPac, 2011c). The stems and branches often have recurved prickles and sometimes glands or glandular hairs (DSEWPac, 2011c). The leaves are in opposite pairs, are ovate to oblong-ovate, often covered with coarse hairs on the upper surface, strongly aromatic and 4-10 cm long and 3-6 cm wide (DSEWPac, 2011c). The inflorescence consists of 20-40 flowers ranging from yellow, orange-yellow, deep orange, deep red, pink, rose-pink to white (DSEWPac, 2011c).

Lantana occurs in disturbed sites such as roadsides, cultivated pastures and fencelines on rich organic soils and well-drained clay and basalt soils (DSEWPac, 2011c). Lantana forms dense thickets, which changes the structure of native bushland and pasture, increases fuel loads and adversely affects the species richness of soil biodiversity (DSEWPac, 2011c). Lantana can reproduce vegetatively and by seed, which can be spread by animals (DSEWPac, 2011c).

Mimosa (*Mimosa pigra*)

Mimosa is a shrub 5-6 m tall with touch sensitive compound leaves 12-22 cm long with up to 45 pairs of leaflets (DSEWPac, 2011d). Mimosa has thorns 5-12 mm long scattered along the stems and branches (DSEWPac, 2011d). The flower heads are round, 10-20 mm diameter and comprised of about 100 pink or mauve flowers (DSEWPac, 2011d). The seed pods are flat, 30-120 mm long, 7-14 mm wide and densely hairy (DSEWPac, 2011d).

Mimosa occurs in moist areas such as riverbanks, coastal plains and floodplains, particularly in humid and sub-humid tropical regions (DSEWPac, 2011d). Mimosa produces copious amounts of seed, which are dispersed by water, humans, animals, mud on vehicles and movement of

contaminated soils (DSEWPac, 2011d). Mimosa forms dense monoculture stands, replacing all native vegetation (DSEWPac, 2011d). The invasion of mimosa threatens productive industry and cultural and conservation values of wetlands, including nationally and internationally significant wetlands, where it reduces biodiversity by out-competing native plants and reducing habitat suitability for native fauna (DSEWPac, 2011d).

Parkinsonia (*Parkinsonia aculeata*)

Parkinsonia is a shrub or tree to 8-10 m tall with 5 mm long thorns on its stems (DSEWPac, 2011e). The compound leaves of parkinsonia are up to 300 mm long with numerous green leaflets 4-10 mm long (DSEWPac, 2011e). There are sharp spines 5-15 mm long at the leaf base (DSEWPac, 2011e). The flowers are predominantly yellow and up to 20 mm diameter (DSEWPac, 2011e). The fruit is an elongated pod 3-13 cm long and 3.5 mm wide and narrows at both ends (DSEWPac, 2011e).

Parkinsonia occurs mainly on seasonally flooded sites in pastures, roadsides, grasslands, open woodland and rangelands, and also around dams, bores, stream banks and floodplains on sand to clay soils (DSEWPac, 2011e). Parkinsonia produces abundant seed, which is dispersed by moving water, and on unclean machinery (DSEWPac, 2011e). Parkinsonia can form dense thickets, which can impede access, dam watercourses, cause erosion, lower water tables and provide refuges for feral animals such as pigs (DSEWPac, 2011e).

Salvinia (*Salvinia molesta*)

Salvinia is a free-floating aquatic fern, which forms a thick mat of vegetation (DSEWPac, 2011f). The fronds of salvinia are arranged along the stem in three, with two fronds being leaf like and the third frond being root-like and submerged in the water (DSEWPac, 2011f). The leaf-like fronds are round in shape, 4-40 mm long and 7-25 mm wide, covered in hairs pale green to greenish brown and folded along the mid-rib (DSEWPac, 2011f). The root-like fronds are up to 30 cm long and covered with fine brown hairs (DSEWPac, 2011f).

Salvinia occurs in still or slow-moving water bodies with high nutrient levels (DSEWPac, 2011f). Salvinia modifies aquatic fauna habitats, excludes light and reduces oxygen levels leading to water stagnation and pollution, impedes water flow, and can harbour mosquitoes (DSEWPac, 2011f).

Prickly acacia (*Vachellia nilotica*)

Prickly acacia is a thorny shrub or spreading tree, which grows to 4-7 m high and occasionally to 10m (DSEWPac, 2011g). Young trees have bark with a tinge of orange and/or green, and usually have long white straight spines 10-50 mm long in pairs at the base of each leaf (DSEWPac, 2011g). Older trees have dark, rough bark and lose most of their thorns (DSEWPac, 2011g). Prickly acacia has compound leaves 30-40 mm long, with 10-25 pairs of leaflets along their length (DSEWPac, 2011g). Flowerheads are globular, golden-yellow, about 10 mm diameter and in groups of 2-6 in the leaf axils (DSEWPac, 2011g). The seed pods are a distinguishing feature, being grey-green, covered in fine hairs, 100-200 mm long and having deep constrictions between the seeds to give them a necklace like appearance (DSEWPac, 2011g).

Prickly acacia occurs on cracking clay soils with high water holding capacity, but can also occur on sandy soils in areas of higher rainfall (DSEWPac, 2011g). It grows best around waterways and on seasonally inundated floodplains with 350-1500 mm of annual rainfall (DSEWPac, 2011g). Established stands of prickly acacia form impenetrable dense thorny thickets, reducing primary

productivity, interfering with stock mustering and access to water, and changing the structure and composition of grasslands which impacts the overall ecology of the system (DSEWPaC, 2011g). Prickly acacia reproduces only by seeds, which are dispersed by flowing water and consumption by cattle (DSEWPaC, 2011g).

3.10 Fauna

3.10.1 Fauna records

The NT Fauna Atlas identified 14,929 records of 386 fauna taxa identified to species level and a further 18 fauna taxa identified to genus level, within 20 km of the survey areas. The majority of these records are along the Kakadu Hwy and in the low lying quarry areas nearer the Mary River.

3.10.2 Fauna species of conservation significance

The EPBC PMST identified 32 fauna species listed as threatened under the EPBC Act as occurring or potentially occurring within 20 km of lease areas. Four are listed as critically endangered, 13 as endangered and 25 as vulnerable. Of these species, six occur in marine habitats and will not be discussed further. These species are humpback whale (*Megaptera novaehollandiae*), Loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), Hawksbill turtle (*Eretmochelys imbricate*) and olive ridley turtle (*Lepidochelys olivacea*). Records of four species listed as endangered and four species listed as vulnerable under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. The NT Fauna Atlas also identified records of 14 species listed as threatened under the TPWC Act within a 20 km radius of the survey areas (Figure 13). One of these species is listed as critically endangered, one as endangered and 12 as vulnerable.

Bird species of conservation significance

Twenty-five bird species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring or potentially occurring within a 20 km radius of the survey areas (Table 9). Eleven of these species are listed as threatened under the EPBC Act; two as critically endangered, four as endangered and five as vulnerable. Five of these species listed as threatened under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of ten bird species listed as threatened under the TPWC Act, nine as vulnerable and one as endangered, were also identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of a further 13 species listed as near threatened and one species listed as data deficient under the TPWC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. All NT Fauna Atlas records within 20km of the survey areas is mapped in Figure 13. Further information on relevant to assessment of likelihood of occurrence of threatened bird species in the survey areas is provided below.

Curlew sandpiper (*Calidris ferruginea*) - *Calidris ferruginea* is a small to medium sized shorebird that is present in Australia during the non-breeding season from late August to April and is listed as vulnerable under the TPWC Act and critically endangered under the EPBC Act (Department of the Environment, 2017). In Australia, *C. ferruginea* inhabit coastal and brackish lagoons, intertidal mud and sand flats, estuaries, saltmarshes and occasionally inland freshwater wetlands (Ward, 2012). The

closest record of this species to the survey areas is 37 km north-west of Toms Gully. There is a moderate likelihood that this species will be present in the survey areas during annual migration.

Table 9: Bird species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within a 20 km radius of the survey areas. En: endangered, Vu: vulnerable, DD: data deficient, NT: near threatened

Species name	Common name	Status			NT Fauna Atlas
		TPWC	EPBC	PMST	
<i>Acrocephalus australis</i>	Australian reed-warbler	NT			X
<i>Amaurornis moluccana</i>	Pale-vented bush-hen	NT			X
<i>Ardeotis australis</i>	Australian bustard	NT			X
<i>Arenaria interpres</i>	Ruddy turnstone	NT			X
<i>Burhinus grallarius</i>	Bush stone-curlew	NT			X
<i>Calidris ferruginea</i>	Curlew sandpiper	Vu	Cr	X	
<i>Charadrius leschenaultii</i>	Great sand plover	Vu	Vu		X
<i>Charadrius mongolus</i>	Lesser sand plover	Vu	En		X
<i>Dromaius novaehollandiae</i>	Emu	NT			X
<i>Epthianura crocea tunneyi</i>	Alligator Rivers yellow chat	En	En	X	
<i>Erythrorhynchus radiatus</i>	Red goshawk	Vu	Vu	X	X
<i>Erythrura gouldiae</i>	Gouldian finch	Vu	En	X	X
<i>Falco hypoleucos</i>	Grey falcon	Vu			X
<i>Falcunculus frontatus whitei</i>	Crested shrike-tit (northern)	NT	Vu	X	
<i>Geophaps smithii smithii</i>	Partridge pigeon (eastern)	Vu	Vu	X	X
<i>Limosa limosa</i>	Black-tailed godwit	NT			X
<i>Lonchura flaviprymna</i>	Yellow-rumped manikin	NT			X
<i>Lophoictinia isura</i>	Square-tailed kite	NT			X
<i>Numenius madagascariensis</i>	Eastern curlew	Vu	Cr	X	
<i>Numenius phaeopus</i>	Whimbrel	NT			X
<i>Poecilodryas cerviniventris</i>	Buff-sided robin	NT			X
<i>Rostratula australis</i>	Australian painted snipe	Vu	En	X	
<i>Tringa brevipes</i>	Grey-tailed tattler	NT			X
<i>Turnix castanotus</i>	Chestnut-backed button-quail	DD			X
<i>Tyto novaehollandiae kimberli</i>	Masked owl (northern)	Vu	Vu	X	

Great sand plover (*Charadrius leschenaultii*) - *Charadrius leschenaultii* is a small to medium sized shorebird that is present in Australia from July to mid to late April and is listed as vulnerable under the TPWC Act and EPBC Act (Department of the Environment, 2017). In Australia, *C. leschenaultii* inhabits sandy beaches and sheltered mudflats, and also occasionally inland saline wetlands close to

the coast (Ward, 2016). The closest record of this species to the survey areas is 18 km north-east of Quest 29. Given this species is found mainly in coastal areas and saline wetlands and these habitats are not present in the survey areas, there is a low likelihood that this species will be present in the survey areas during migration.

Lesser sand plover (*Charadrius mongolus*) – *Charadrius mongolus* is a small to medium sized shorebird that is present in Australia between September and May and is listed as vulnerable under the TPWC Act and endangered under the EPBC Act (Department of the Environment, 2017). In Australia, *C. mongolus* inhabits sheltered mudflats, sandy beaches, estuaries and mangroves, and occasionally inland saline wetlands close to the coast. The closest record of this species to the survey areas is 18 km north-east of Quest 29. Given this species is found mainly in coastal areas and saline wetlands and these habitats are not present in the survey areas, there is a low likelihood that this species will be present in the survey areas during migration.

Alligator Rivers yellow chat (*Epthianura crocea tunneyi*) – *Epthianura crocea tunneyi* is a small bird that is restricted to a small number of sites on the floodplains from the Adelaide River to the East Alligator River (Woinarski & Armstrong, 2006). It is listed as endangered under the TPWC Act and EPBC Act. Most records of this subspecies are from floodplain depressions and channels, concentrating around wetter areas at the end of the dry season (Woinarski & Armstrong, 2006). The closest record of this species to the survey areas is 34 km north-west of Toms Gully. Given the potentially suitable habitat for this species in the survey areas, there is a low-moderate likelihood that *E. c. tunneyi* is present in the survey areas.

Red goshawk (*Erythrotriorchis radiatus*) – *Erythrotriorchis radiatus* is a large reddish-brown hawk with conspicuous dark streaks from chin to belly and barring on the underwing and tail (Woinarski, 2006b). It is listed as vulnerable under the TPWC Act and EPBC Act. It occurs across much of northern Australia where it generally occurs in tall open eucalypt forest and riparian areas characteristic of higher rainfall areas (Woinarski, 2006b). The closest record of *E. radiatus* to the survey areas is 6.5 km east of Toms Gully. Given the large territory size of this species (up to 200 km²; Woinarski, 2006) and the relatively close proximity of prior records, there is a high likelihood that this species occurs in the survey areas.

Gouldian finch (*Erythrura gouldiae*) – *Erythrura gouldiae* is an easily recognised colourful finch that is restricted to isolated areas of tropical savannas in the NT and the Kimberley (Department of Environment and Natural Resources, 2017). It is listed as vulnerable under the TPWC Act and endangered under the EPBC Act. In the late wet season and dry season (February to October) *E. gouldiae* inhabits wooded hills containing a group of eucalypts called snappy or salmon gums, with hollows for nesting sites (Department of Environment and Natural Resources, 2017). In the wet season, *E. gouldiae* inhabits lowland drainages to feed on seeds on perennial grasses (Department of Environment and Natural Resources, 2017). The closest record of *E. gouldiae* to the survey areas is 1.5 km south-east of Toms Gully. Given the proximity of prior records and potentially suitable habitat in the survey areas, there is a high likelihood that *E. gouldiae* is present in the survey areas.

Grey falcon (*Falco hypoleucos*) – *Falco hypoleucos* is a medium-sized pale falcon found in low densities across all Australian mainland states and territories, mainly in the arid and semi-arid zone but with records up to Darwin in the NT (Ward, 2012b). It is listed as vulnerable under the TPWC Act. *Falco hypoleucos* generally inhabits lightly-timbered lowland plains, typically on inland drainage systems (Ward, 2012b). They use the nests of other species, and prefer those in the tallest tree along

watercourses (Ward, 2012b). The closest record of *F. hypoleucos* to the survey areas is 13 km north-west of Rustlers Roost. Given the proximity of prior records and the potentially suitable habitat there is a high likelihood that this species occurs within the survey areas.

Crested shrike-tit (northern) (*Falcunculus frontatus whitei*) – *Falcunculus frontatus whitei* is a distinctive medium-sized bird that occurs between the south-west Kimberley east to Borroloola and north into north-east Arnhem Land (Woinarski & Ward, 2012). It is listed as near threatened under the TPWC Act and vulnerable under the EPBC Act. This subspecies inhabits a range of eucalypt and melaleuca woodlands, from relatively wet to strongly seasonal areas in Arnhem Land to semi-arid woodland in the southern Victoria River District (Woinarski & Ward, 2012). The closest record of *F. f. whitei* to the survey areas is 85 km north-east of Toms Gully. Despite the potentially suitable habitat, the distance to the closest known record of the species suggests that there is a low likelihood that *F. f. whitei* occurs in the survey areas.

Partridge pigeon (*Geophaps smithii smithii*) – *Geophaps smithii smithii* is a medium-sized ground dwelling pigeon listed as vulnerable under both the TPWC Act and EPBC Act (Woinarski, 2006a). It is distributed across the Top End NT and Kimberley but has disappeared from the lower rainfall parts of its range (Woinarski, 2006a). *Geophaps smithii smithii* mainly inhabits lowland eucalypt open forest and woodland with grassy understorey (Woinarski, 2006a). This species has been recorded within the Toms Gully survey area, therefore there is a high likelihood of it occurring in the survey areas.

Eastern curlew (*Numenius madagascariensis*) – *Numenius madagascariensis* is a very large shorebird that is a non-breeding migrant in Australia for the austral summer (Ward, 2012c). It is listed as vulnerable under the TPWC Act and critically endangered under the EPBC Act. The species has been recorded along the coast and offshore islands of the NT, and are most common in mangrove areas but can also be found on intertidal flats and saltmarshes (Ward, 2012c). The closest record of this species to the survey areas is 28 km north-west of Toms Gully. Given that this species inhabits coastal areas there is a low likelihood that it occurs within the survey areas.

Australian painted snipe (*Rostratula australis*) – *Rostratula australis* is a wading bird that is found throughout Australia, though mostly recorded in south-east Australia (Taylor, et al., 2013). It is listed as vulnerable under the TPWC Act and endangered under the EPBC Act. The species inhabits shallow, vegetated, freshwater swamps, claypans or inundated grassland (Taylor, et al., 2013). The closest record of *R. australis* to the survey areas is 57 km north-west of Rustlers Roost. Due to potentially suitable habitat, there is a moderate likelihood that *R. australis* will occur within the survey areas.

Masked owl (northern) (*Tyto novaehollandiae kimberli*) – *Tyto novaehollandiae kimberli* is a large dark owl occurring on the north Australian mainland (Woinarski & Ward, 2012). It is listed as vulnerable under the TPWC Act and EPBC Act. The species occurs mainly in eucalypt tall open forest, but also roosts in monsoon rainforests and forages in more open vegetation types including grasslands (Woinarski & Ward, 2012). The closest record of this species to the survey areas is 35 km north-west of Toms Gully. As there is potentially suitable habitat for *T. n. kimberli* present in the survey areas there is a moderate likelihood that this species is present in the survey areas.

Mammals of conservation significance

Seventeen mammal species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring within a 20 km radius of the survey areas (Table 10). Nine of these species are listed as threatened under the EPBC Act; one as critically endangered, three as endangered and five as vulnerable. Three of these species listed as threatened under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of seven mammal species listed as threatened under the TPWC Act; one as critically endangered, three as endangered and five as vulnerable, were also identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of a further six species listed as near threatened and three species listed as data deficient under the TPWC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. All NT Fauna Atlas records of conservation significant mammals within 20km of the survey areas are mapped in Figure 13. Further information relevant to assessment of likelihood of occurrence of threatened mammal species in the survey areas is provided below.

Table 10: Mammal species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within the lease areas. Vu: vulnerable, En: endangered, Cr: critically endangered, DD: data deficient, NT: near threatened.

Species name	Common name	Status			NT Fauna Atlas
		TPWC	EPBC	PMST	
<i>Antechinus bellus</i>	Fawn antechinus	En	Vu	X	X
<i>Conilurus penicillatus</i>	Brush-tailed rabbit-rat	En	Vu	X	
<i>Dasyurus hallucatus</i>	Northern quoll	Cr	En	X	X
<i>Isodon macrourus</i>	Northern brown bandicoot	NT			X
<i>Megaderma gigas</i>	Ghost bat	NT	Vu	X	
<i>Mesembriomys gouldii gouldii</i>	Black-footed tree-rat	Vu	En	X	X
<i>Onychogalea unguifera</i>	Northern nailtail wallaby	NT			X
<i>Petrogale concinna canescens</i>	Nabarlek (Top End)	Vu	En	X	
<i>Phascogale pirata</i>	Northern brush-tailed phascogale	En	Vu	X	
<i>Pseudomys nanus</i>	Western chestnut mouse	NT			X
<i>Rattus tunneyi</i>	Pale field-rat	Vu			X
<i>Rhinonictes aurantia</i>	Orange leaf-nosed bat	NT			X
<i>Saccolaimus saccolaimus nudiclunatus</i>	Bare-rumped sheath-tailed bat	DD	Cr	X	
<i>Sminthopsis bindi</i>	Kakadu dunnart	DD			X
<i>Sminthopsis virginiae</i>	Red-cheeked dunnart	DD			X
<i>Trichosurus vulpecula arnhemensis</i>	Common brushtail possum (Top End)	NT			X
<i>Xeromys myoides</i>	Water mouse	DD	Vu	X	

Fawn antechinus (*Antechinus bellus*) – *Antechinus bellus* is a small dayurid marsupial found in the savannah woodland and tall open forest on the Top End NT (Young, 2012). It is listed as endangered under the TPWC Act and vulnerable under the EPBC Act. The closest record of *A. bellus* to the survey

areas is 3.5 km south-east of Toms Gully. Given the proximity of prior records, and the presence of potentially suitable habitat, there is a high likelihood that *A. bellus* occurs within the survey areas.

Brush-tailed rabbit-rat (*Conilurus penicillatus*) – *Conilurus penicillatus* is a moderate-sized, partly arboreal rat, only known to currently persist in the NT on the Cobourg Peninsula, Bathurst, Melville and Inglis Islands, and Groote Eylandt (Woinarski & Hill, 2012). It is listed as endangered under the TPWC Act and vulnerable under the EPBC Act. The preferred habitat of the species is eucalypt tall-open forest, but, at least on the Cobourg Peninsula, it also occurs on coastal grasslands (Woinarski & Hill, 2012). The closest record of this species is 30 km south-west of Quest 29, however this was before 1971. Given the high survey effort for this species in recent years and associated observed declines in populations (see Woinarski & Hill, (2012)), and a lack of records within the immediate area surrounding the survey areas, there is a low likelihood that *C. penicillatus* occurs within the survey areas.

Northern quoll (*Dasyurus hallucatus*) – *Dasyurus hallucatus* is a distinctive carnivorous marsupial, about the size of a small cat, occurring across much of northern Australia (Woinarski & Hill, 2012b). It is listed as critically endangered under the TPWC Act and endangered under the EPBC Act. *Dasyurus hallucatus* occurs in a wide range of habitat, but rocky areas appear to be most suitable (Woinarski & Hill, 2012b). It was common in many eucalypt open forests (Woinarski & Hill, 2012b). There are records of *D. hallucatus* within Toms Gully. Given this, but also taking into account recent broad-scale decline (Woinarski & Hill, 2012b), there is a moderate likelihood of *D. hallucatus* being present in the survey areas.

Ghost bat (*Megaderma gigas*) – *Megaderma gigas* is a large species of bat, currently distributed across northern Australia (Ward & Milne, 2016). It is listed as near threatened under the TPWC Act and vulnerable under the EPBC Act. The distribution is influenced by the availability of suitable caves and mines for roost sites, with one of the largest colonies occurring in gold mine workings at Pine Creek NT (Ward & Milne, 2016). The closest record of *M. gigas* to the survey areas is 38 km south of Quest 29. There is the potential for caves to be present in the rocky areas within the survey areas, therefore there is a moderate likelihood that *M. gigas* is present.

Black-footed tree-rat (*Mesembriomys gouldii gouldii*) – *Mesembriomys gouldii gouldii* is one of the largest rodents in Australia and is found in the Top End NT (Hill, 2012). The species inhabits tropical woodlands and open forests in coastal areas, sheltering in tree hollows and pandanus stands during the day (Hill, 2012). The closest record of *M. g. gouldii* is 5 km north of Quest 29. Given the proximity of prior records and potentially suitable habitat in the area, there is a high likelihood that this species occurs in the survey areas.

Nabarlek (Top End) (*Petrogale concinna canescens*) – *Petrogale concinna canescens* is a very small rock-wallaby that has been recorded in scattered populations from the Arafura Swamp in the east to the Daly River catchment in the west (Ward & Woinarski, 2012). The species is restricted to rocky sandstone or granite areas, especially on steep slopes, with large boulders, caves and crevices, and may move to forage in adjacent flat areas (Ward & Woinarski, 2012). The closest record of *P. C. canescens* is 61 km south-east of Quest 29. Given the proximity of prior records, there is a low likelihood that *P. c. canescens* is present in the survey areas.

Northern brush-tailed phascogale (*Phascogale pirata*) – *Phascogale pirata* is a mid-sized carnivorous marsupial restricted to the Top End NT (Woinarski & Ward, 2012b). Little is known of the ecology of

P. pirata, but most records are from tall open forest dominated by *E. miniata* and *E. tertodonta* (Woinarski & Ward, 2012b). The closest record of this *P. pirata* to the survey areas is 53.5 km south-west of Rustlers Roost. Given the potentially suitable habitat in the survey areas, but taking into account proximity to prior records, there is a moderate likelihood that *P. pirata* occurs in the survey areas.

Pale field-rat (*Rattus tunneyi*) – *Rattus tunneyi* is a medium sized rodent found in higher rainfall areas of northern Australia (Young & Hill, 2012). It is listed as vulnerable under the TPWC Act. *Rattus tunneyi* inhabits dense vegetation along creeks (Young & Hill, 2012). The closest record of the species is 3.5 km south-east of Toms Gully. Given the potentially suitable habitat and the proximity of prior records, there is a high likelihood that this species is present in the survey areas.

Bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus nudicluniatatus*) – *Saccolaimus saccolaimus nudicluniatatus* is a large, high-flying, insectivorous bat distributed across north-eastern Australia, including Top End NT (Milne & Woinarski, 2006). It is listed as data deficient under the TPWC Act and critically endangered under the EPBC Act. The species has been recorded in open pandanus woodland and eucalypt tall open forests (Milne & Woinarski, 2006). The closest record of *S. s. nudicluniatatus* to the survey areas is 60 km north-west of Rustlers Roost. Given the difficulty associated with recording the species and potentially suitable habitat, there is a moderate likelihood that *S. s. nudicluniatatus* occurs within the survey areas.

Water mouse (*Xeromys myoides*) – *Xeromys myoides* is a small rodent known from just ten records from northern Arnhem Land in the east to the Daly River in the west (Woinarski, 2006c). It is listed as data deficient under the TPWC Act and vulnerable under the EPBC Act. *Xeromys myoides* inhabits mangrove forests, freshwater swamps and floodplain saline grasslands (Woinarski, 2006c). The closest record of *X. myoides* to the survey areas is 107 km north-east of Rustlers Roost. However this record was prior to 1970 (Woinarski, 2006c). Given the proximity of prior records, there is a low likelihood that *X. myoides* is present in the survey areas.

Reptile species of conservation significance

Thirteen reptile species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring within a 20 km radius of the survey areas (Table 11). Two of these species are listed as threatened under the EPBC Act; one as endangered and one as vulnerable. Three of these reptile species listed as threatened under the EPBC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of five reptile species listed as threatened under the TPWC Act, all as vulnerable, were also identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Records of a further two species listed as near threatened and six species listed as data deficient under the TPWC Act were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. All NT Fauna Atlas records of conservation significant reptiles within 20km of the survey areas are mapped in Figure 13. Further information relevant to assessment of likelihood of occurrence of threatened reptile species in the survey areas is provided below.

Table 11: Reptile species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within 20km of the lease areas. Vu: vulnerable, DD: data deficient, NT: near threatened.

Species name	Common name	Status			NT Fauna Atlas
		TPWC	EPBC	PMST	
<i>Acanthophis hawkei</i>	Plains death adder	Vu	Vu	X	
<i>Demansia olivacea</i>	Olive whip snake	DD			X
<i>Dendrelaphis punctulatus</i>	Green tree snake	DD			X
<i>Lucasium occultum</i>	Yellow-snouted gecko	Vu	En	X	
<i>Pseudechis australis</i>	King brown snake	NT			X
<i>Tiliqua scincoides</i>	Common blue-tongued lizard	DD			X
<i>Varanus baritji</i>	Black-spotted ridge-tailed monitor	DD			X
<i>Varanus glebopalma</i>	Long-tailed rock monitor	DD			X
<i>Varanus mertensi</i>	Mertens’ water monitor	Vu			X
<i>Varanus mitchelli</i>	Mitchell’s water monitor	Vu			X
<i>Varanus panoptes</i>	Floodplain monitor	Vu			X
<i>Varanus primordius</i>	Northern ridge-tailed monitor	NT			X
<i>Varanus scalaris</i>	Spotted tree monitor	DD			X

Plains death adder (*Acanthophis hawkei*) – *Acanthophis hawkei* has a disjointed distribution on the floodplains of the Adelaide, Mary and Alligator Rivers, and the Barkly Tableland (Ward & Phillips, 2012). It is listed as vulnerable under the TPWC Act and EPBC Act. *Acanthophis hawkei* inhabits flat, treeless, cracking soil plains of northern Australia (Ward & Phillips, 2012). The closest record of *A. hawkei* to the survey areas is 23 km north-west of Toms Gully. As any potentially suitable habitat is likely to be limited in extent in the survey areas, there is a low likelihood of *A. hawkei* occurring.

Yellow-snouted gecko (*Lucasium occultum*) – *Lucasium occultum* is a small ground-dwelling gecko known from north-west Kakadu, the Wildman River portion of the Mary River National Park and Annaburroo Station (Beggs, et al., 2012). It is listed as vulnerable under the TPWC Act and endangered under the EPBC Act. All records have been from areas with well-developed leaf litter and grasses in open forests dominated by *E. miniata* and *E. tetradonta*, typically with red sandy-loam soils. The closest record of *L. occultum* to the survey areas is 27 km north-east of Toms Gully. As very little is known of the ecology of this species, and there is potentially suitable habitat, there is a moderate likelihood that *L. occultum* occurs within the survey areas.

Mertern’s water monitor (*Varanus mertensi*) – *Varanus mertensi* is a medium- to large-sized semi-aquatic monitor found across far north Australia from the Kimberly to the west side of Cape York Peninsula (Ward, et al., 2006). It is listed as vulnerable under the TPWC Act. *Varanus mertensi* inhabits coastal and inland waters in all river systems of the Top End (Ward, et al., 2006). The closest record of *V. mertensi* to the survey areas is 3.5 km south-east of Toms Gully. Given the presence of potentially suitable habitat, there is a high likelihood that *V. mertensi* occurs within the survey areas.

Mitchell’s water monitor (*Varanus mitchelli*) – *Varanus mitchelli* is a slender medium-sized monitor found across the Kimberley and the Top End, and an isolated population in north-western Queensland (Ward, 2012d). It is listed as vulnerable under the TPWC Act. *Varanus mitchelli* inhabits

margins of watercourses, swamps and lagoons (Ward, 2012d). The closest record of *V. mitchelli* to the survey areas is 3.5 km south-east of Toms Gully. Given the presence of potentially suitable habitat, there is a high likelihood that *V. mitchelli* occurs in the survey areas.

Floodplain monitor (*Varanus panoptes*) – *Varanus panoptes* is a large, heavy-built terrestrial monitor with a broad geographic range across far northern Australia (Ward, et al., 2012b). It is listed as vulnerable under the TPWC Act. *Varanus panoptes* occurs in a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands (Ward, et al., 2012b). There are records of *V. panoptes* in Toms Gully. Therefore, there is a high likelihood that *V. panoptes* occurs within the survey areas.

Fish and shark species of conservation significance

Five fish and shark species of conservation significance were identified by the PMST and/or NT Fauna Atlas as occurring within a 20 km radius of the survey areas (Table 12). All of these species are listed as threatened under both the EPBC Act and TPWC Act. Records of one of these species, *Pristis pristis* (largetooth sawfish), were identified by the NT Fauna Atlas within a 20 km radius of the survey areas. Further information relevant to assessment of likelihood of occurrence of threatened reptile species in the survey areas is provided below.

Table 12: Fish and shark species of conservation significance identified by the EPBC PMST and NT Fauna Atlas within the lease areas. Vu: vulnerable, En: endangered, Cr: critically endangered

Species name	Common name	Status			
		TPWC	EPBC	PMST	NT Fauna Atlas
<i>Glyphis garricki</i>	Northern river shark	En	En	X	
<i>Glyphis glyphis</i>	Speartooth shark	Vu	Cr	X	
<i>Pristis clavata</i>	Dwarf sawfish	Vu	Vu	X	
<i>Pristis pristis</i>	Largetooth sawfish	Vu	Vu	X	X
<i>Pristis zijsron</i>	Green sawfish	Vu	Vu	X	

Northern river shark (*Glyphis garricki*) – *Glyphis garricki* is known from the Adelaide, and east and south Alligator River systems in the NT, and the Kimberley coast and King Sound in WA (Ward & Larson, 2012a). It is listed as endangered under both the TPWC Act and EPBC Act. There is little known about the ecology of *G. garricki* but it is probably restricted to shallow, brackish reaches of large rivers. The closest record of this *G. garricki* to the survey areas is 30 km west of Rustlers Roost. Given the absence of potentially suitable habitat, there is a low likelihood that this species occurs within the survey areas.

Speartooth shark (*Glyphis glyphis*) – *Glyphis glyphis* is a medium-sized whaler shark that is known to occur in the eastern Gulf of Carpentaria, Cape York Peninsula and the Alligator Rivers region across to the Adelaide River NT (Ward & Larson, 2012b). It is listed as vulnerable under the TPWC Act and critically endangered under the EPBC Act. *Glyphis glyphis* has been recorded in brackish waters in the NT (Ward & Larson, 2012b). The closest record of *G. glyphis* to the survey areas is 27 km north-west of Toms Gully. Given that there are no brackish habitats, there is a low likelihood that this species occurs in the survey areas.

Dwarf sawfish (*Pristis clavata*) – *Pristis clavata* is a small, robust shark-like sawfish occurring in shallow waters in coastal and estuarine areas of tropical Australia, extending some distance up rivers almost into fresh water (Larson, et al., 2012). It is listed as vulnerable under both the TPWC Act and EPBC Act. The closest record of *P. clavata* to the survey areas is 95 km north-west of Toms Gully. Given the lack of suitable habitat, there is a low likelihood that this species will occur in the survey areas.

Large-tooth sawfish (*Pristis pristis (microdon)*) – *Pristis pristis* is a medium-sized sawfish known from several drainages in northern Australia from Western Australia to Queensland (Larson, et al., 2006). It is listed as vulnerable under both the TPWC Act and EPBC Act. *Pristis pristis* prefers muddy bottoms of freshwater areas and upper reaches of estuaries, but has been reported to be primarily a marine/estuarine species that spends its first 3-4 years in freshwater (Larson, et al., 2006). The closest record of *P. pristis* to the survey areas is 12.5 km north-west of Rustlers Roost. The creeks running through the survey areas are relatively small, and probably do not provide habitat for an animal as large as *P. pristis*. Therefore, there is a low likelihood that *P. pristis* occurs within the survey areas.

Green sawfish (*Pristis zijsron*) – *Pristis zijsron* is a large, robust shark-like sawfish found in Australian tropical waters (Stirrat, et al., 2006). In the NT, specimens have been collected in Darwin Harbour and other evidence of occurrence in Garig Gunak Barlu National Park and in the Arafura Sea around Groote Eylandt (Stirrat, et al., 2006). It is listed as vulnerable under the TPWC Act. *Pristis zijsron* occurs in areas with a muddy substrate, and throughout its range has been reported to inhabit marine inshore waters, estuaries, lagoons and freshwater, but mainly marine and estuarine areas (Stirrat, et al., 2006). The closest record of *P. zijsron* to the survey areas is 95 km north-west of Toms Gully. Given that *P. zijsron* is found mainly in coastal and estuarine areas, there is a low likelihood that this species occurs within the survey areas.

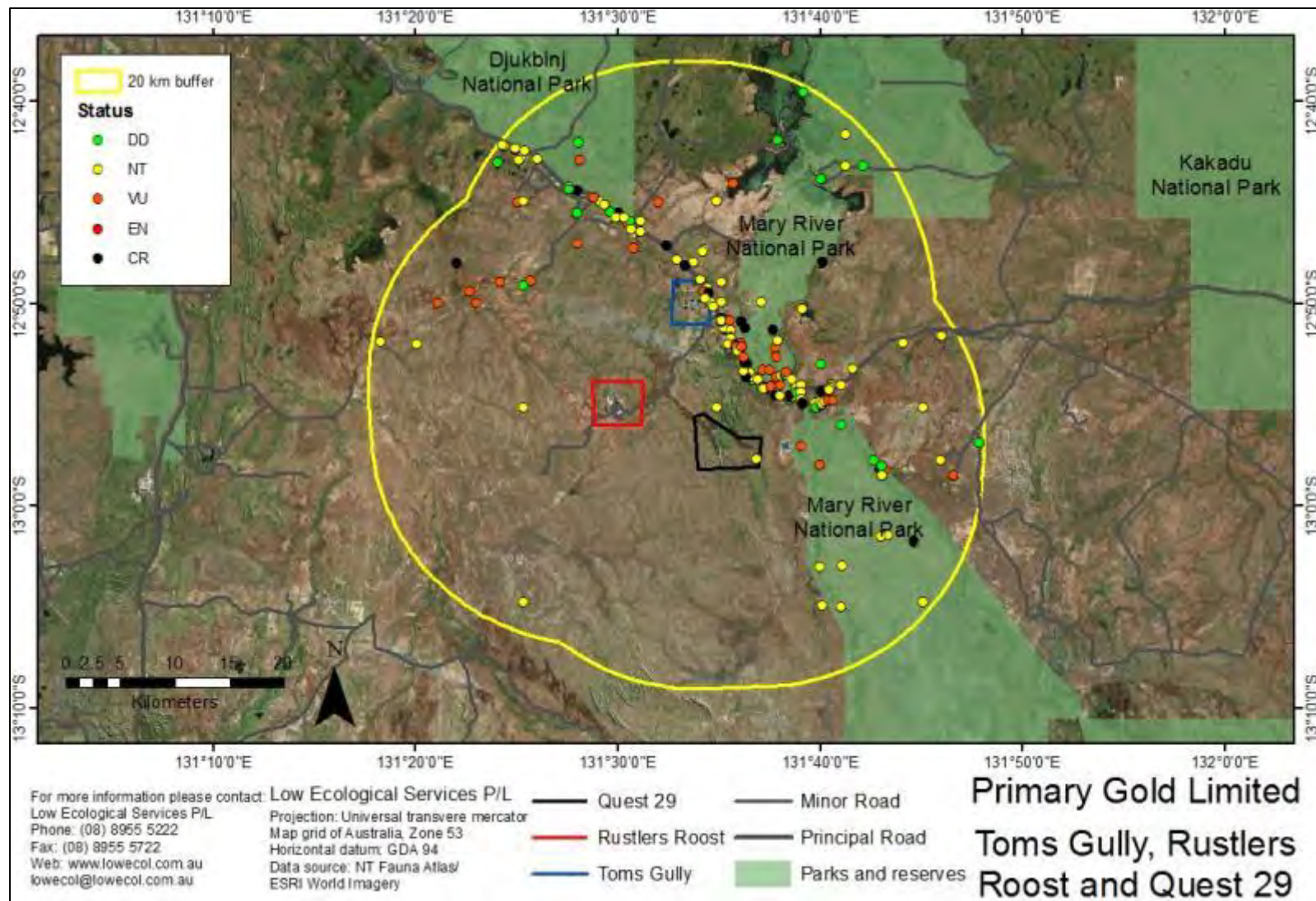


Figure 13: Location of records of fauna species of conservation significance listed under the TPWC Act with records in the NT Flora Atlas within 20 km of Toms Gully, Rustlers Roost and Quest 29

3.10.3 Migratory species

The EPBC PMST and NT Fauna Atlas identified 45 migratory species as occurring or potentially occurring within 20 km of the survey areas (Table 13).

Table 13: Fauna species listed as migratory under the EPBC Act as identified by the PMST and the NT Fauna Atlas as occurring or having potentially suitable habitat within the Area of Interest, their conservation status, observation during the on-ground survey, listing under international agreements and likelihood of occurrence (Likelihood) in the lease areas.

Mi: Migratory; Ma: Marine, J: Japan-Australia Migratory Bird Agreement; C: China-Australia Migratory Bird Agreement; R: Republic of Korea-Australia Migratory Bird Agreement; B: Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals)

Scientific name	Common name	EPBC	PMST	NT Fauna Atlas	International agreement
<i>Acrocephalus orientalis</i>	Oriental reed-warbler	MiMa	X		J, C, B
<i>Actitis (Tringa) hypoleucos</i>	Common sandpiper	MiMa		X	J, C, R, B
<i>Anoxypristis cuspidata</i>	Narrow sawfish	MiMa	X		B
<i>Apus pacificus</i>	Fork-tailed swift	MiMa	X	X	J, C, R
<i>Arenaria interpres</i>	Ruddy turnstone	MiMa		X	J, C, R, B
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MiMa		X	J, C, R, B
<i>Calidris ferruginea</i>	Curlew sandpiper	MiMa	X		J, C, R, B
<i>Caretta caretta</i>	Loggerhead turtle	MiMa	X		B
<i>Cecropis daurica (Hirundo daurica)</i>	Red-rumped swallow	MiMa	X		J, C, R
<i>Charadrius leschenaultii</i>	Great sand plover	MiMa		X	J, C, R, B
<i>Charadrius mongolus</i>	Lesser sand plover	MiMa		X	J, C, R, B
<i>Charadrius veredus</i>	Oriental plover	MiMa	X		J, C, R, B
<i>Chelonia midas</i>	Green turtle	MiMa	X		B
<i>Crocodylus porosus</i>	Saltwater crocodile	MiMa	X	X	B
<i>Cuculus optatus</i>	Oriental cuckoo	MiMa	X	X	J, C, R
<i>Dermochelys coricea</i>	Leatherback turtle	MiMa	X		B
<i>Eremochelys imbricata</i>	Hawksbill turtle	MiMa	X		B
<i>Glareola maldivarum</i>	Oriental pratincole	MiMa	X		J, C, R
<i>Hirundo rustica</i>	Barn swallow	MiMa	X		J, C, R
<i>Hydroprogne (Sterna) caspia</i>	Caspian tern	MiMa		X	J
<i>Lepidochelys olivacea</i>	Olive ridley turtle	MiMa	X		B
<i>Limosa limosa</i>	Black-tailed godwit	MiMa		X	J, C, R, B
<i>Manta alfredi</i>	Reef manta ray	MiMa	X		B
<i>Manta birostris</i>	Giant manta ray	MiMa	X		B
<i>Megaptera novaeangliae</i>	Humpback whale	MiMa	X		B
<i>Motacilla cinerea</i>	Grey wagtail	MiMa	X		J, C, R
<i>Motacilla flava</i>	Yellow wagtail	MiMa	X		J, C, R
<i>Natator depressus</i>	Flatback turtle	MiMa	X		B
<i>Numenius madagascariensis</i>	Eastern curlew	MiMa	X		J, C, R, B

Scientific name	Common name	EPBC	PMST	NT Fauna Atlas	International agreement
<i>Numenius phaeopus</i>	Whimbrel	MiMa		X	J, C, R, B
<i>Pandion haliaetus</i>	Osprey	MiMa	X		B
<i>Plegadis falcinellus</i>	Glossy ibis	MiMa		X	B
<i>Pluvialis fulva</i>	Pacific golden plover	MiMa		X	J, C, R, B
<i>Pristis clavata</i>	Dwarf sawfish	Mi	X		B
<i>Pristis pristis</i>	Large-tooth sawfish	Mi	X		B
<i>Pristis zijsron</i>	Green sawfish	MiMa	X		B
<i>Rhipidura rufifrons</i>	Rufous fantail	MiMa	X		B
<i>Sousa chinensis</i>	Indo-Pacific humpback dolphin	Mi	X		B
<i>Sterna hirundo</i>	Common tern	MiMa		X	J, C, R
<i>Sternula albifrons</i>	Little tern	MiMa		X	J, C, R, B
<i>Tringa (Heteroscelus) brevipes</i>	Grey-tailed tattler	MiMa		X	J, C, R, B
<i>Tringa glareola</i>	Wood sandpiper	MiMa		X	J, C, R, B
<i>Tringa nebularia</i>	Common greenshank	MiMa	X	X	J, C, R, B
<i>Tringa stagnatilis</i>	Marsh sandpiper	MiMa		X	J, C, R, B
<i>Xenus cinereus</i>	Terek sandpiper	MiMa		X	J, C, R, B

3.10.4 Introduced fauna species

Thirteen introduced fauna species were identified by the EPBC PMST as occurring or potentially occurring within 20 km of the survey areas (Table 14). Nine introduced fauna species were identified by the NT Fauna Atlas within 20 km of the survey areas (Table 14).

Table 14: Introduced fauna species identified as occurring or potentially occurring within 20 km of the survey areas by the EPBC PMST, NT Fauna Atlas and observation during the on-ground survey.

Scientific name	Common name	PMST	NT Fauna Atlas	On-ground
<i>Bos Taurus</i>	Cattle	X	X	X
<i>Bubalus bubalis</i>	Swamp buffalo	X	X	X
<i>Canis lupis familiaris</i>	Domestic dog	X		
<i>Columba livia</i>	Rock dove	X	X	
<i>Equus asinus</i>	Donkey	X	X	
<i>Equus caballus</i>	Horse	X		
<i>Felis catus</i>	Cat	X	X	X
<i>Hemidactylus frenatus</i>	Asian house gecko	X	X	
<i>Indotyphlops braminus</i>	Flower-pot blind snake	X	X	
<i>Mus musculus</i>	House mouse	X		X
<i>Rattus rattus</i>	Black rat	X		
<i>Rhinella marina</i>	Cane toad	X	X	X
<i>Sus scrofa</i>	Pig	X	X	X

3.11 State and Territory Reserves

The PMST identified five Territory reserves in the area surrounding Toms Gully. These are Adelaide River Foreshore Conservation Area (39km from Toms Gully processing plant), Djukbinj National Park (62km), Harrison Dam Conservation Area (31km), Leaning Tree Lagoon (20km) and Mary River National Park (4km).

4 FIELD SURVEY RESULTS

4.1 Survey Conditions

The survey was conducted during the 2016 build up (end of the dry season) from November 1st – 7th. Climatic conditions during the survey were warm and humid. Rainfall in the month preceding the survey, was higher than average, with 122.8mm of rain recorded at the Middle Point Ranges weather station located 33km NW of the survey sites (BOM, 2017).

4.2 Survey Locations

Surveying was conducted in identified habitat areas suitable for target threatened species listed under the EPBC and TPWC Acts and identified by the NT EPA as occurring or potentially occurring within the study areas. Coordinates for each site are provided in Appendix 1.

4.3 Flora species

There were 122 species from 34 families identified during the on-ground survey (Appendix 2)). These included no species of conservation significance and seven introduced species. A number of flora species present could not be identified to species level due to a lack of seed heads, fruit or flowers, these were identified to genus and efforts will be made to identify these species during the late wet season survey.

4.3.1 Conservation significant flora

No flora species of conservation significance were recorded in the study areas. Several flora species could not be identified due to species level however all were determined not to be any of the threatened species outlined in the desktop survey due to their identified genus, description or and/or location.

4.3.2 Introduced flora species

A total of eight introduced flora species were recorded during the survey, four of which are listed weeds federally or in the Northern Territory. *Andropogon gayanus* (Gamba Grass) and *Hyptis suaveolens* (Hyptis) were the most widespread (Table 15). Four introduced species were recorded in the Toms Gully survey area. These included *Andropogon gayanus*, *Hyptis suaveolens*, *Hymenachne amplexicaulis* and *Heliotropium indicum*. Two species were found at study sites in the Rustlers Roost area, including *Hymenachne amplexicaulis* and *Stylosanthes viscosa*. Incidentally, *Mimosa pigra* was also recorded next to the WRD in Rustlers Roost. Four weed species were recorded in the Quest 29 region: *Andropogon gayanus*, *Hyptis suaveolens*, *Cenchrus pedicellatus* (Mission Grass) and *Cynodon dactylon* (Couch Grass).

Table 15. Introduced flora species identified in the lease areas, including NT, EPBC and WoNS status.

Species name	Common name	Status			Lease Areas
		NT	EPBC	WoNS	
<i>Andropogon gayanus</i>	Gamba grass	B	Inv	X	Toms Gully, Quest 29
<i>Cenchrus pedicellatus</i>	Mission grass (annual)				Quest 29
<i>Cynodon dactylon</i>	Couch grass				Quest 29
<i>Heliotropium indicum</i>					Toms Gully
<i>Hymenachne amplexicaulis</i>	Olive hymenachne	B,C	Inv	X	Toms Gully, Rustlers Roost
<i>Hyptis suaveolens</i>	Hyptis	B			Toms Gully Quest 29
<i>Mimosa pigra</i>	Mimosa	B	Inv	X	Adjacent to Rustlers Roost
<i>Stylosanthes viscosa</i>					Rustlers Roost

4.4 Habitat types the survey area

Nine habitats were identified during the on-ground survey. These habitat types are described in detail in the table below (Table 16).

Table 16: Habitat types identified during the on-ground survey of the lease and proposed drilling areas.

Habitat	Survey sites	Lease Area	Description	Photograph
WRD	TGWD1	Toms Gully	Rocky slope of waste rock dump with a vegetation community of <i>Eucalyptus camaldulensis</i> to 15 metres in height over <i>Acacia holosericea</i> with an understorey of <i>Petalostigma pubescens</i>, <i>Andropogon gayanus</i> (weed), <i>Hyptis suaveolens</i> (weed) and <i>Eriachne sp.</i> Soils were mixed with quartzite and siltstone rocks to 20 cm in size. Non-dominant species: <i>Cochlospermum fraseri</i>, <i>Owenia vernicosa</i>, <i>Pterocaulon serrulatum</i>	
Boulder	CamT3.2	Toms Gully	Large Boulder and outcrop slope with open forest of <i>Eucalyptus miniata</i>, <i>Erythrophleum chlorostachys</i>, <i>Corymbia polycarpa</i> and <i>Ficus sp.</i> with a maximum height of 25 metres. The mid-story contained <i>Cochlospermum fraseri</i>, <i>Brachychiton megaphyllus</i>, <i>Petalostigma pubescens</i> and <i>Ampelocissus acesosa</i>. The understorey was dominated by the weed species <i>Andropogon gayanus</i> and <i>Hyptis suaveolens</i> with density increasing closer to the station track. Soils were shallow loam with boulders to 2 metres in size and widespread outcrop. Non-dominant species: <i>Buchanania obovata</i>, <i>Erythrina verpertilio</i>, <i>Livistona inermis</i>, <i>Galactia megaphylla</i>	

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Habitat	Survey sites	Lease Area	Description	Photograph
Major Creek line	ST2	Toms Gully	Creek line with tall open-forest along banks consisting of <i>Bambusa arnhemica</i>, <i>Barringtonia acutangula</i>, <i>Acacia auriculiformis</i> and <i>Melaleuca dealbata</i> to 30 metres in height. The lower stories included a community of <i>Pandanus aquaticus</i>, <i>Petalostigma pubescens</i> and <i>Aristida</i> sp. Non-dominant species: <i>Planchonia careya</i>, <i>Petalostigma quadriloculare</i>, <i>Mnesithea rottboellioides</i>, <i>Melaleuca viridiflora</i>, <i>Erythrophleum chlorostachys</i>, <i>Lophostemon lactifluus</i>, <i>Brachychiton megaphyllus</i>, <i>Ampelocissus acetosa</i>, <i>Grewia retusifolia</i>, <i>Hyptis suaveolens</i> (weed), <i>Heliotropium indicum</i> (introduced), <i>Glinus oppositifolius</i>, <i>Drosera darwiniensis</i>, <i>Eriachne</i> sp. <i>Brunonia</i> sp.	
Lowland Woodland	SR2, ST1, CamT4	Rustlers Roost Toms Gully	Lowland woodland of <i>Corymbia polycarpa</i> +/- <i>Lophostemon lactifluus</i>/<i>Erythrophleum chlorostachys</i>/<i>Eucalyptus miniata</i>/ <i>E. tectifera</i>/ <i>E. camaldulensis</i> to 18m in height, over <i>Buchanania obovata</i> and <i>Acacia holosericea</i> +/- <i>Petalostigma pubescens</i>/ <i>Melaleuca viridiflora</i> /<i>Ficus opposita</i>/ <i>Cochlospermum fraseri</i> and an understory of <i>Themeda triandra</i> +/- <i>Aristida pruinosa</i>/<i>Andropogon gayanus</i> (weed)/<i>Cynodon dactylon</i> (introduced). Soils were moderately deep grey silty loams or deep clay loams with siltstone rocks up to 20 cm in size. Non-dominant species: <i>Eucalyptus clavigera</i>, <i>Corymbia alba</i>, <i>E. tetradonta</i>, <i>Corymbia bleeseri</i> <i>Melaleuca nervosa</i>, <i>Barringtonia acutangula</i>, <i>Terminalia ferdinandiana</i>, <i>Petalostigma quadriloculare</i>, <i>Lophostemon lactifluus</i>, <i>Brachychiton megaphyllus</i>, <i>Ampelocissus acetosa</i>, <i>Grevillea mimosoides</i>, <i>Cajanus acutifolius</i>, <i>Clerodendrum tatei</i>, <i>Eragrostis</i> sp., <i>Eriachne burkittii</i>, <i>Gycine</i> sp., <i>Polymeria ambigua</i>, <i>Sida</i> sp. , <i>Spermaeoce</i> sp., <i>Stylosanthes viscosa</i> (introduced), <i>Coldenia procumbens</i>, <i>Pterocaulon serrulatum</i>, <i>Euphorbia</i> sp., <i>Fimbristylis</i> sp., <i>Hyptis suaveolens</i> (weed), <i>Hymenachne amplexicaulis</i> (weed)	

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Habitat	Survey sites	Lease Area	Description	Photograph
Seasonally inundated plain	CamT2, CamQ2	Tom’s Gully Quest 29	Open forest of <i>Lophostemon lactifluus</i> and some <i>Erythrophleum chlorostachys</i> +/- <i>Miliusa traceyi</i>/<i>Ficus virens</i> var. <i>virens</i> over a moderately dense mid-storey of <i>Melaleuca viridiflora</i> +/-<i>Pandanus spiralis</i>/<i>Melaleuca nervosa</i> and a sparse ground layer of <i>Hyptis suaveolens</i> (weed) +/-<i>Imperata cylindrica</i>/<i>Cynodon dactylon</i> (weed)/ <i>Abrus precatorius</i>. Soils were deep, grey-dark brown sandy loams and loamy clays with rock cover up to 60cm in size (CamQ2) or absent (CamT2). Non-dominant species: <i>Acacia auriculiformis</i>, <i>Bridelia tomentosa</i>, <i>Planchonia careya</i>, <i>Xanthostemon paradoxus</i>, <i>Galactia megalophylla</i>, <i>Xyris complanata</i>, <i>Tinospora smilacina</i>	
Open woodland on slope	SQ01, SQ02, CamQ01	Quest 29	Open woodland of <i>Corymbia dichromophloia</i> and <i>Eythrophleum chlorostachys</i> +/- <i>C. bleeseri</i>/<i>Eucalyptus tintinnans</i>/<i>Corymbia terminalis</i> up to 20 metres in height over <i>Planchonia careya</i> +/- <i>Cochlospermum fraseri</i>/<i>Terminalia ferdinandiana</i> and ground layer of one or more of the following: <i>Eriachne</i> sp., <i>Chrysopogon fallax</i>, annual sorghum and <i>Sorghum plumosum</i>. Soils were shallow (<10cm) to moderately deep (10-40 cm) silty loams with siltstone rock cover up in 60 cm in size. Sites SQ02 and CamQ01 had a larger rock size covering the slope and as a result a less diverse floral assemblage than SQ01. Non-dominant species: <i>Eucalyptus tectifica</i>, <i>Erythrophleum chlorostachys</i>, <i>Ficus aculeata</i>, <i>Lophostemon lactifluus</i> (at bottom of slope), <i>Brachychiton megaphyllus</i>, <i>Buchanania obovata</i>, <i>Waltheria indica</i>, <i>Galactia megaphylla</i>, <i>Ampellocissus acetosa</i>, <i>Aristida</i> sp.	

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Habitat	Survey sites	Lease Area	Description	Photograph
Creek Floodplain	CamT1, CamR1	Toms Gully Rustlers Roost	<i>Corymbia polycarpa</i> and <i>Corymbia bigalerita</i> +/- <i>Melaleuca argentea</i>/<i>Eucalyptus miniata</i>/ <i>Erythrophleum chlorostachys</i> up to 20 metres in height over <i>Melaleuca viridiflora</i>, <i>Ficus scobina</i> and <i>Terminalia microcarpa</i>, and a ground layer of <i>Ampelocissus acetosa</i>, <i>Imperata cylindrica</i>. Soils were deep, silty loams with no rock cover Non-dominant species: <i>Hyptis suaveolens</i> (weed)	
Woodland on Slope	ST4, SR3, SR4, CamR2, CamQ3, SQ3, SQ4, CamR4	Toms Gully Rustlers Roost Quest 29	Woodland of <i>Eucalyptus miniata</i>, <i>Corymbia bleeseri</i> and <i>Erythrophleum chlorostachys</i> +/- <i>Eucalyptus tectifica</i>/<i>Xanthostemon paradoxus</i> up to 18 metres in height, a mid-storey of <i>Buchanania obovata</i>, +/- <i>Livistona inermis</i>/<i>Terminalia ferdinandiana</i>/<i>Grevillea mimosoides</i> and a ground layer of +/- <i>Triodia bitextura</i>/ <i>Grevillea pteridifolia</i>/<i>Tephrosia humifusa</i> /<i>Sauropus glauceus</i>/<i>Eragrostis sp.</i>/<i>Eriachne avenacea</i>/ <i>E. mucronata</i>/annual <i>Sorghum</i>. Soils were moderately deep, grey silty loams, grey-brown sandy loams and clay loams with sandstone stones to 20cm and isolated large boulders at ST1. Non-dominant species: <i>Eucalyptus clavigera</i>, <i>Eucalyptus tintinnans</i>, <i>Petalostigma quadriloculare</i>, <i>Cochlospermum fraseri</i>, <i>Planchonia careya</i>, <i>Drosera darwiniensis</i>, <i>Jacquermontia sp.</i>, <i>Galactia megalophylla</i>, <i>Evolvulus alsinoides</i>, <i>Tephrosia poretta</i>, <i>Euphorbia muelleri</i>	

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Habitat	Survey sites	Lease Area	Description	Photograph
Dam-side Low Open Forest	CamR3	Rustlers Roost	Low open forest of <i>Corymbia polysciada</i>, <i>Eucalyptus dichromophloia</i> and <i>Erythrophleum chlorostachys</i> up to 10 metres in height over <i>Acacia holosericea</i>, <i>A. lamprocarpa</i> and <i>Antidesma ghaesembilla</i> with a ground layer of <i>Fimbristylis sp.</i> and water lilies on the dam. Soils were brown-grey sandy loam with sandstone and quartzite rocks to 60cm in size. Non-dominant species: None recorded	

4.5 Fauna

One hundred and thirty-nine fauna species were recorded during the on-ground surveys of Toms Gully, Rustlers Roost and Quest 29. This included 89 bird species, 20 mammal species, 15 reptile species, 12 amphibian species and three arthropod species. Seventy-one species were recorded in the Toms Gully survey area; 47 bird species, 17 mammal species, nine reptile species and nine amphibian species (**Error! Reference source not found.**). Ninety-one species were recorded in the Rustlers Roost area; 66 bird species, nine mammal species, nine reptile species, six amphibian species and one arthropod species (**Error! Reference source not found.**). Sixty-nine fauna species were recorded in the Quest 29 survey area; 51 birds, nine mammals, four reptiles, three amphibians and two arthropods (**Error! Reference source not found.**). A copy of the bat identification report provided by Dennis Matthews can be found in Appendix 6.

4.5.1 Threatened fauna

No threatened fauna species were recorded during on-ground surveys of Toms Gully, Rustlers Roost and Quest 29, despite targeted survey effort for threatened species identified by the NT Fauna Atlas and PMST (see section 2.2 for a description of the methods employed for each identified threatened species).

4.5.2 Fauna species of other conservation significance

No fauna species listed as migratory were recorded during the November 2016 on-ground survey. One species listed as near-threatened under the TPWC Act, *Rhinonycteris aurantia* (orange leaf-nosed bat) was recorded in the Toms Gully survey area (ST3 and ST4). Two species listed as data deficient under the TPWC Act, *S. virginiae* (red-cheeked dunnart) and *V. baritji* (black-spotted ridge-tailed monitor), were recorded in the Rustlers Roost survey area. *Sminthopsis virginiae* was recorded at SR4. This is 13 km west of the nearest record of the species in Mary River National Park. *Varanus baritji* was recorded at SR3. This is 9.5 km south-west of the nearest record of the species, also in Mary River National Park.

4.5.3 Introduced fauna

Six introduced fauna species were recorded during surveys of Toms Gully, Rustlers Roost and Quest 29. These were cattle, water buffalo, cane toad, horse, house mouse and pig. Cattle were recorded in Rustlers Roost. Water buffalo were recorded at Annie’s Dam in Rustlers Roost. Cane toads were ubiquitous throughout all three survey areas. Horses and house mouse were recorded in Toms Gully. Pigs were recorded in all three survey areas.

5 CONCLUSION

No flora species of conservation significance identified by the PMST report or in the NT Flora Atlas, were recorded in the on-ground surveys. A total of eight introduced flora species were recorded, with three being Weeds of National Significance (WoNS) and NT listed with a fourth being only NT listed.

The late dry season survey of Toms Gully, Rustlers Roost and Quest 29 recorded nine habitat areas within the study areas, with woodland on slope, open woodland on slope and lowland woodland being the most common. The remaining habitat areas surveyed included waste rock dump (WRD), a major creekline, a seasonally inundated plain, a creek floodplain and a low open forest on the side of a dam.

The fauna survey did not result in the detection of any threatened species despite targeted surveys in identified habitat areas being conducted. One species listed as near threatened under the TPWC Act, *Rhinonycteris aurantia* (orange leaf-nosed bat) was recorded in the Toms Gully survey area. Two species listed as data deficient under the TPWC Act, *Sminthopsis virginiae* (red-cheeked dunnart) and *Varanus baritji* (black-spotted ridge-tailed monitor) were recorded in the Rustlers Roost survey area.

It is recommended that a late wet season survey be conducted to determine if any threatened species are present in the survey area seasonally.

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7 APPENDICES

APPENDIX 4. Location of sites, in GDA94 co-ordinate system, surveyed during the November on-ground survey by LES

Survey area	Site	Latitude	Longitude
Toms Gully	ST1	- 12.83841	131.55345
	ST2	- 12.82973	131.55084
	ST3	- 12.84643	131.56313
	ST4	- 12.84327	131.54800
	CamT1	- 12.82841	131.56405
	CamT2	- 12.82270	131.55667
	CamT3	- 12.84048	131.57201
	CamT3.2	- 12.83443	131.56747
	CamT4	- 12.83659	131.54611
Rustlers Roost	SR1	- 12.92310	131.48938
	SR2	- 12.92165	131.50247
	SR3	- 12.94020	131.49487
	SR4	- 12.92588	131.48011
	CamR1	- 12.91929	131.48378
	CamR2	- 12.92767	131.50539
	CamR3	- 12.92029	131.48883
	CamR4	- 12.93206	131.49067
Quest 29	SQ1	- 12.95495	131.60526
	SQ2	- 12.95428	131.59575
	SQ3	- 12.94336	131.58037
	SQ4	- 12.92755	131.56660
	CamQ1	- 12.96330	131.59821
	CamQ2	- 12.95277	131.58470
	CamQ3	- 12.93757	131.57472
	CamQ4	- 12.92947	131.56952

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APPENDIX 5. Flora list from on-ground survey of the survey area showing site where species was observed and incidental observation (Inc.)

Species	Family	Type	Toms Gully									Rustlers Roost								Quest 29							
			Camera				Trapping					Camera				Trapping				Camera				Trapping			
			T 1	T 2	T 3	T 4	T 1	T 2	T 3	T 4	TWDO 1	R 1	R 2	R 3	R 4	R 1	R 2	R 3	R 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Acacia lampocarpa	Fabaceae	Tree												X													
Acacia sp.	Fabaceae	Tree				X																					
Acacia auriculiformis	Fabaceae	Tree		X				X																			
Acacia holosericea	Fabaceae	Tree					X				X	X		X		X	X										
Abrus precatorious	Fabaceae	Vine																			X						
Alloteropsis semialata	Poaceae	Grass																				X					
Ampelocissus acetosa	Vitaceae	Vine	X				X	X		X													X				
Andropogon gayanus	Poaceae	Grass			X		X			X	X											X					
Antidesma ghaesembilla	Phyllanthaceae	Shrub												X													
Apocynaceae	Apocynaceae	Shrub						X																			
Aristida latifolia	Poaceae	Grass										X															
Aristida pruinosa	Poaceae	Grass															X										
Aristida sp.	Poaceae	Grass						X																X			
Bambusa arnhemica	Poaceae	Grass						X																			
Barringtonia acutangula	Lecythidaceae	Tree				X		X																			
Bothriochloa blahii	Poaceae	Grass								X																	
Brachychiton megaphyllus	Malvaceae	Tree			X	X		X		X										X				X			
Bridelia tomentosa	Phyllanthaceae	Tree		X																							

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Species	Family	Type	Toms Gully									Rustlers Roost								Quest 29							
			Camera				Trapping				TWD01	Camera				Trapping				Camera				Trapping			
			T1	T2	T3	T4	T1	T2	T3	T4		R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Brunonia sp.	Goodeniaceae	Forb						X																			
Brunoniella sp.	Acanthaceae	Forb					X																				
Buchanania obovata	Anacardiaceae	Tree			X	X	X					X	X				X	X	X	X						X	X
Cajanus acutifolius	Fabaceae	Shrub								X							X										
Coldenia procumbens	Boraginaceae	forb, prostrate				X																					
Cenchrus polystachios/pedicillatus	Poaceae	Grass, Introduced (declared Class B,C)																					X				
Chrysopogon fallax	Poaceae	Grass																	X					X			
Clerodendrum tatei	Lamiaceae	Forb								X							X										
Coelospermum reticulatum	Rubiaceae	Shrub														X											
Cochlospermum fraseri	Bixaceae	Tree			X	X	X				X						X			X					X		X
Corymbia alba	Myrtaceae	Tree																									
Corymbia bleeseri	Myrtaceae	Tree				X				X								X	X				X		X		
Corymbia dichromophloia	Myrtaceae	Tree												X	X	X						X		X	X		
Corymbia ferruginea	Myrtaceae	Tree								X																	
Corymbia polycarpa	Myrtaceae	Tree	X		X		X		X			X					X						X				X
Corymbia polysciada	Myrtaceae	Tree												X													
Corymbia terminalis	Myrtaceae	Tree																		X							
Cynodon dactylon	Poaceae	Grass,																			X						

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Species	Family	Type	Toms Gully									Rustlers Roost								Quest 29							
			Camera				Trapping				TWD0 1	Camera				Trapping				Camera				Trapping			
			T 1	T 2	T 3	T 4	T 1	T 2	T 3	T 4		R 1	R 2	R 3	R 4	R 1	R 2	R 3	R 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
		Introduced (not listed)																									
Drosera darwiniensis	Droseraceae	Forb						X										X									
Eleocharis sp.	Cyperaceae	Sedge								X																	
Eragrostis cumingii	Poaceae	Grass																				X					
Eragrostis sp.	Poaceae	Grass															X					X					X
Eriachne avenacea	Poaceae	Grass																									X
Eriachne burkittii	Poaceae	Grass													X		X										
Eriachne mucronata	Poaceae	Grass																									
Eriachne sp.	Poaceae	Grass						X			X																
Erythrina vespertilio	Fabaceae	Tree			X																						
Erythrophleum chlorostachys	Fabaceae	Tree		X	X			X		X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Eucalyptus bigalerita	Myrtaceae	Tree	X																			X					
Eucalyptus camaldulensis	Myrtaceae	Tree					X				X																
Eucalyptus clavigera	Myrtaceae	Tree				X											X										
Eucalyptus dichromophloia	Myrtaceae	Tree								X																	
Eucalyptus miniata	Myrtaceae	Tree			X	X				X		X	X		X	X	X	X	X			X				X	X
Eucalyptus tectifica	Myrtaceae	Tree				X	X						X											X		X	X
Eucalyptus tetradonta	Myrtaceae	Tree				X				X																	
Eucalyptus tintinnans	Myrtaceae	Tree														X										X	

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Species	Family	Type	Toms Gully									Rustlers Roost								Quest 29							
			Camera				Trapping					Camera				Trapping				Camera				Trapping			
			T 1	T 2	T 3	T 4	T 1	T 2	T 3	T 4	TWDO 1	R 1	R 2	R 3	R 4	R 1	R 2	R 3	R 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Euphorbiaceae	Euphorbiaceae	Forb																				X					
Euphorbia muelleri	Euphorbiaceae	Forb											X			X											
Euphorbia sp.	Euphorbiaceae	Forb				X				X																	
Evovulus alsinoides	Convolvulaceae	Forb																									X
Exocarpus latifolius	Santalaceae	Tree																									
Ficus aculeata	Moraceae	Tree/shrub																					X				
Ficus opposita	Moraceae	Tree/shrub					X																				
Ficus scobina	Moraceae	Tree/shrub	X							X																	
Ficus virens var. virens	Moraceae	Tree																			X						
Ficus sp.	Moraceae	Tree, Rock fig			X																						
Fimbristylis sp.	Cyperaceae	Sedge				X									X												
Flemingia parviflora	Fabaceae	Forb																				X				X	
Galactia megalophylla	Fabaceae	Forb/vine		X	X												X						X				
Glinus oppositifolius	Molluginaceae	Prostrate forb						X																			
Glochidion xerocarpum	Phyllanthaceae	Tree										X				X											
Glycine sp.	Poaceae	Forb														X											
Goodenia armstrongiana	Goodeniaceae	forb					X																				
Grevillea mimosoides	Proteaceae	Tree					X																		X	X	
Grevillea pteridifolia	Proteaceae	Tree																							X		

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Species	Family	Type	Toms Gully									Rustlers Roost								Quest 29							
			Camera				Trapping				TWD0 1	Camera				Trapping				Camera				Trapping			
			T 1	T 2	T 3	T 4	T 1	T 2	T 3	T 4		R 1	R 2	R 3	R 4	R 1	R 2	R 3	R 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Grewia retusifolia	Malvaceae	Shrub						X																			
Helicteres darwininiensis	Malvaceae	Forb, Prostrate					X																				
Heliotropium indicum	Boraginaceae	Forb, Introduced (not listed)						X																			
Hibbertia brevipedunculata	Dilleniaceae	Forb					X			X						X											
Hibiscus zonatus	Malvaceae	Forb														X											
Hymenachne amplexicaulis	Poaceae	Grass, Introduced (WONS)				X										X											
Hyptis suaveolens	Lamiaceae	Weed (declared Class B, C)	X	X				X	X		X										X		X				
Imperata cylindrica	Poaceae	Grass	X	X																							
Jaquermontia sp.	Convolvulaceae	Forb																				X	X				
Livistona inermis	Areaceae	Palm			X					X						X			X								
Lophostemon lactifluus	Myrtaceae	Tree		X		X	X	X														X		X			
Lophostemon sp.	Myrtaceae	Tree							X																		
Melaleuca sp.	Myrtaceae	Tree														X											
Melaleuca argentic	Myrtaceae	Tree	X																								
Melaleuca dealbata	Myrtaceae	Tree						X																			
Melaleuca nervosa	Myrtaceae	Tree		X			X																				

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Species	Family	Type	Toms Gully									Rustlers Roost								Quest 29							
			Camera				Trapping				TWD01	Camera				Trapping				Camera				Trapping			
			T1	T2	T3	T4	T1	T2	T3	T4		R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Melaleuca viridiflora	Myrtaceae	Tree	X	X				X	X												X						
Miliusa traceyi	Annonaceae	Tree					X													X		X					
Mnesithea rottboellioides	Poaceae	Grass						X																			
Neptunia sp.	Fabaceae	Forb					X																				
Owenia vernicosa	Meliaceae	Tree									X																
Pandanus aquaticus	Pandanaceae	Palm						X	X													X					
Pandanus spiralis	Pandanaceae	Palm		X								X															
Petalostigma pubescens	Picrodendraceae	Tree			X			X			X											X					
Petalostigma quadriloculare	Picrodendraceae	Shrub					X	X				X				X						X					
Planchonia careya	Lecythidaceae	Tree		X				X				X			X					X				X	X		
Polymeria ambigua	Convolvulaceae	forb, Prostrate														X						X					
Pterocaulon serrulatum	Asteraceae	Forb				X					X																
Sauropus glauceus	Euphorbiaceae	Shrub								X												X					
Scleria sphacelata	Cyperaceae	Sedge													X												
Sida sp.	Malvaceae	Forb														X											
Sorghum plumosum	Poaceae	Grass																		X				X			
Sorghum sp. (Annual sorghum)	Poaceae	Grass							X				X					X	X								
Spermaeoce sp.	Rubiaceae	Forb														X											

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Species	Family	Type	Toms Gully									Rustlers Roost								Quest 29							
			Camera				Trapping				TWD01	Camera				Trapping				Camera				Trapping			
			T1	T2	T3	T4	T1	T2	T3	T4		R1	R2	R3	R4	R1	R2	R3	R4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Stylosanthes viscosa	Fabaceae	Forb, Introduced (not listed)															X										
Tephrosia sp.	Fabaceae	Forb							X																		
Tephrosia humifusa	Fabaceae	Forb																				X					
Tephrosia polyzyga	Fabaceae	Forb														X											
Tephrosia porecta	Fabaceae	Forb											X														
Terminalia ferdinandiana	Combretaceae	Tree					X					X						X	X			X	X	X			
Terminalia microcarpa	Combretaceae	Tree	X																								
Thelypteridaceae	Thelypteridaceae	Fern														X											
Themeda triandra	Poaceae	Grass					X										X										X
Tinospora smilacina	Menispermaceae	Vine		X																							
Triodia bitextura	Poaceae	Grass																X									
Vachellia valida	Fabaceae	Tree/shrub																								X	
Waltheria indica	Malvaceae	Shrub																				X	X				
Xanthostemon paradoxus	Myrtaceae	Tree		X								X				X		X									
Xyris complanata	Xyridaceae	Forb, sedge-like		X																							

APPENDIX 6. Fauna list from on-ground survey of the Tom’s Gully survey area from trapping sites (ST1, ST2, ST3 and ST4), camera sites (CT1, CT2, CT3.2 and CT4), tailings dam (Dam) mine pit (Pit), waste rock dump (WRD) and incidental observations (Inc.)

Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
Amphibian	-	Frog		X														
	<i>Rhinella marina</i>	Cane toad	X	X	X	X				X			X				X	
	<i>Cyclorana australis</i>	Giant frog				X					X		X				X	
	<i>Cyclorana longipes</i>	Long-footed frog				X												
	<i>Litoria caerulea</i>	Green tree-frog				X								X				
	<i>Litoria inermis</i>	Peters' frog											X					
	<i>Litoria nasuta</i>	Rocket frog												X				
	<i>Litoria rothii</i>	Roth's tree-frog				X							X	X			X	
	<i>Litoria sp.</i>			X														
	<i>Litoria watjulumensis</i>	Wotjulum frog									X							
	<i>Platypectrum ornatum</i>	Ornate burrowing frog		X														
Bird	<i>Aprosmictus erythropterus</i>	Red-winged parrot	X	X		X												
	<i>Aquila audax</i>	Wedge-tailed eagle														X		
	<i>Ardea alba</i>	Great egret	X	X					X									
	<i>Ardea ibis</i>	Cattle egret			X													
	<i>Burhinus grallarius</i>	Bush stone-curlew									X	X					X	
	<i>Cacatua galerita</i>	Sulphur-crested cockatoo			X												X	
	<i>Cacatua sanguinea</i>	Little corella	X															
	<i>Cacomantis variolosus</i>	Brush cuckoo	X					X	X									
	<i>Calyptrorhynchus banksii</i>	Red-tailed black cockatoo		X					X									
	<i>Centropus phasianinus</i>	Pheasant coucal	X	X	X			X								X		X
	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo		X														
	<i>Chlamydera nuchalis</i>	Great bowerbird			X													

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Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
Bird	<i>Cisticola exilis</i>	Golden-headed cisticola							X									
	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	X															
	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike			X			X										
	<i>Dacelo leachii</i>	Blue-winged kookaburra	X	X	X		X		X									
	<i>Ducula bicolor</i>	Pied imperial pigeon	X															
	<i>Egretta novaehollandiae</i>	White-faced heron	X															
	<i>Ephippiorhynchus asiaticus</i>	Black-necked stork						X							X	X		
	<i>Eudynamys scolopacea</i>	Common koel			X													
	<i>Eurystomus orientalis</i>	Dollarbird	X		X	X		X										
	<i>Geopelia humeralis</i>	Bar-shouldered dove		X	X													
	<i>Geopelia placida</i>	Peaceful dove	X	X	X				X									
	<i>Gerygone olivacea</i>	White-throated gerygone			X													
	<i>Grallina cyanoleuca</i>	Magpie-lark	X															
	<i>Haliastur sphenurus</i>	Whistling kite		X	X			X										
	<i>Heteronotia bynoei</i>	Bynoe's gecko				X												
	<i>Lalage sueurii</i>	White-winged triller							X									
	<i>Lichenostomus unicolor</i>	White-gaped honeyeater	X	X	X			X										
	<i>Lichmera indistincta</i>	Brown honeyeater			X				X									
	<i>Melithreptus albogularis</i>	White-throated honeyeater	X					X										
	<i>Merops ornatus</i>	Rainbow bee-eater			X			X	X							X		
	<i>Milvus migrans</i>	Black kite			X													
	<i>Myzomela obscura</i>	Dusky honeyeater			X													
	<i>Oriolus flavocinctus</i>	Yellow oriole	X															
	<i>Pachycephala rufiventris</i>	Rufous whistler	X					X										
	<i>Pardalotus striatus</i>	Striated pardalote							X									

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Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
Bird	<i>Philemon sp.</i>	Friabird				X												
	<i>Poephila personata</i>	Masked finch			X				X									
	<i>Psitteuteles versicolor</i>	Varied lorikeet	X	X		X	X		X									X
	<i>Rhipidura leucophrys</i>	Willie wagtail							X									
	<i>Scythrops novaehollandiae</i>	Channel-billed cuckoo			X													
	<i>Smicrornis brevirostris</i>	Weebill						X										
	<i>Sphecotheres viridis</i>	Figbird		X		X												
	<i>Tadorna radjah</i>	Radjah shelduck	X															
	<i>Threskiornis spinicollis</i>	Straw-necked ibis		X	X				X									
	<i>Todiramphus macleayii</i>	Forest kingfisher			X													
	<i>Trichoglossus haematodus</i>	Rainbow lorikeet		X	X													X
Mammal	<i>Canis lupus</i>	Dingo						X										
	<i>Equus caballus</i>	Horse			X													
	<i>Macropus agilis</i>	Agile wallaby				X			X									
	<i>Macropus antilopinus</i>	Antilopine wallaroo	X			X											X	
	<i>Mus musculus</i>	House mouse			X													
	<i>Sus scrofa</i>	Pig		X														
Reptile	-	Gecko									X							
	<i>Carlia amax</i>	Carlia sp.		X														
	<i>Carlia gracilis</i>	Slender rainbow skink		X														
	<i>Carlia munda</i>	Striped rainbow skink				X												
	<i>Carlia sp.</i>			X	X													
	<i>Crocodylus johnstoni</i>	Freshwater crocodile		X														
	<i>Cryptoblepharus cygnatus</i>	Swanson's snake-eyed skink	X															
	<i>Delma tincta</i>	Excitable delma				X							X					

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Group	Scientific name	Common name	ST1	ST2	ST3	ST4	CT2	CT3.2	CT4	Sp1	Sp2	Sp3	Sp5	Sp7	Dam	WRD	Inc.	Pit
Reptile	<i>Diporiphora magna</i>	Yellow-sided two-lined dragon				X							X					
	<i>Liasis olivaceus</i>	Olive python								X								
	<i>Lophognathus gilberti</i>	Gilbert's dragon		X														

APPENDIX 7. Fauna list from on-ground survey of the Rustlers Roost survey area from trapping sites (SR1, SR2, SR3 and SR4), camera sites (CR1, CR2, CR3 and CR4), Annie’s Dam (Dam) and incidental observations (Inc.)

Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
Amphibian	<i>Rhinella marina</i>	Cane toad	X	X							
	<i>Litoria bicolor</i>	Northern dwarf tree-frog					X				
	<i>Litoria caerulea</i>	Green tree-frog	X		X		X			X	X
	<i>Litoria rothii</i>	Roth's tree-frog					X				
	<i>Litoria rubella</i>	Red tree-frog								X	
	<i>Litoria tornieri</i>	Tornier's frog					X				
Arthropod	-	Centipede				X					
	<i>Danaus affinis</i>	Black and white tiger								X	
Bird	<i>Anhinga melanogaster</i>	Darter								X	
	<i>Aprosmictus erythropterus</i>	Red-winged parrot			X						
	<i>Aquila audax</i>	Wedge-tailed eagle									X
	<i>Ardea alba</i>	Great egret								X	
	<i>Ardea ibis</i>	Cattle egret								X	
	<i>Ardea picata</i>	Pied heron								X	
	<i>Artamus leucorhynchus</i>	White-breasted woodswallow								X	
	<i>Artamus minor</i>	Little woodswallow								X	
	<i>Cacatua galerita</i>	Sulphur-crested cockatoo				X					
	<i>Cacatua sanguinea</i>	Little corella									X
	<i>Cacomantis variolosus</i>	Brush cuckoo	X		X	X	X	X		X	
	<i>Calyptrorhynchus banksii</i>	Red-tailed black-cockatoo			X	X		X		X	
	<i>Centropus phasianinus</i>	Pheasant coucal		X	X					X	
	<i>Certhionyx pectoralis</i>	Banded honeyeater					X	X			
	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo							X		

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
Bird	<i>Cisticola exilis</i>	Golden-headed cisticola		X							
	<i>Climacteris melanura</i>	Black-tailed treecreeper						X		X	
	<i>Colluricincla harmonica</i>	Grey shrike-thrush	X	X							
	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	X					X		X	
	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike	X		X			X	X		
	<i>Corvus orru</i>	Torresian crow			X					X	
	<i>Dacelo leachii</i>	Blue-winged kookaburra	X					X		X	X
	<i>Dendrocygna arcuata</i>	Wandering whistling-duck								X	
	<i>Dendrocygna eytoni</i>	Plumed whistling-duck								X	
	<i>Dicaeum hirundinaceum</i>	Mistletoebird					X				
	<i>Eudynamys scolopacea</i>	Common koel								X	
	<i>Eurystomus orientalis</i>	Dollarbird	X			X		X		X	
	<i>Falco berigora</i>	Brown falcon					X	X			X
	<i>Geopelia humeralis</i>	Bar-shouldered dove					X			X	
	<i>Geopelia placida</i>	Peaceful dove	X				X	X		X	
	<i>Gerygone sp.</i>	Gerygone									X
	<i>Grallina cyanoleuca</i>	Magpie-lark	X					X		X	X
	<i>Haliastur sphenurus</i>	Whistling kite					X	X		X	X
	<i>Hamirostra melanosternon</i>	Black-breasted buzzard								X	
	<i>Irediparra gallinacea</i>	Comb-crested jacana								X	
	<i>Lalage sueurii</i>	White-winged triller								X	
	<i>Lichenostomus unicolor</i>	White-gaped honeyeater					X				
	<i>Lichmera indistincta</i>	Brown honeyeater				X					
	<i>Malurus melanocephalus</i>	Red-backed fairy-wren	X			X	X				
	<i>Melithreptus albogularis</i>	White-throated honeyeater				X	X	X			

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
Bird	<i>Merops ornatus</i>	Rainbow bee-eater				X	X			X	
	<i>Milvus migrans</i>	Black kite						X		X	
	<i>Myiagra rubecula</i>	Leaden flycatcher						X			
	<i>Neochmia phaeton</i>	Crimson finch					X			X	
	<i>Oriolus flavocinctus</i>	Yellow oriole					X				
	<i>Pachycephala lanioides</i>	White-breasted whistler	X								
	<i>Pachycephala rufiventris</i>	Rufous whistler	X	X	X	X	X	X	X	X	
	<i>Pardalotus striatus</i>	Striated pardalote			X						
	<i>Phalacrocorax melanoleucos</i>	Little pied cormorant								X	
	<i>Phalacrocorax sulcirostris</i>	Little black cormorant								X	
	<i>Philemon buceroides</i>	Helmeted friarbird			X						
	<i>Philemon citreogularis</i>	Little friarbird				X			X	X	
	<i>Philemon sp.</i>	Friarbird				X					
	<i>Platalea regia</i>	Royal spoonbill								X	
	<i>Podargus strigoides</i>	Tawny frogmouth						X		X	
	<i>Poephila acuticauda</i>	Long-tailed finch	X						X	X	X
	<i>Poephila personata</i>	Masked finch	X					X		X	
	<i>Pomatostomus temporalis</i>	Grey-crowned babbler	X			X					
	<i>Psitteuteles versicolor</i>	Varied lorikeet					X	X	X	X	
	<i>Rhipidura leucophrys</i>	Willie wagtail	X	X	X		X			X	X
	<i>Smicrornis brevirostris</i>	Weebill							X		
	<i>Tachybaptus novaehollandiae</i>	Australian grebe								X	
	<i>Tadorna radjah</i>	Radjah shelduck								X	
	<i>Taeniopygia bichenovii</i>	Double-barred finch					X				
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis								X	

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Group	Scientific name	Common name	SR1	SR2	SR3	SR4	CR1	CR2	CR4	Dam	Inc.
Bird	<i>Todiramphus sanctus</i>	Sacred kingfisher								X	
	<i>Trichoglossus haematodus</i>	Rainbow lorikeet	X				X				
	<i>Vanellus miles</i>	Masked lapwing								X	
Mammal	<i>Bos taurus</i>	Cattle						X		X	
	<i>Bubalus bubalis</i>	Water buffalo								X	
	<i>Canis lupus</i>	Dingo									X
	<i>Macropus agilis</i>	Agile wallaby					X				X
	<i>Macropus antilopinus</i>	Antilopine wallaroo									X
	<i>Sminthopsis virginiae</i>	Red-cheeked dunnart				X					
	<i>Sus scrofa</i>	Pig								X	
Reptile	-	Skink			X						
	<i>Crocodylus johnstoni</i>	Freshwater crocodile								X	
	<i>Diporiphora magna</i>	Yellow-sided two-lined dragon			X	X					
	<i>Gehyra nana</i>	Northern spotted rock dtella				X					
	<i>Liasis olivaceus</i>	Olive python				X	X				
	<i>Lophognathus gilberti</i>	Gilbert's dragon			X		X				
	<i>Menetia alanae</i>	Top End dwarf skink		X	X						
	<i>Menetia sp.</i>			X							
	<i>Morethia storri</i>	Storr's snake-eyed skink				X					
	<i>Strophurus ciliaris</i>	Spiny-tailed gecko				X					
	<i>Varanus baritji</i>	Black-spotted ridge-tailed monitor			X						

APPENDIX 8. Fauna list from on-ground survey of the Quest 29 survey area from trapping sites (SQ1, SQ2, SQ3 and SQ4), camera sites (CQ1, CQ2, CQ3 and CQ4.2), stock dam (Dam) and incidental observations (Inc.)

Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ4.2	CQ2	CQ3	Dam	Inc
Amphibian	<i>Rhinella marina</i>	Cane toad	X	X	X	X					
	<i>Litoria caerulea</i>	Green tree-frog				X			X		
	<i>Litoria rubella</i>	Red tree-frog							X		
Arthropod	<i>Danaus chrysippus</i>	Plain tiger							X		
	<i>Junonia orithya</i>	Blue argus							X		
Bird	<i>Aprosmictus erythropterus</i>	Red-winged parrot		X	X			X			X
	<i>Aquila audax</i>	Wedge-tailed eagle				X					
	<i>Ardea intermedia</i>	Intermediate egret	X								
	<i>Cacatua galerita</i>	Sulphur-crested cockatoo	X		X				X		
	<i>Cacatua sanguinea</i>	Little corella					X		X		
	<i>Cacomantis variolosus</i>	Brush cuckoo				X			X		
	<i>Calyptorhynchus banksii</i>	Red-tailed black cockataoo	X		X	X					
	<i>Centropus phasianinus</i>	Pheasant coucal				X					X
	<i>Certhionyx pectoralis</i>	Banded honeyeater					X				
	<i>Chlamydera nuchalis</i>	Great bowerbird		X		X		X			X
	<i>Conopophila rufogularis</i>	Rufous-throated honeyeater	X							X	
	<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike				X		X		X	
	<i>Coracina papuensis</i>	White-bellied cuckoo-shrike	X			X	X	X	X		
	<i>Coracina tenuirostris</i>	Cicadabird	X								
	<i>Corvus orru</i>	Torresian crow							X		
	<i>Coturnix ypsilophora</i>	Brown quail					X				
	<i>Dacelo leachii</i>	Blue-winged kookaburra		X		X	X		X		X
	<i>Ducula bicolor</i>	Pied imperial pigeon					X	X	X		

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Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ4.2	CQ2	CQ3	Dam	Inc
Bird	<i>Eudynamys scolopacea</i>	Common koel			X		X	X			
	<i>Eurystomus orientalis</i>	Dollarbird	X		X	X	X	X	X		X
	<i>Geopelia humeralis</i>	Bar-shouldered dove			X	X		X	X		
	<i>Geopelia placida</i>	Peaceful dove	X		X	X	X			X	
	<i>Grallina cyanoleuca</i>	Magpie-lark	X				X	X			
	<i>Haliastur sphenurus</i>	Whistling kite	X	X	X					X	X
	<i>Hamirostra melanosternon</i>	Black-breasted buzzard									X
	<i>Hieraaetus morphnoides</i>	Little eagle			X						
	<i>Lichenostomus flavescens</i>	Yellow-tinted honeyeater					X				
	<i>Lichenostomus unicolor</i>	White-gaped honeyeater					X	X	X		
	<i>Lichmera indistincta</i>	Brown honeyeater				X					
	<i>Melithreptus albogularis</i>	White-throated honeyeater			X	X	X	X	X		
	<i>Merops ornatus</i>	Rainbow bee-eater							X		
	<i>Microeca flavigaster</i>	Lemon-bellied flycatcher					X				
	<i>Milvus migrans</i>	Black kite							X		X
	<i>Myiagra rubecula</i>	Leaden flycatcher					X			X	
	<i>Myzomela obscura</i>	Dusky honeyeater				X	X		X		
	<i>Oriolus flavocinctus</i>	Yellow oriole						X	X		
	<i>Pachycephala lanioides</i>	White-breasted whistler			X						
	<i>Pachycephala rufiventris</i>	Rufous whistler			X	X	X	X	X	X	
	<i>Philemon buceroideis</i>	Helmeted friarbird			X			X	X		
	<i>Philemon citreogularis</i>	Little friarbird		X	X					X	
	<i>Phylidonyris albifrons</i>	White-fronted honeyeater								X	
	<i>Platycercus venustus</i>	Northern rosella			X						
	<i>Poephila acuticauda</i>	Long-tailed finch								X	

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Group	Scientific name	Common name	SQ1	SQ2	SQ3	SQ4	CQ4.2	CQ2	CQ3	Dam	Inc
Bird	<i>Poephila personata</i>	Masked finch				X	X			X	
	<i>Pomatostomus temporalis</i>	Grey-crowned babbler						X			
	<i>Psitteuteles versicolor</i>	Varied lorikeet				X			X		
	<i>Rhipidura leucophrys</i>	Willie wagtail			X				X		
	<i>Rhipidura rufiventris</i>	Northern fantail						X			
	<i>Taeniopygia bichenovii</i>	Double-barred finch		X						X	
	<i>Threskiornis spinicollis</i>	Straw-necked ibis	X								
	<i>Trichoglossus haematodus</i>	Rainbow lorikeet	X								
Mammal	<i>Macropus agilis</i>	Agile wallaby	X		X						
	<i>Macropus antilopinus</i>	Antilopine wallaroo			X				X		X
	<i>Sus scrofa</i>	Pig	X	X	X			X	X		
Reptile	<i>Carlia gracilis</i>	Slender rainbow skink	X								
	<i>Diporiphora magna</i>	Yellow-sided two-lined dragon	X								
	<i>Heteronotia bynoei</i>	Bynoe's gecko									X
	<i>Lophognathus gilberti</i>	Gilbert's dragon									X
	Skink sp.			X							

Echolocation call identification report

Client: Bill Low Ecological Services

Contact: Nicola Hanrahan

Date: 9/3/2017

Project: Mary River – North Australia

Important information about the call identifications presented in this report.

Echolocation call analysis is complex and many species cannot be identified by call alone. It is highly recommended for most surveys that echolocation call recording be accompanied by trapping. Call analysis normally shows the specific species that need to be trapped for confirmation of that species in the study area.

Call analysis is affected by many factors, these include the suite of species present, the quality of calls recorded (equipment settings, microphone quality, background noise from wind, insects, echoes), the quality of the reference call database for the region and the experience of the analyst.

The time taken to identify calls depends on the above and the needs of the client. Deriving a simple species inventory for each detector night is much quicker than attempting to identify every call for each detector night.

In many projects, a very low proportion of all calls recorded may be of sufficient quality to allow identification. It is a sign of the competence of the analyst to reject calls based on poor quality.

The identifications in this report are based on a combination of manual and automated methods using either reference calls from the region or from species calls recorded outside

the region if they are likely to represent the calls from species in the survey region. Any doubt on species’ identifications is always explained.

Species identified per night is at a very high standard and is only identified if I am sure that a species occurs in the recordings for that night. For the table data the proportion of calls (files) identified in this report is very high but with a lower reliability. That is to say that once I am sure of a species presents I lower the standard to best identify as many files as possible. This lowering is hard to put a value on but would be higher than 80% confidence. This is to allow for data on Bat Passes per night as represented in the Results Table.

This data in no way represents abundance of species per night. The bat detector microphone will record a bat file when it is loud enough to trigger the electronics. The volume of space sampled by the microphone varies, due to loudness of the call, frequency of the call, temperature and humidity. Additionally one bat may feed around a detector many times or not. Additionally the detection of Anabat detectors varies between detectors due to the sensitivity setting – there is no information as to the calibration of the Detectors.

There is NO abundance data from a Anabat Detector.

This report includes the recommendations set out in the reporting standards for echolocation call analysis developed by the Australasian Bat Society.

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Data

Species likely to be present in the area

Chaerephon jobensis
Chalinolobus gouldii
Chalinolobus nigrogriseus
Hipposideros ater
Hipposideros stenotis
Macroderma gigas
Miniopterus orianae orianae
Myotis macropus
Mormopterus beccarii
Mormopterus cobourgiana
Nyctophilus arnhemensis
Nyctophilus daedalus
Nyctophilus geoffroyi
Nyctophilus walkeri
Pipistrellus adamsi
Pipistrellus westralis
Rhinocnictus aurantia
Saccolaimus flaviventris
Saccolaimus saccolaimus
Scotorepens greyii
Taphozous georgianus
Taphozous kapalgensis
Vespadelus caurinus
Vespadelus finlaysoni

Species that do not echolocate that are in the area (Blossum bats and Fuitbats)

Macroglossus minimus
Pteropus alecto
Pteropus scapulatus

A good list... but Bat detectors cannot separate all these species. In the Table the species groups are listed.

Results

Species found to be present (there were over 15,000 bat files (these were created from Wac files into 10 second Anabat files)

	CHGO	CHJO	MOBE?	NYSP	RHAU	SAFL	TAGE	TAKA	VECA	Species 1		Species9
Q02												
5/11/16		X	X	X			X		X	X		
Q04												
5/11/16				X						X		
R01												
3/11/16				X								
R02												
1/1/00				X						X		
2/11/16										X		
R03												
4/11/16										X		
R04												
6/11/16										X		
T01												
3/11/16		X		X		X		X	X	X		X
T02												
1/11/16	X	X		X		X				X		X
2/11/16	X	X		X				X		X		
T03												
6/11/16		X		X	X	X	X		X	X		X
T04												
4/11/16	X	X	X	X	X	X	X	X	X	X		X

Species 1 – *Scotorepens greyii* (or *S. sanborni*) or *Chalinolobus nigrogriseus*

Species 9 – *Pipistrellus westralis* or *Miniopterus orianae orianae*

NYSP – *Nyctophilus* species includes *Nyctophilus arnhemensis* or *Nyctophilus daedalus* or *Nyctophilus geoffroyi* or *Nyctophilus walkeri*

Identification

The calls were manually scanned in AnalookW and compared with known reference calls for the region held by myself and Damian Milne’s “Key to the Bats of the Top End of the

Northern Territory”. The identification is my responsibility. A species inventory was tabulated for each detector night.

Comments

Species 1 dominates the calls with possibly more than 65% of all calls.

Chaerephon jobensis was the second most common call followed by *Saccolaimus flaviventris*.

Taphozous kapalgensis calls were not well recorded, but I am confident that the species was present on the sites recorded in the table.

Nyctophilus species cannot be separated at this stage with a bat detector, these calls could represent any number of these species. About 5% of calls were *Nyctophilus* species.

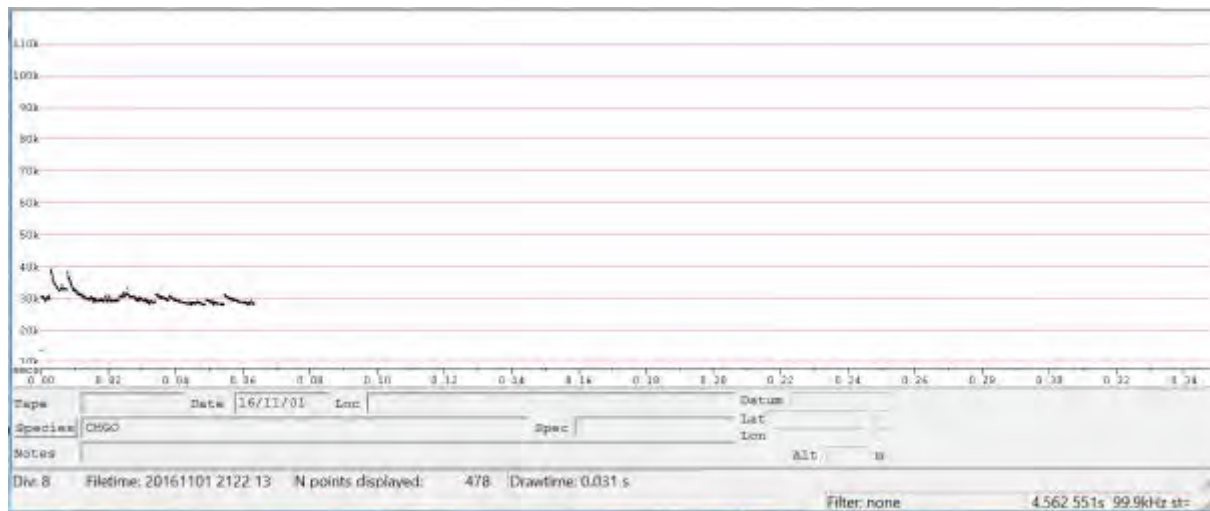
All other species were recorded by less than 5% of the total calls.

Mormopterus beccarii, has a “?” on the table, this species is of a lower reliability in the identification, but was still included as a separate species.

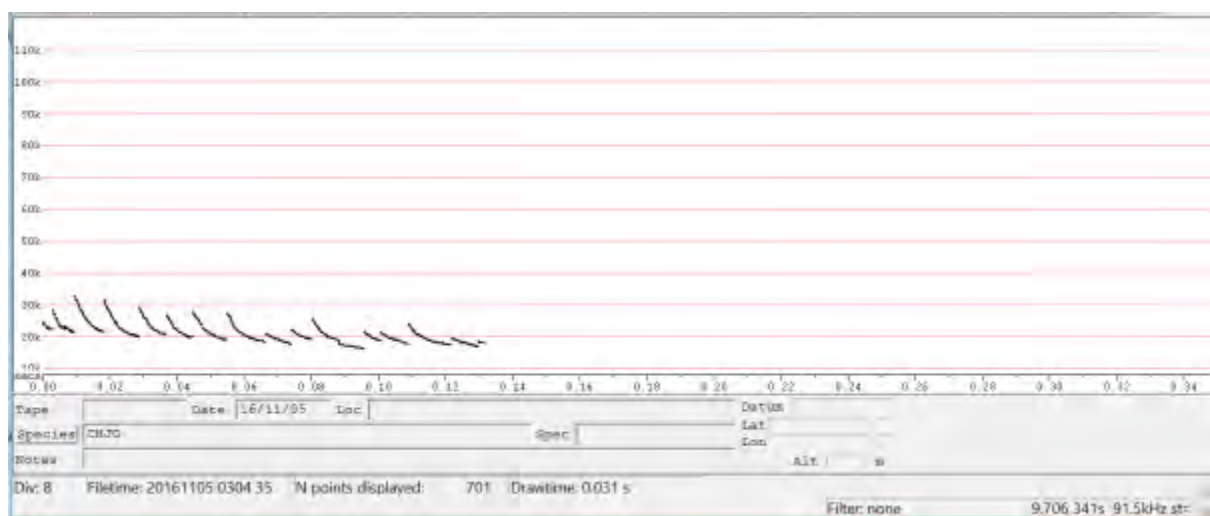
All the issues of species Id can only be resolved by trapping, with so many species overlapping in calls in the Top End, this report is the best I can do from calls alone.

SAMPLPE ANABAT FILES

Chalinolobus gouldii

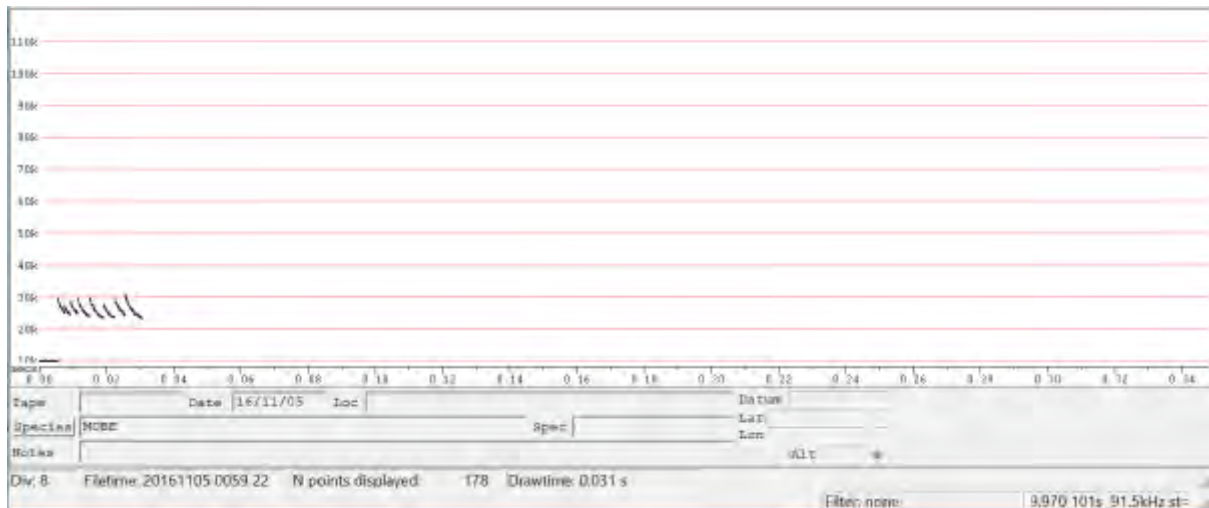


Chalinolobus jobensis

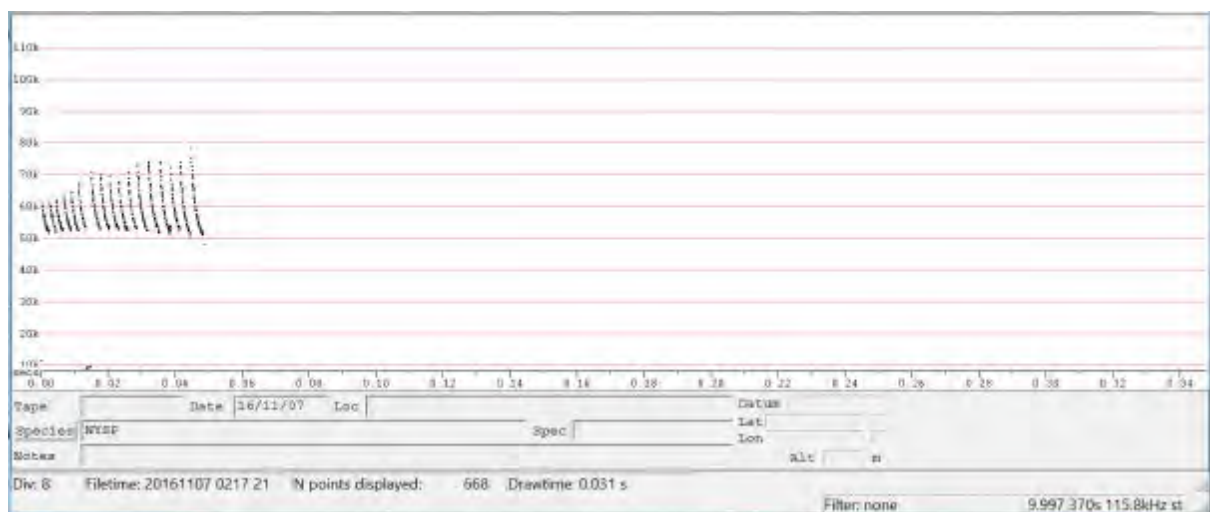


Mormopterus beccarii

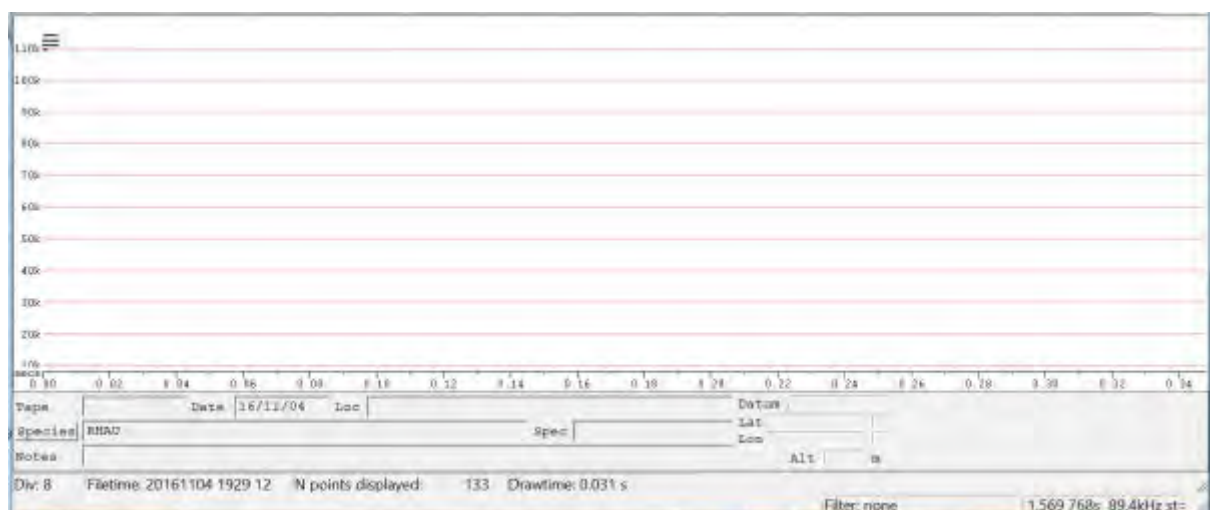
Primary Gold Limited – Tom’s Gully, Rustler’s Roost and Quest 29
Flora and Fauna Survey Report



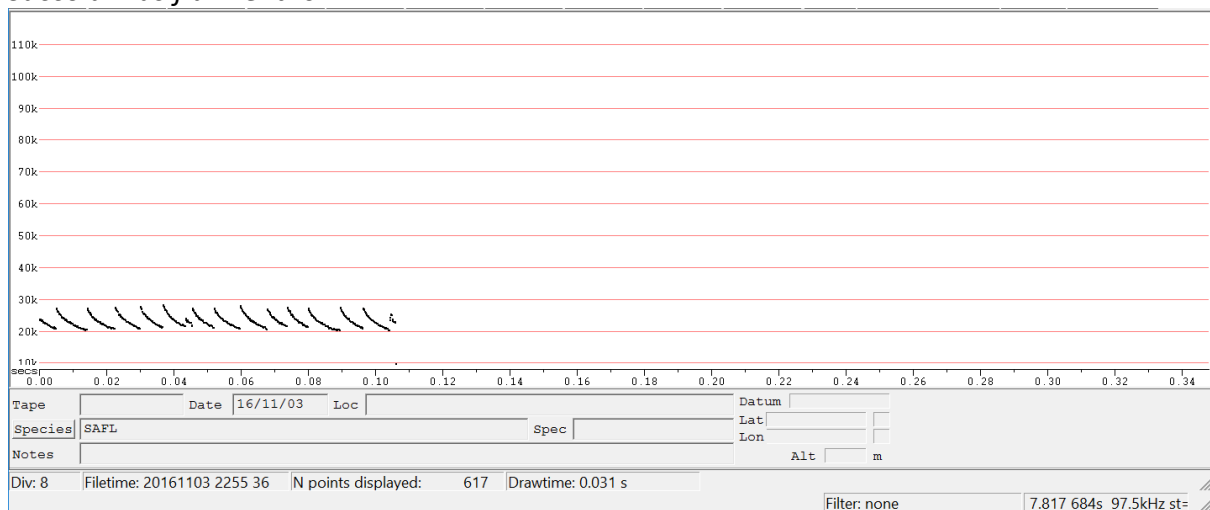
Nyctophilus species



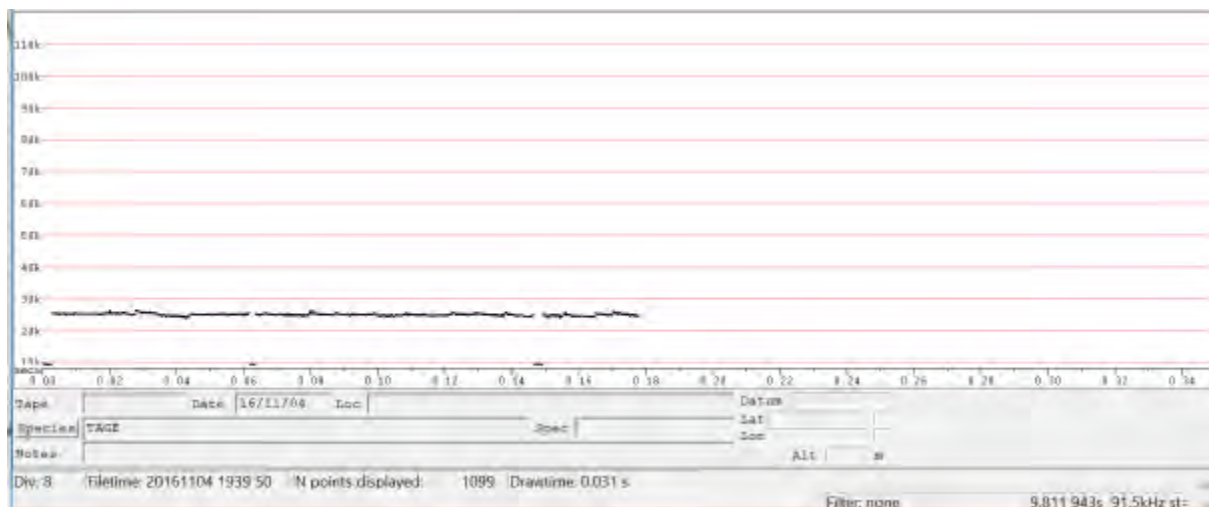
Rhinonicteris aurantius



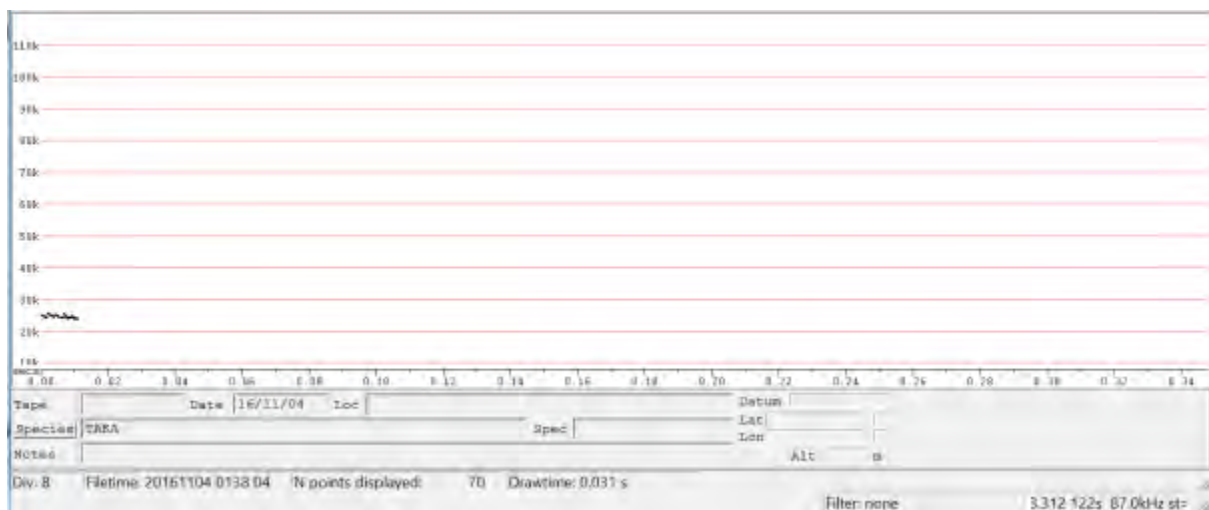
Saccolaimus flaviventris



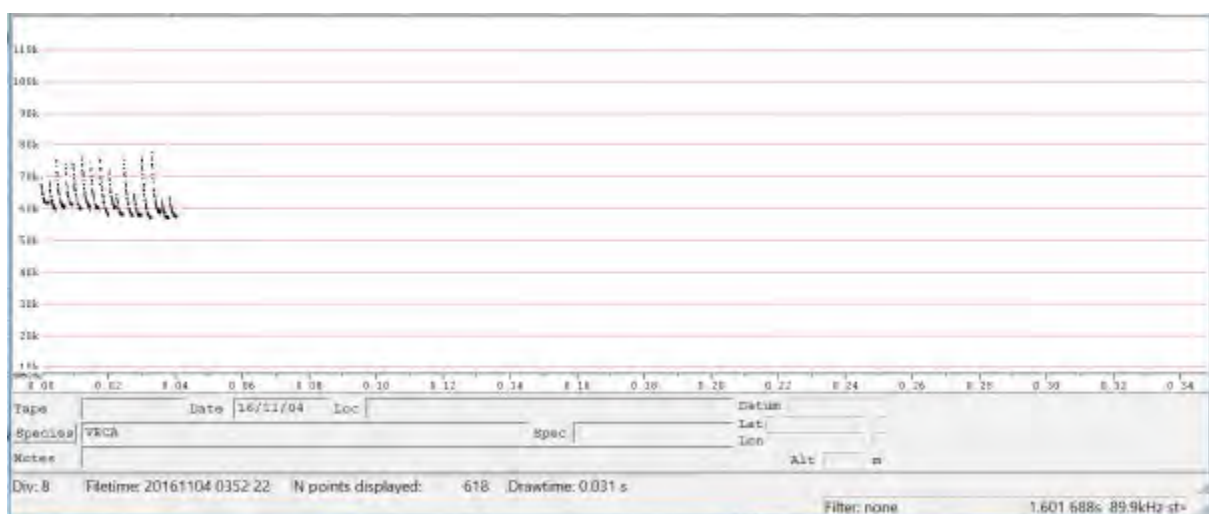
Taphozous kapalgensis



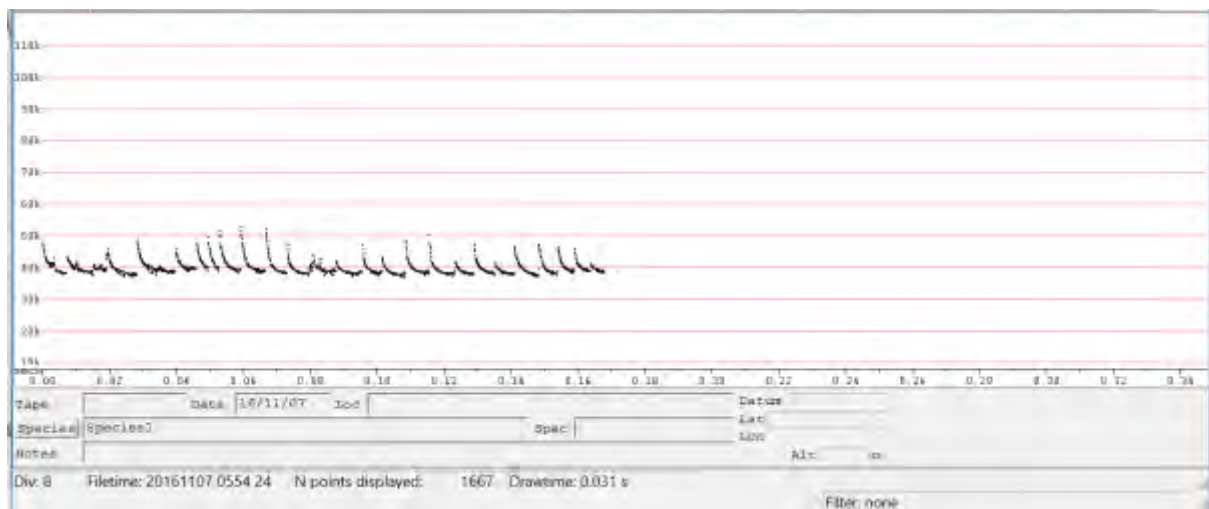
Taphozous kapalgensis



Vespadelus caurinus



Species1



Species9

