



# MIDDLEMOUNT COAL MINE

## SOUTHERN EXTENSION PROJECT Environmental Values Assessment

### APPENDIX C Terrestrial Ecology Assessment

November 2020



LEADING THE WAY  
IN ENVIRONMENTAL  
MANAGEMENT



**MIDDLEMOUNT COAL MINE  
SOUTHERN EXTENSION PROJECT  
TERRESTRIAL ECOLOGY  
November 2020**

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## Executive Summary

Biodiversity Australia Pty Ltd was engaged by Middlemount Coal Pty Ltd (MCPL) to undertake terrestrial ecological surveys and to prepare an impact assessment for the proposed Middlemount Coal Mine Southern Extension Project (herein referred to as the Project). The main elements of the Project would include extension of the open cut pit to the south, re-positioning of the approved southern flood levee and water management infrastructure, realignment and extension of the eastern diversion of Roper Creek, minor extensions to waste rock emplacement footprint and changes to the final landform.

The primary outcomes of this terrestrial ecological assessment were to verify Regional Ecosystem (RE) mapping; identify any threatened species under the *Nature Conservation Act 1992* (NC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); identify and describe any Matters of State and National Environmental Significance; and identify proposed avoidance and mitigation measures to protect the natural values including consideration of biodiversity offset requirements.

Vegetation within the study area is characterised by a mix of remnant and non-remnant (regrowth and cleared areas) communities. The existing landform is generally flat with no significant geological features such as outcrops, cliff lines or escarpments. The main topographic feature of the study area is Roper Creek which is an ephemeral creek line. A second creek line, named Thirteen Mile Gully, feeds into Roper Creek in the study area.

Past agricultural land use has resulted in extensive clearing in the area and has introduced a number of threats to biodiversity such as weed invasion, feral species, edge effects and fragmentation. This is likely to have excluded many sensitive species from the area and reduced the ecological value for flora and fauna, especially rare and threatened species. Pastoral properties and a number of open cut and underground coal mines now dominate the local surrounding land use.

No threatened flora species listed under the NC Act or EPBC Act were detected during the survey. One RE within the study area (RE 11.3.1) consists of Brigalow forest which is listed as Endangered under the Queensland *Vegetation Management Act 1999* (VM Act). Two REs comprising Poplar Box woodland (RE 11.3.2 and RE 11.3.2b) are listed as Of Concern under the VM Act. These REs were found to meet the criteria for the Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (TEC) (RE 11.3.1) and Poplar Box Grassy Woodland on Alluvial Plains TEC (RE 11.3.2), which are both listed as Endangered under the EPBC Act.

Three threatened fauna species were recorded during the field surveys, the Greater Glider (*Petauroides volans*), Koala (*Phascolarctos cinereus*) (scat only) and Squatter Pigeon (Southern) (*Geophaps scripta scripta*). These species are listed as Vulnerable under the NC Act and EPBC Act. Two additional threatened fauna species, the Ornamental Snake (*Denisonia maculata*) and White-throated Needle-tail (*Hirundapus caudacutus*), were considered potential occurrences in the study area based on local records identified in the literature and database searches and the presence of suitable habitat. Both species are also listed as Vulnerable under the NC Act and EPBC Act.

The assessment identified several Matters of State Environmental Significance in the study area. These were regulated vegetation (the Of Concern and Endangered REs referred to above), connectivity areas and protected wildlife habitat for threatened fauna species.

The Project area is predominantly non-remnant vegetation (approximately 165 ha) with patches of remnant vegetation (totalling approximately 68 ha) (overall footprint is approximately 233 ha). The magnitude of impacts on biodiversity from the Project would be less than the Western Extension Project, which was more than double the footprint (571 ha) comprising clearance of approximately 380.5 ha of non-remnant vegetation and 190.5 ha of remnant vegetation. The approved Middlemount Coal Mine surface disturbance area totals approximately 3,071 ha.



The Project would result in the loss of 68 ha of remnant vegetation in the extended footprint areas (until it is revegetated) but is not likely to result in a new or materially increased adverse indirect impact on biodiversity compared to the existing approved mine.

The Project has potential to result in significant impacts on Matters of State Environmental Significance. Specifically, the Project would result in the clearance of 'endangered' or 'of concern' RE's 11.3.1 (approximately 2.2 ha), 11.3.2 (approximately 19.3 ha) and 11.3.2b (approximately 1 ha), as well as clearance of approximately 3.7 ha of Res 11.3.2 and 11.3.25, located within the defined distance of a vegetation management watercourse. The Project would result in the clearance of approximately 68 ha of connectivity areas.

The Project would also result in the clearance of protected wildlife habitat, in particular, approximately 63.3 ha of habitat for the Koala and Greater Glider.

Two diversions to Roper Creek are already approved at the Middlemount Mine which would fragment the riparian vegetation along Roper Creek. As an offset for this impact, the Stage 2 Offset Area was established by MCPL in 2013 and it includes enhancement and conservation of an 11 km stretch of the Roper Creek immediately to the west of the mine. This offset has been secured under a Voluntary Declaration and is managed for conservation purposes. The Project would increase disturbance to the riparian vegetation along Roper Creek for the realignment and extension of the eastern diversion of Roper Creek, however, it would not involve a new barrier to fauna movement (that impact would occur as a result of the approved mine), and the diversion would be revegetated with similar flora species as part of its construction.

Mitigation measures for the Project are expected to be consistent with existing Environmental Authority (EA) conditions and MCPL plans (e.g. Erosion and Sediment Control Plan and Rehabilitation Management Plan). Specific measures to reduce impacts on biodiversity include marking clearing limits, pre-clearing surveys and clearing supervision, and reducing light spillage into adjacent retained habitat. Offsets for the Project are expected to be consistent with existing EA conditions. Impacts on Matters of State Environmental Significance would be offset (including REs 11.3.1, 11.3.2 and 11.3.2b, as well as impacts on the Koala and Greater Glider).



## Abbreviations

Table 1: List of abbreviations used within the report

BoM	Bureau of Meteorology
CE	Critically Endangered
DAWE	Department of Agriculture, Water and the Environment
DEE	Department of the Environment and Energy
DEHP	Department of Environment and Heritage Protection
DES	Department of Environment and Science
DPIE	Department of Planning, Industry and Environment
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DEWHA	Department of Environment, Water, Heritage and the Arts
DNRM	Department of Natural Resources and Mines
DotE	Department of the Environment
E	Endangered
EA	Environmental Authority
EHP	Ecology & Heritage Partners
EP Act	<i>Environmental Protection Act 1994</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDE	Groundwater Dependant Ecosystems
GIS	Geographic Information System
ha	Hectares
IBRA	Interim biogeographic regionalisation of Australia
M	Migratory
MCPL	Middlemount Coal Pty Ltd
ML	Mining Lease
MNES	Matters of National Significance
MSES	Matters of State Significance
NC Act	<i>Nature Conservation Act 1992</i>
NT	Near Threatened
OMP	Offset Management Plan
PB	Parsons Brinckerhoff Pty Ltd
PIR	Passive Infrared
Qld	Queensland
RE	Regional Ecosystem
REDD	Regional Ecosystem Description Database
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
V	Vulnerable
VM Act	<i>Vegetation Management Act 1999</i>



# 1. Introduction

Biodiversity Australia Pty Ltd was engaged by Middlemount Coal Pty Ltd (MCPL) to undertake terrestrial ecological surveys and to prepare an impact assessment for the proposed Middlemount Coal Mine Southern Extension Project (herein referred to as the Project).

## 1.1 Project Description

MCPL owns and operates the Middlemount Coal Mine, an existing open cut coal mine located approximately 90 kilometres (km) north-east of Emerald and approximately 3 km to the south-west of the Middlemount Township, Queensland (Qld).

MCPL propose to seek approval for changes to the approved Middlemount Coal Mine, herein referred to as the Southern Extension Project (the Project). The main activities associated with the development of the Project would include:

- extension of the open cut pit to the south within Mining Lease (ML) 70379;
- continued extraction of run-of-mine coal up to approximately 5.7 million tonnes per annum using conventional open cut mining equipment;
- placement of waste rock in existing emplacements, expanded emplacements (West Dump and East Dump) and within the mined-out void;
- minor extensions to waste rock emplacement footprint;
- progressive development of sediment dams, pipelines and other water management equipment and structures;
- re-positioning of the approved southern flood levee and water management infrastructure;
- realignment and extension of the approved (but not yet constructed) eastern diversion of Roper Creek inside the ML;
- progressive development of new haul roads and internal roads;
- continued development of soil stockpiles, laydown areas and borrow areas;
- continued use of existing and approved supporting mine infrastructure;
- extension of the approved mine life by approximately eight years (to 2044); and
- a change to the final landform for the end of the mine life.

The study area comprises multiple areas of land immediately surrounding the existing mine boundary, and includes land immediately adjacent to the Project area (defined below). The majority of these are situated directly south of the existing open cut mine, with an additional area located to the east. The collective of these areas constitute the study area. This area totals approximately 274 hectares (ha). The locality is defined as land within 10 km of the Project.

The Project area is comprised of the additional surface disturbance area associated with the Project (Figure 2), and totals approximately 233 ha.



## 1.2 Objectives

The following lists the objectives of the Ecological Impact Assessment:

- Desktop literature review of relevant government databases and previous ecological assessments.
- Flora survey and field validation of Regional Ecosystems (RE) and habitat types within the study area as per the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al.* 2020).
- Survey as per the requirements of the *Guide to Determining Terrestrial Habitat Quality Version 1.3* (Department of Environment and Heritage Protection [DEHP] 2020a) to determine land-based offset requirements.
- Targeted surveys for threatened flora and fauna species listed under the Qld *Nature Conservation Act 1994* (NC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Identification of any Matters of State Environmental Significance (MSES) and Matters of National Environmental Significance (MNES).
- Assessment of impacts on terrestrial ecology, including MSES.
- Identification of avoidance and mitigation measures to protect the natural values, particularly threatened or near-threatened species, including consideration of biodiversity offset requirements in accordance with the *Queensland Environmental Offsets Policy* (DEHP 2017).



Figure 1: Location of the study area

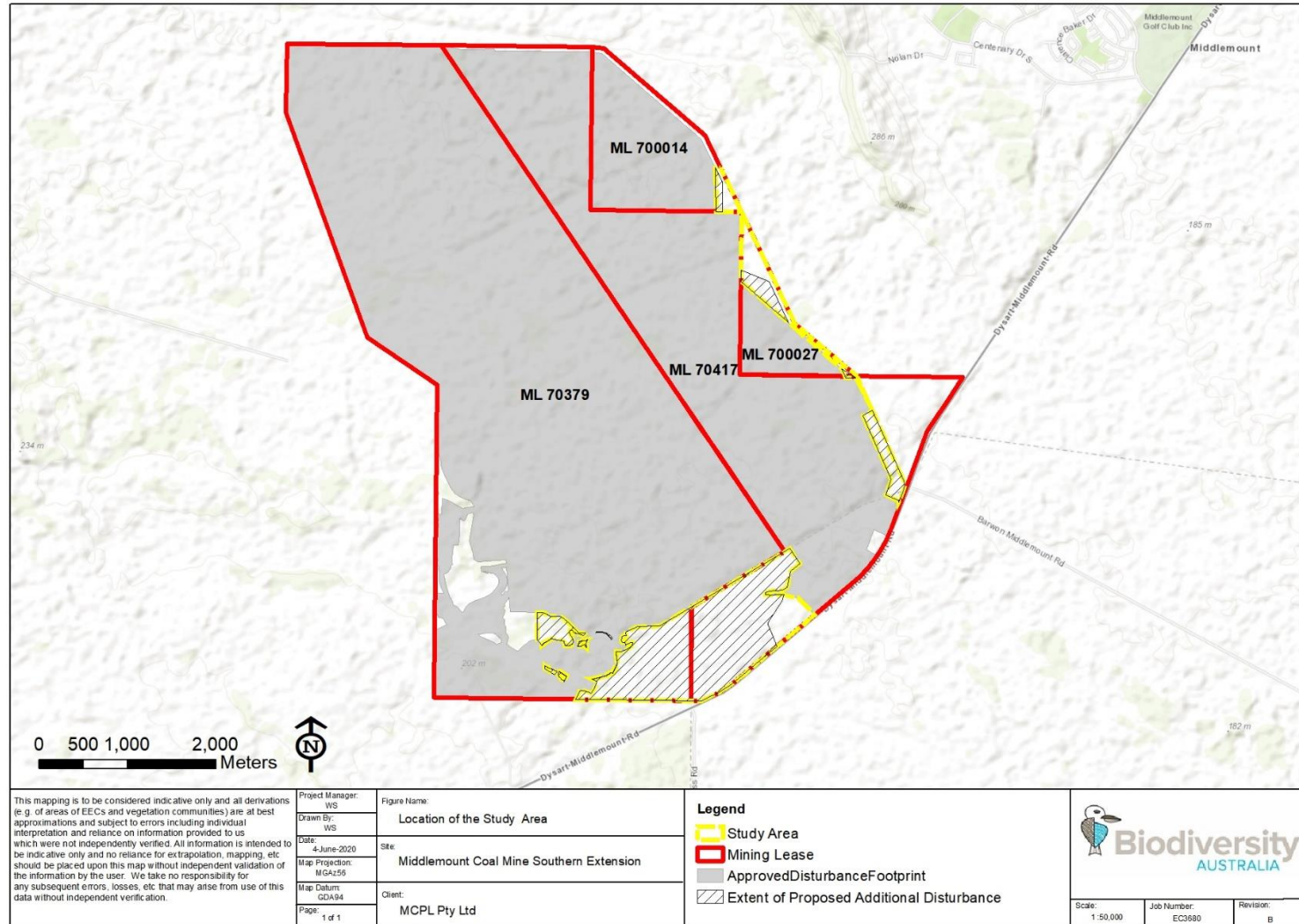
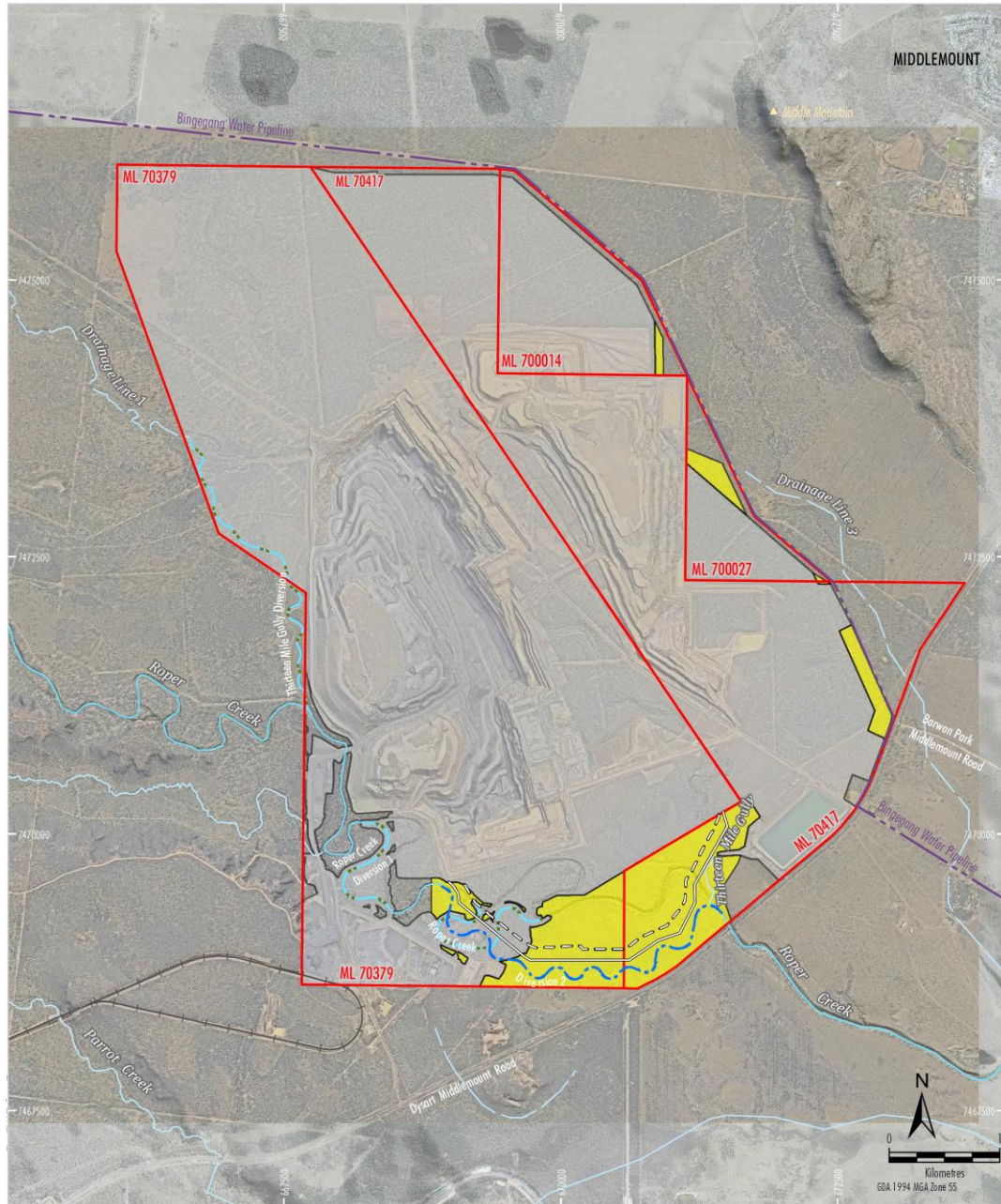


Figure 2: Approximate Project Footprint



- LEGEND
- Mining Lease Boundary (ML)
  - Middlemount Rail Spur and Loop
  - Approved Disturbance Footprint
  - Approved Diversion Structure
  - Realigned Diversion Structure
  - Levee
  - Open Cut Pit Extension
  - Approximate Extent of Additional Disturbance

Source: MCPL (2020); The State of Queensland (2020)  
 Orthophoto: MCPL (September 2019)



SOUTHERN EXTENSION PROJECT  
 Approximate Project Footprint



## 2. Background Information

The Middlemount Coal Mine is an existing open cut coal mine located approximately 3 km to the south west of the Middlemount township within the Isaac Regional Local Government Area. The Project occurs within the Isaac-Comet Downs subregion of the Brigalow Belt North Bioregion.

### 2.1 Regional and Local Setting

The study area occurs within the Isaac-Comet Downs subregion of the Brigalow Belt North Bioregion, which falls within the Isaac Regional Council. Surrounding land uses largely comprise open cut and underground coal mines and grazing land. The nearest protected area is June National Park which occurs 30 km to the east. Bundoora State Forest is located approximately 25 km to the south-west of the study area.

### 2.2 Land Use and Disturbance History

Pastoral properties dominate the local land use along with a number of open cut and underground coal mines. No cropping or fruit growing areas are known to occur in the locality.

Clearing for cattle grazing in the region has been extensive, and the study area contains cleared areas that have been grazed in the past. No recent evidence of cattle grazing was noted in the study area. Cattle grazing has also required the establishment of fences and stock dams in the study area which has facilitated further clearing. As a result of this clearing and grazing, vegetation in the region is highly fragmented and exists as a mosaic of remnant and regrowth woodland and derived pasture grassland.

No recent fires are known to have occurred on the study area and no charcoal was observed on any tree trunks during the field survey.

### 2.3 Soils, Topography and Geology

The study area is located on a relatively flat landform with elevation ranging from approximately 170-180 metres (m) Australian Height Datum. The highest point in the study area is in the southwest corner near Dysart-Middlemount Road. No distinct geological features such as rocks outcrops, cliffs or escarpments occur on the study area (Figure 3).

The main topographic feature of the study area is Roper Creek which is an ephemeral creek line. This runs roughly west to east across the southern portion of the study area. A second creek line, named Thirteen Mile Gully, feeds into Roper Creek in the study area (Figure 4).

The study area contains three Land Zones as per Wilson and Taylor (2012). Alluvial formations associated with the Roper Creek floodplain fall into Land Zone 3 which is defined as recent Quaternary alluvial systems. This zone typically comprises fertile alluvial soils including Vertosols and Sodosols. In the study area, this zone supports Eucalypt woodland and Brigalow vegetation. Land Zone 3 covers the majority of the study area.

The level sandy plains which cover the eastern portion of the study area fall into Land Zone 5 which is described as Tertiary to early Quaternary loams and sandy plains and plateaus. In western Qld, this land zone typically contains sandy to loamy red Kandosols and Tenosols (Wilson and Taylor 2012). Soils encountered on the study area were well drained and contained a high sand content with a shallow organic layer. This zone typically supports Poplar Box woodland in the study area, however most of this community has been cleared and exists as derived grassland.



An elevated area is located in the southwest of the study area which is located on Land Zone 7. This zone is described as Cainozoic duricrusts formed on a variety of rock types. Landforms are usually steep sided mesas, buttes and edges of dissected tablelands and plateaus. Soils are either absent or shallow Rudosols and Tenosols. These usually have minimal development potential as they are typically shallow infertile soils or exposed rock (Wilson and Taylor 2012). In the study area, this land zone supports Lancewood (*Acacia shirleyi*) shrubland and Eucalypt woodland.

The study area is underlain by the Burngrove Formation as part of the Bowen Basin. The dominant lithology of this formation is described as mudstone, siltstone, sandstone, coal and tuff (Department of Natural Resources and Mines [DNRM] 2015), as shown in Figure 3.

## 2.4 Drainage Features

The study area is located in the Roper Creek catchment within the Fitzroy River Basin, which drains an area of approximately 150,000 square km (DNRM 2015).

The main drainage feature of the study area is Roper Creek (Figure 4). This is defined as a watercourse under the Qld *Water Act 2000*. This runs west to east and south-east across the southern portion of the study area. It comprises an ephemeral creek that has running water in the wet season and is generally dry throughout the rest of the year, with some small pools usually remaining in places. Roper Creek was flowing at the time of the field survey. As part of the Project, Roper Creek would be diverted south of its current path.

A small section of Thirteen Mile Gully is located in the east of the southern portion of the study area. This contained pools of water during the survey, with a larger pool located just south of the study area boundary. This feeds into Roper Creek within the study area. A large section of this creek has been diverted into Roper Creek approximately 3.5 km to the northwest of the study area and the creek has been largely removed upstream from the site. A drainage is also located to the east of the study area (Figure 4).

Localised depressions (gilgai) occur within the patches of Brigalow in the study area. These contain a shallow layer of clay and hold water after heavy rains. Standing water was present in many of these Brigalow patches during the field surveys, and some contained submergent and floating aquatic plants.

A localised depression is also located in the south-east of the study area which had a groundcover of sedge species at the time of the survey. This is not mapped as a palustrine wetland.

## 2.5 Previous Relevant Ecological Investigations

### 2.5.1 Parsons Brinckerhoff 2010

Parsons Brinckerhoff Pty Ltd (PB) (2010a) undertook the Environmental Impact Statement for the Middlemount Coal Mine Stage 1 and 2 areas. Part of their area of investigation extended onto the current study area.

The field survey methodology employed by PB involved a comprehensive terrestrial flora and fauna survey. A brief outline of the methods and major findings of this study are described below.

A flora survey was undertaken based on the methods described in Neldner *et al.* (2020) in November 2009 and February/March 2010. A combination of secondary, tertiary and quaternary survey sites were used to sample vegetation and validate RE mapping. Targeted searches for threatened flora were also undertaken.



Figure 3: Geology of the study area

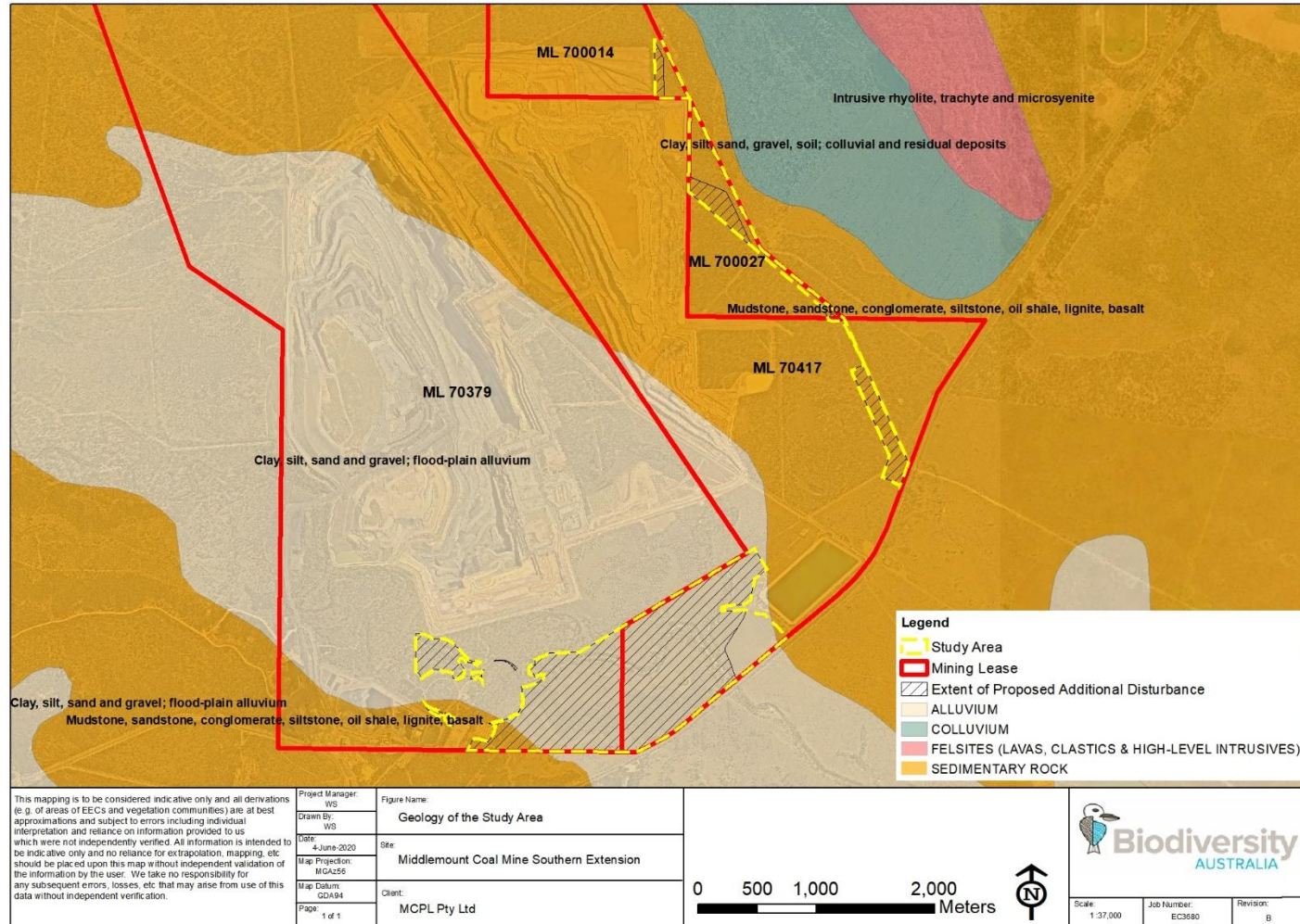
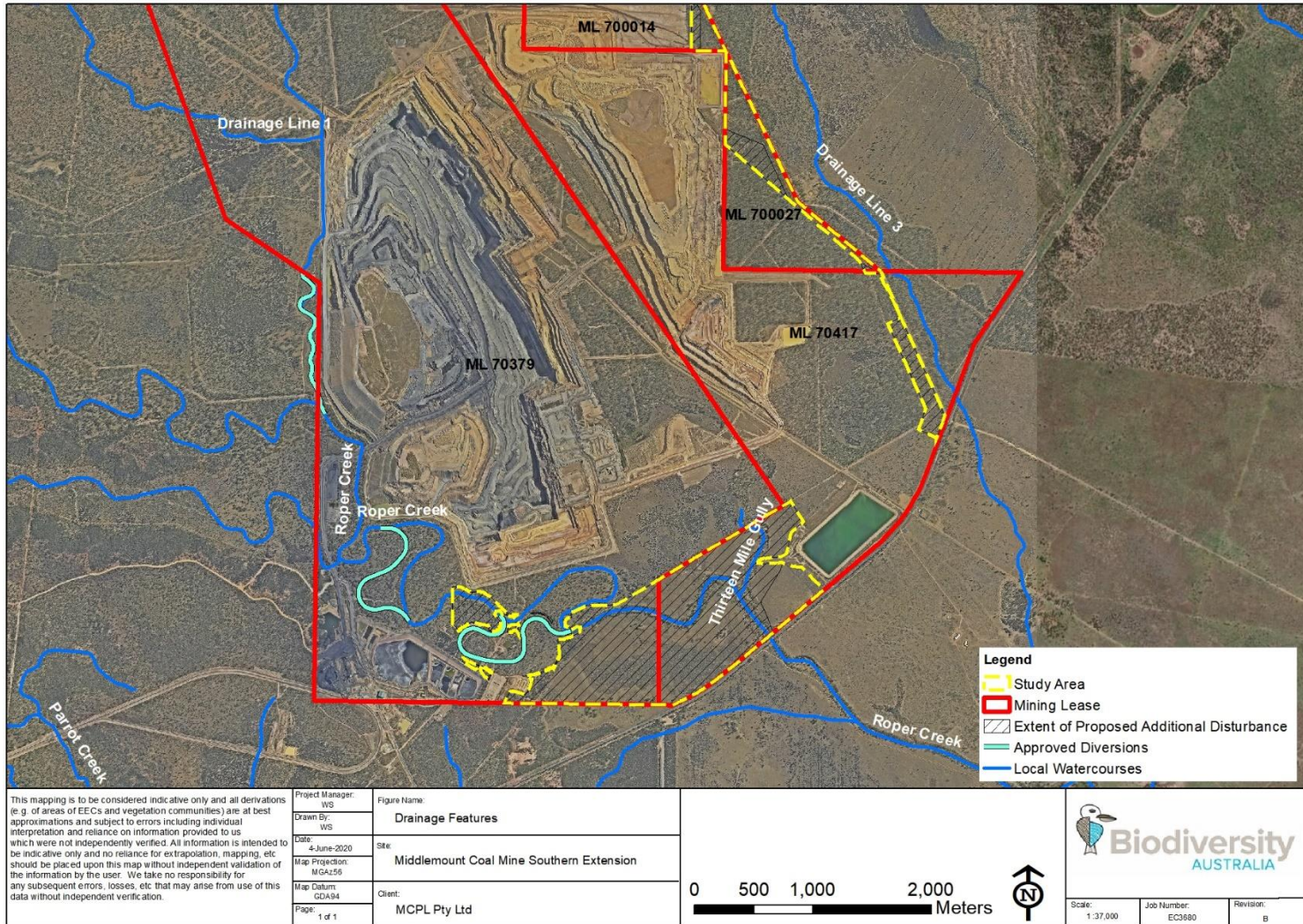


Figure 4: Drainage features in the study area



This resulted in the validation and mapping of 15 REs in the Stage 2 mine area. Three of these communities are listed as Endangered under the VM Act and the EPBC Act, with a further two listed as 'Of Concern'.

Two threatened flora species listed as 'Near Threatened' under the NC Act were detected in the Project area, these being *Desmodium macrocarpum* and *Cerbera dumicola*. *Desmodium macrocarpum* has since been de-listed.

PB's (2010a) fauna survey used a range of survey techniques to sample fauna species and their habitats in the Project area. These included habitat classification and assessment, bird census, herpetofauna searches, spotlighting, live animal trapping and ultrasonic bat call detection. These were undertaken over two survey periods in November 2009 and February/March 2010.

The PB (2010a) fauna survey detected 165 species of vertebrate animal, including eight introduced species. Three threatened species were detected; these being the Squatter Pigeon (southern), Ornamental Snake and the Little Pied Bat (*Chalinolobus picatus*). The Little Pied Bat has since been de-listed under the NC Act.

## 2.5.2 Ecology and Heritage Partners 2012

Ecology & Heritage Partners (EHP) (2012) conducted ecological investigations within the Offset Area for the Stage 2 Middlemount Coal Mine Project (shown on Figure 3-7 of the Main Text). The scope of work for the investigations were to verify the REs and high value regrowth present within the Offset Area, quantify the area of each RE, identify the status of REs under the VM Act, conduct surveys for threatened flora and fauna species and conduct surveys for weeds and pest species.

Field surveys were conducted by a team of four botanists from 10-14 July, 29 July-3 August and 13-17 August 2012. The main survey methodology employed was quaternary vegetation surveys. Targeted surveys for threatened flora species were undertaken via foot traverses along random 50 m transects along with opportunistic searches in potential habitat. Fauna survey methods involved opportunistic surveys and habitat assessments.

The Stage 2 Offset Area was found to contain 17 distinct REs. Approximately half of the Offset Area qualified as remnant vegetation with the remainder comprising non-remnant vegetation. The only endangered REs found in the Offset Areas were Brigalow woodlands (REs 11.3.1, 11.3.1b, 11.4.3, 11.4.8, 11.4.9a and 11.9.1), which are also listed as Endangered Brigalow TEC under the EPBC Act.

Two threatened flora species listed under the VM Act were detected during the surveys comprising *Desmodium macrocarpum* (no longer listed as a threatened species) and *Cerbera dumicola*. Two threatened fauna species listed under the NC Act were detected comprising the Koala and Squatter Pigeon (southern). These species are now both listed as Vulnerable under the EPBC Act. The Koala was found in the southwest of the Stage 2 Offset Area while the Squatter Pigeon (southern) was recorded in roughly the centre of the Stage 2 Offset Area.

Four vertebrate pest species were recorded comprising the Pig (*Sus scrofa*), Dog (*Canis lupus familiaris*), Rabbit (*Oryctolagus cuniculus*) and Cat (*Felis catus*). Three weed species listed under the former Qld *Land Protection (Pest and Stock Route Management) Act 2002* were recorded comprising the Harissia Cactus (*Harrisia martini*), Velvety Tree Pear (*Opuntia tomentosa*) and Parthenium Weed (*Parthenium hysterophorus*).



## 2.5.3 Biodiversity Australia (Naturecall)

### 2.5.3.1 Biodiversity Australia 2013-2019

Biodiversity Australia (formerly Naturecall Environmental [Naturecall]) conducts annual monitoring of the Middlemount Coal Offset Areas comprising the Stage 2 Offset, Rail Loop and Spur, Parrot Quarry and Thirteen Mile Gully Diversion offset areas, which are all located on MCPL land adjacent to the Middlemount Coal Mine (Naturecall 2013, 2014a, 2015a, 2016a, 2017a, Biodiversity Australia 2018a, 2019). Monitoring is undertaken in accordance with the MCPL Offset Management Plan (MCPL 2012 and its revision in 2019) and comprises annual vegetation monitoring surveys photo monitoring, as well as visual inspections and assessment of threats to the success of the Offset Areas. Three of the BioCondition survey points are located within the current Western Extension study area.

In accordance with the MCPL Offset Management Plan, dedicated fauna surveys were undertaken in the offset areas in May 2014 and May 2017. The following fauna survey techniques were employed:

- spotlighting;
- diurnal bird surveys;
- diurnal herpetofauna searches;
- installation of Passive Infrared (PIR) cameras;
- amphibian searches;
- opportunistic observations; and
- assessment of habitat features and complexity.

The fauna surveys have detected three threatened fauna species within the offset areas comprising the following:

- Greater Glider (*Petauroides volans*) – Vulnerable NC Act and EPBC Act.
- Koala (*Phascolarctos cinereus*) – Vulnerable NC Act and EPBC Act.
- Squatter Pigeon (southern) (*Geophaps scripta scripta*) - Vulnerable NC Act and EPBC Act.

### 2.5.3.2 Naturecall 2014

Naturecall (2014c) prepared an ecological assessment report for the realignment of the Bingegang Pipeline which is located to the north and east of the Middlemount Coal Mine. A section of the realigned pipeline runs through the eastern study area.

The ecological survey was conducted in July 2014 and consisted of RE verification and mapping, passive fauna surveys along with habitat and weed mapping.

The RE mapping and field validation found the majority of vegetation along the realigned pipeline route consisted of Poplar Box Woodland analogous to RE 11.5.3. Small patches of a Brigalow community were detected along the realigned pipeline route which qualified as the State and Commonwealth listed Brigalow (*Acacia harpophylla* dominant and co-dominant [RE 11.5.16]) threatened ecological community (Brigalow TEC), listed as Endangered under the NC Act and the EPBC Act. No threatened flora species were detected.

The fauna surveys detected a single threatened species – the Squatter Pigeon (southern) (*Geophaps scripta scripta*) which is listed as Vulnerable under the NC Act and the EPBC Act.



### 2.5.3.3 Naturecall 2015

Naturecall (2015b) conducted field surveys and prepared a Terrestrial Ecological Impact Assessment for the North-eastern Extension Project, located to the north of the current study area. The surveys were undertaken over one week in October 2015. The field survey methodology comprised the following:

- *Flora and Habitat Quality Surveys* – RE verification and mapping, threatened flora transects, Terrestrial Habitat Quality Assessments.
- *Fauna Surveys* – Spotlighting, call playback, PIR cameras, diurnal bird surveys, herpetofauna searches, scat and track searches.

The flora and habitat quality surveys confirmed that the entire site comprised Poplar Box Woodland analogous to RE 11.5.3. Several small localized depressions were also recorded which were mapped as 11.5.3b. No threatened flora species were recorded during the surveys and none were considered potential occurrences.

### 2.5.3.4 Biodiversity Australia 2018

Biodiversity Australia conducted field surveys and prepared a Terrestrial Ecological Impact Assessment for the Western Extension Project, located to the north and northwest of the current study area.

Field surveys were conducted in May and July of 2017 and comprised vegetation sampling and mapping, active fauna surveys (including but not limited to spotlighting, harp trapping, herpetofauna searches and camera stationing) and passive fauna surveys (i.e. habitat quality assessments).

The surveys conducted did not detect any threatened flora species however threatened REs were found to occur within the study area. Two of the REs recorded (RE 11.3.1 and RE 11.4.9) consisted of Brigalow forest which are listed as Endangered under the Qld *Vegetation Management Act, 1999* (VM Act) and EPBC Act. Two other REs occurring within the study area comprised of open woodland on alluvial plains are listed as Of Concern under the VM Act (RE 11.3.2 and RE 11.3.4).

Three threatened fauna species were recorded during the field surveys, the Koala (*Phascolarctos cinereus*) (scat only), Greater Glider (*Petauroides volans*) and Squatter Pigeon (Southern). These species are listed as Vulnerable under the NC Act and EPBC Act. Two additional threatened fauna species, the Ornamental Snake (*Denisonia maculata*) and Powerful Owl (*Ninox strenua*), were considered potential occurrences in the study area based on local records identified in the literature and database searches and presence of suitable habitat.



## 3. Methodology

### 3.1 Desktop Study and Literature Review

A desktop assessment was initially conducted to identify any changes in Remnant RE mapping or benchmarks since the establishment of the Offset Area (EHP 2012). The following data sources and GIS layers were reviewed:

- Atlas of Living Australia (2020).
- BirdLife Australia Atlas (2020).
- Department of Agriculture, Water and the Environment (DAWE) Protected Matters Database search for MNES listed under the EPBC Act for a radius of 10 km of the study area (2020a).
- Department of Environment and Science (DES) (2020d) Regional Ecosystems digital data layer (Version 11).
- DES (2018) Biodiversity Planning Assessment for the Brigalow Belt Bioregion - Version 2.1.
- DES (2020b): Matters of State Environmental Significance (MSES) - Environmental Reports online.
- Department of Natural Resources, Mines and Energy (2020b): Wildlife Online and Biomaps searches for Endangered, Vulnerable and Near Threatened species within a 10 km radius of the study area.
- Department of State Development, Infrastructure and Planning (2020) State Planning Policy interactive mapping system.
- Department of Sustainability, Environment, Water, Population and Communities (2012b) Environment Protection and Biodiversity Conservation Act Offsets Assessment Guide.
- Queensland Herbarium (2019a) BioCondition Benchmarks for Regional Ecosystem Condition Assessment: Brigalow Belt.
- Queensland Herbarium (2019b) Regional Ecosystem Description Database (REDD).

The results of these searches are presented in Section 4.

In addition to the desktop assessment, the following literature was reviewed for ecological information such as previous records of threatened flora and fauna, and survey techniques:

- Biodiversity Australia (2019). Ecological Monitoring for Middlemount Coal Offset Areas.
- Biodiversity Australia (2018a). Ecological Monitoring for Middlemount Coal Offset Areas.
- Biodiversity Australia (2018b). Ecological Impact Assessment: Western Extension Project, Middlemount Coal Mine.
- Biodiversity Australia (2018c). Western Extension Project Offset Area Baseline Report, Middlemount Coal Mine.
- EHP (2013a). Vegetation Offsets for Middlemount Rail Spur and Loop.
- EHP (2013b). Vegetation Offsets for Parrot Quarry.
- EHP (2013c). Vegetation Offsets for Middlemount Coal Mine Thirteen.
- EHP (2012). Ecological Investigations within the Offset Area for Stage 2 of the Middlemount Coal Mine, Queensland.
- Eyre *et al.* (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2.



- Eyre *et al.* (2011). Method for the Establishment and Survey of Reference Sites for BioCondition. Version 2.0.
- FRC Environmental (2010). Middlemount Coal Project EIS, Stage 2: Aquatic Ecology
- GHD (2012). Rail Spur Environmental Offset Package.
- MCPL (2019). Middlemount Coal Mine Offset Management Plan/Vegetation Management Plan.
- MCPL (2013a). Middlemount Coal Mine Offset Management Plan/Vegetation Management Plan.
- MCPL (2013b). Middlemount Coal Mine Rail Loop and Spur Vegetation Offset Proposal.
- MCPL (2013c). Parrot Quarry Vegetation Offset Proposal.
- MCPL (2013d). Thirteen Mile Gully Diversion Vegetation Offset Proposal.
- MCPL (2017b). Middlemount Coal Mine – Drainage Lines in Mining Leases 70379.
- Naturecall (2014c). Ecological Assessment Report for Bingegang Pipeline Relocation.
- Naturecall (2015b). Terrestrial Ecological Impact Assessment. – North East Extension.
- Naturecall (2016b). Vegetation Validation and Terrestrial Habitat Assessment for North-east Extension Offset Area.
- Naturecall (2017a). North-eastern Extension Offset Area Baseline Report.
- Naturecall (2017b). Ecological Monitoring for Offset Area, Middlemount Coal Mine – BioCondition Monitoring Survey.
- Naturecall (2016a). Ecological Monitoring for Offset Area, Middlemount Coal Mine – BioCondition Monitoring Survey.
- Naturecall (2015a). Ecological Monitoring for Offset Area, Middlemount Coal Mine – BioCondition Monitoring Survey.
- Naturecall (2014a). Ecological Monitoring for Offset Area, Middlemount Coal Mine – Fauna and Pest Species Survey.
- Naturecall (2014b). Ecological Monitoring for Offset Area, Middlemount Coal Mine.
- Owen Foley (2014). Residual Void Flora and Fauna Capability Study.
- PB (2010a). Middlemount Coal Project, Stage 2: Terrestrial Ecological Impact Assessment. In MCPL (2011) Middlemount Coal Project Stage 2 Environmental Impact Statement.
- PB (2010b). Middlemount Coal Project Stage 2 Aquatic Ecological Impact Assessment. In MCPL (2011) Middlemount Coal Project Stage 2 Environmental Impact Statement.
- WRM Water and Environment (2018). Middlemount Coal Mine – Western Extension Project Surface Water Impact Assessment.

### 3.2 Field Survey

The field surveys were proportionate to the relatively small area of proposed clearance (less than 10% of the approved footprint) and in consideration of the large number of previous surveys at the Middlemount Coal Mine.



### 3.2.1 Flora Surveys

Field surveys for these assessments were undertaken by two ecologists. Field surveys dates were 3-6 March 2020 and 20-21 June 2020.

The primary aims of the field survey were to verify the Department of Natural Resources, Mines and Energy RE mapping for the study area; refine previous RE mapping by PB (2010a); identify and describe MSES and MNES (e.g. threatened flora species, REs and Commonwealth listed TECs); and collect sufficient data to conduct a terrestrial habitat quality assessment in accordance with the Guidelines (DES 2020a). Details of the flora and habitat quality surveys are provided in the following sections.

#### 3.2.1.1 Flora Sampling and Vegetation Mapping

REs in the study area were surveyed and field verified as per the *Methodology for Surveying and Mapping Regional Ecosystems and Vegetation Communities in Queensland Version 5.1* (Neldner *et al.* 2020). This consisted of quaternary flora survey methods.

Four quaternary surveys were undertaken over the study area. The location of each survey site is shown in Figure 7. The following information was collected at Quaternary sites:

- Date.
- Collector.
- Coordinates.
- Remnant or regrowth.
- RE map unit.
- Height and cover of each layer.
- Land Zone.
- Species present.

REs were also verified during field traverses and through conducting Terrestrial Habitat Quality assessments.

Changes to RE mapping were made in the field using a tablet loaded with GIS Kit Pro (Garafa Inc.). This allowed highly accurate mapping of vegetation boundaries live in the field. This was followed by desktop mapping using ArcGIS 10.2 for Windows and recent satellite imagery (September 2019) supplied by MCPL.

#### 3.2.1.2 Targeted Searches for Threatened Flora Species

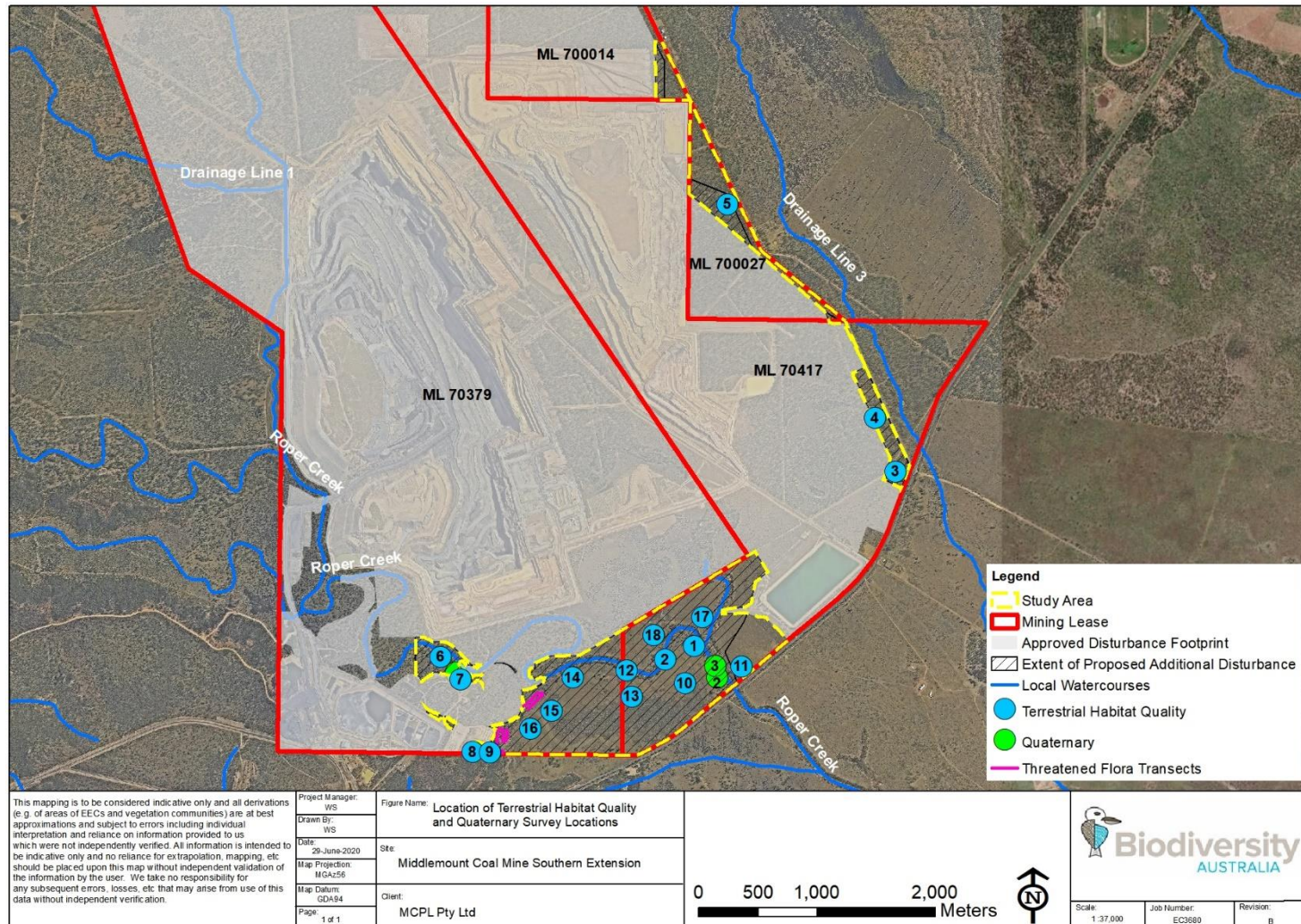
The DES *Flora Survey Guidelines - Protected Plants* (DES 2019) states that threatened flora surveys are required if the site falls within a high-risk area (as defined by an online mapping tool) or if a threatened species is known to occur within the study area. The study area does not fall within a high-risk area (see map in Appendix A-4-1) and no threatened flora species are known to occur in the study area.

A survey for threatened flora species was still carried out given the time elapsed since previous surveys and to provide more certainty on presence/absence of threatened flora species. This was achieved via conducting three timed meander transect searches (DES 2019) which were undertaken in suitable habitats for the target threatened flora species.

These undertaken in the southwest of the study area in RE 11.7.2, 11.7.4 and 11.3.1 on 20 June 2020. The location of the threatened flora surveys is shown in Figure 5.



Figure 5: Location terrestrial habitat quality and quaternary survey sites



### 3.2.1.3 Threatened Ecological Community Identification

Vegetation communities identified during the surveys were assessed for their conservation status under the EPBC Act, VM Act and DES Biodiversity Status. Brigalow communities were assessed according to the *Approved Conservation Advice* for the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community (Department of the Environment [DotE] 2013a) and Poplar Box Woodland on alluvial soils was assessed according to the Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains (Department of the Environment and Energy [DEE] 2019) as well as the Species Profile and Threats Database (DAWE 2020b).

### 3.2.1.4 Groundwater Dependant Ecosystems Identification

A groundwater dependent ecosystem is any ecosystem that relies on access to groundwater, either permanently or intermittently, to meet some or all of their water requirements so as to sustain resident flora and fauna compositions and ecological processes (Richardson et al. 2011).

An investigation of vegetation communities within the study area that potentially use groundwater was conducted in consideration of the *Information Guidelines Explanatory Note: Assessing Groundwater-dependent Ecosystems* (Doody et al. 2019) and *Methods for the Identification of High Probability Groundwater Dependent Vegetation Ecosystems* (Department of Primary Industries - Water 2016).

The *Groundwater Dependent Ecosystems Atlas* (GDE Atlas) (BOM 2020) was consulted to identify potential GDEs within the study area, which uses modelling to map and allocate any potential GDE with a value on a scale of Low to High potential.

The final determination of GDE presence within the study area is based on the presence of flora species within the vegetation communities that have potential to be dependent on groundwater either permanently or intermittently, as well as consideration of groundwater information provided by Australasian Groundwater and Environment Consultants (AGE).

### 3.2.1.5 Habitat Quality Assessment

The survey methodology outlined in the *Guide to Determining Terrestrial Habitat Quality Version 1.3* (DES 2020a) was used to collect field attributes and determine terrestrial habitat quality scores for the study area and known/potential threatened species. This methodology uses BioCondition plots to collect field data (Eyre et al. 2015).

A total of 18 site condition assessments (plots and transects) were undertaken in the study area. The location of these plots is shown in Figure 5. Site selection was based on field verified RE mapping and analysis of high-resolution satellite imagery and aimed to sample a representative coverage of the site vegetation.

- The following information was recorded at each of the field sampling sites:
- Observer, location and date.
- RE map unit.
- Photographic record of vegetation.
- Habitat description.
- Tree canopy and subcanopy height.
- Native plant species richness in each layer.
- Number of large trees.
- Recruitment.



- Course woody debris.
- Non-native plant cover.
- Percent cover of each layer.

The data collected was also used to determine terrestrial habitat quality scores for the study area and known/potential threatened species, in accordance with the *Guide to Determining Terrestrial Habitat Quality Version 1.3* (DES 2020a) and to assist in determining offset requirements for the Project.

### 3.2.1.6 Flora Survey Limitations

The field surveys were undertaken in early autumn (post-wet season).

The post-wet season survey in March 2020 was preceded by heavy rains, as well as some rainfall during the survey period, and most grass species were in seed at this time making them easily detectable. This allowed for a high rate of detection of flora species. Locally recorded threatened flora species would be easily detectable either year-round (e.g. *Cerbera dumicola* – near threatened) or during the March survey period.

### 3.2.2 Fauna Surveys

Fauna surveys were undertaken over the study area by two ecologists from 3-6 March 2020 and 20-21 June 2020.

Weather conditions for the survey periods are detailed in Section 3.2.3.

Fauna surveys were conducted in accordance with the following guidelines:

- Terrestrial Vertebrate Fauna Survey Guidelines for Qld v3 (Eyre *et al.* 2018).
- Survey Guidelines for Australia's Threatened Reptiles (Department of Sustainability, Environment, Water, Population and Communities [DSEWPC] 2011a).
- Survey Guidelines for Australia's Threatened Mammals (DSEWPC 2011b).
- Survey Guidelines for Australia's Threatened Birds (Department of the Environment, Water, Heritage and the Arts [DEWHA] 2010a).
- Survey Guidelines for Australia's Threatened Bats (DEWHA 2010b).
- EPBC Act referral guidelines for the vulnerable Koala (combined Qld, New South Wales [NSW] and the Australian Capital Territory) (DotE 2014).
- EPBC Act Draft Referral Guidelines for the nationally listed Brigalow Belt reptiles (DSEWPC 2011c).
- Species Profile and Threats Database (DAWE 2020b).

Fauna surveys targeted threatened species listed under the NC Act and EPBC Act, as well as pest species, however common species were also surveyed. The following fauna surveys methods were utilised:

- Terrestrial and aquatic habitat assessments.
- Spotlighting.
- Microbat call recording and analysis.
- Herpetofauna surveys.
- Diurnal bird surveys.
- PIR camera stations.



- Koala surveys.
- Scat, track and secondary evidence searches.

These survey methods are described in detail in the following sections.

### 3.2.2.1 Terrestrial Habitat Assessment

Habitat assessments were undertaken across the study area at the terrestrial habitat quality survey plots and during foot traverses over the study area.

Habitats were defined according to parameters such as:

- Structural and floristic characteristics of the vegetation (e.g. understorey type and development, crown depth, groundcover density, etc.).
- Degree and extent of disturbance (e.g. fire, logging, weed invasion, modification to structure and diversity, etc.).
- Presence of water in any form (e.g. dams, creeks, drainage lines, soaks).
- Size and abundance of hollows and fallen timber.
- Availability of shelter (e.g. rocks, logs, hollows, undergrowth).
- Wildlife corridors, refuges and proximate habitat types (i.e. connectivity between suitable habitats).
- Presence of resources (e.g. mistletoe, nectar, gum, seed, sap, etc.).

This information, along with information obtained from the desktop assessment was used to formulate a list of potentially occurring threatened fauna species for the study area.

### 3.2.2.2 Spotlighting

Spotlighting was conducted for 2 hours per night for five nights across the study area.

This involved driving transects from a vehicle moving at walking pace along roads and tracks and walking transects using hand-held spotlights through both vegetated areas and along tracks.

All habitat components (i.e. understorey/canopy trees for arboreal fauna), the ground and terrestrial strata (e.g. logs, areas with good leaf litter accumulations, etc.) were searched for terrestrial fauna.

Spotlighting was conducted approximately one hour after dusk. Conditions varied between clear and overcast, and wind ranged from placid to light. Light rain was experienced on the second night of spotlighting.

### 3.2.2.3 Microbat Call Recording and Analysis

Microbat call detection was undertaken using two Anabat Express units (Titley Scientific). The units were deployed overnight at two locations, one facing a track near Roper Creek and the other on the edge of Poplar Box Woodland (see Figure 6 and Figure 7). Six-unit nights of recording was conducted in the study area. This resulted in >60 hours of recording.

The recordings were forwarded to Greg Ford of Balance! Environmental, a bat call identification consultant, for identification of the bat species.



### 3.2.2.4 Herpetofauna Searches

Searches primarily targeting the Ornamental Snake, Yakka Skink (*Egernia rugosa*), Brigalow Scaly-foot (*Paradelma orientalis*), Dunmall's Snake (*Furina dunmalli*) and Golden-tailed Gecko (*Strophurus taenicauda*) were undertaken within 50 m x 50 m quadrats. These were conducted at six locations within the study area (Figure 6 and Figure 7).

Herpetofauna searches involved active diurnal lifting up and rolling of timber and debris, inspection of dense vegetation and leaf litter and observation of likely basking sites for a total of 60-person minutes per site. Nocturnal herpetofauna torch searches were carried out in suitable habitat in conjunction with walking spotlight transects.

### 3.2.2.5 Diurnal Bird Surveys

Birds were surveyed by detecting calls and searching using binoculars at point positions or along a walking transect within two hours of dawn when peak activity usually occurs.

Specific bird censuses were undertaken each morning during the survey periods for 30 minutes with two observers. A total of eight bird surveys were carried out in the study area (Figure 6 and Figure 7).

Incidental observations of birds were also recorded during other survey activities. This provided short-term seasonal data on bird occurrences in the area for the particular seasons.

### 3.2.2.6 Passive Infrared Camera Stations

Six infra-red cameras were deployed at various locations over the study area. Cameras were set for three nights (Figure 6 and Figure 7).

The cameras were set either in forested areas or facing a road/track and were baited with either a mixture of oats, peanut butter and apple, or a meat bait consisting of chicken necks and tinned cat food.

Target species were the Northern Quoll (*Dasyurus hallucatus*), arboreal mammals, raptors and feral species such as European Red Foxes (*Vulpes vulpes*), dogs/dingoes (*Canis spp.*), feral cats and pigs.

### 3.2.2.7 Koala Surveys

Two dedicated Koala Spot Assessment Technique (SAT) surveys were undertaken in the study area on 21 June 2020. One was undertaken in the south of the study area adjacent to Roper Creek and the second was undertaken in the east of the study area adjacent to the Bingegang Pipeline road. The location of the SAT surveys is shown in Figure 6 and 7.

The SAT surveys were undertaken as per the method described by Phillips and Callahan (2011). This consisted of identifying a centre tree which is known to be frequented by the Koala, known to contain faecal pellets of the Koala or is likely to be considered as a potentially important tree for the Koala. In the event that a tree of this criteria was not located, a centre tree was randomly selected in an area of habitat most likely to support this species.

Once a centre tree was selected, active searches for Koala scats were undertaken under this tree and under the 29 nearest trees. Searches involved checking the ground and leaf litter within a 1 m radius of each tree, for a period of two minutes per tree or until a scat was found.

Opportunistic Koala scat searches were also undertaken across the study area under preferred food trees in areas of suitable habitat. Diurnal and nocturnal searches for Koalas were undertaken along Roper Creek. This consisted of searching trees for Koalas and searching for indicative Koala scratch marks on trees.



### **3.2.2.8 Track, Scat and Sign Searches**

Searches for scats, tracks, feeding signs and scratch marks on trees were undertaken opportunistically along roads/tracks and within forested areas at the herpetofauna survey sites.

The sandy roads within and around the study area provided ideal locations for track searches, and any tracks found were photographed and identified using the methodology outlined in Triggs (1996). Predator scats were targeted for survey as remains can provide records of cryptic fauna.

### **3.2.2.9 Fauna Survey Limitations**

Heavy rains preceded and occurred during the survey and Roper Creek was flowing during the survey. Standing water was present in the gilgai habitats and along low-lying tracks. This allowed for high detection rates of amphibians (and species which prey on them). As evident in the survey results, a broad range of fauna species were detected during the survey, and the methods used are considered effective for detecting a range of threatened species in the region.



Figure 6: Location of fauna surveys - southern portion of study area

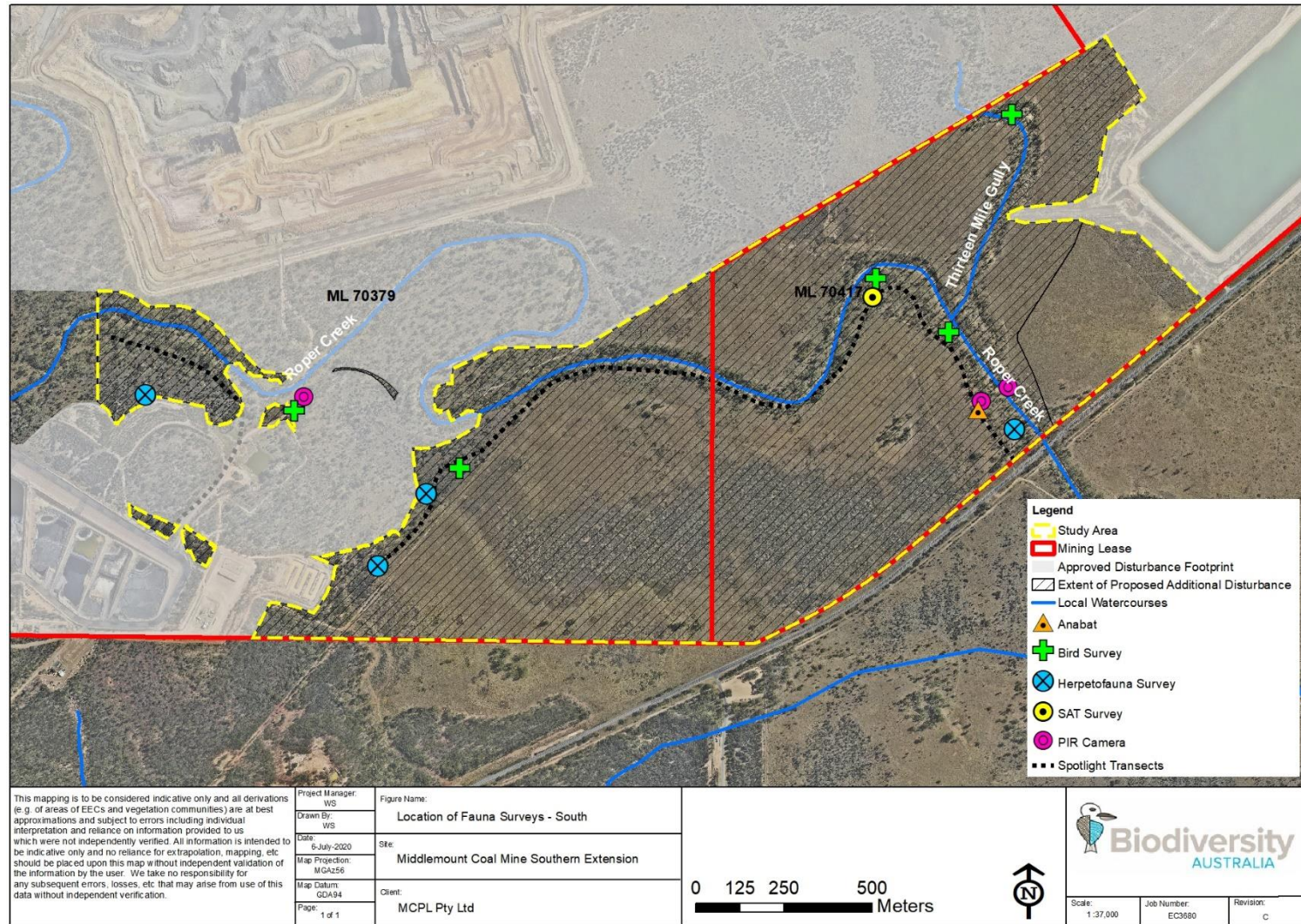
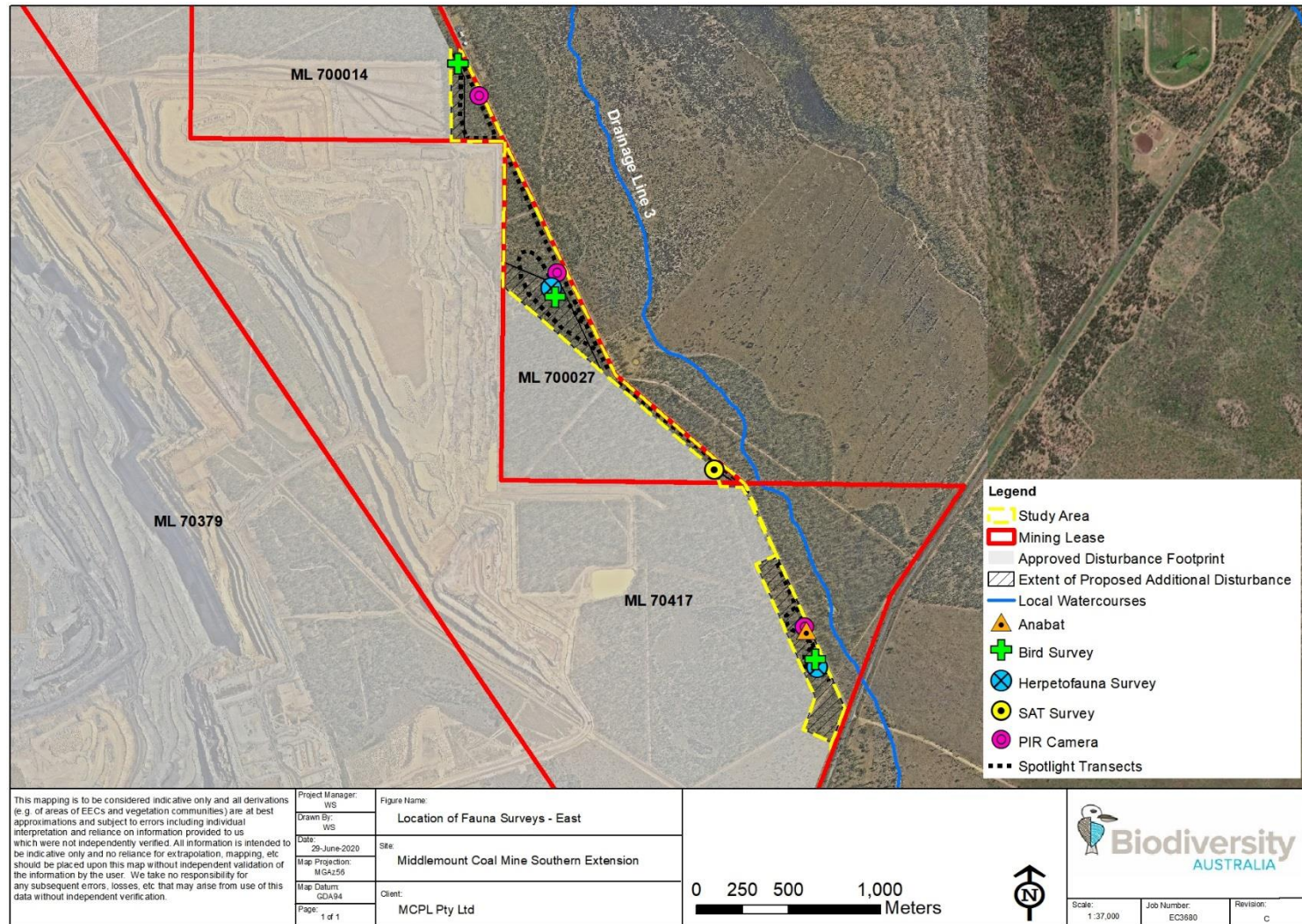


Figure 7: Location of fauna surveys - eastern portion of study area



### 3.2.3 Weather Conditions During the Survey

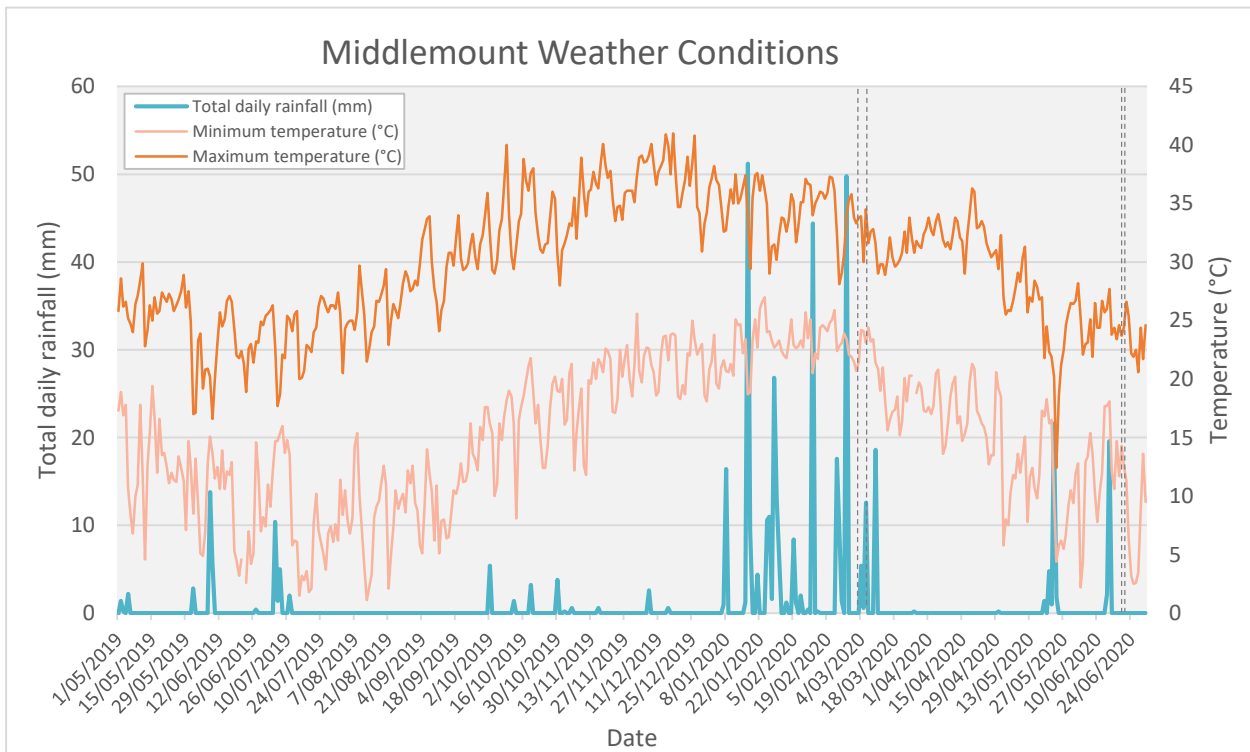
The main survey period survey was conducted during a period of warm, wet weather. The initial survey day comprised the only day where dry conditions were experienced with light showers between 0.6 and 12.6 millimetres (mm) per day experienced throughout the remaining survey. According to Middlemount Mine rainfall data, the survey period was conducted at the end of a two-month long wet season of which three heavy rainfall events occurred (51.2 mm on 17/01/2020; 44.4 mm on 13/02/2020; 49.8 mm on 27/02/2020).

Temperatures during the survey period ranged from a minimum of 21.5°C to a maximum of 34.5°C. These temperatures were typical of the slowly declining temperatures expected as the seasons progressed from summer to autumn.

The second survey period was conducted during a dry period with declining winter temperatures. This survey period fell over two survey days with temperatures ranging from a minimum of 12.6°C to a maximum of 24.4°C.

Middlemount rainfall and temperature data from the past year is graphed in relation to the survey period in Figure 8.

Figure 8: Precipitation/temperature recorded at Middlemount over the previous year (survey period marked with dotted line)



## 4. Results

### 4.1 Flora

The study area was found to have reasonable floristic diversity, however exotic grasses have outcompeted native species over large areas of the study area, which has led to changes in forest structure and composition.

A total of 155 flora species were recorded during the survey. Fifteen of these were introduced species with the remainder being native. The highest flora diversity was found in remnant Poplar Box and Brigalow communities which had an intact ground layer. Groundcover along Roper Creek primarily comprised introduced species. No threatened flora species were recorded during the surveys. The flora list for the study area is provided in Appendix A-2.

RE descriptions are provided in the following section.

#### 4.1.1 Regional Ecosystems

Vegetation surveys ground-truthed eight distinct REs in the study area. Minor changes to existing RE mapping by PB (2010a) and Queensland Herbarium (2017) were made by the field validation process described in Section 3.2.1, by refining RE boundaries and separating out mixed REs.

A description of the ground-truthed REs in the study area are provided in Tables 2 to 9. The communities are named as per the REDD V11.1 (Queensland Herbarium 2019b). The Queensland Herbarium RE mapping is shown in Figure 9 and a field verified RE map has been produced and is shown in Figure 10.

Photos 1 to 8 following the description illustrate the vegetation communities within the study area.

Table 2: Regional Ecosystem 11.3.1 description

RE Type	11.3.1: <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains
Extent on Site	Occurs as several small patches in the south-west of the study area close to Roper Creek. Total area is 2.2 ha (Photo 1).
General Description	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> Consists of a mid-dense tree layer ranging from 8-12 m in height. Brigalow (<i>Acacia harpophylla</i>) is the dominant species. Uncommon canopy associates include Queensland Ebony (<i>Lysiphyllum caronii</i>) and Yellow-wood (<i>Terminalia oblongata</i>).</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> A low tree/tall shrub layer to 6 m in height is present in some patches. Common to occasional species in this layer include juvenile Brigalow, False Sandalwood (<i>Eremophila mitchellii</i>) and Sandalwood (<i>Santalum lanceolatum</i>).</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> A patchy shrub layer to 1 m in height is sometimes present. Consists of Currant Bush (<i>Carissa ovata</i>), Nepine (<i>Capparis lasiantha</i>) and Ellangowan Poison Bush (<i>Eremophila deserti</i>).</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> Groundcover is generally open with patches of leaf litter and bare ground present. Exotic grasses dominant the groundcover in some patches. Species recorded include a range of grasses including Slender Chloris (<i>Chloris divaricata</i>), <i>Paspalidium distans</i>, Hairy Panic (<i>Panicum effusum</i>), <i>Enteropogon acicularis</i>; and forbs such as Ruby Saltbush (<i>Enchylaena tomentosa</i>) and Soft Roly-poly (<i>Salsola australis</i>). Exotic species which dominate in some areas include Buffell Grass (<i>Cenchrus ciliaris</i>), Green Panic (<i>Megathyrsus maximus</i>) and Sesbania Pea (<i>Sesbania cannabina</i>). Occasional aquatic species were recorded in areas of Brigalow with gilgai present. These areas had standing water present during the survey and aquatic species recorded include Water Primrose (<i>Ludwigia peploides</i>), Water Snowflake (<i>Nymphoides indica</i>) and Swamp Lily (<i>Ottelia ovalifolia</i>).</p>



<p><b>Condition</b></p>	<p>Generally in poor condition due to small patch sizes which experience high edge effects and weed invasion.</p> <p>Patches of non-remnant Brigalow also occur adjacent to remnant patches and across a large area between Roper Creek and Middlemount Road which were cleared approximately 3 years ago. The recently cleared areas feature a dense layer of young Brigalow to 1m in height with mostly exotic groundcover.</p>
<p><b>Conservation Status</b></p>	<p>'Endangered' under VM Act and 'Endangered' Biodiversity Status. Also qualifies as Endangered Brigalow TEC under the EPBC Act.</p>

Photo 1: RE 11.3.1



Table 3: Regional Ecosystem 11.3.2 description

<b>RE Type</b>	11.3.2: <i>Eucalyptus populnea</i> woodland on alluvial plains
<b>Extent on Site</b>	Occurs along the Roper Creek floodplain in the east and west of the study area. Total area is 19.5 ha (Photo 2).
<b>General Description</b>	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> The canopy comprises an open tree layer which is dominated by Poplar Box (<i>Eucalyptus populnea</i>). Other canopy associates include Moreton Bay Ash (<i>Corymbia tessellaris</i>) and Clarkson's Bloodwood (<i>Corymbia clarksoniana</i>). Height ranges from 15-18 m.</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> A low tree layer ranging from 6-10 m in height is occasionally present. This consists of young Poplar Box, Leichardt Bean (<i>Cassia brewsteri</i>) and occasional Native Willow (<i>Acacia salicina</i>) and Quinine Tree (<i>Petalostigma pubescens</i>).</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> This community features an open to mid-dense tall shrub layer ranging from 0.5-1.5 m in height. Commonly recorded species in this layer include Dysentery Bush (<i>Grewia latifolia</i>), Coffee Bush (<i>Breynia oblongifolia</i>), Currant Bush (<i>Carissa ovata</i>) and Western Boobialla (<i>Myoporum montanum</i>).</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> In most situations the groundcover is dense, however it is sometimes open and patchy. Height ranges from 0.05 to 0.5 m. Dominant species recorded in this layer include Buffel Grass, Green Panic, Sabi Grass, Black Speargrass (<i>Heteropogon contortus</i>), <i>Sida cordifolia</i> and Yellow Buttons (<i>Chrysocephalum apiculatum</i>).</p>
<b>Condition</b>	<p>Good remnant condition overall, with most disturbance occurring in the ground layer as a result of cattle grazing. Weed cover increases closer to Roper Creek where exotic grasses begin to dominate the ground layer. Buffel Grass (<i>Cenchrus ciliaris</i>) is also a dominant weed throughout.</p> <p>Large non-remnant areas of this community also occur in the south of the study area. Some areas feature a regenerating layer of canopy trees to approximately 2 m height while other areas do not have any eucalypt regeneration. The groundcover is largely dominated by exotic pasture grasses.</p>
<b>Conservation Status</b>	'Of concern' under VM Act and 'Of concern' Biodiversity Status. Some patches within the study area qualify as Endangered Poplar Box Woodland TEC under the EPBC Act.

Photo 2: RE 11.3.2



Table 4: Regional Ecosystem 11.3.2b description

<b>RE Type</b>	11.3.2b: <i>Eucalyptus camaldulensis</i> (sometimes <i>E. populnea</i> and or <i>E. tereticornis</i> ) woodland in drainage depressions
<b>Extent on Site</b>	One small patch occurs in the south-east of the study area. Area is 1.03 ha.
<b>General Description</b>	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> The canopy comprises an open to sparse tree layer which is dominated by Poplar Box (<i>Eucalyptus populnea</i>). A couple of Queensland Blue Gum (<i>Eucalyptus tereticornis</i>) are also present. Height ranges from 16-18 m.</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> A sparse sub-canopy from 8-12 m in height is present. This consists of young Poplar Box, and scattered Leichardt Bean (<i>Cassia brewsteri</i>) and Queensland Ebony (<i>Lysiphillum carronii</i>).</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> Absent.</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> Consists of a dense layer of grasses and herbs. Some depressions also present which feature sedges. Dominant species are <i>Juncus usitatus</i>, Giant Sedge (<i>Cyperus exaltatus</i>), Common Fringe Rush (<i>Fimbristylis dichotoma</i>) and Pigweed (<i>Portulaca oleracea</i>).</p>
<b>Condition</b>	Good condition with few disturbances noted. Weeds are common in the ground layer, especially around the edges of the community.
<b>Conservation Status</b>	'Of concern' under VM Act and 'Of concern' Biodiversity Status. Patch within the study area does not qualify as Endangered Poplar Box Woodland TEC under the EPBC Act.

Photo 3: RE 11.3.2b



Table 5: Regional Ecosystem 11.3.25 description

RE Type	11.3.25: <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines
Extent on Site	Occurs as a thin band along Roper Creek. Area on site is 14.06 ha (Photo 4).
General Description	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> The canopy comprises an open tree layer which is dominated by Qld Blue Gum (<i>Eucalyptus tereticornis</i>), River Oak (<i>Casuarina cunninghamiana</i>) and Moreton Bay Ash (<i>Corymbia tessellaris</i>) with occasional Poplar Box (<i>Eucalyptus populnea</i>) located around the edges. Height ranges from 18-25 m.</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> A sparse lower tree layer ranging from 6-12 m in height occurs throughout. This largely consists of young Qld Blue Gum and River Oak. Other species recorded include Sandpaper Fig (<i>Ficus opposita</i>), White Cedar (<i>Melia azedarach</i>), Yellow-wood (<i>Terminalia oblongata</i>) and Castor Oil Plant (<i>Ricinus communis</i>).</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> Occasional shrub species present ranging from 0.5-1.5 m in height. Species include Currant Bush (<i>Carissa ovata</i>) and Dysentery Bush (<i>Grewia latifolia</i>).</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> A dense layer of grasses and herbs is present and largely consists of exotic species. These include Morning Glory (<i>Ipomoea indica</i>), Green Panic (<i>Megathyrsus maximus</i>), Buffel Grass (<i>Cenchrus ciliaris</i>) and Red Natal Grass (<i>Melinis repens</i>). Native species recorded include <i>Commelina cyanea</i>, Crinum Lily (<i>Crinum flaccidum</i>) and Spiny Matrush (<i>Lomandra longifolia</i>).</p>
Condition	Moderate to poor condition. Weed invasion has degraded most of the community and erosion from previous cattle grazing was also noted.
Conservation Status	'Least concern' under VM Act and 'Of concern' Biodiversity Status.

Photo 4: RE 11.3.25



Table 6: Regional Ecosystem 11.3.7 description

RE Type	11.3.7: <i>Corymbia</i> spp. woodland on alluvial plains
Extent on Site	Occurs on the level plain adjacent to Roper Creek, generally in the west of the study area. Covers an area of 6.18 ha.
General Description	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> Comprises an open canopy ranging in height from 17-23 m. Moreton Bay Ash (<i>Corymbia tessellaris</i>) is the dominant species, with canopy associates including Clarkson's Bloodwood (<i>Corymbia clarksoniana</i>) and Poplar Box (<i>Eucalyptus populnea</i>).</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> Consists of a lower tree layer of canopy juveniles ranging from 8-13 m in height.</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> Occasional patches of shrubs are present. Common to dominant species include Currant Bush (<i>Carissa ovata</i>), Coffee Bush (<i>Breynia oblongifolia</i>) and Dysentery Bush (<i>Grewia latifolia</i>). Height ranges from 0.5-1 m.</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> Consists large of exotic grasses including Buffel Grass (<i>Chenchrus ciliaris</i>), Sabi Grass (<i>Urochloa mosambicensis</i>) and Green Panic (<i>Megathyrus maximus</i>). Occasional native species recorded include Comet Grass (<i>Perotis rara</i>), Dark Wiregrass (<i>Aristida calycina</i>), Yellow Rattlepod (<i>Crotalaria mitchellii</i>) and Flannel Weed (<i>Sida hackettiana</i>).</p>
Condition	Occurs in poor to moderate condition due to high edge effects and weed invasion.
Conservation Status	'Least concern' under VM Act and 'Of concern' Biodiversity Status.

Photo 5: RE 11.3.7



Table 7: Regional Ecosystem 11.5.3 description

RE Type	11.5.3: <i>Eucalyptus populnea</i> ± <i>E. melanophloia</i> ± <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces.
Extent on Site	Only occurs in the northern section of the study area adjacent to the Bingegang Pipeline. The total area within the study area is 44.61 ha.
General Description	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> The canopy consists of an open layer of generally even aged mature trees ranging from 15-20 m in height. Poplar Box (<i>Eucalyptus populnea</i>) is the dominant species. Common to occasional canopy associates include Clarkson's Bloodwood (<i>Corymbia clarksoniana</i>), Reid River Box (<i>Eucalyptus brownii</i>), Moreton Bay Ash (<i>Corymbia tessellaris</i>) and Ghost Gum (<i>Corymbia dallachiana</i>).</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> The subcanopy generally consists of an open to sparse tall shrub/small tree layer from 4-10 m in height dominated by Leichardt Bean (<i>Cassia brewsteri</i>), Quinine Tree (<i>Petalostigma pubescens</i>), Ironwood (<i>Acacia excelsa</i>), Native Willow (<i>Acacia salicina</i>) and False Sandalwood (<i>Eremophila mitchellii</i>). Other less common species in this layer include Silver Oak (<i>Grevillea parallela</i>), Dead Finish (<i>Archidendropsis basaltica</i>), Bootlace Oak (<i>Hakea lorea</i>) and Red Ash (<i>Alphitonia excelsa</i>).</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> A low shrub layer to 0.7 m in height is occasionally present and consists of patches of Currant Bush (<i>Carissa ovata</i>) along with other species such as Stylo (<i>Stylosanthes scabra</i>), Dysentery Bush (<i>Grewia latifolia</i>), Fine Sida (<i>Sida filiformis</i>) and <i>Sida cordifolia</i>.</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> The groundcover ranges from dense to open with height usually ranging from 0.1-0.5 m in height. Introduced grasses such as Buffel Grass (<i>Cenchrus ciliaris</i>), Sabi Grass (<i>Urochloa mosambicensis</i>) and Red Natal Grass (<i>Melinis repens</i>) are the dominant species overall, however less disturbed areas also existed that feature an open groundcover of native grasses such as Black Speargrass (<i>Heteropogon contortus</i>), Native Millet (<i>Panicum decompositum</i>), Queensland Bluegrass (<i>Dichanthium sericeum</i>), and Forest Bluegrass (<i>Bothriochloa blahdii</i>).</p>
Condition	<p>Good condition overall with most areas featuring an intact canopy and understorey. Grazing has impacted the ground layers however via trampling and spreading exotic grasses. Weed cover is moderate to high but limited to exotic grass infestations in the ground layer and occasional Prickly Pear (<i>Opuntia stricta</i>).</p> <p>Large non-remnant areas of this community also occur in the west of study area. Some areas feature a regenerating layer of canopy trees to approximately 4 m in height while other areas do not have any eucalypt regeneration. The groundcover is largely dominated by exotic pasture grasses.</p>
Conservation Status	'Least concern' under VM Act and 'Not of concern' Biodiversity Status.



Photo 6: RE 11.5.3



Table 8: Regional Ecosystem 11.7.2 description

RE Type	11.7.2: <i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone
Extent on Site	Occurs in two small patches in the south-west of the study area. Area is 0.76 ha.
General Description	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> Comprises a moderately dense canopy layer ranging from 10-12 m in height. Lancewood (<i>Acacia shirleyi</i>) is the dominant species.</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> A small tree layer is present in the community. This is dominated by Turkey Bush (<i>Erythroxylum australe</i>), Quinine Tree (<i>Petalostigma pubescens</i>), Red Ash (<i>Alphitonia excelsa</i>) and <i>Psydrax attenuata</i>. Height generally ranges from 3-6 m.</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> Absent.</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> Comprises an open cover of native grasses and herbs to 0.3 m in height. The dominant species in this layer are Tableland Couch (<i>Calyptrichloa gracillima</i>) and Hooky Grass (<i>Ancistrachne uncinulata</i>).</p>
Condition	Occurs in good remnant condition with only minor disturbances from road construction nearby. Weed cover is very low.
Conservation Status	'Least Concern' under VM Act and 'Not of Concern' Biodiversity Status.



Photo 7: RE 11.7.2



Table 9: Regional Ecosystem 11.7.4 description

<b>RE Type</b>	11.7.4: <i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust
<b>Extent on Site</b>	Occurs in two small patches in the south-west of the study area. Total area is 1.63 ha.
<b>General Description</b>	<p><b>a) Canopy:</b>  <i>Structure and Species:</i> Comprises an open canopy dominated by Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>). Occasional Dawson's Gum (<i>Eucalyptus cambageana</i>), Clarkson's Bloodwood (<i>Corymbia clarksoniana</i>) and Poplar Box (<i>Eucalyptus populnea</i>) are also present in low abundance. Height is generally in the range of 13-18 m.</p> <p><b>b) Subcanopy:</b>  <i>Structure and Species:</i> Features a well-developed and diverse subcanopy layer of tall shrubs and small tree species. Species recorded in this layer include <i>Psydrax attenuata</i>, Turkey Bush (<i>Erythroxylum australe</i>), Quinine Tree (<i>Petalostigma pubescens</i>), Red Ash (<i>Alphitonia excelsa</i>), Chalky Wattle (<i>Acacia cretata</i>), Lancewood (<i>Acacia shirleyi</i>) and Leichardt Bean (<i>Cassia brewsteri</i>). Height ranges from 4-8 m.</p> <p><b>c) Shrub layer:</b>  <i>Structure and Species:</i> A patchy shrub layer is present, however is sparse overall. Dominant species include Sticky Hop Bush (<i>Dodonaea viscosa</i>), Currant Bush (<i>Carissa ovata</i>) and Dysentery Bush (<i>Grewia latifolia</i>). A few Prickly Pear (<i>Opuntia stricta</i>) are also present.</p> <p><b>d) Ground layer:</b>  <i>Structure and Species:</i> Consists of an open layer of grasses and herbs. Dominant species are Tableland Couch (<i>Calyptrichloa gracillima</i>), Wattle Matrush (<i>Lomandra filiformis</i>), Native Wandering Jew (<i>Commelina diffusa</i>), Tropical Speedwell (<i>Evolvulus alsinoides</i>) and Pigweed (<i>Portulaca oleracea</i>). Some exotic grasses such as Buffel Grass (<i>Cenchrus ciliaris</i>) and Green Panic (<i>Megathyrus maximus</i>) are also present.</p>
<b>Condition</b>	Occurs in good remnant condition with only minor disturbances and edge effects from tracks and clearings nearby. Weed cover is low.
<b>Conservation Status</b>	'Least concern' under VM Act and 'Not of concern' Biodiversity Status.



Photo 8: RE 11.7.4



Figure 9: Mapped Regional Ecosystems

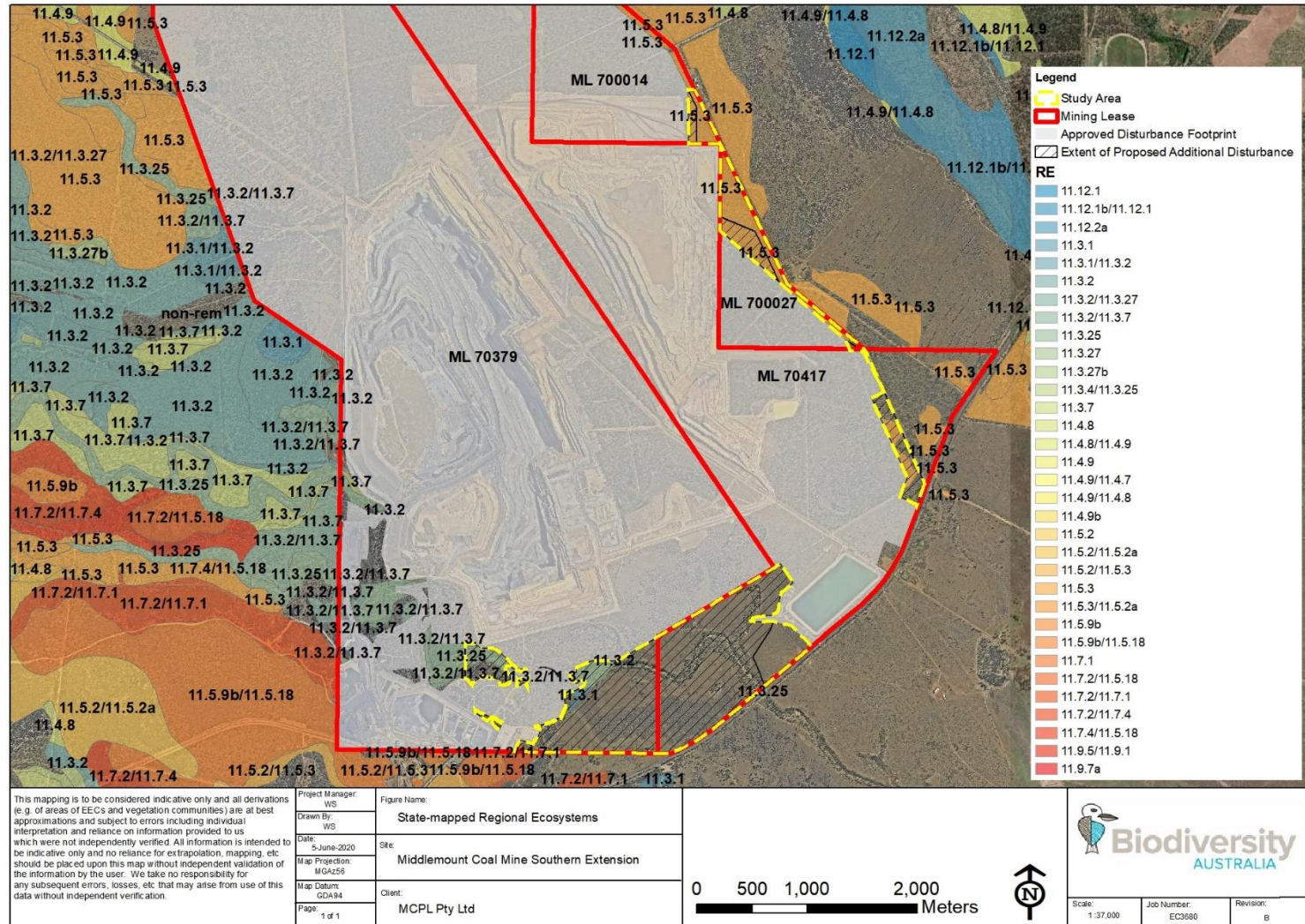
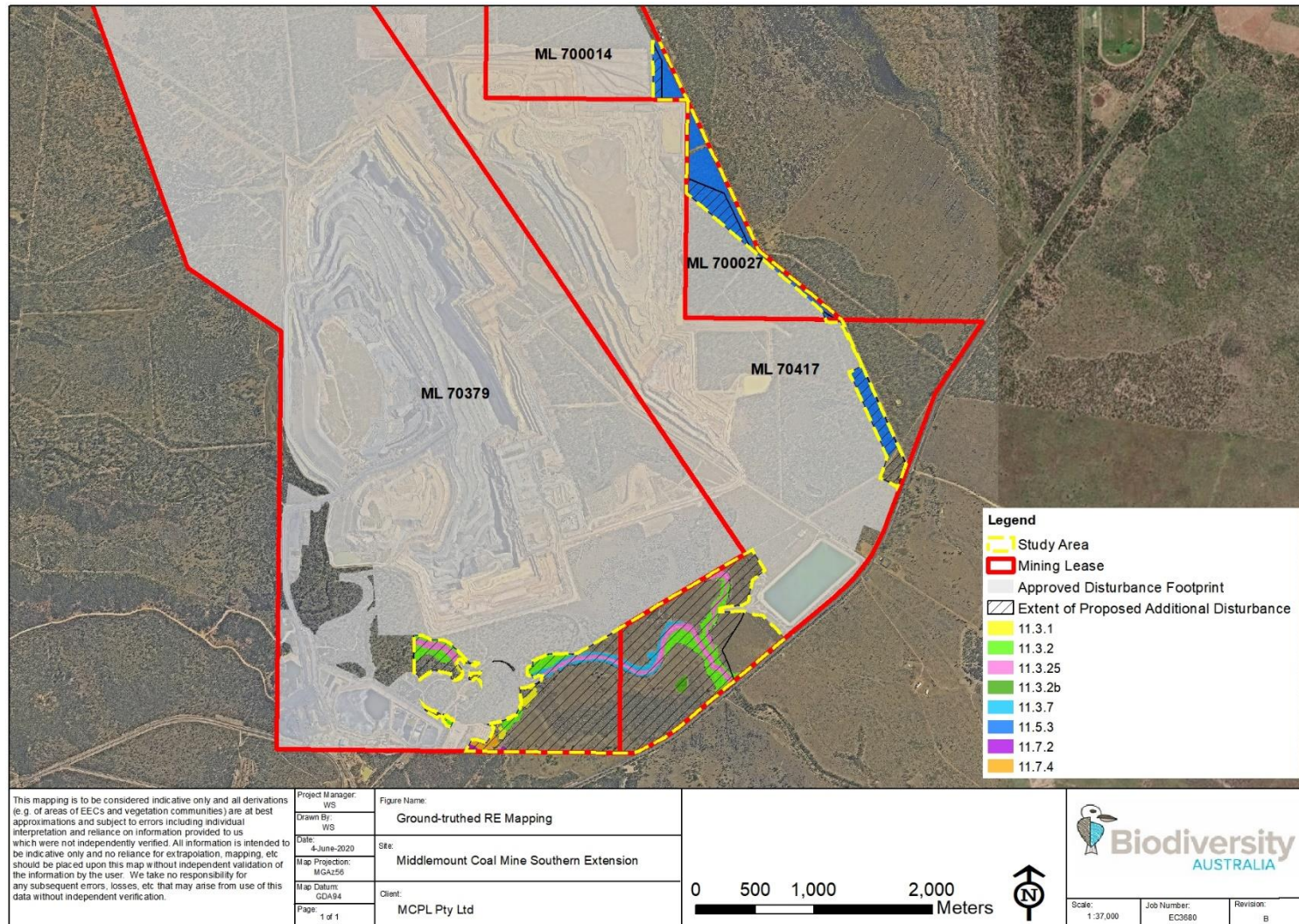


Figure 10: Field verified Regional Ecosystems



#### 4.1.1.1 Endangered and Of Concern Regional Ecosystems

Desktop assessments identified the following threatened REs listed in Table 10 have been mapped in the study area.

Table 10: Endangered and Of Concern Regional Ecosystems recorded in database searches

Regional Ecosystem	Code	VM Act Status	Source
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	11.3.1	Endangered	Qld Herbarium 2017
<i>Eucalyptus populnea</i> woodland on alluvial plains	11.3.2	Of concern	Qld Herbarium 2017

All patches of Brigalow and Poplar Box Woodland communities in the study area were assessed to determine if they qualified as remnant vegetation using the criteria in Neldner *et al.* 2020. This was achieved using analysis of satellite imagery to determine disturbance history and analysis of canopy cover and canopy height compared to published benchmarks.

Two REs listed as Endangered or Of Concern under the VM Act were recorded during the field surveys. The details of these are provided in Table 11. Figure 11 shows the location of these communities in the study area. Section 4.1.3 provides a description of these communities.

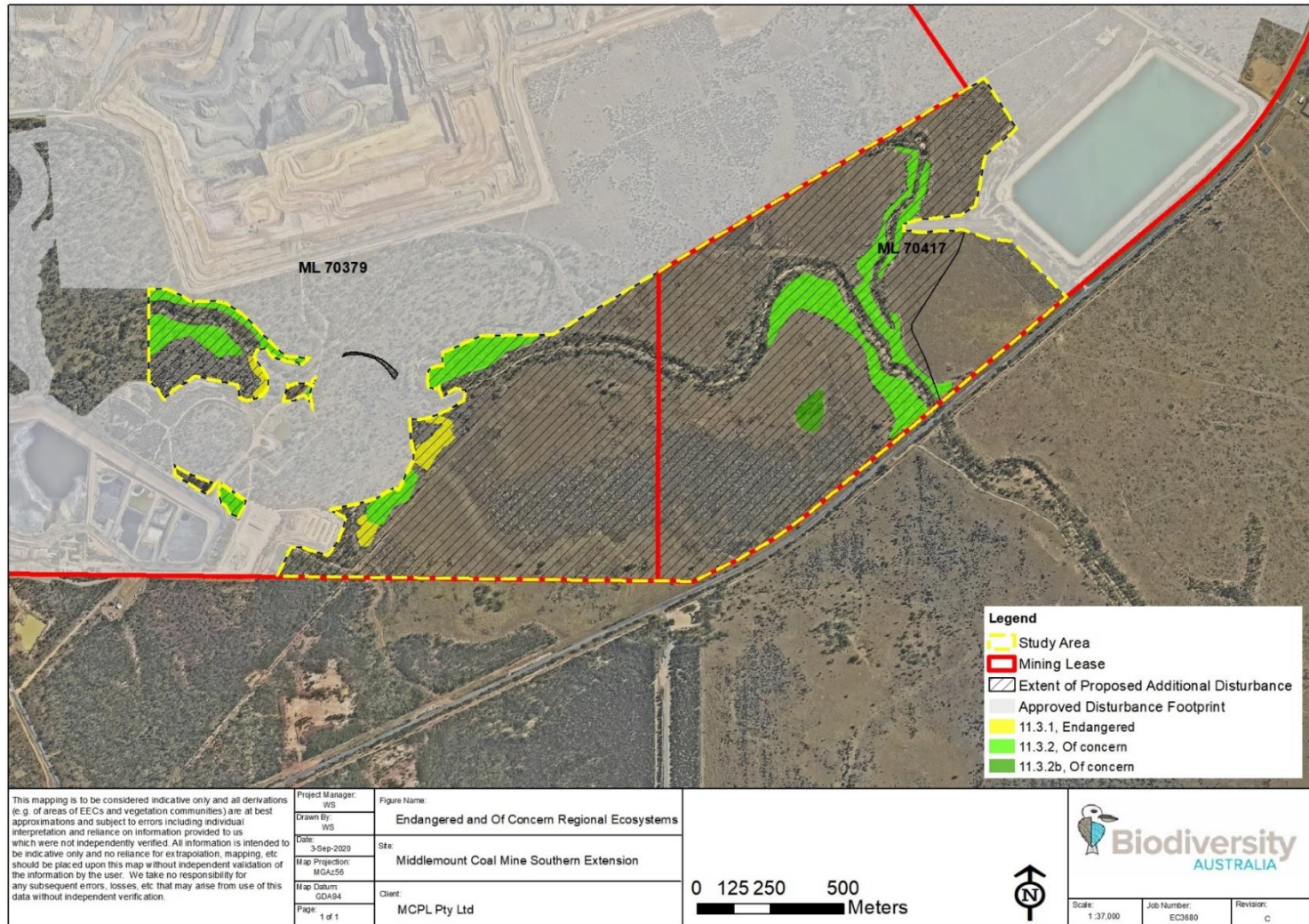
Areas of non-remnant Brigalow and Poplar Box woodland were also recorded in the study area. Most of these patches had been cleared in the past five years and were readily determined to be non-remnant.

Table 11: Endangered and Of Concern Regional Ecosystems recorded in the study area

Regional Ecosystem	Code	VM Act Status	Area
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	11.3.1	Endangered	2.23 ha
<i>Eucalyptus populnea</i> woodland on alluvial plains	11.3.2 and 11.3.2b	Of concern	20.61 ha



Figure 11: Endangered and Of Concern Regional Ecosystems listed under the VM Act



#### 4.1.2 Groundwater Dependant Ecosystems

A Groundwater Dependent Ecosystem (GDE) is an ecosystem in which the plant and/or animal community is dependent on the availability of groundwater to maintain its structure and function. Desktop mapping of potential GDEs throughout Qld (Bureau of Meteorology [BoM] 2020) indicates that areas with high, moderate and low potential for groundwater interaction occur within the Project locality. The desktop GDE mapping (BoM 2020) indicates:

- Terrestrial vegetation associated with part of Roper Creek is mapped as a low potential Terrestrial GDE.
- Woodland areas adjacent to the Bingeang Pipeline Road are also mapped as a low potential Terrestrial GDE.
- The same areas mapped as terrestrial GDEs are mapped as moderate to high potential Inflow Dependant Ecosystems.

No other terrestrial vegetation is mapped as potential GDEs (BoM 2020). The desktop BoM GDE mapping (not ground-truthed) is shown in Appendix A-4-6.

The accuracy of the desktop GDE mapping (BoM 2020) of the Project locality has been reviewed by Biodiversity Australia, with the following conclusions made in relation to the presence/absence of GDEs based on detailed site surveys and assessments:

- The majority of the terrestrial vegetation associated with Roper Creek and Thirteen Mile Gully is unlikely to be dependent on groundwater given the vegetation along these drainage features also occurs more widely across the landscape and is not restricted to areas where it could potentially access groundwater. The RE 11.3.25 along Roper Creek contains Qld Blue Gum (*Eucalyptus tereticornis*) and River Oak (*Casuarina cunninghamiana*) which are sometimes reliant on access to groundwater, however, the groundwater levels adjacent to Roper Creek range between 18.9 m below ground level (mbgl) and 22.7 mbgl (AGE 2020). Based on the depth to groundwater surrounding Roper Creek being around 20 mbgl it is unlikely that these communities would be reliant on access to groundwater.
- Aquatic habitat associated with Roper Creek and Thirteen Mile Gully is unlikely to be dependent on groundwater given the ephemeral nature of the drainage features.
- All other terrestrial vegetation is unlikely to be dependent on groundwater given that there is no evidence that any vegetation surrounding the Project has experienced any impacts (i.e. dieback) from the existing operations to the north and west of the study area.



### 4.1.3 Threatened Ecological Communities

#### 4.1.3.1 Brigalow

The Brigalow communities within the study area have been assessed against the diagnostic and condition criteria listed in the *Approved Conservation Advice* (DotE 2013a) and the Species Profile and Threats Database (DAWE 2020b). This is provided in Table 12.

Table 12: Brigalow TEC assessment

Criteria	Result
1) The presence of <i>Acacia harpophylla</i> as one of the most abundant tree species in the patch. <i>A. harpophylla</i> is either dominant in the tree layer, or co-dominant with other species (notably <i>Casuarina cristata</i> , other species of <i>Acacia</i> , or species of <i>Eucalyptus</i> ).	Yes – Brigalow ( <i>Acacia harpophylla</i> ) is dominant in the patches in the study area (see vegetation descriptions in Section 4.1.1).
2a) In Qld - the patch is in one of the following Qld bioregions (including outliers) and it meets the description of one of 16 Qld REs determined at the time of the national listing of the Brigalow ecological community under the EPBC Act. The 16 REs are, as described by the Qld Herbarium (Wilson and Taylor 2012): In the Qld Brigalow Belt Bioregion – REs 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14 and 11.12.21.	Yes – Patches of Brigalow in the study area conform to 11.3.1.
2b) In NSW - the patch meets one of the following NSW Vegetation Classification and Assessment (VCA) community descriptions. The NSW VCA communities are: VCA IDs 29, 31 and 35; as described in Benson <i>et al.</i> (2006).	Not applicable.
2c) The vegetation in the patch is Brigalow regrowth with species composition and structural elements broadly typical of one of the identified Qld REs or NSW vegetation communities (although species density may be reduced). This can be assumed to be the case where it has been at least 15 years since it was last comprehensively cleared (not just thinned); unless direct evidence proves otherwise.	Yes – All of the remnant patches of Brigalow meet this criterion. Regrowth patches have been cleared within the last 15 years (determined through analysis of historic satellite imagery and communication with former landowner) and do not have typical structure and composition. These areas have been excluded.
3) The patch is 0.5 ha or more in size	Yes - All patches of Brigalow in the study area are >0.5 ha in area.
4) Exotic perennial plants comprise less than 50% of the total vegetation cover of the patch, as assessed over a minimum sample area of 0.5 ha (100 m by 50 m), that is representative of the patch.	Yes – exotic perennial plants comprised <50% cover in all remnant Brigalow patches in the study area. Percentages of exotic species recorded at three individual remnant Brigalow patches were: – 28% (THQ7) – 20% (Q4) – 30% (Rapid plot 42)
<b>Result</b>	All remnant Brigalow communities in the study area qualify as Brigalow TEC.

The above assessment confirms that Brigalow communities in the study area qualifies as Brigalow TEC listed under the EPBC Act. The location of the TECs in the study area is shown in Figure 12.



#### 4.1.3.2 Poplar Box Woodland

The Poplar Box Woodland communities within the study area have been assessed against the diagnostic and condition criteria listed in the *Approved Conservation Advice* (DEE 2019) and the Species Profile and Threats Database (DAWE 2020b). This is provided in Table 13.

Table 13: Poplar Box Woodland TEC assessment

Criteria	Result
Occurs in the Brigalow Belt North, Brigalow Belt South, Southeast Qld, Cobar Penepains, Darling Riverine Plains, NSW South Western Slopes, Riverina and Murray Darling Depression Interim Biogeographic Regionalisation of Australia (IBRA) Bioregions.	Yes – site occurs in the Brigalow Belt North Bioregion.
Associated with ancient and recent depositional alluvial plains with clay, clay-loam, loam and sandy loam, typically duplex soils or sodosols. This includes areas that may not be part of currently defined floodplains.	Yes – the community is located on alluvial deposits associated with Roper Creek.
A grassy woodland to grassy open woodland with a tree crown cover of 10% or more at patch scale.	Yes – has open woodland structure with canopy cover of >10%. Cover at individual patches surveyed is as follows: <ul style="list-style-type: none"> <li>- 44.4% (THQ6)</li> <li>- 28% (THQ1)</li> <li>- 20% (Q2)</li> </ul>
A tree canopy must be present that shows these features: <ul style="list-style-type: none"> <li>• Canopy tree species are capable of reaching 10 m or more in height;</li> <li>• <i>Eucalyptus populnea</i> (Poplar Box) must be present in the canopy and is the dominant tree species; and</li> <li>• Where hybrids of Poplar Box with other <i>Eucalyptus</i> spp. are present, they should be counted as part of the <i>Eucalyptus populnea</i> component of the tree canopy when assessing the previous criterion.</li> </ul>	The community present in the study area meets these requirements. The canopy height is around 15-18 m and is dominated by Poplar Box. Refer to vegetation description in Section 4.1.1.
Mid layer (1-10 m) crown cover of shrubs to small trees is low, about 30% or less.	Yes – community has low shrub cover <30%. Shrub cover at individual patches surveyed is as follows: <ul style="list-style-type: none"> <li>- 0.6% (THQ6)</li> <li>- 3.3% (THQ1)</li> <li>- 5% (Q2)</li> </ul>
A ground layer (<1 m) mostly dominated across a patch by native grasses, other herbs and occasionally chenopods (during extended dry periods), ranging from sparse to thick (in response to canopy development, soil moisture, disturbance and/or management history).	The community features a ground layer which contains a mix of native and exotic grasses and herbs. Field observations noted a mosaic of native and exotic dominated groundcover patches across the community. Typical exotic species include Buffel Grass ( <i>Cenchrus ciliaris</i> ), Sabi Grass ( <i>Urochloa mosambicensis</i> ), Green Panic ( <i>Megathyrsus maximus</i> ) and Red Natal Grass ( <i>Melinis repens</i> ). Patches of native grass included species such as Black Speargrass ( <i>Heteropogon contortus</i> ), <i>Aristida</i> spp., Comet Grass ( <i>Perotis rara</i> ) and Brown's Lovegrass ( <i>Eragrostis brownii</i> ). Percentage exotic cover at survey sites were: <ul style="list-style-type: none"> <li>- 80% (THQ6)</li> <li>- 80% (THQ1)</li> <li>- 75% (Q2)</li> </ul>

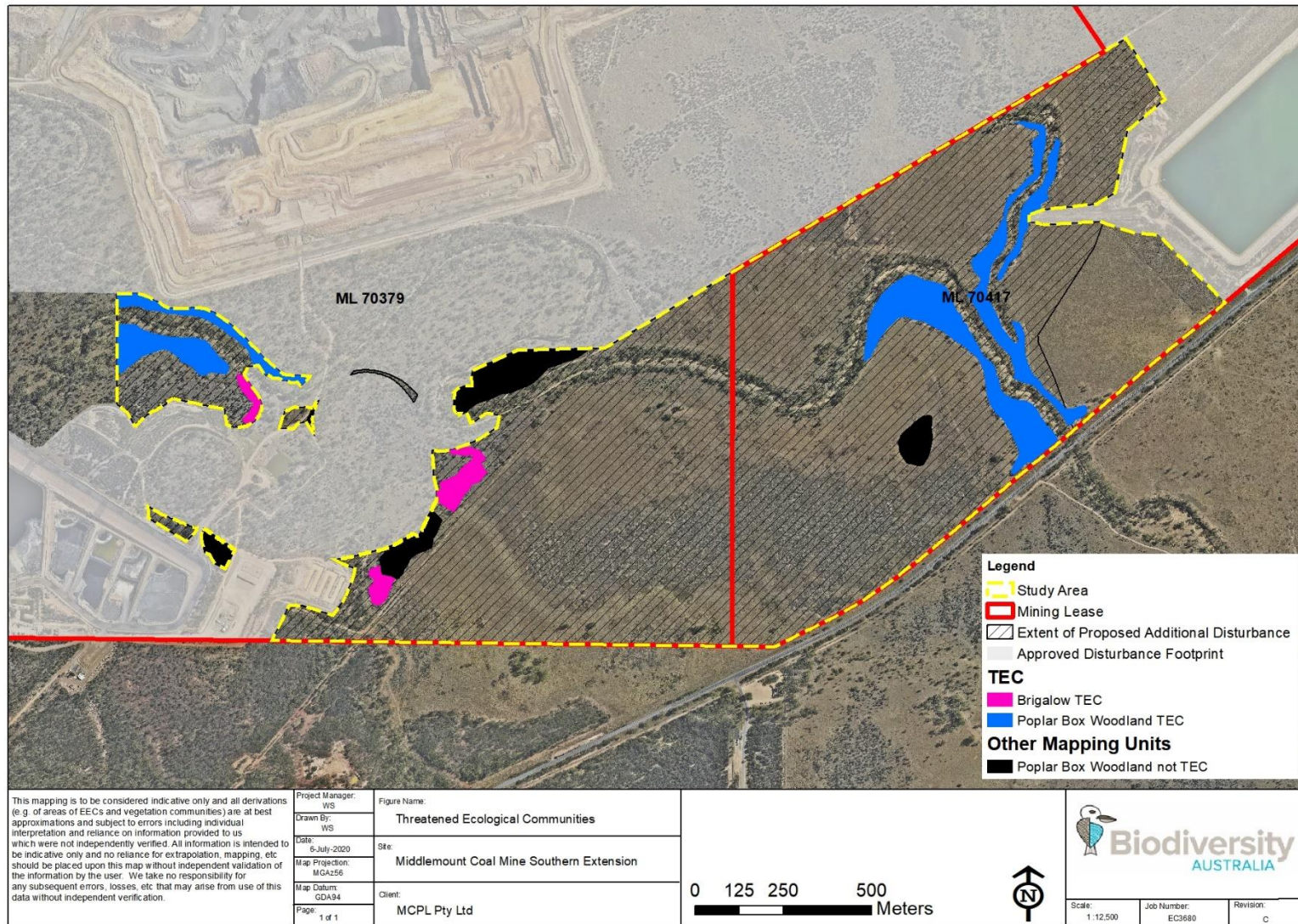


Criteria	Result
<p>A list of diagnostic native plant species and some of the key native fauna that make up the ecological community is given at Appendix A; although particular species may be abundant or rare, or not necessarily present, at every location.</p>	<p>The community contains a range of diagnostic native plant species.</p> <p>These include Poplar Box (<i>Eucalyptus populnea</i>), Wilga (<i>Geijera parviflora</i>), False Sandalwood (<i>Eremophila mitchellii</i>), Whitewood (<i>Atalaya hemiglauca</i>), Black Speargrass, <i>Aristida spp.</i> and Australian Bluebell (<i>Wahlenbergia gracilis</i>).</p>
<p>Condition classes and minimum patch size thresholds:</p> <ul style="list-style-type: none"> <li>• Class A (Highest quality): &gt;1 ha</li> <li>• Class B (Good quality): &gt;5 ha</li> <li>• Class C (Moderate quality): &gt;5 ha</li> </ul>	<p>Remnant patches in the study area would fall within the Class C category (moderate quality) due to the prevalence of exotic species in the ground layer. This class must have a minimum patch size of &gt;5 ha.</p> <p>Most patches that occur along Roper Creek form part of a larger extent of the community that occurs beyond the study area and are &gt;5 ha. One 2.4 ha patch adjoins areas approved to be cleared and has been excluded. All other patches along Roper Creek are &gt; 5 ha.</p> <p>Two isolated patches occur further from Roper Creek and do not meet the minimum patch size. These have been excluded.</p> <p>Non-remnant areas of the community in the study area would not meet the diagnostic criteria and minimum condition thresholds and would therefore not qualify as the TEC.</p>
<p><b>Result</b></p>	<p>Most of the Poplar Box Woodland on alluvial communities in the study area qualify as the TEC.</p>

The above assessment confirms that Polar Box Woodland communities in the study area occurring on Land Zone 3 qualify as the TEC listed under the EPBC Act. The location of the TEC's in the study area is shown in Figure 12.



Figure 12: Threatened Ecological Communities listed under the EPBC Act



#### 4.1.4 Threatened Flora

Database and literature searches returned records of one flora species within a 10 km radius of the study area as shown in Table 14 below. The complete online search results are provided in Appendix 5.

Table 14: Locally recorded threatened flora species

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Source
-	<i>Cerbera dumicola</i>	NT	-	DES 2020b
Key: Near Threatened (NT).				

No threatened flora species were recorded during the field surveys. There are no previous records of threatened flora species within the study area. The study area does not occur within a high-risk trigger area (see report in Appendix A-4-1).

A small extent of potential habitat for *Cerbera dumicola* is present within the south-west of the study area in REs 11.7.2 and 11.7.4, however the species was not identified here during these or previous field surveys despite targeted surveys.

Due to the disturbance history over most of the study area (e.g. grazing, weed invasion), lack of local records and limited habitat types present, the potential for threatened flora to occur would be significantly reduced and no threatened flora species are considered potential occurrences.

#### 4.1.5 Declared Weeds

As detailed in Section 4.1, a total of 15 exotic flora species were recorded within the study area. Weed invasion is common throughout the study area, especially in disturbed areas, however it is largely limited to the groundcover stratum. Naturalised introduced pasture species such as Buffel Grass (*Cenchrus ciliaris*), Sabi Grass (*Urochloa mosambicensis*) and Red Natal Grass (*Melinis repens*) along with herbs including *Sida* spp., Cobblers Pegs (*Bidens pilosa*), Gomphrena Weed (*Gomphrena celosioides*) and Stylo (*Stylosanthes scabra*) were the main weeds encountered. These species dominated the ground layer in the derived grassland habitats, and incursion of these species into adjacent Eucalypt woodlands was common.

Table 15 lists the noxious weeds declared under the Qld *Biosecurity Act 2014* recorded within the study area. Prickly Pear (*Opuntia stricta*) and Harrisia Cactus (*Harrisia martinii*) were recorded. The distribution of these species was patchy and these species are unlikely to pose a significant risk to the ecological integrity of the study area due to their low density.

Table 15: Noxious Weeds recorded within the study area

Scientific Name	Common Name	Biosecurity Act Category	Weed of National Significance	Abundance
<i>Opuntia stricta</i>	Prickly Pear	Class 2,3,4,5	Yes	Low
<i>Opuntia tomentosa</i>	Velvety Tree Pear	Class 3	Yes	Low
<i>Harrisia martinii</i>	Harrisia Cactus	Class 3	No	Low



## 4.2 Fauna

### 4.2.1 Broad Fauna Habitats

Fauna habitats within the study area were categorised and mapped into six broad habitat types. The broad fauna habitat types present in the study area are:

- 1. Eucalypt woodland/forest;
- 2. Riparian Eucalypt woodland;
- 3. *Acacia harpophylla* woodland/forest;
- 4. *Acacia shirleyi* forest;
- 5. Regrowth vegetation; and
- 6. Cleared grassland.

Table 16 details the REs which make up each broad fauna habitat type in the study area along with the area (in ha) of each. Broad fauna habitat mapping is shown in Figure 13.

Table 16: Broad fauna habitat types

Broad Fauna Habitat Type	Regional Ecosystem	Field Verified Area (ha)
<b>Eucalypt Woodland</b>	11.3.2/11.3.2b	20.53
	11.3.7	6.18
	11.5.3	44.61
	11.7.4	1.63
<b>Subtotal (Eucalypt Woodland)</b>		72.95
<b>Riparian Eucalypt Woodland</b>	11.3.25	14.06
<b><i>Acacia harpophylla</i> Woodland/forest</b>	11.3.1	2.22
<b><i>Acacia shirleyi</i> Forest</b>	11.7.2	0.76
<b>Regrowth Vegetation</b>	-	92.68
<b>Cleared Grassland</b>	-	91.83
<b>Total</b>		274*

\* denotes a rounded number

Table 17 describes the habitat values per category, with focus on habitat value and suitability for foraging, nesting, roosting, and breeding requirements for potentially occurring threatened species listed under the NC Act and EPBC Act.



Figure 13: Fauna habitat type mapping of the study area

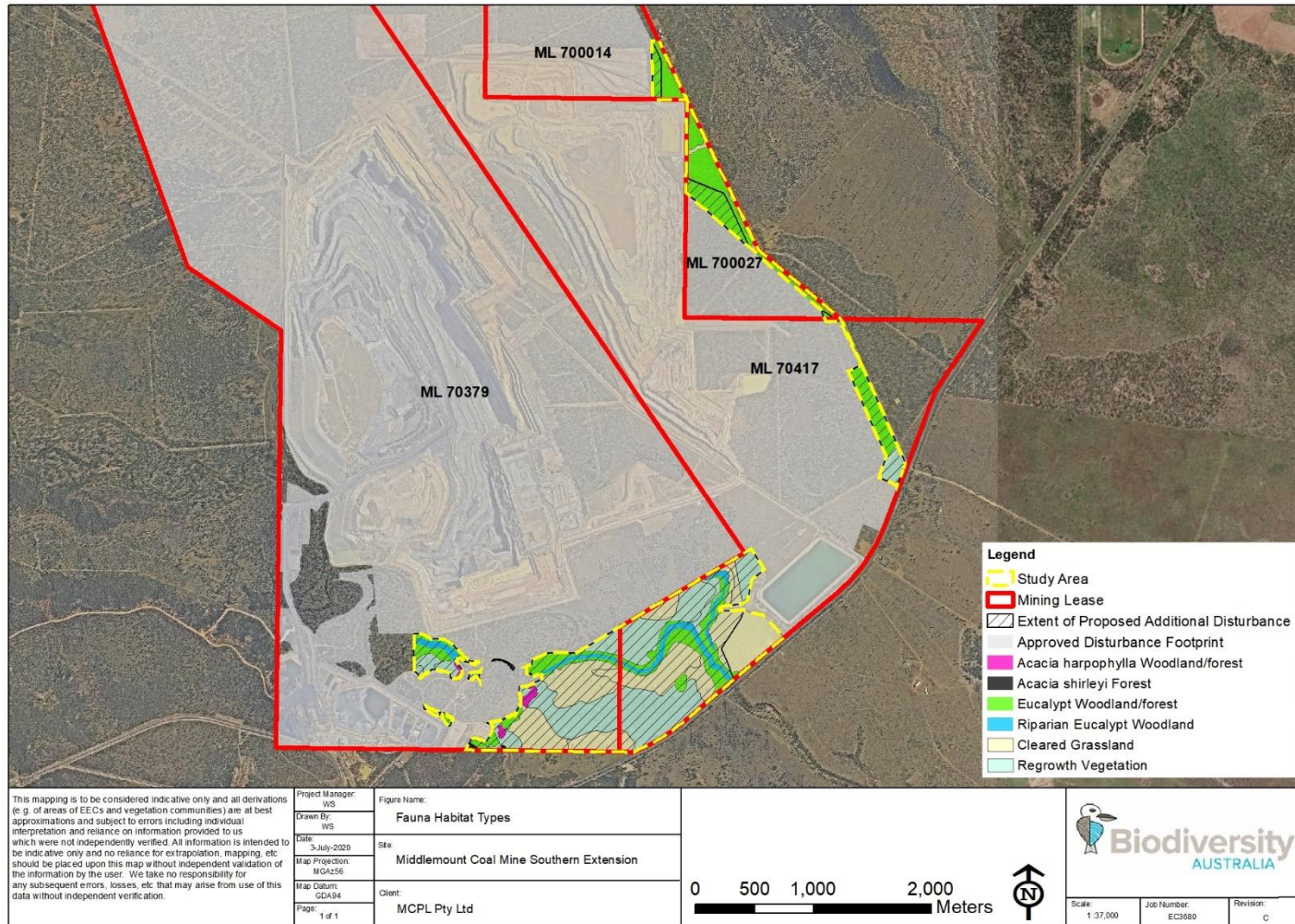
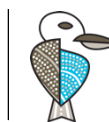


Table 17: Fauna habitat assessment

Habitat attribute / Category	Site Values					
	1. Eucalypt Woodland	2. Riparian Eucalypt Woodland	3. <i>Acacia harpophylla</i> Woodland/forest	4. <i>Acacia shirleyi</i> Forest	5. Regrowth Vegetation	6. Cleared Grassland
<b>Groundcover</b>	<p>Variable density and composition depending on disturbance history. Some areas feature a moderately dense cover of exotic grasses while some are more open and dominated by native grasses and shrubs.</p> <p>A number of native grass species provide a potential food resource for the Squatter Pigeon (southern). Some areas also have a mosaic of open sandy areas and native grasses which is preferred habitat for this species.</p>	<p>Generally consists of a dense layer of herbs and grasses, with exotic species dominant.</p>	<p>Sparse to open ground cover of mostly native grasses, with areas of bare ground.</p> <p>Provides potential shelter and prey habitat for threatened reptiles.</p>	<p>A moderately dense and low groundcover layer of native grasses is present. Low diversity and mainly consists of Tableland Couch.</p>	<p>Dominant ground cover composition of exotic grasses with native grasses and herbs being less common (Photos 13 and 14). Dense areas of Brigalow regrowth have a sparse groundcover.</p>	<p>Dominated by exotic grasses and herbs throughout. Occasional patches of native grass such as Black Speargrass.</p>
<b>Leaf Litter</b>	<p>High under canopy trees and scattered throughout the mixed grass undergrowth.</p>	<p>Only low extent of leaf litter under canopy trees and most is overgrown with weeds.</p>	<p>Mature Brigalow habitats contained accumulations of leaf litter which would provide shelter and prey habitat for a range of small reptiles. Some patches had less leaf litter do a patchy canopy and exotic grass invasion.</p>	<p>Well-developed leaf litter accumulations occur in some places. Foraging substrate for common reptiles and small mammals.</p>	<p>Very sparse leaf litter due to absence of canopy and understorey trees.</p>	<p>No leaf litter present due to absence of trees and shrubs.</p>



Habitat attribute / Category	Site Values					
	1. Eucalypt Woodland	2. Riparian Eucalypt Woodland	3. <i>Acacia harpophylla</i> Woodland/forest	4. <i>Acacia shirleyi</i> Forest	5. Regrowth Vegetation	6. Cleared Grassland
<b>Logs and Debris</b>	Reasonable abundance of hollow logs and debris present due to the nature of Eucalyptus shedding limbs. Larger logs provide shelter and prey habitat for ground dwelling reptiles.	A few habitat logs occur along the banks and within Roper Creek. These would provide shelter for fauna and snags in the creek when it contains water.	Moderate to high density of coarse woody debris, which is typical of this habitat type. Could provide potential shelter and prey habitat for the Ornamental Snake (Photo 11). Hollow logs are however rare.	High density of coarse woody debris from fallen Acacias. No hollow logs present. (Photos 9 and 10).	Very few logs observed. Some log and debris piles occur as a result of past clearing. These would likely provide refuge for common species only, as well as feral species such as the Fox and Feral Cat.	Logs and fallen timber generally sparse, however some large logs are present as a result of past clearing. These would likely provide refuge for common species only, as well as feral species such as the Fox and Feral Cat.
<b>Rocky outcrops</b>	Absent	Absent	Absent	Extensive rock outcropping and surface rocks are present in this habitat type. This would provide ideal reptile shelter and foraging habitat.	Absent	Absent
<b>Aquatic habitat</b>	Aquatic habitats in this habitat type is limited to small ephemeral soaks that would only hold water for short periods. No value to aquatic species.	Roper Creek is an ephemeral creek line and flow is restricted to high rainfall periods. The creek was flowing at the time of the survey. Water was highly turbid and flowing rapidly. Some pools of water remain in the creek for longer periods after the wet season and would provide fish and aquatic invertebrate habitat.	Brigalow habitats contain gilgai that hold water during the wet season and provide habitat for amphibians. Water was present in gilgai during the survey and a range of amphibian species were recorded using these habitats.	Absent	Absent aside from a few soaks and drainage depressions that would hold water temporarily after rain. Habitat for common frog species which could potentially attract Ornamental Snake.	Absent



Habitat attribute / Category	Site Values					
	1. Eucalypt Woodland	2. Riparian Eucalypt Woodland	3. <i>Acacia harpophylla</i> Woodland/forest	4. <i>Acacia shirleyi</i> Forest	5. Regrowth Vegetation	6. Cleared Grassland
<b>Hollows</b>	Hollow-bearing trees and stags are common within this habitat type. A range of hollow-sizes are present i.e. <5 cm to >20 cm diameter cavities.  Hollows provide known denning habitat for the Greater Glider as well as a range of common species.	Occasional Blue Gums in this community contain hollows. These would provide a denning resource for the Greater Glider as well as common birds, microbats and arboreal mammals.	Low occurrence of tree hollows in occasional eucalyptus species present.	Absent	Absent	Absent
<b>Nectar sources</b>	Woodland habitats contain a range of nectar producing species e.g. eucalypts, acacias and grevilleas.  Only some Poplar Box were in flower during the survey, with most species not flowering.	Eucalypts in this community would provide a seasonal nectar source.	<i>Acacia harpophylla</i> is the primary nectar source and would provide foraging resources for fauna when in flower.	<i>Acacia shirleyi</i> is the primary nectar source and would provide foraging resources for fauna when in flower.	This habitat type does not provide a significant nectar source due to the lack of mature trees.	Absent
<b>Koala food trees</b>	Moreton Bay Ash, Reid River Box and Poplar Box are the main Koala browse species in this community (DotE 2014).  Koala scats were recorded in this habitat type.	Queensland Blue Gum is the dominant Eucalypt and is a preferred Koala browse species.	Absent	Absent	Absent aside from Eucalypt saplings which do not provide a foraging resource to Koalas at present.	Absent



Habitat attribute / Category	Site Values					
	1. Eucalypt Woodland	2. Riparian Eucalypt Woodland	3. <i>Acacia harpophylla</i> Woodland/forest	4. <i>Acacia shirleyi</i> Forest	5. Regrowth Vegetation	6. Cleared Grassland
Connectivity values	<p>Woodland in the south along Roper Creek consists of narrow linear remnants that are bisected by roads and mining areas</p> <p>Woodland is more contiguous in the east of the study area, however is becoming split into smaller patches as a result of the advancing mine and is fragmented by several roads and fence lines.</p> <p>This habitat type would benefit the local movements of a range of fauna species, including arboreal species such as the Koala and Greater Glider.</p>	<p>This community consists of a narrow linear remnant along Roper Creek. It would provide good connectivity values for arboreal species such as Gliders and the Koala. Many species, including Feral Dogs and Cats also move along the creek lines.</p>	<p>The small patches of Brigalow habitats would contribute to the connectivity values of the other site habitats; however it is generally isolated, and would not provide any specific connectivity values for fauna.</p>	<p>Provides minor connectivity values due to small patch size and limited connectivity to larger areas of habitat. Would allow some facilitation of fauna movement in the southwest of the study area and extending beyond to the southwest.</p>	<p>Poor values at present and would be mainly used by small terrestrial species. No connectivity values for arboreal species and only highly mobile fauna would use these habitats.</p>	<p>Poor values at present and would be mainly used by small terrestrial species. No connectivity values for arboreal species and only highly mobile fauna would use these habitats.</p>

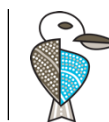


Photo 9: Riparian Eucalypt woodland along Roper Creek (habitat 2)



Photo 10: Coarse woody debris in *Acacia shirleyi* Forest (Habitat 4)



Photo 11: Coarse woody debris in *Acacia harpophylla* Woodland/forest (Habitat 3)



Photo 12: Gilgai present in *Acacia harpophylla* Woodland/forest (Habitat 3)



Photo 13: Typical regrowth vegetation (Habitat 5)



Photo 14: Dense exotic groundcover in Cleared Grassland (Habitat 6)



## 4.2.2 Local Corridors and Habitat Linkages

The Eucalypt woodland/riparian eucalypt woodland in the southern portion of the study area continues along Roper Creek (downstream) to the south of ML 70417. The habitat associated with Roper Creek to the west (upstream) is already approved to be cleared (and already offset) as part of the Middlemount Coal Mine.

The Eucalypt woodland habitat in the eastern portions of the study area is located on the edge of the existing/approved East Dump. This Eucalypt woodland is part of larger patches.

## 4.2.3 Observed and Detected Fauna

A total of 79 fauna species were detected during the survey either opportunistically or during targeted surveys. Birds were the most common fauna group observed with a total of 51 species detected. Twenty-four (24) mammals, three amphibians and seven reptiles were also detected. Photos 15-16 were taken during the surveys of the study area.

Mammal species recorded largely comprised microbats, however three Glider species were also recorded. The Echidna was observed during the June survey period in the southwest of the study area.

Three threatened species were recorded during the surveys. These comprised the Greater Glider, Koala (scat only) and Squatter Pigeon (southern). These species are further discussed in Section 4.2.5.

Three pest species were also recorded during surveys comprising the Wild Dog, Feral Cat and Rabbit. These are further discussed in Section 4.2.6.

Appendix A-3 provides the total fauna list for the study area and the method of detection.

Photo 15: Rough-collared Frog



Photo 16: Bynoe's Gecko



#### 4.2.4 Fauna Assemblages

The fauna detected on the site generally consisted of common, generalist and wide-ranging species capable of persisting in modified habitats. Native mammals were reasonably well represented in the survey results, especially microbats. A total of 13 microbat species were positively identified through the Anabat analysis. The diverse range of habitats would provide a good foraging base and numerous hollows present in the study area would provide a range of roosting and breeding opportunities for these species.

Of note was the detection of three different Glider species comprising the Greater Glider (listed as Vulnerable under the NC Act and EPBC Act), Squirrel Glider and Sugar Glider. The Poplar Box woodland communities in the study area provide good foraging and breeding habitat for these species.

Bird diversity was high with a relatively diverse range of passerines detected across the study area. Three raptor species were also detected which indicates the study area has a reasonable prey base. The results are considered an indication of the range of foraging resources present (e.g. flowering canopy and understorey trees, fruiting species) and good understorey development in places providing shelter.

Ideal conditions for amphibian surveys were experienced during the March survey period, however a limited number of frog species were detected at this time. Amphibians would provide a good prey base for snakes.

Reptiles were poorly represented in the survey considering the above average survey effort employed. This is likely to be an indication of poor habitat quality and lack of habitat components such as rock outcrops and cracking clays (Wilson 2003). The presence of Cane Toads and other feral species (i.e. cats, dogs) may have impacted on reptile abundance.



## 4.2.5 Threatened Fauna Species

Database and literature searches returned records of four fauna species within a 10 km radius of the study area as shown in Table 18 below. The complete online search results are provided in Appendix A-4-2. The location of previously recorded threatened species in close proximity to the study area is provided in Figure 14.

Table 18: Locally recorded threatened fauna species

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Source
Squatter Pigeon (southern)	<i>Geophaps scripta scripta</i>	V	V	EHP 2012, PB 2010a, Naturecall 2014b, Naturecall 2013-2017, Biodiversity Australia 2018b
Greater Glider	<i>Petauroides volans</i>	V	V	DEHP 2020, Naturecall 2013-2017, Biodiversity Australia 2018b
Koala	<i>Phascolarctos cinereus</i>	V	V	EHP 2012, DEHP 2020, Naturecall 2013-2017, Biodiversity Australia 2018b
Ornamental Snake	<i>Denisonia maculata</i>	V	V	PB 2010a

Key: Vulnerable (V).

Three of these previously recorded, listed threatened fauna species were recorded during the field surveys. These comprised the Greater Glider and Koala (scat only) within the study area; and the Squatter Pigeon (southern) to the north-west of the study area. These are discussed in the following sections, and Figure 15 displays their recorded location. Although not recorded during field surveys, the potentially occurring Ornamental Snake has been recorded in nearby areas during surveys undertaken by PB (see Section 2.5.1) and in various literature and databases, and is therefore discussed in Section 4.2.5.4. The White-throated Needletail is also considered a low potential occurrence as the study area contains broadly suitable habitat. This has not been recorded on MCPL land during previous surveys.

No additional threatened fauna species were recorded within the study area during the survey.

### 4.2.5.1 Greater Glider

The Greater Glider occurs in forests and woodlands across eastern Australia where it forages on eucalypt leaves and occasionally flowers (Threatened Species Scientific Committee [TSSC] 2016). It requires large tracks of remnant forests which contain old growth trees containing hollows which it uses for denning.

Conservation advice (TSSC 2016) details that the Greater Glider is largely restricted to eucalypt forests and woodland, with its diet comprising mostly eucalypt leaves. Consistent with this, previous observations of this species on MCPL owned land have noted that it prefers Eucalypt woodlands and open forest associated with major creeks and drainage lines, equivalent to RE types 11.3.2, 11.3.25, 11.3.4 and 11.3.7. It has also been occasionally noted in Poplar Box woodland equivalent to RE 11.5.3. Based on these previous observations, preferred forage species appear to be Moreton Bay Ash, Silver-leaved Ironbark and Poplar Box.

The Greater Glider (Vulnerable – EPBC Act) was detected during the survey period via spotlighting surveys. The Glider was detected on four nights in vegetation fringing Roper Creek (RE 11.3.25 and 11.3.2) in the southern portion of the study area. A maximum of four individuals, including a juvenile Glider, were recorded here in one night. Another individual was recorded on one night immediately north of the eastern portion of the study area adjacent to the Bingeang Pipeline Road within RE 11.5.3. This individual would utilise vegetation within the study area. Two Gliders were also recorded on 20<sup>th</sup> June next to a track located 200m north of the study area.



Greater Gliders have small home ranges ranging between 1.3 and 4 ha (Comport *et al.* 1996, Pope *et al.* 2005, TSSC 2016). The study area would therefore encompass entire home ranges of the Gliders, and they would also be expected to extend off site to the east of the eastern portion of the study area.

The Greater Glider has been previously recorded on MCPL lands during fauna surveys and clearing supervision works. BioCondition monitoring surveys of the existing offset areas observed at least 16 Greater Gliders in 2017, which were primarily recorded along Roper Creek (Naturecall 2017b).

#### 4.2.5.2 Koala

The Koala is an obligate folivore that predominantly feeds on leaves from *Eucalyptus* trees (DAWE 2020). Koalas feed on a wide range of eucalypt species, however they have a small number of preferred food trees. These preferred tree species vary depending on location. A review of available literature and information from previous surveys within MCPL lands (see Section 2.5) have found that the following trees are preferred species in the local area:

- Reid River Box (*Eucalyptus brownii*).
- Narrow-leaved Ironbark (*Eucalyptus crebra*).
- Queensland Peppermint (*Eucalyptus exserta*).
- Queensland Blue Gum (*Eucalyptus tereticornis*).
- Moreton Bay Ash (*Corymbia tessellaris*).

Four of these preferred species were recorded within the study area. Reid River Box was recorded within the study area, however was scarce and only present within RE 11.5.3. Narrow-leaved Ironbark was commonly recorded within RE 11.7.4. Queensland Blue Gum was common within vegetation fringing Roper Creek (RE 11.3.25). Moreton Bay Ash was also commonly recorded throughout the study area with frequent records of this species in RE 11.3.2/11.3.2b, RE 11.3.25 and RE 11.3.7. Queensland Peppermint was not detected within the study area, however is found on MCPL owned land to the west of the Middlemount Coal Mine.

Although preferred Koala food trees were common throughout the Eucalypt woodland/forest communities within the study area, these communities were sparse and open, providing an overall scarcity of foraging resources.

No Koalas were observed or heard calling despite targeted surveys, however the presence of the Koala within the study area was detected via opportunistic scat searches and an SAT plot. Koala scats were identified under a single Reid River Box within a eucalypt forest/woodland in the eastern portion of the study area (Photo 17). The age of the scats from visual identifiers was estimated at six months old.

An SAT survey was undertaken here, however only one scat was recorded giving an activity level of 3%. The SAT plot undertaken along Roper Creek in the south of the study area did not yield any results.

Koala scats were previously recorded in a similar location during surveys for the Western Extension Project in 2017 (Biodiversity Australia 2018b). Koala scats recorded during this study were also recorded under a Reid River Box and verified by a scat analysis expert, Luke Forster of Trace Ecology. The 2017 record marked the first confirmed record of the Koala in the eastern part of MCPL lands. At the time, it was not known if this record formed part of the habitat for a resident Koala population or if it was merely a transient Koala moving through the area. Recent anecdotal reports of Koala activity in this area were obtained through MCPL in June 2020 who reported seeing a Koala during fauna spotting works (K. Hall pers. comm.) as well as Koala tracks along a dirt road (D. Statham pers. comm.). With the identification of Koala scats a similar location to the 2017 record, and recent reports of observations and tracks, it now appears more likely an indication of a resident Koala.



Photo 17: Koala scats located within the study area



A number of additional historic records of the Koala have been recorded in MCPL owned land. In 2012, EHP recorded an individual Koala in the south of the Stage 2 Offset Area and Biodiversity Australia recorded an individual adjacent to Parrot Quarry Road in 2014 (Naturecall 2014a).

Given the limited evidence of the Koala recorded in this survey and sparse records in the area (despite numerous past surveys and ongoing offset monitoring/management), it appears that a low-density Koala population is present on MCPL lands and surrounding areas. Given the general low nutrient soils and scarcity of preferred foraging trees, Koala home ranges would be very large.

A large portion of the REs mapped within the study area would provide potential foraging habitat for the Koala based on the occurrence of known and potential Koala food trees including preferred species described above (i.e. Reid River Box, Narrow-leaved Ironbark, Queensland Blue Gum and Moreton Bay Ash). This includes RE 11.3.2/11.3.2b, RE 11.3.25, RE 11.3.7, RE 11.5.3 and RE 11.7.4, equating to approximately 63.27 ha of Koala habitat across the disturbance footprint. These areas would provide beneficial movement corridors (i.e. connectivity) for the Koala throughout the landscape, particularly areas of contiguous habitat.

#### 4.2.5.3 Squatter Pigeon (southern)

A single Squatter Pigeon (southern) was opportunistically recorded along the roadside, north of the mine. This species was not recorded within the study area during the survey period.

Although not recorded within the study area during this current survey, the Squatter Pigeon (southern) has been recorded within the study area historically. Fauna surveys conducted by Biodiversity Australia in 2017 for the Western Extension Project identified the Squatter Pigeon (southern) along the Bingegang Pipeline Road (Biodiversity Australia 2018b). This species has also been previously recorded on MCPL owned land in 2010, 2013 and 2015 (Will Steggall pers obs., Naturecall 2013, PB 2010a).



A number of habitat attributes which would provide suitable habitat for the Squatter Pigeon (southern) are present. These include a number of native grass species, permanent water resources and a mosaic of open sandy areas. Within the study area, suitable habitats are likely to comprise RE 11.3.1, RE 11.3.2/11.3.2b, RE 11.3.25, RE 11.3.7, RE 11.5.3 and RE 11.7.4. In addition to these remnant habitats, the Squatter Pigeon (southern) is regularly sighted foraging in non-remnant habitats including pasture grassland, regrowth woodland and roadside clearings (PB 2010a, Naturecall 2013, 2014a). There a number of ephemeral water bodies within the study area which would provide a suitable water source for the Squatter Pigeon (southern).

#### 4.2.5.4 Ornamental Snake

The Ornamental Snake was not recorded in the study area during the surveys despite targeted surveys. It has, however, been recorded by PB in 2010 on MCPL owned land on gilgai soils approximately 400 m north of the study area near Roper Creek.

The southern portion of the study area provides small patches of suitable habitat for the Ornamental Snake in the form of Brigalow habitats (RE 11.3.1) with gilgai and drainage depressions which provide habitat for preferred prey species (i.e. frogs). The habitats in the study area have, however, been substantially modified as a result of clearing, weed invasion and cattle grazing. This has reduced the quality of habitat available for the Ornamental Snake and has led to fragmentation and isolation of habitats.

#### 4.2.5.5 Habitat Quality scores

Terrestrial habitat quality assessments (plots) were undertaken in the study area during the field survey. The data collected in the field was analysed to produce species habitat attribute scores and a site-based attribute score as per the *Guide to Determining Terrestrial Habitat Quality Version 1.3* (DES 2020a) methodology.

Species habitat assessment scores were calculated for all threatened species listed under the NC Act (and EPBC Act) that are known to or potentially occur within the study area. The following table details the results of this assessment for each species. Species habitat scores are presented as a number out of ten, with zero indicating habitat unable to support the specified species and ten having an extremely high ability to support the fauna species.

Table 19: Species habitat scoring

Species Habitat Attribute	Greater Glider	Koala	Squatter Pigeon (southern)	Ornamental Snake
Quality and availability of food and habitat required for foraging	16.7	15	18.3	12.5
Quality and availability of habitat required for shelter and breeding	12.5	10	22.5	15
Quality and availability of habitat required for mobility	12.5	12.5	20	10
Absence of threats	8	8	10	8
<b>Species Habitat Score / 10</b>	<b>4.97</b>	<b>4.55</b>	<b>7.08</b>	<b>4.55</b>

Species assessment scores were calculated using a rating system out of five, which was then multiplied to give a score out of 25 for each indicator. Appendix A-5 provides the scorings for each species for which these species habitat scores were based.



Figure 14: Previously recorded threatened fauna

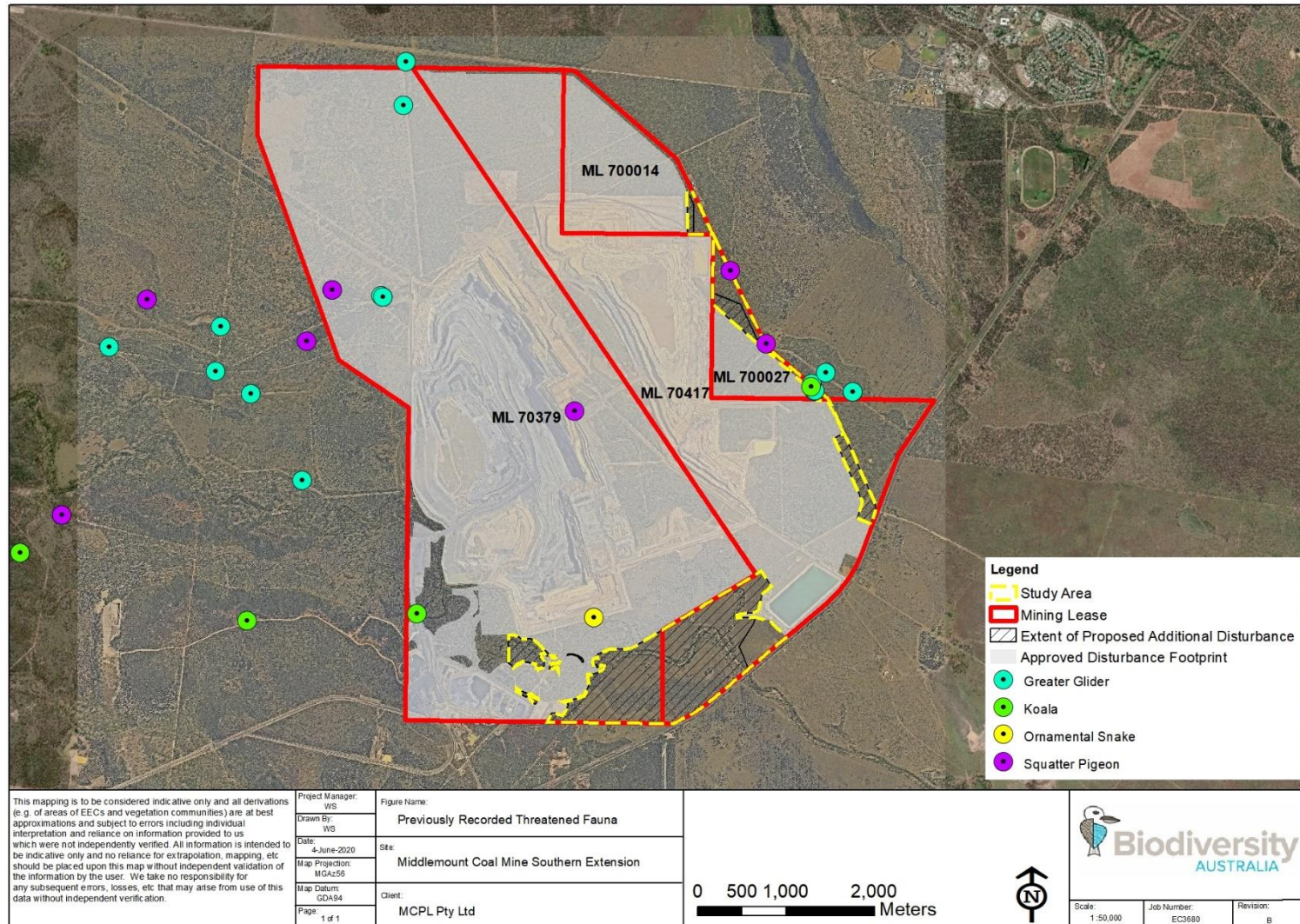
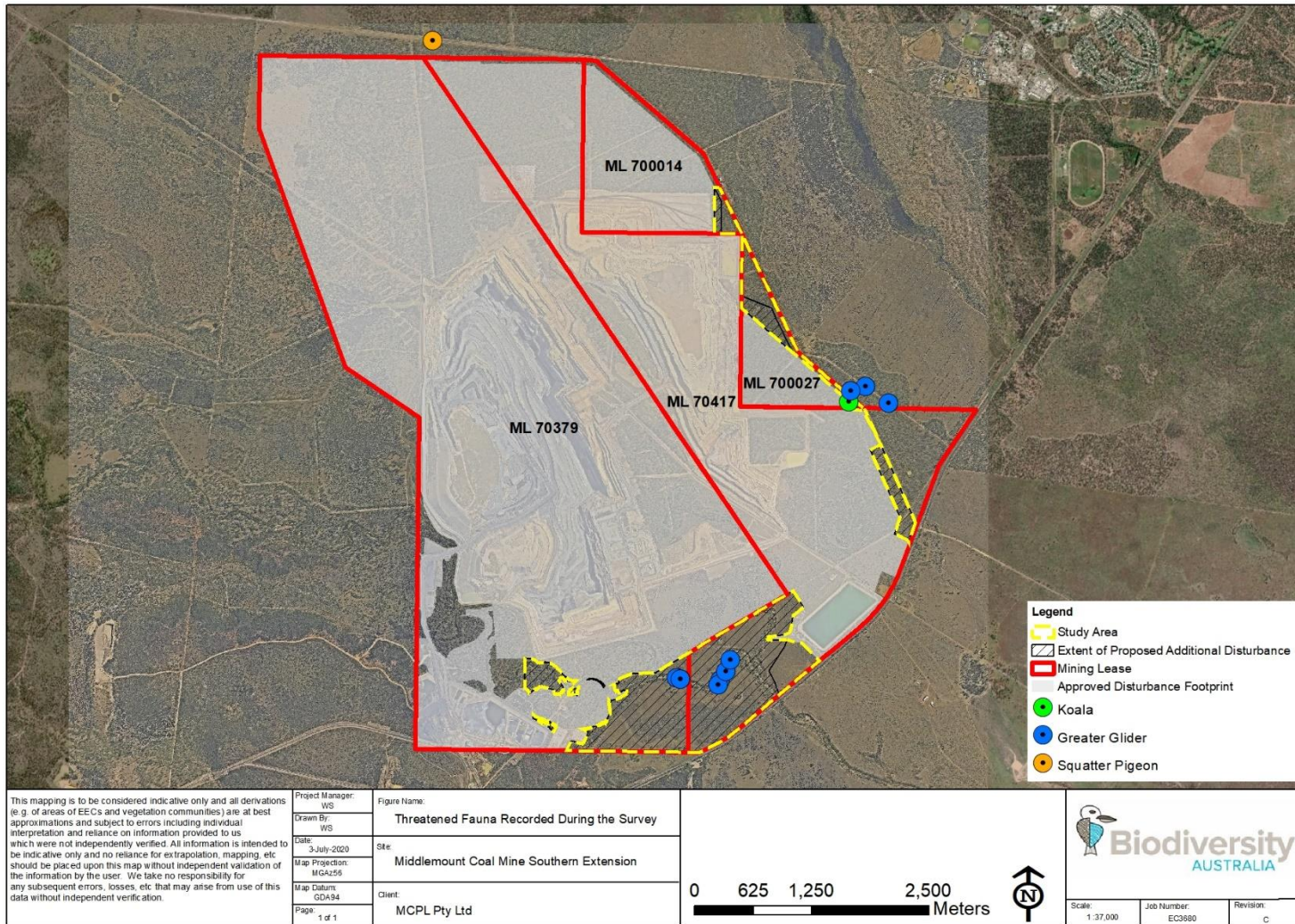


Figure 15: Location of recorded threatened fauna species within the study area in 2020



Data obtained from the terrestrial habitat quality assessments was also used to determine sampling site BioCondition scores. Habitat quality assessments were undertaken at 18 locations. The following table details the assessment unit delineation for the habitat quality score assessment and the survey plot associated with each unit. Non-remnant vegetation analogous to RE 11.7.2 could not be assessed as the assessment unit was too small to sample with a habitat quality plot.

Table 20: Assessment unit delineation

Assessment Unit	RE	Broad Condition State	Area (ha)	Related Plot
AU1	11.3.1	Remnant	2.22	T7
AU2	11.3.2/11.3.2b	Remnant	20.53	T1, T6, T10
AU3	11.3.25	Remnant	14.06	T2
AU4	11.3.7	Remnant	6.18	T12
AU5	11.5.3	Remnant	44.61	T4, T5
AU6	11.7.2	Remnant	0.76	T8
AU7	11.7.4	Remnant	1.63	T9
AU8	11.3.1	Non-remnant	57.13	T13, T15
AU9	11.3.2	Non-remnant	88.64	T14, T16, T17, T18
AU10	11.5.3	Non-remnant	38.69	T3, T11

The results of the sampling-site BioCondition scores are tabulated in Appendix A-5. The overall site-based attribute score is 4.45.

This and the species assessment scores are to inform DES of the habitat quality within the study area; and either one, or a combination of both, will be used as the basis for measuring the conservation outcome and suitability of offset areas.

#### 4.2.6 Animal Pests

Evidence of four feral species were noted within the study area during surveys. These species comprise the following:

- Wild Dog (*Canis lupus familiaris*);
- European Rabbit (*Oryctolagus cuniculus*);
- Feral Cat (*Felis catus*); and
- Cane Toad (*Rhinella marina*).

The presence of these species was noted via a combination of track identifications and via direct observation. The European Rabbit and the Cane Toad were directly observed within the study area, whilst the Wild Dog and Feral Cat were identified by the presence of tracks. These species are not uncommon throughout MCPL owned land, with numerous records of each species in previous surveys (Naturecall 2017b, Biodiversity Australia 2018a, 2018b, 2019). Although undetected during the current survey, the Red Fox (*Vulpes vulpes*) and Feral Pig (*Sus scrofa*) have also been historically recorded in the general area.



### 4.3 Matters of State Environmental Significance

The results of the MSES search identified areas of threatened species habitat for the Ornamental Snake mapped in the south of the study area. Habitat for three additional threatened species was identified during surveys. Regulated vegetation occurs in patches in the study area.

The Roper Creek watercourse within the study area is not classified as a high ecological value waterway.

High ecological value wetlands are described in the Qld State Planning Policy as follows:

- Wetland in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;
- Wetlands and watercourses in high ecological value waters as identified under the Environmental Protection (Water) Policy 2009, Schedule 2.

No high ecological value wetlands are mapped or were located within the study area.

Table 21 defines the MSES that are relevant to the Project.

Table 21: Matters of State Environmental Significance

Prescribed Environmental Matter	Location of Impact
<b>Regulated Vegetation</b>	
RE 11.3.1 <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	Figure 16
RE 11.3.2/11.3.2b <i>Eucalyptus populnea</i> woodland on alluvial plains	Figure 16
Remnant vegetation within 5 m of the defining bank of Roper Creek	Figure 16
<b>Connectivity Areas</b>	
Connectivity Areas	Figure 17
<b>Protected Wildlife Habitat</b>	
Habitat for an animal that is vulnerable wildlife: <ul style="list-style-type: none"> <li>• Ornamental Snake</li> <li>• Greater Glider</li> <li>• Koala</li> <li>• Squatter Pigeon (southern)</li> </ul>	Figure 17 Figure 18 Figure 19 Figure 20
Habitat for an animal that is Special Least Concern Wildlife: <ul style="list-style-type: none"> <li>• Echidna</li> </ul>	-

#### 4.3.1 Regulated Vegetation

Regulated vegetation mapped on the study area includes Endangered (RE 11.3.1) and Of Concern (RE 11.3.2/11.3.2b) REs listed under the VM Act.

Remnant vegetation within 5 m of the defining bank of Roper Creek in the study area is also regulated vegetation. This is shown in Figure 16.



### 4.3.2 Protected Wildlife Habitat

The field surveys identified three species which are listed threatened species in Qld under the NC Act and hence qualify as MSES. These were the Koala (scat only) and Greater Glider which were recorded within the study area, and the Squatter Pigeon (southern) which was recorded nearby. The Echidna was also recorded which is a Special Least Concern species.

Based on local records and presence of suitable habitat within the study area, the NC Act listed Ornamental Snake and White-throated Needletail are also considered as potentially occurring (Table 22). The potential for these species to occur on the site is also reviewed in Appendix A-1.

Table 22: Potentially occurring threatened species under the NC Act

Group	Species	Listing Status		Likelihood of Occurrence
		NC Act	EPBC Act	
<b>Reptiles</b>	Ornamental Snake ( <i>Denisonia maculata</i> )	V	V	Low to fair chance of occurrence given historic records and disturbance history of preferred habitat.
<b>Birds</b>	White-throated Needletail ( <i>Hirundapus caudacutus</i> )	V	V	No local records, however this species could use the air space above the site as it wide ranging. Low chance of occurrence.

### 4.3.3 Connectivity Areas

The landscape fragmentation and connectivity tool (DEHP 2018) has been applied to the Project. The results are provided in Section 5.14.2.

## 4.4 Matters of National Environmental Significance

The results of the MNES search are provided in Table 23. The search was undertaken using a 10 km search radius from the study area.

Table 23: Matters of National Environmental Significance search results

Category	Result	Description
World Heritage Properties	No	-
National Heritage Places	No	-
Wetlands of International Importance	No	-
Great Barrier Reef Marine Park	No	-
Commonwealth Marine Area	No	-
Listed TECs	3	Two listed TECs are known to occur within the area and one is likely to occur within the locality.
Listed Threatened Species	23	Species or species habitat known/likely/may occur within the area.
Listed Migratory Species	12	Migratory wetland, terrestrial and marine species or species habitat known/likely/may occur within the area

The protected matters search tool (DAWE 2020a) identified a range of MNES that could potentially occur in the locality. Threatened species and ecological communities listed as MNES were recorded in the study area during the field surveys. These are discussed in the following sections.



Figure 16: Regulated vegetation

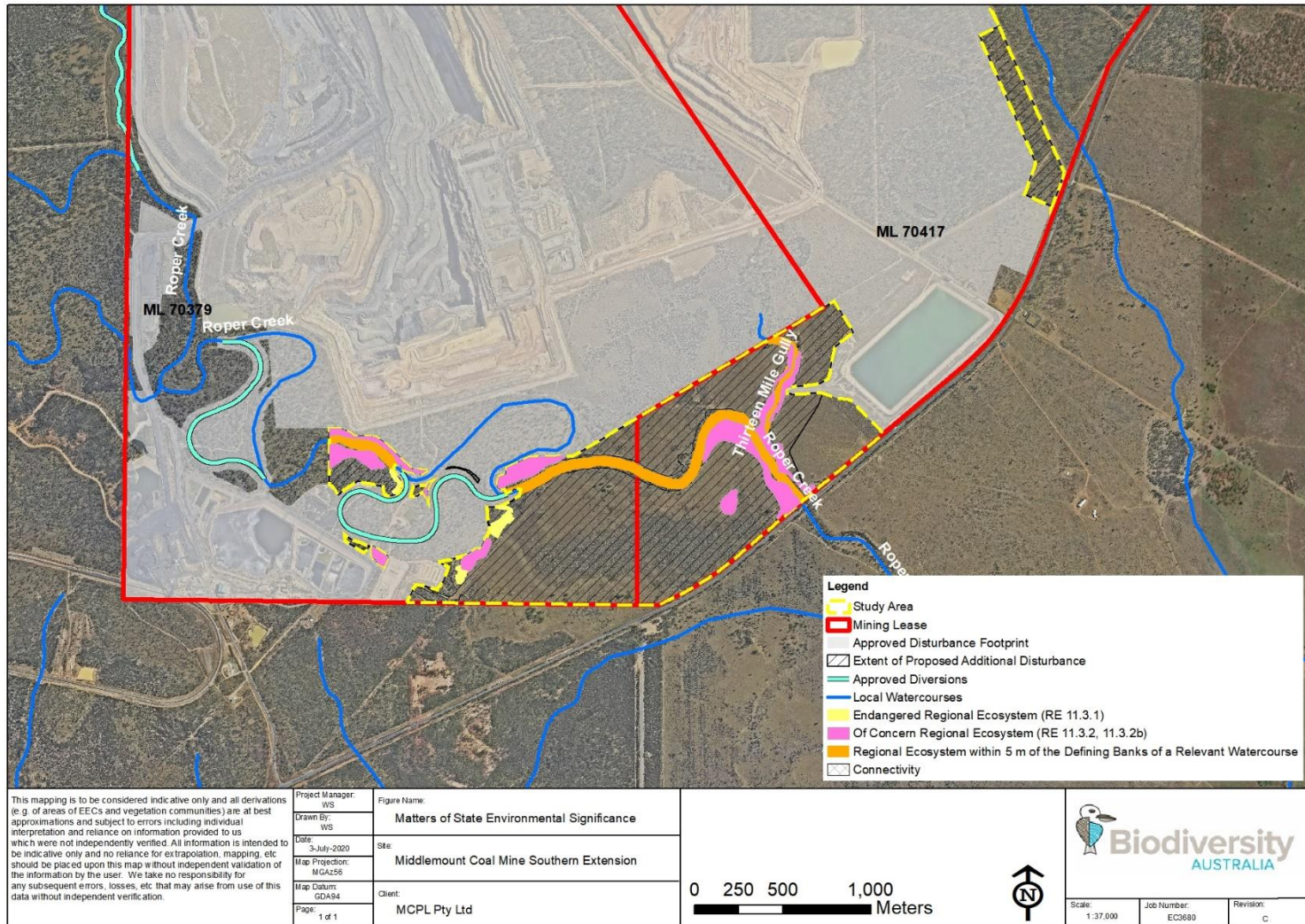


Figure 17: Protected wildlife habitat – Ornamental Snake

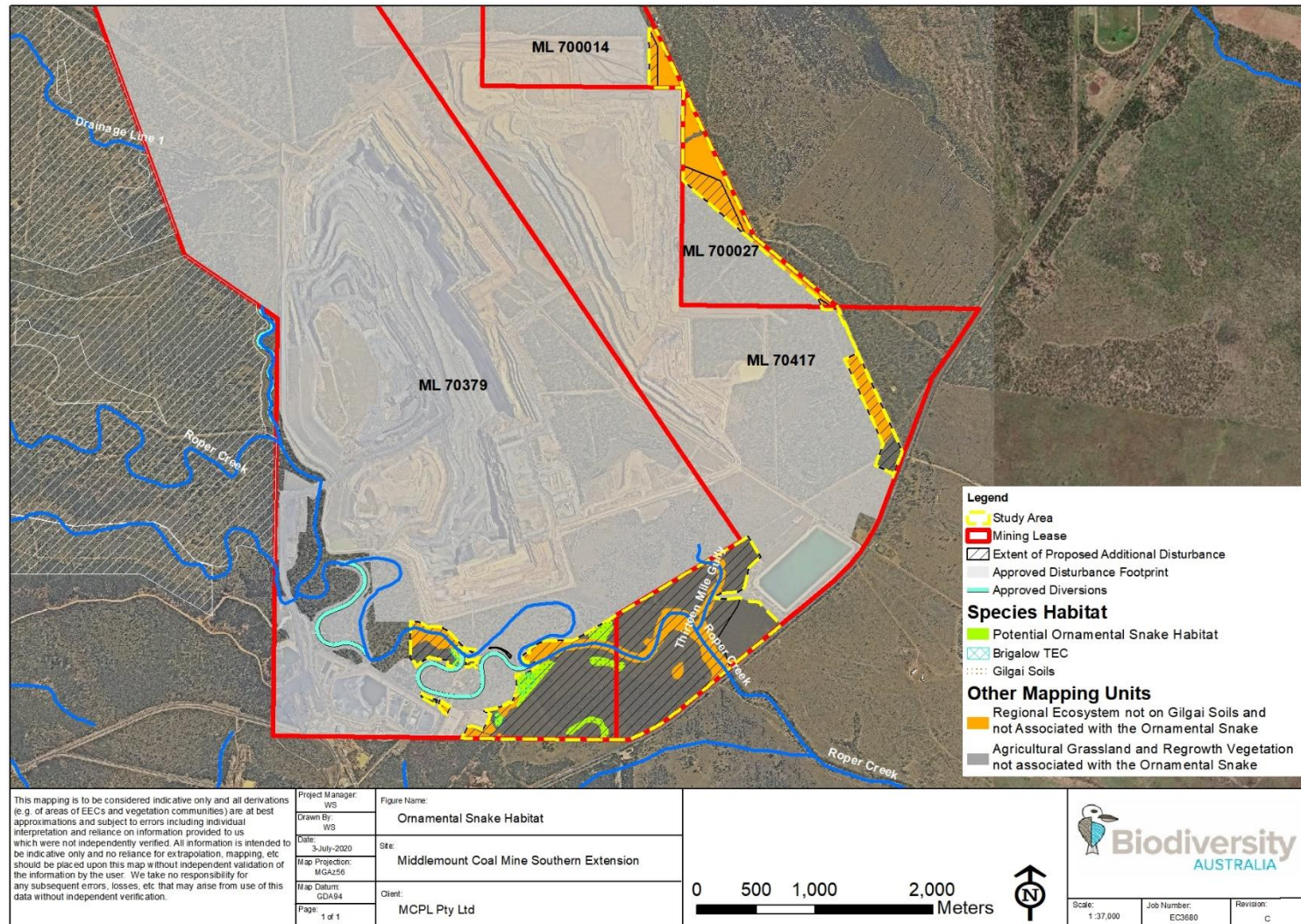


Figure 18: Protected wildlife habitat – Greater Glider

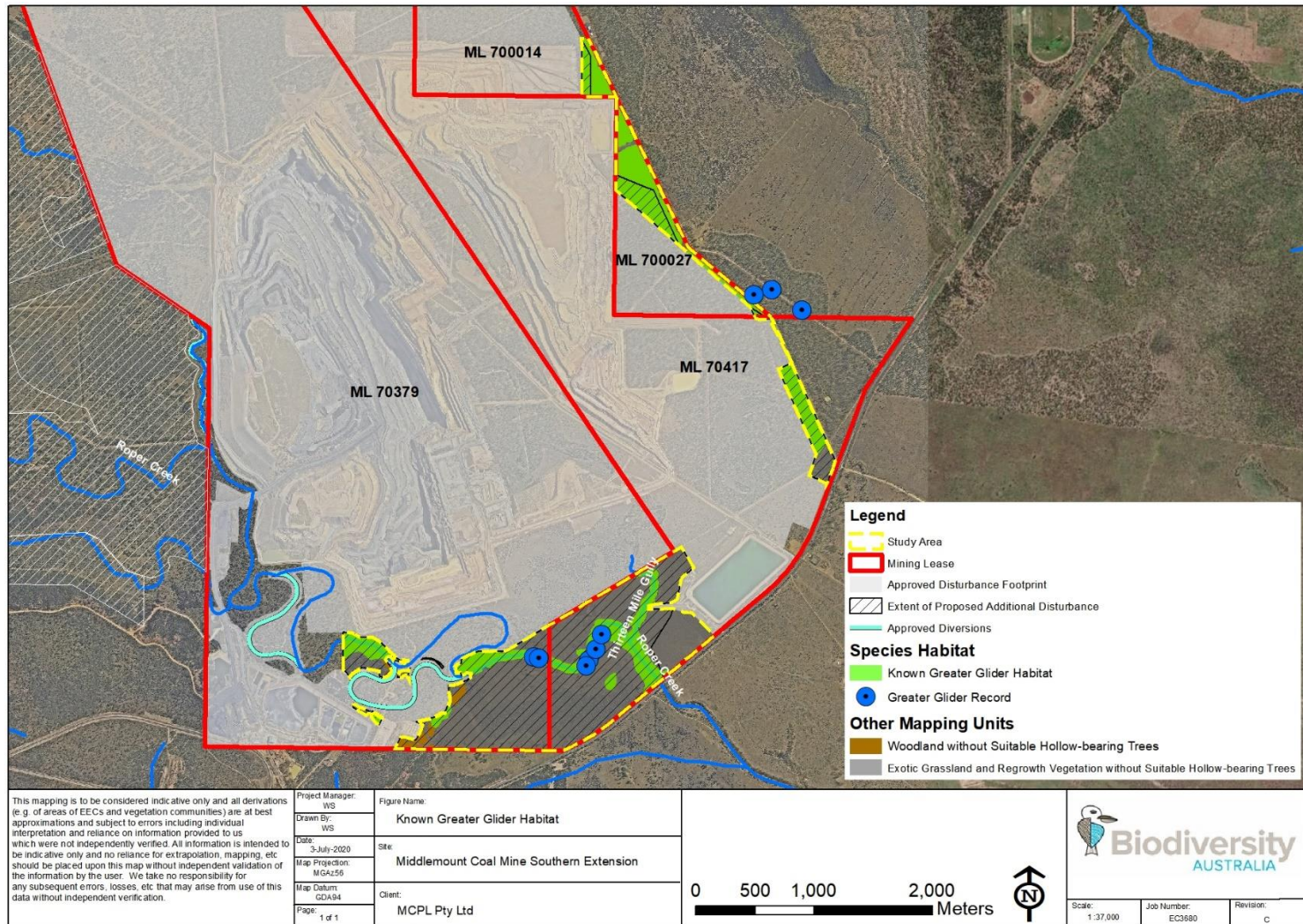


Figure 19: Protected wildlife habitat – Koala

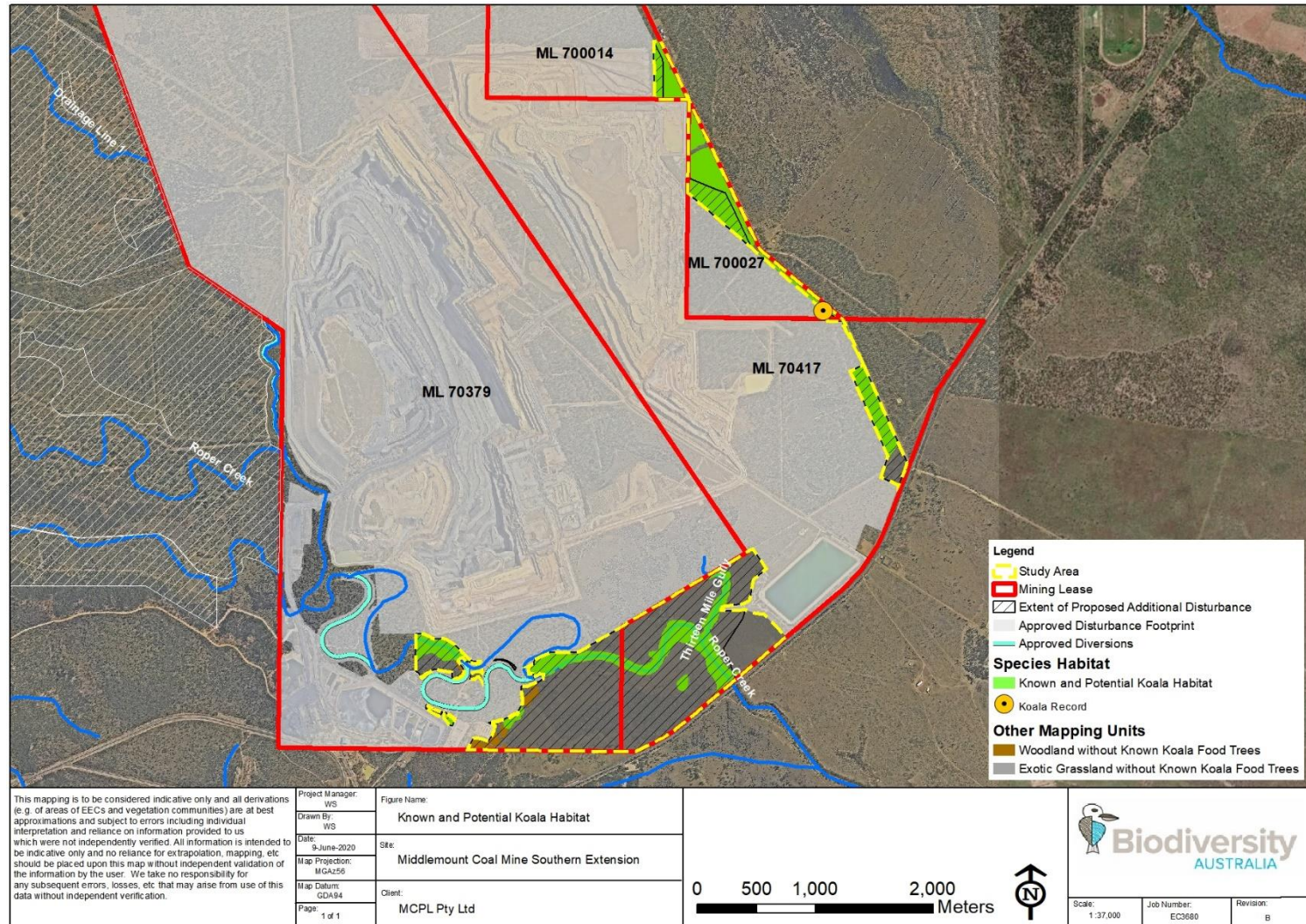
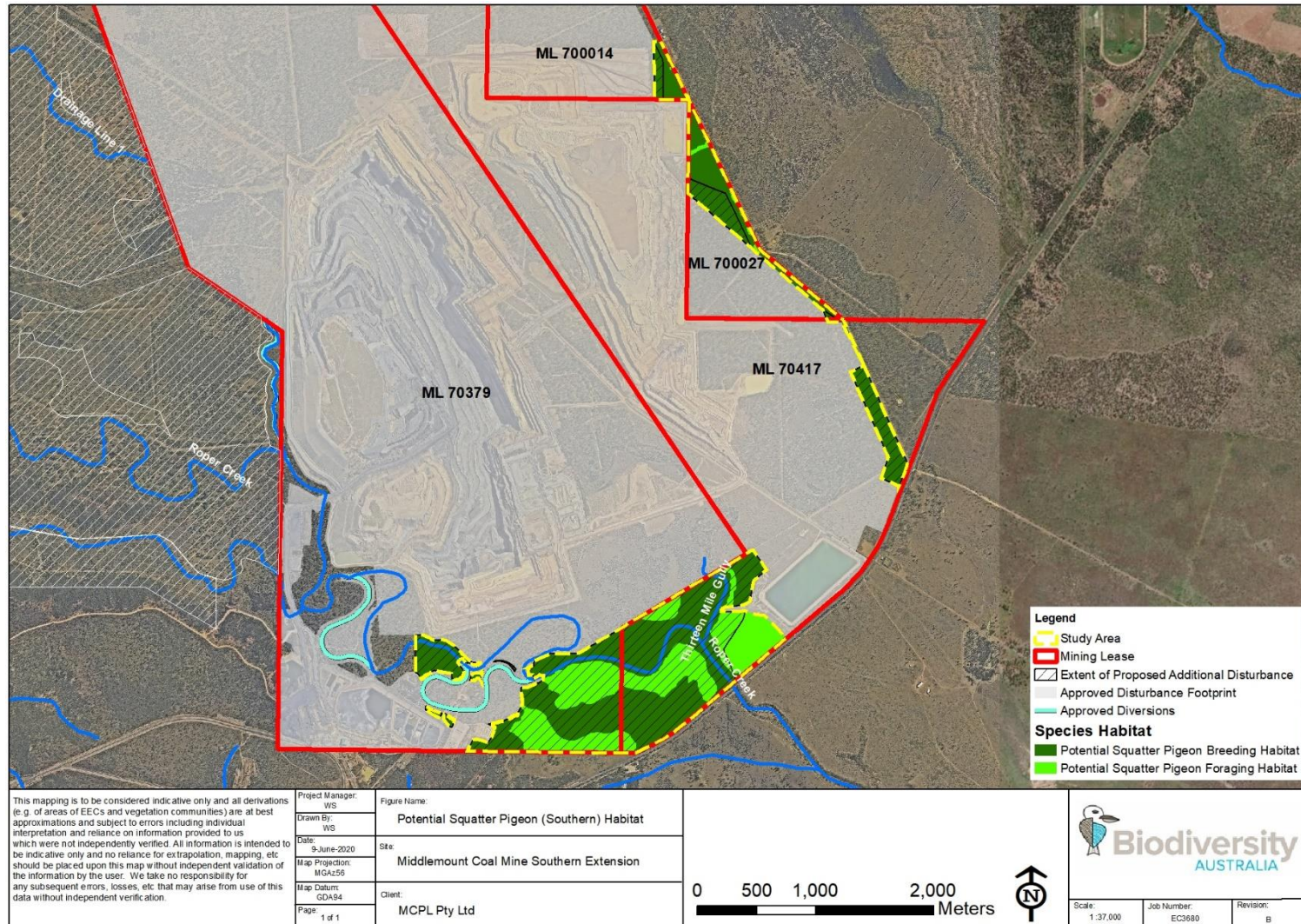


Figure 20: Protected wildlife habitat – Squatter Pigeon (southern)



#### 4.4.1 Threatened Ecological Communities

Vegetation conforming to the Brigalow and Poplar Box TECs were recorded in the study area during the field survey. The process used to identify these TECs is described in Section 3.2.1.3.

The Brigalow community within the study area is equivalent to RE 11.3.1 (2.23 ha). Only remnant Brigalow in the study area meets the diagnostic and condition criteria for this TEC (DotE 2013a). Young regrowth Brigalow growing to approximately 1 m in height also occurs in the study area; however, it is not characteristic of the TEC and has few indicator species.

Field surveys also identified the presence of Poplar Box Woodland on alluvial soils community within the study area. This is comprised of RE 11.3.2 (19.5 ha). Areas of regrowth Poplar Box woodland occur in the study area; however, it only comprises young regrowth growing from approximately 1-4 m in height and does not meet the diagnostic or condition criteria for the TEC.

Further description of these communities is provided in Section 4.1.3 with Figure 12 displaying the distribution of these TECs over the study area.

#### 4.4.2 Threatened Species

Three federally listed threatened species were recorded during the field surveys – the Greater Glider, Koala (scat only) and Squatter Pigeon (southern). These are all listed as Vulnerable under the EPBC Act. The occurrence and distribution of these species on site has been discussed in Section 4.2.5.

As shown in Table 24 below, two additional fauna species listed as Vulnerable under the EPBC Act are considered to potentially occur in the study area. The potential for threatened species to occur in the study area is also reviewed in Appendix A-1.

Table 24: Potentially occurring threatened fauna species

Group	Species	Predicted Type of Occurrence	Listing Status		Likelihood of Occurrence
			NC Act	EPBC Act	
<b>Aves</b>	White-throated Needletail ( <i>Hirundapus caudacutus</i> )	Species or species habitat likely to occur within area	V	V	Low chance of occurring as not previously recorded on MCPL land and presence of large areas of similar and higher quality habitat in the locality.
<b>Reptiles</b>	Ornamental Snake ( <i>Denisonia maculata</i> )	Species or species habitat likely to occur within area	V	V	Low to fair chance of occurrence given historic records and disturbance history of preferred habitat.

#### 4.4.3 Migratory Species

One migratory species, the Crested Tern (*Thalasseus bergii*) was recorded during the survey. Migratory birds listed under international agreements (and the EPBC Act) are also 'Special Least Concern' fauna species listed under the NC Act.



## 5. Potential Impacts

### 5.1 Native Vegetation and Habitat Clearance

The disturbance footprint of the Project covers an area of approximately 233 ha, of which the majority (165 ha) is cleared or non-remnant vegetation. Over the life of the Project, a total of 67.88 ha of remnant vegetation would be cleared. Table 25 details the type and status of remnant vegetation that is required to be removed for the Project.

Table 26 details the classification and extent of non-remnant vegetation to be removed.

Table 25: Details on remnant vegetation to be removed

Field-verified RE	Biodiversity Status	VM Act Status	TEC Status under EPBC Act <sup>1</sup>	Habitat type	Area (ha)
11.3.1	Endangered	Endangered	Brigalow TEC	<i>Acacia harpophylla</i> Woodland/forest	2.22
11.3.2	Of Concern	Of Concern	Poplar Box Woodland TEC <sup>2</sup>	Eucalypt woodland/forest	19.5
11.3.2b	Of Concern	Of Concern	Not TEC	Eucalypt woodland/forest	1.03
11.3.25	Of Concern	Least Concern	Not TEC	Riparian Eucalypt woodland	14.06
11.3.7	Of Concern	Least Concern	Not TEC	Eucalypt woodland/forest	6.18
11.5.3	Not of Concern	Least Concern	Not TEC	Eucalypt woodland/forest	22.69
11.7.2	Not of Concern	Least Concern	Not TEC	<i>Acacia shirleyi</i> Forest	0.76
11.7.4	Not of Concern	Least Concern	Not TEC	Mixed Woodland/forest	1.63
<b>Total</b>					<b>68.07</b>

<sup>1</sup> All TECs within the Project footprint are listed as 'Endangered' under the EPBC Act.

<sup>2</sup> Poplar Box Woodland TEC does not occur over the full extent of RE 11.3.2 within the Project footprint.

Table 26: Details on regrowth and cleared vegetation to be removed

Field-verified Pre-clear RE	Habitat type	Area (ha)
11.3.1	<i>Acacia harpophylla</i> woodland/forest	52.77
11.3.2	Eucalypt woodland/forest	29.27
11.5.3	Eucalypt woodland/forest	10.19
11.7.2	<i>Acacia shirleyi</i> forest	1.04
Cleared land	-	71.64
<b>Regrowth</b>		<b>93.2</b>
<b>Total</b>		<b>164.84</b>

The vegetation that would be removed contains a number of fauna habitat components such as potential nesting/denning/roosting habitat for hollow-obligate species in hollow-bearing trees, shelter provided by dense vegetation and fallen timber, foraging resources (e.g. nectar and sap sources), fruiting resources, seeds and grains along with prey habitat.



The vegetation proposed to be removed by the Project includes known or potential habitat resources for the following threatened fauna species:

- Greater Glider (63.27 ha, comprising only of remnant vegetation).
- Koala (63.27 ha, comprising only of remnant vegetation).
- Squatter Pigeon (southern) (233 ha, comprising 68.07 ha of remnant vegetation and 164.84 ha of regrowth).
- Ornamental Snake (12.81 ha, comprising 2.22 ha of remnant vegetation and 10.59 ha of regrowth; within this remnant and regrowth vegetation).

The RE's associated with the habitat types for each of the threatened fauna species listed above are described in Section 4.2.5.

## 5.2 Individual Fauna Mortality and Injury

The removal of native vegetation associated with the Project, particularly hollow-bearing trees and logs, has the potential for direct mortality of fauna species. This potential risk is increased during the breeding seasons (generally spring to late autumn), and cooler seasons when mammals and reptiles enter torpor.

To reduce the likelihood of direct mortality to native fauna species, MCPL would implement the vegetation clearance protocol described in Section 6.2.

## 5.3 Habitat Fragmentation

The vegetation communities in the disturbance footprint are largely patchy and fragmented, providing limited connectivity for fauna. The vegetation within the north-eastern portion of the disturbance footprint is more contiguous and provides some degree of connectivity, however is fragmented by several roads and fence lines.

The Project is adjacent to the approved mine surface disturbance footprint, and clearance of vegetation within the Project footprint is not likely to isolate any external habitats (only increase the size of the existing footprint). The removal of vegetation from the disturbance footprint would, however, increase the level of local fragmentation and reduce connectivity between remaining habitats in the locality.

The Project would also increase the barrier already presented by the existing mine for terrestrial fauna species which would generally avoid crossing cleared land. This would have the greatest impact on less mobile species, including herpetofauna (e.g. snakes, lizards and frogs), arboreal mammals (e.g. Sugar Glider, Squirrel Glider and Greater Glider) and small mammals (e.g. rodents).

While fragmentation at the local scale would be high, the loss of habitat resulting from the Project in the wider area would only incrementally increase fragmentation in an already highly fragmented landscape. Many of the fauna groups represented in the area are highly mobile (e.g. birds, bats macropods), and would be accustomed to the level of fragmentation. Post-mine landforms are proposed to be progressively rehabilitated to include woodland habitat, except for residual voids.

## 5.4 Edge Effects

Changes to the edges of vegetation communities have been attributed to a range of detrimental effects on different ecosystems. These changes have been linked to effects such as the alteration of environmental conditions, changes in species abundance and distributions and changes in species interactions (Murcia 1995).



Existing vegetation in the Project area and adjacent land is currently fragmented from pastoral areas, the existing mining works, roads and easements; hence any edge effects are likely to have already manifested. The Project would extend the range of edge effects to areas surrounding the disturbance footprint. Newly exposed edges created by clearing works may be subject to higher levels of weed invasion.

Further, given the open nature of the adjacent woodland habitats, no alterations to microclimate or species assemblage are likely to occur as a result of the Project.

## 5.5 Vehicle Strike

Studies have shown a significant increase in fauna vehicle strike incidents where road densities and vehicle speeds are high, which can result in the direct mortality of fauna (Clevenger *et al.* 2002, Gurriga *et al.* 2012). The Project would contain new haul roads which would increase the risk of road strike to the site, however all roads on the mine site are limited to 40 km/hour which would greatly reduce this risk.

## 5.6 Surface Water

The Project would result in changes to the natural flow regimes of the local drainage features, as a result of the following activities:

- the capture and re-use of drainage from operational disturbance areas;
- the re-positioning of the approved southern flood levee and water management infrastructure; and
- the realignment and extension of the approved (but not yet constructed) eastern diversion of Roper Creek inside the ML.

## 5.7 Groundwater Dependent Ecosystems

As discussed in Section 4.1.2, some of the vegetation within the study area is mapped as being a low potential GDE. The Project would involve further diversion of Roper Creek which may lead to reduced groundwater flows. Given that the vegetation along the existing path of Roper Creek would be removed and the creek would be diverted to the south, changes in groundwater would not affect the mapped potential GDEs in the disturbance footprint.

Potential impacts to downstream vegetation communities as a result of changes to the groundwater and surface water regime are unlikely to be significant and no adverse impacts have been noted as a result of existing operations.

## 5.8 Invasive Weeds

The exposure of new vegetation edges and an increase in vehicle and foot traffic within the study has potential to introduce and increase the spread of weeds. The introduction of weeds can have a significant impact on native flora and fauna by altering natural features and ecological processes within ecosystems and outcompeting native flora for necessary sunlight, shade, nutrients and space (NSW Department of Planning, Industry and Environment [DPIE] 2019).

Newly exposed edges created by clearing works have the potential to be subject to higher levels of weed invasion, however the likelihood that weeds would spread into adjoining native woodland/forest vegetation as a result of the Project would be low as declared weeds would be controlled as per management measures outlined in the existing Offset Management Plan/Vegetation Management Plan (MCPL 2019). Further, construction areas and the post-mine landforms would be progressively rehabilitated with native vegetation (limiting opportunities for weeds to grow).



## 5.9 Feral Animals

Mining, industrial and rural developments are often associated with the introduction of non-native fauna species (e.g. rodents, foxes and rabbits) by incidentally creating favourable conditions and habitat niches. Feral cats and foxes are significant predators of native fauna species and have severely reduced populations of birds (including the Squatter Pigeon [southern]) and small mammals (National Parks and Wildlife Service 2001, Dickman 1996, May and Norton 1996, Department of Agriculture and Fisheries 2016). Wild Dogs are significant threats to species such as the Koala (Wilkes and Snowden 1998, Connell Wagner 2000, Department of Agriculture and Fisheries 2016), while other feral animals, such as rabbits, are linked to severe land degradation and soil erosion, threatening habitats critical to many endangered native species (Department of Agriculture and Fisheries 2019).

These species are known to have a negative impact on native fauna by competing for food and shelter, destroying habitat, hyper-predation and by spreading disease (Department of Agriculture and Fisheries 2016). Additionally, the mere presence of these predators alone has been shown to affect fauna behaviour, e.g. avoidance of predator-inhabited areas that otherwise provide suitable habitat and range contraction. If unmitigated, the potential for an increase in feral animals surrounding the disturbance footprint would pose a substantial risk to native fauna in areas surrounding the Project.

Four feral species were detected during the survey, the Feral Cat, Wild Dog, European Rabbit and Cane Toad. Feral pests that are already present in the Project area are likely to displace into adjoining areas during construction, however, the number of feral pests that would be displaced would be reduced by controlling feral pests. As outlined in Section 6.6, the control of feral pests is an existing measure that would be adopted for the Project.

## 5.10 Bushfire Risk

Bushfire is an essential component of vegetation dynamics in Australia (particularly in eucalypt forests), but the frequency and intensity must be appropriate to each vegetation type, and most accidental wildfires are not likely to be beneficial.

An increase in mine activities and mine vehicles could potentially increase the risk of starting wildfires through hot exhausts, hot works or human error. The Project area is contiguous with areas of vegetated land that are largely dry and contain flora species that are conducive to catching fire (e.g. eucalypts), and as such is both prone to wildfire incursion and a potential source of fire.

Bushfire prevention and management measures are described in Section 6.9.

## 5.11 Noise, Dust and Lighting

The Project would result in the generation and distribution of dust from Project-related activities such as blasting, materials handling and vehicle movements (Katestone 2018). The Project would also result in the generation of noise from Project-related activities such as blasting, materials handling and vehicle movements (Renzo Tonin 2018). The scale of dust and noise impacts would increase in comparison to the existing operations, as operational noise sources and the extent of blasting would be extended into the new mining areas (Renzo Tonin 2018).

Potential dust impacts on flora and/or fauna in surrounding habitats associated with the Project is likely to increase as a result of a larger extent of mining activities than existing operations.



Any potential noise-related impact on fauna residing in surrounding habitat would likely be localised and minor given fauna often readily habituate to continuous noise, and sudden noises from blasting would only occur in intervals. This has been evidenced during the current and previous survey work surrounding the existing operations through sightings of fauna using habitat adjacent to active mining areas. Some more sensitive fauna species are known to be discouraged by loud noise, however, and may avoid habitat areas surrounding the disturbance footprint.

The Project would result in an increase (relative to the existing operations) in the use of artificial lighting within the Project locality. Despite this, the incremental impact of this additional night-lighting is expected to be minor given the lights would be operated in accordance with the relevant Australian Standard.

## 5.12 Erosion and Sedimentation

The Project has the potential to increase the natural rate of erosion and sedimentation surrounding the Project and downstream of Roper Creek, due to the additional disturbance areas associated with the extension to the open cut pit. MCPL would revise the existing Erosion and Sediment Control Plan (WRM Water and Environment [WRM] 2012) to manage erosion and sedimentation in and around the disturbance footprint and downstream.

With the continuation of these management measures, it is unlikely that the Project would result in significant erosion or sedimentation impacts that would adversely impact native flora and/or fauna within or downstream of the Project area.

## 5.13 Cumulative Impacts

Removal of vegetation and habitat for the Project would add to cumulative loss of vegetation from past land uses and significant clearing associated with the existing/approved Middlemount Coal Mine. The Project would also contribute to the cumulative impacts of vegetation clearance associated with a number of operational mines within the wider locality, these include:

- German Creek East – located approximately 5 km south of the Project area;
- Foxleigh – located approximately 15 km south-east of the Project area;
- Lake Lindsay – located approximately 15 km south south-east of the Project area; and
- Norwich Park – located approximately 20 km north-west of the Project area.

At a site level, the proposed clearance associated with the Project would result in an increase in remnant vegetation clearance of approximately 10% when compared to the existing/approved Middlemount Coal Mine.

Approximately 630 ha of native vegetation has been approved to be cleared for previous stages of the Middlemount Coal Mine, however, the loss of vegetation associated with the approved mining operations has already been offset in accordance with the relevant State and Commonwealth legislation.

On a larger scale, the native vegetation communities/regional ecosystems to be cleared during the life of the Project all occur more widely in surrounding landscapes and subregions (after Accad *et al.* 2017). The Project would result in the loss of approximately 0.015% of the remnant vegetation remaining within the Isaac Comet Downs subregion, based on 2017 remnant vegetation cover estimates (Accad *et al.* 2017).

The proposed offset areas for the Project would significantly increase the area of protected habitat that would be managed for conservation. The existing and proposed offset areas provide habitat for a number of common and threatened species as demonstrated from monitoring surveys (EHP 2012, Naturecall 2014-2017, Biodiversity Australia 2018-2019) and their continued regeneration would help offset biodiversity losses from the Middlemount Coal Mine. In addition, the progressive rehabilitation of mining areas over the life of the Project would provide habitat in the medium to long term.



Given the above, the additional clearance associated with the Project is considered to represent only a minor increase in cumulative vegetation loss. Accordingly, the Project is not anticipated to have a significant cumulative impact on terrestrial ecology.

## 5.14 Matters of State Environmental Significance

The *Queensland Environmental Offsets Policy* (DEHP 2017) has a *Significant Residual Impact Guideline* (DEHP 2014) to determine if a prescribed activity would have a significant residual impact on MSES. A significant residual impact is defined as an adverse impact, whether direct or indirect, of a prescribed activity on all or part of a prescribed environmental matter that:

- a) *remains, or will or is likely to remain, (whether temporarily or permanently) despite onsite avoidance and mitigation measures for the prescribed activity; and*
- b) *is, or will or is likely to be, significant.*

Table 27 provides a significant residual impact assessment summary on MSES for the Project.

Table 27: Matters of State Environmental Significance - Significant Residual Impact Assessment

Prescribed Environmental Matter	Presence on site	Significant Residual Impact Likely?
<b>Regulated Vegetation</b>		
Endangered or Of Concern RE	The Project area contains Endangered and Of Concern REs.	Yes. Refer to Section 5.14.1.
REs (not within an urban area) that intersect a wetland on the vegetation management wetlands map.	No	-
REs (not within an urban area) within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map.	Yes. RE 11.3.25 and thin sections of 11.3.2 along Roper Creek and Thirteen Mile Gully fall in this category.	Yes. Refer to Section 5.14.1.
<b>Connectivity areas</b>		
Connectivity area that is a RE (not in urban area). The disturbance footprint contains remnant vegetation that forms part of a corridor mapped as being of State biodiversity significance.	The disturbance footprint contains remnant vegetation.	Yes. Refer to Section 5.14.2 for discussion.
<b>Wetlands and Watercourses</b>		
A wetland of HES shown on the map of referable wetlands	No HES wetlands occur in the study area.	-
<b>Protected wildlife habitat</b>		
Habitat for an animal that is vulnerable wildlife.	Three species listed as vulnerable under the NC Act were recorded on site during the survey (Koala [scat only], Greater Glider and Squatter Pigeon [Southern]). One additional threatened fauna species (Ornamental Snake) is considered to have potential to occur on the site and be potentially impacted by the Project.	Yes. Assessment in Section 5.14.3 has determined that a significant residual impact on the Koala and Greater Glider is likely.
Habitat for an animal that is special least concern wildlife.	One species listed as special least concern fauna was recorded during the survey (Echidna)	No significant residual impact is likely.



Legally secured offset area		
Any areas declared as an environmental offset protection area, high nature conservation value under the VM Act or another area prescribed under a regulation.	No	-

### 5.14.1 Regulated Vegetation

Regulated vegetation is a 'prescribed regional ecosystem' that:

- is an Endangered or Of Concern RE;
- intersects with an area shown on the vegetation management wetlands map; or
- is located within the defined distance from the defining banks of a watercourse identified on the vegetation management watercourse map.

For clearing other than clearing for linear infrastructure, a significant residual impact is triggered if the following thresholds are exceeded

Table 28: Significant residual impact criteria – regulated vegetation

		Clearing in a regional ecosystem that is: <i>endangered, or of concern</i>	Clearing in the portion of a regional ecosystem that lies within a mapped wetland	Clearing in a regional ecosystem that is within the defined distance of a watercourse
<b>1</b>	<b>For clearing for linear infrastructure:</b> <ul style="list-style-type: none"> <li>- greater than 25m wide in a grassland (structural category) regional ecosystem; or</li> <li>- greater than 20m wide in a sparse (structural category) regional ecosystem; or</li> <li>- greater than 10m wide in a dense to mid-dense (structural category) regional ecosystem.</li> </ul> <b>For clearing other than clearing for linear infrastructure:</b> <ul style="list-style-type: none"> <li>- area greater than 5 ha where in a grassland (structural category) regional ecosystem; or</li> <li>- area greater than 2 ha where in a sparse (structural category) regional ecosystem; or</li> <li>- area greater than 0.5 ha where in a dense to mid-dense (structural category) regional ecosystem.</li> </ul>	✓	✓	✓
<b>2</b>	Clearing within 50m of the defining bank	N/A	✓	N/A
<b>3</b>	Clearing within 5m of the defining bank	N/A	N/A	✓

Source: (DEHP 2014)

#### 5.14.1.1 Residual Impact Assessment

The Project would involve the removal of Endangered and Of Concern REs, and vegetation within the defined distance from the banks of Roper Creek. The area of impact and trigger thresholds for a significant residual impact are shown in Table 29.



Table 29: Significant residual impact test – regulated vegetation

Field-verified RE	VMA Status	Category	Structural category	Area to be removed	Significant impact?
11.3.1	Endangered	Regulated Vegetation	Mid dense	2.22 ha	Yes
11.3.2 and 11.3.2b	Of Concern	Regulated Vegetation	Sparse	20.35 ha	Yes
11.3.25	Least Concern	Regulated Vegetation	Mid dense	14.06 ha	Yes

Clearing of regulated vegetation for the Project would exceed the threshold a trigger a significant residual impact for RE 11.3.1 and 11.3.2.

#### 5.14.2 Connectivity Areas

As mentioned in Table 27, the landscape fragmentation and connectivity tool (DEHP 2018) was applied to the Project. The output from the tool showed that the Project exceeded the threshold for an impact on connectivity and fragmentation (see log file in Appendix A-6).

#### 5.14.3 Protected Wildlife Habitat

##### 5.14.3.1 Components to be Assessed - Endangered and Vulnerable Wildlife

The following species are subject to the significant residual impact test:

- Koala.
- Greater Glider.
- Squatter Pigeon (southern).
- White-throated Needletail.
- Ornamental Snake.

An action is likely to have a significant impact on endangered and vulnerable wildlife if the impact on the habitat is likely to (DEHP 2014):

- *lead to a long-term decrease in the size of a local population; or*
- *reduce the extent of occurrence of the species; or*
- *fragment an existing population; or*
- *result in genetically distinct populations forming as a result of habitat isolation; or*
- *result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat; or*
- *introduce disease that may cause the population to decline, or*
- *interfere with the recovery of the species; or*
- *cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.*



A *population* for a species is defined by the guidelines (DEHP 2014) as an occurrence of the species in a particular area. In relation to endangered, vulnerable and special least concern species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within that particular bioregion.

The following addresses each of the previous points listed.

**a) Lead to a long-term decrease in the size of a local population.**

Koala

A scat from a Koala was recorded in the disturbance footprint during the survey. No Koalas were observed and only a few old scats were found under a tree near the Bingegang Pipeline Road. Anecdotal reports of a Koala in this area within 3 months prior to the survey were provided by MCPL. The Koala has also been previously recorded on MCPL lands to the west in 2012 and 2014 (Naturecall 2014a). Sparse local records and poor local soil quality (and hence low-quality habitat) would mean Koalas in the area would have large home ranges which are likely to be associated with riparian areas where preferred browse trees are common. This is consistent with Koala sightings on MCPL lands on alluvial flats and riparian areas associated with Roper Creek (Naturecall 2014a).

The Project would remove approximately 63.27 ha of known and potential habitat for the Koala. Due to limited abundance of preferred browse species and poor soils, the habitat to be removed is, however, considered lower quality habitat that would only form part of the marginal home range of a Koala.

Two diversions to Roper Creek are already approved at the Middlemount Mine which would fragment the riparian vegetation along Roper Creek and reduce connectivity for the Koala. As an offset for this impact, the Stage 2 Offset Area was established by MCPL in 2013 and it includes enhancement and conservation of an 11 km stretch of the Roper Creek immediately to the west of the mine. This offset has been secured under a Voluntary Declaration and is managed for conservation purposes. The Project would increase disturbance to the riparian vegetation along Roper Creek for the realignment and extension of the eastern diversion of Roper Creek, however, it would not involve a new barrier to Koala movement (that impact would occur as a result of the approved mine), and the diversion would be revegetated with similar flora species as part of its construction. Further removal of vegetation along Roper Creek would require Koalas to cross more open ground while moving throughout their home range, potentially leading to higher risk of dog attack.

The removal/modification of a portion of habitat for the Koala is unlikely to lead to a long-term decrease in the size of a local population of Koala given:

- the Koala has not been directly observed within the Project area (only scats);
- similar potential habitat for this species is more widespread in the landscape outside the Project area; and
- Koala records are widespread in the landscape outside the Project area.



### Greater Glider

The Greater Glider was recorded in several locations in the study area. It has also been extensively recorded in the Stage 2 Offset Area to the west of the site (Naturecall 2017b). Greater Gliders have small home ranges ranging between 1.3 and 4 ha (Comport *et al.* 1996, Pope *et al.* 2005, TSSC 2016). The disturbance footprint would therefore encompass entire home ranges of the Gliders, and they would be also expected to extend off site.

The Project would remove approximately 63.27 ha of known habitat for this species, comprised of open woodlands. This habitat would be used for both foraging and denning/breeding within hollow-bearing trees. Considering the loss of hollow-bearing trees (breeding habitat) and small range of this species, the Project has the potential to decrease the local population until such time that additional breeding resources are available in the offset areas.

### Squatter Pigeon (southern)

The Squatter Pigeon (southern) has been recorded in the east of the disturbance footprint during previous surveys for the Western Extension Project (Naturecall 2017). During recent field surveys it was detected to the north of the disturbance footprint on the pipeline road.

The disturbance footprint contains suitable habitat for this species in the form of woodland habitat as well as non-remnant woodland vegetation and disturbed areas which are also frequently used for foraging (DEE 2017a). This species has large home ranges and is seasonally nomadic (TSSC 2015), hence the local population would extend well beyond the Project area.

The Project would remove of approximately 233 ha of known/potential habitat for this species. In terms of the large home range of this species, its high mobility and the presence of extensive alternative habitat in the locality, the Project is unlikely to lead to a decrease in the local population.

### Ornamental Snake

This species was not recorded in the disturbance footprint, despite targeted surveys. It has, however, been recorded by PB in 2010 on MCPL owned land on gilgai soils approximately 400 m north of the disturbance footprint near Roper Creek.

The southern portion of the disturbance footprint provides small patches of suitable habitat for the Ornamental Snake in the form of Brigalow habitats with gilgai and drainage depressions which provide habitat for preferred prey species (i.e. frogs).

The Project would remove 12.8 ha of potential habitat which comprises remnant Brigalow habitats and drainage depressions (gilgai) in non-remnant areas. Given that a number of targeted surveys undertaken by Biodiversity Australia and other consultants since 2010 have not detected this species within the disturbance footprint, it is considered to be a low to fair chance of occurrence within the potential habitat in the disturbance footprint. The removal of a relatively small extent of potential habitat in the disturbance footprint while a negative impact, is unlikely to lead to a long-term decrease in the local population.

### White-throated Needletail

The Project is unlikely to have an impact on White-throated Needletail given this species is almost exclusively aerial.



**b) Reduce the extent of occurrence of the species.**

The extent of occurrence of a species is the overall distribution of a species (TSSC n.d.). The Project is not near the edge of the known distribution of the Koala, Greater Glider, Squatter Pigeon (south), Ornamental Snake or White-throated Needle-tail and therefore the Project would not reduce the extent of occurrence of these species.

**c) Fragment an existing population.**

The Squatter Pigeon (southern) and White-throated Needle-tail are highly mobile species and known to be capable of crossing human-modified habitat. The Project would thus offer no barrier to movement and hence would not fragment an existing population.

The Koala is also relatively mobile, able to cross clearings and roads, though is highly susceptible to other threats such as dog attack and vehicle strike. The Project would reduce connectivity for the Koala population, especially in the south of the study area along Roper Creek. Some connective habitat would still remain around the disturbance footprint to the east to facilitate local movements. As such, while the Project would lead to further fragmentation of habitat and reduce connectivity, there is no potential for fragmentation of an existing Koala population.

The Greater Glider relies on canopy connection to move throughout its home range and would rarely come to the ground and cross clearings and open ground. The Project would remove connective habitat for this species, and in conjunction with approved mining activities in MCPL leases, is likely to fragment populations of the Greater Glider, especially those which occur along Roper Creek in the south of the disturbance footprint.

Removal of habitat for the Project would lead to further habitat fragmentation of potential habitat for the Ornamental Snake. Most of the habitat to the north where it was previously recorded will be removed as it is part of the existing Middlemount Coal Mine disturbance footprint, leaving only small patches of marginal habitat remaining.

**d) Result in genetically distinct populations forming as a result of habitat isolation.**

The Project would be unlikely to isolate an existing population of the Squatter Pigeon (southern), White-throated Needle-tail or Koala, as they are more mobile.

It is possible that any potential population of Ornamental Snake within the impact area are already genetically isolated as a result of previous clearing for agriculture and mining in the area. The removal of Ornamental Snake habitat for the Project would be likely to further fragment and isolate any remaining populations.

The Project has the potential to further isolate populations of the Greater Glider, however due to the scale of the project, and re-establishment of linkages with eventual rehabilitation, it would be unlikely to result in the formation of genetically distinct populations.

**e) Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat.**

The Project area currently has a number of introduced and invasive species including predators such as the Feral Cat and Fox and weed species including Prickly Pear. No new invasive species that are likely to affect any endangered or vulnerable species would likely be introduced as a result of the Project.

**f) Introduce disease that may cause the population to decline.**

Due to the nature of the Project, the risk of a new disease (relevant to the species) being introduced to the site would be unlikely.



**g) Interfere with the recovery of the species.**

Ideally, the goal in threatened species recovery is to increase the abundance and range of the threatened species, so that it is not at risk of becoming extinct. As detailed previously, the Project would lead to habitat loss and contribute to threatening processes which would interfere with the recovery of threatened species to varying degrees. This includes directly reducing habitat for the species known to occur and reducing the amount of available potential habitat for other species.

**h) Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.**

For the Squatter Pigeon (southern) and White-throated Needletail, the habitat in the Project area has an evident disturbance history and is unlikely to qualify as an ecologically significant location, especially given the extent of identical and higher quality habitat that occurs in the wider area.

The Koala and Greater Glider have been recorded within and surrounding the disturbance footprint, and habitats within the disturbance footprint would provide foraging and breeding habitat, as well as habitat linkages. Therefore, the Project would disrupt potential foraging, breeding and resting sites for the Koala and Greater Glider.

The Ornamental Snake has not been recorded in the disturbance footprint, and it is unlikely that the habitats present would constitute ecologically significant locations for this species due to the marginal habitat present and its isolation from areas of higher quality habitat.

**5.14.3.2 Conclusion**

The Project is not considered to result in a significant residual impact on the Squatter Pigeon (southern), due to its highly mobile nature and the large extent of suitable habitat in the wider area that is readily accessible.

Given that the Ornamental Snake was not recorded in the disturbance footprint and has not been reliably recorded on MCPL land since 2010, the impact of the Project is unlikely to be significant given the small area of potential habitat to be cleared relative to the wider extent of habitat (including habitat in the offset areas).

The Project is likely to result in a significant residual impact on the Koala and Greater Glider in the context of the assessment requirements under DEHP (2014) due to clearance of habitat known to be used by both species potentially for breeding, feeding, nesting and resting.

The Project is unlikely to have an impact on White-throated Needletail given this species is almost exclusively aerial.

Thus, as per the Significant Residual Impact Guideline (DEHP 2014), the Project would require an offset for the Koala and Greater Glider.

**5.14.3.3 Components to be Assessed - Special Least Concern Animals**

The Echidna is listed as a Special Least Concern species under the NC Act and was recorded in the study area during the survey.

An action is likely to have a significant impact on a special least concern (non-migratory) animal wildlife habitat if it is likely that it will result in (DEHP 2014):

- *a long-term decrease in the size of a local population; or*
- *a reduced extent of occurrence of the species; or*
- *fragmentation of an existing population; or*



- *result in genetically distinct populations forming as a result of habitat isolation; or*
- *disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.*

#### 5.14.3.4 Assessment of Significance

This section addresses each of the previous points listed.

##### **a) a long-term decrease in the size of a local population; or**

The Echidna was observed during the survey in the southwest of the disturbance footprint within RE 11.7.4. The Echidna has also been recorded previously on MCPL land in the Western Extension Project area, within the Stage 2 offset area and near Parrot Quarry Road during previous surveys (Naturecall 2016a). A local population of the Echidna would extend well beyond the disturbance footprint given these previous records and that suitable habitat also occurs on adjacent land to the south and west.

The Project would impact the Echidna via removing approximately 161 ha of habitat which includes open woodland, Acacia forest and less suitable regrowth vegetation. The Project would not result in the clearance of any ecologically significant locations. This would affect foraging habitat and connectivity would also be reduced (but not be fragmented). However given that the local population would extend well beyond the disturbance footprint, and that large areas of suitable habitat significantly greater than the additional surface disturbance area for the Project would remain on directly adjoining MCPL land to the west and south of the disturbance footprint, as well approximately 5,861 ha of suitable habitat in the existing Offset Areas, the Project is only likely to affect a few individuals of the overall population and would be unlikely to lead to a decline.

##### **b) a reduced extent of occurrence of the species; or**

The Project would remove habitat that may be used by the local population of this species. This would result in a minor contraction of the extent of occurrence.

##### **c) fragmentation of an existing population; or**

The Echidna is a mobile species and would be able to cross disturbed areas and open ground. Sufficient connectivity for this species outside the disturbance footprint would remain after clearance and no populations are likely to become fragmented as a result of the Project.

##### **d) result in genetically distinct populations forming as a result of habitat isolation; or**

As discussed above, no fragmentation or isolation of the local population is likely to result from the Project.

##### **e) disruption to ecologically significant locations (breeding, feeding or nesting sites) of a species.**

The Project would affect generic foraging and potentially breeding habitat for the local Echidna population. Given the extent of similar and higher quality habitat located on adjacent and nearby lands, the habitat on site is unlikely to be of any specific significance to the local population.

#### 5.14.3.5 Conclusion

Given the above, the Project is unlikely to have a significant impact on the habitat or local population of the Echidna.



## 6. Impact Avoidance, Mitigation and Management Measures

MCPL has minimised potential impacts associated with land clearance through the use of existing infrastructure and facilities (where possible) and minimising out-of-pit waste emplacements via backfilling of the open cut pit void.

The Project would be subject to a number of mitigation measures to reduce the overall impact of the Project on biodiversity and ensure potential off-site impacts are minimised. The conclusions of the impact assessments undertaken have assumed that the following mitigation measures would be implemented.

### 6.1 Refinement of the Mine Design to Avoid Land Clearance

The following refinements to the mine design have resulted in minimising additional land disturbance:

- use of existing infrastructure and facilities at the Middlemount Coal Mine, where possible, to avoid the need for additional clearance works;
- optimising the backfilling of the open cut pit to minimise the overall mine footprint (i.e. reduce the size of the out-of-pit waste emplacement); and
- locating the proposed waste emplacements to be continuous with the existing/approved waste emplacements to minimise the total disturbance footprint.

### 6.2 Vegetation Clearing Management

The following measures would be implemented to manage clearing on site:

- The sequence of vegetation clearing would be undertaken in a manner to ensure fauna is not isolated from adjacent habitat preventing their escape.
- Approved disturbance limits would be clearly marked (e.g. via pegging and/or flagging tape) before clearing in order to prevent any inadvertent clearance. Site induction would specify that no clearing is to occur beyond the marked area and any machinery or materials associated with the development are not to be parked/stored in adjacent retained vegetation.
- Where possible, timing of vegetation clearing would avoid the breeding season for the Greater Glider (i.e. April to June).
- The area of clearing work is to be inspected for fauna by a fauna spotter immediately prior to commencement of any vegetation removal. Pre-clearing checks would include searches of habitat (e.g. lifting and destructive searches of logs) and searches for bird nests. Trapping surveys for capture of arboreal species is also recommended. If possible, any detected fauna is to be relocated to nearby suitable areas outside of the disturbance footprint or other approved clearing areas prior to clearing.
- During the pre-inspection, all hollow-bearing trees, stags and large hollow logs are to be clearly marked with flagging tape to allow easy identification during clearing.
- A fauna spotter is to remain on site to supervise clearing to retrieve any fauna detected during works and undertake appropriate action (e.g. euthanize severely injured animals and/or relocate uninjured animals where possible).
- A release area for any fauna captured prior to or during clearing is to be identified prior to commencement of clearing works. Consideration should be given to the following factors when selecting release areas:
  - Presence of suitable foraging and breeding habitat for the species;



- Connectivity to other habitats and populations (e.g. do not select release areas that are isolated pockets of vegetation);
- Whether the habitat will be cleared or modified in the future; and
- Distance from disturbances associated with the mine e.g. noise, light, dust.
- If a Koala is present in the proposed clearing area, it would be left to move away from the clearance area on its own accord.
- Measures described in the Middlemount Coal Species Management Program would continue to be followed.

### 6.3 De-watering Management

Any waterbodies which require diversion or de-watering for the Project are to be subject to the following measures:

- Capture of as many aquatic fauna species as possible in the waterbody through electrofishing, scoop netting, trapping etc. prior to de-watering.
- Selection of suitable release area for any aquatic fauna.
- Presence of an aquatic ecologist during de-watering activities to capture and relocate stranded aquatic fauna.

### 6.4 Rehabilitation

Consistent with Environmental Authority (EA) EPML00716913, the rehabilitation goals for the existing Middlemount Coal Mine would remain unchanged for the Project. These areas are:

- to ensure the final landform is safe to humans and wildlife;
- to ensure the site is non-polluting;
- to ensure the final landform is stable; and
- to ensure the site is able to sustain an agreed post-mining land use.

Rehabilitation progress and rehabilitation activities would regularly be re-evaluated, and the results would inform future rehabilitation initiatives. All post-mine landforms, except final voids and sections of the low wall, would have a self-sustaining vegetation or rock mulch cover.

### 6.5 Weed Management

MCPL currently implements weed control measures at the existing operations in accordance with the Middlemount Coal Mine Environmental Management Plan (MCPL 2017a). These measures would be continued for the Project and include spot spraying of *Biosecurity Act 2014* listed weed species.

### 6.6 Feral Animal Management

MCPL currently implements feral animal control measures at the existing operations in accordance with the Middlemount Coal Mine Environmental Management Plan (MCPL 2017a). These measures would be continued for the Project and include wild dog and cat control.



## 6.7 Erosion and Sedimentation

MCPL currently implements standard erosion and sedimentation control measures at the existing operations. These measures would be continued for the Project and would be applied as per an Erosion and Sediment Control Plan (WRM 2012).

## 6.8 Artificial Lighting

Artificial lighting would be required during the operation of Project. This would not be directed into adjacent retained habitat to reduce impacts on nocturnal fauna potentially using this habitat.

## 6.9 Bushfire Prevention and Management

MCPL would aim to maintain vegetation structure and composition, protect mine assets and safeguard human life through the implementation of bushfire management techniques, including:

- physical protection of assets through clean firebreaks;
- active fire suppression of unplanned and potentially destructive fires (to vegetation and built assets); and
- pro-active fuel and ecosystem management to sustain ecological fire regimes as much as possible.



## 7. Offset Strategy

Avoidance and mitigation measures from the Project on terrestrial flora and fauna (including State significant biodiversity values) are described in Section 6. This section describes an offset strategy to address residual impacts on matters that are not able to be avoided as part of the Project.

### 7.1 Existing Offset Areas

An *Offset Management Plan/Vegetation Management Plan* (MCPL 2019) has been prepared to manage offsets delivered under previous stages of the Middlemount Coal Mine. Eight designated offset areas currently exist on MCPL owned land to the west of the Project (shown on Figure 3-7 of the Main Text ), which covers approximately 5,861.4 ha. This includes three Commonwealth Offset Areas under the EPBC Act:

- Middlemount Coal Stage 2 Project Commonwealth Offset Area;
- North-eastern Extension Project Commonwealth Offset Area; and
- Western Extension Project Commonwealth Offset Area.

Five State (Qld) Offset Areas are also covered in this plan:

- Rail Loop and Spur Offset Area;
- Parrot Quarry Offset Area;
- Thirteen Mile Gully Diversion Offset Area;
- North-eastern Extension State Offset Area; and
- Western Extension State Offset Area.

Proposed offsets for the Project would consider the existing offset areas and the *Offset Management Plan/Vegetation Management Plan* (MCPL 2019).

### 7.2 Offset Policies

MCPL propose to offset significant residual impacts on MSES in accordance with the *Queensland Environmental Offsets Policy Version 1.8* (DES 2020c). Impacts to MNES would be addressed as part of the MSES offset strategy as they both address the same matters.

### 7.3 Significant Residual Impacts

MCPL propose to offset all matters that would be significantly residually impacted by the Project. Significant residual impacts to MSES that are associated with the Project have been outlined in Section 5, and are summarised in Table 30.



Table 30: Summary of terrestrial ecology matters relevant to the Project

Prescribed Environmental Matter	Approved Maximum Extent of Impact (ha)	Proposed Additional Significant Residual Impact (ha)
<b>Regulated Vegetation</b>		
Regional Ecosystems (not within an urban area) that intersect a watercourse on the vegetation management watercourse map – RE 11.3.25e	1	0
Endangered Regional Ecosystem – RE 11.4.9	0.5	0
Endangered Regional Ecosystem – RE 11.3.1	15	2.22
Of Concern Regional Ecosystem (not within an urban area) – RE 11.3.2	43.5	19.5
Of Concern Regional Ecosystem (not within an urban area) – RE 11.3.2/11.3.4	1.5	0
Regional Ecosystems (not within an urban area) that intersect a wetland on the vegetation management wetlands map – RE 11.3.27d	1.9	0
Of Concern Regional Ecosystem (not within an urban area) – RE 11.3.2b	0	1.03
Regional Ecosystems (not within an urban area) that intersect a wetland on the vegetation management wetlands map – Res 11.3.2 and 11.3.25	0	3.7
<b>Connectivity areas</b>		
Connectivity area that is a regional ecosystem (not in urban areas)	371.5	67.95
<b>Wetlands and Watercourses</b>		
A wetland of high ecological significance shown on the Map of Referable Wetlands	0.75	0
<b>Protected wildlife habitat</b>		
Habitat for an animal that is vulnerable wildlife – <i>Denisonia maculata</i> (ornamental snake)	15.5	12.81
Habitat for an animal that is vulnerable wildlife – <i>Geophaps scripta scripta</i> (squatter pigeon)	569.5	233
Habitat for an animal that is vulnerable wildlife – <i>Petauroides volans</i> (greater glider)	175	63.27
Habitat for an animal that is vulnerable wildlife – <i>Phascolarctos cinereus</i> (koala)	175	63.27
Habitat for an animal that is special least concern wildlife – <i>Tachyglossus aculeatus</i> (short-beaked echidna)	190.5	0
<b>Legally Secured Offset Areas</b>		
Legally secured offset area – Stage 2 Offset Area*	32	0
Legally secured offset area – Rail Loop and Spur Offset Area	22	0

## 7.4 Offset Timing

EA EPML00716913 Condition F35 states that "A notice of election for the environmental offset, must be provided to the administering authority no less than three (3) months before the proposed commencement of the significant residual impacts to the prescribed environmental matters."

As such, an offset proposal would be lodged with the State (Qld) and Commonwealth Governments at least three months prior to the commencement of construction activities in accordance with the relevant offsets policies (i.e. the *EPBC Act Environmental Offsets Policy* [DSEWPC 2012a] and *Queensland Environmental Offsets Policy Version 1.8* [DES 2020c]).



## 7.5 Offset Approach

A land-based proponent-driven offset is proposed to address all impacts associated with the Project. All efforts would be made to identify and secure offsets that would provide the same or similar vegetation/habitat characteristics as the matters in the Project area. The offset area for protected wildlife would contain, or be capable of containing (after rehabilitation management), a self-sustaining population of the impacted species. Habitat quality assessments would be undertaken in accordance with the *Guide to determining Terrestrial Habitat Quality Version 1.3* (DES 2020a). Identification of TEC communities would be assessed in accordance with the relevant conservation advices.

## 7.6 Offset Reporting Framework

The offset reporting framework would be determined in the offset proposal in accordance with relevant offset policies at the time, and with consideration of the existing *Offset Management Plan/Vegetation Management Plan* (MCPL 2019).



## 8. Conclusion

This report has assessed the impacts of a southern extension to the approved Middlemount Coal Mine, which would see an extension of the mine by approximately 233 ha, along with additional associated actions.

This assessment and survey has identified that the site and surrounding area is generally in a modified state as a result of a number of past and current disturbances such as clearing, mining activities and cattle grazing. This has fragmented the landscape and reduced the support value of the habitat on site for locally recorded and potentially occurring species and resulted in indirect impacts that may have discouraged them from using habitat in the area.

The study area for this assessment covers an area of 274 ha and comprises multiple areas of land immediately surrounding the existing mine boundary. The majority of these are situated directly south of the existing open cut mine, with an additional area located to the east. Field surveys were undertaken by two ecologists in March and June 2020. The vegetation field survey methods utilised included Terrestrial Habitat Quality Surveys, Quaternary vegetation surveys and targeted threatened flora searches. Fauna survey methods utilised included herpetofauna searches, diurnal bird surveys, Koala SAT surveys, PIR cameras, microbat call recording and analysis and spotlighting surveys.

Field verifications of REs confirmed that one RE within the study area consists of Brigalow forest (RE 11.3.1) which is listed as Endangered under the VM Act and EPBC Act (Brigalow TEC); and two REs comprised a Poplar Box woodland (REs 11.3.2 and 11.3.2b) which is listed as Of Concern under the VM Act and Endangered under the EPBC Act (Poplar Box Woodland TEC). No threatened flora species were recorded on the site during surveys, and none were considered to be potential occurrences.

Targeted fauna surveys undertaken on the study area detected three threatened fauna species listed as Vulnerable under the NC Act and EPBC Act. These comprised the Greater Glider, Koala [scat only] and Squatter Pigeon (southern). Due to the presence of suitable habitat/vegetation associations and local records, two threatened fauna species listed as Vulnerable under the NC Act and EPBC Act (Ornamental Snake and White-throated Needletail) were considered to be potential occurrences in the study area. One Special Least Concern species comprising the Echidna was also recorded during the field surveys.

The recorded and potentially occurring threatened fauna species were assessed under the relevant State legislation. Impact assessment for the identified MSES determined that the Project would have a significant residual impact on regulated vegetation, connectivity and on the Koala and Greater Glider.

Mitigation measures for the Project are expected to be consistent with existing Environmental Authority (EA) conditions and MCPL plans (e.g. Erosion and Sediment Control Plan and Rehabilitation Management Plan). Specific measures to reduce impacts on biodiversity include marking clearing limits, pre-clearing surveys and clearing supervision, and reducing light spillage into adjacent retained habitat. Offsets for the Project are expected to be consistent with existing EA conditions.



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## 10. Appendices

### A-1 Potential Occurrence Assessment

The following tables are used as a summary to address threatened species in terms of potential occurrence and requirement for formal assessment. A threatened species has been assessed if it is:

- 1) Recorded on-site; or
- 2) Not recorded on site, but recorded within a 10 km radius (the locality), and may occur to some degree on-site due to potential habitat, key habitat component, etc.;
- 3) Not recorded in the locality as yet, but recorded in the bioregion, and thus may occur in the locality, and possibly to some extent, may occur on the site, due to potential habitat.

Likelihood of occurrence is based on the probability of occurrence in terms of:

- Habitat extent (e.g. sufficient to support an individual or the local population; comprises all of home range; forms part of larger territory, etc.); quality (i.e. condition, including an assessment of threats, historical land uses on and off-site, and future pressures); interconnectivity to other habitat; and ability to provide all the species life-cycle requirements (either the site alone, or other habitat within its range);
- Occurrence frequency (i.e. on-site resident; portion of larger territory or seasonal migrant); and
- Usage i.e. breeding or non-breeding; opportunistic foraging (e.g. seasonal, migratory or opportunistic); marginal fringe of core range; refuge; roosts; etc.

An indicative 1-5 scale used by the author to indicate the likelihood of the species to potentially occur in the habitat on the study sites (if they have not been recorded in the locality) is as follows:

- 0: *Unlikely* (<1% probability) - no potentially suitable habitat; too disturbed; or habitat is very poor. No or few records in region or records/site very isolated e.g. by pastoral land, urbanisation, etc.
- 1: *Low* (1-25%) - few minor areas of potential habitat; highly modified site/habitat; or few habitat parameters present, but others absent or relatively insignificant (sub-optimum habitat). Usually very few records in locality.
- 2: *Fair* (25-50%) - some significant areas of potential habitat, but some habitat parameters limited. Potential for occasional foraging e.g. from nearby more optimal areas or known habitat. Records at least within 10-15 km radius of site.
- 3: *Moderate* (50-75%) - quite good potentially suitable habitat on and adjacent to the site, and/or good quality and abundance of some vital habitat parameters. Records within <10km, or adjacent to site, or adjacent to high quality habitat where species likely to occur.
- 4: *High* (>75%) - very good to optimum habitat occurring on or adjacent to the site (support breeding pair or population). Recorded within 5-10 km of site in same or similar habitat.

#### A-1-1 Flora

Searches of relevant literature and databases (DES 2020b) only found records of a single flora species in the locality. A number of other species have the potential to occur within the locality based on regional records and presence of suitable habitat. In the table below, these species are evaluated for their potential to occur on the site.



Table 31: Potential occurrence assessment - flora

Species	No. of Records	NC Act	EPBC Act	Link to Profile	Likelihood of Occurrence
<i>Cerbera dumicola</i>	1	NT	-	<a href="http://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/components/species/?cerbera-dumicola">http://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/components/species/?cerbera-dumicola</a>	Recorded in the locality and in the Stage 2 Project to the west of the site (PB 2010a). The southwest corner of the study area contains a small extent of suitable habitat for this species, however it was not found during surveys. Expected to be readily detected if present. Unlikely to occur.
<i>Cycas megacarpa</i>	0	E	E	<a href="https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=55794">https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=55794</a>	No preferred habitat on site and not recorded locally. This distinctive species would be expected to be readily detected if present. Unlikely to occur.
<i>Dichanthium queenslandicum</i>	0	V	E	<a href="https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=5481">https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=5481</a>	Only small areas of preferred habitat on site and not recorded locally or on MCPL lands during previous surveys. Site disturbance history would also reduce potential to occur. Unlikely to occur.
<i>Dichanthium setosum</i>	0	-	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14159">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14159</a>	Woodland areas on site may broadly qualify as suitable habitat, however there are no local records and no known populations in the region. Unlikely to occur.
<i>Digitaria porrecta</i>	0	NT	-	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=12768">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=12768</a>	Only small areas of preferred habitat on site and not recorded locally or on MCPL lands during previous surveys. Site disturbance history would also reduce potential to occur. Unlikely to occur.
<i>Picris evae</i>	0	V	V	<a href="https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=10839">https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=10839</a>	Site may broadly qualify as potential habitat; however, no local records and site occurs beyond known population extent. Unlikely to occur.
<i>Cadellia pentastylis</i>	0	V	V	<a href="https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=9828">https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=9828</a>	No suitable habitat on site and no local records. Expected to be readily detected if present. Unlikely to occur.

Key: Endangered (E), Vulnerable (V), Near Threatened (NT).



## A-1-2 Fauna Species Eligibility for Test of Significance and MNES Assessment

As previously noted, a number of threatened and migratory fauna have been recorded in the locality, and a number of others are considered potential occurrences. In the table below, these species are evaluated for their potential to occur on the site.

Table 32: Potential occurrence assessment - fauna

Species	No. of Records	NC Act	EPBC Act	Link to Profile	Likelihood of Occurrence
<b>Aves</b>					
Glossy Black Cockatoo ( <i>Calyptorhynchus lathami</i> )	0	V	-	<a href="http://www.birdsinbackyards.net/species/Calyptorhynchus-lathami">http://www.birdsinbackyards.net/species/Calyptorhynchus-lathami</a>	No suitable foraging habitat is present in the study area. Not recorded locally or on MCPL lands during previous surveys. Unlikely chance of occurrence.
Red Goshawk ( <i>Erythrotriorchis radiatus</i> )	0	E	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942</a>	Site, and general area, comprises low quality foraging habitat due to lack of permanent waterways. No local or regional records. Unlikely to occur.
Powerful Owl ( <i>Ninox strenua</i> )	0	V	-	<a href="http://www.birdlife.org.au/bird-profile/powerful-owl">http://www.birdlife.org.au/bird-profile/powerful-owl</a>	Site contains potential foraging and nesting habitat as part of a wider area. No local records and not recorded on MCPL lands during this or previous surveys. Very low to unlikely chance of occurrence.
Australian Painted Snipe ( <i>Rostratula australis</i> )	0	E	E	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037</a>	No large permanent wetlands occur on site, and no local records, hence this species is unlikely to occur.
Black-throated Finch ( <i>Poephila cincta cincta</i> )	0	E	E	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64447">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64447</a>	Site represents poor potential habitat for this species. No local records; and site occurs beyond known distribution. Unlikely to occur.
Star Finch (eastern subspecies) ( <i>Neochimia ruficauda ruficauda</i> )	0	E	E	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26027">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26027</a>	Site represents poor potential habitat for this species due to lack of permanent water and disturbance history. No local records. Unlikely to occur.
Painted Honeyeater ( <i>Grantiella picta</i> )	0	V	V	<a href="http://www.birdlife.org.au/bird-profile/painted-honeyeater">http://www.birdlife.org.au/bird-profile/painted-honeyeater</a>	Site provides generic foraging habitat for this species. Lack of local and regional records, disturbance history or site and locality would however reduce potential to occur. Unlikely to occur.



Species	No. of Records	NC Act	EPBC Act	Link to Profile	Likelihood of Occurrence
Eastern Osprey ( <i>Pandion cristatus</i> )	0	-	M	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=952">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=952</a>	No suitable foraging habitat occurs on site. Unlikely to occur.
Latham's Snipe ( <i>Gallinago hardwickii</i> )	1	-	M	<a href="http://birdlife.org.au/bird-profile/lathams-snipe">http://birdlife.org.au/bird-profile/lathams-snipe</a>	No large permanent wetlands or waterways occur on site, and no local records, hence this species is unlikely to occur.
Glossy Ibis ( <i>Plegadis falcinellus</i> )	1	-	M	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=991">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=991</a>	Some potential habitat occurs on site. <b>Moderate chance of occurrence.</b>
Fork-tailed Swift ( <i>Apus pacificus</i> )	0	-	M	<a href="https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678">https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678</a>	<b>Fair potential</b> , as transient, between Oct-April
White-throated Needletail ( <i>Hirundapus caudacutus</i> )	0	V	V, M	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682</a>	No local records, however site contains broadly suitable habitat. <b>Low chance of occurrence.</b>
Rufous Fantail ( <i>Rhipidura rufifrons</i> )	0	-	M	<a href="http://birdlife.org.au/bird-profile/Rufous-Fantail">http://birdlife.org.au/bird-profile/Rufous-Fantail</a>	No suitable habitat on site. Unlikely to occur.
Satin Flycatcher ( <i>Myiagra cyanoleuca</i> )	0	-	M	<a href="http://birdlife.org.au/bird-profile/Satin-Flycatcher">http://birdlife.org.au/bird-profile/Satin-Flycatcher</a>	Broadly suitable habitat occurs on site. <b>Low chance of occurrence.</b>
Black-faced Monarch ( <i>Monarcha melanopsis</i> )	1	-	M	<a href="http://www.birdlife.org.au/bird-profile/black-faced-monarch">http://www.birdlife.org.au/bird-profile/black-faced-monarch</a>	Broadly suitable habitat occurs on site. <b>Low chance of occurrence.</b>
Yellow Wagtail ( <i>Motacilla flava</i> )	0	-	M	<a href="http://www.birdlife.org/datazone/speciesfactsheet.php?id=8411">http://www.birdlife.org/datazone/speciesfactsheet.php?id=8411</a>	No suitable habitat on site. Unlikely to occur.
Oriental Cuckoo ( <i>Cuculus optatus</i> )	0	-	M	<a href="https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=710">https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=710</a>	Broadly suitable habitat on site. <b>Low chance of occurrence.</b>
<b>Mammalia</b>					
Northern Quoll ( <i>Dasyurus hallucatus</i> )	0	-	E	<a href="http://www.wildlife.org.au/wildlife/speciesprofile/mammals/northern_quoll.html">http://www.wildlife.org.au/wildlife/speciesprofile/mammals/northern_quoll.html</a>	Site may provide generic foraging and denning habitat, however disturbance history of site and general area, presence of feral predators, coupled with lack of records would significantly reduce potential. Unlikely to occur.
Bridled Nail-tail Wallaby ( <i>Onychogalea fraenata</i> )	0	E	E	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=239">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=239</a>	Site habitat generally unsuitable and beyond known distribution. Unlikely to occur.



Species	No. of Records	NC Act	EPBC Act	Link to Profile	Likelihood of Occurrence
Grey-headed Flying Fox ( <i>Pteropus poliocephalus</i> )	0	-	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=186">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=186</a>	Site contains a generic nectar foraging resource; however, no potential roosting habitat occurs in the study site or adjacent. There are no local records of this species and it has not been recorded on MCPL lands to date. The nearest database record for this species is located approximately 200 km east of the study site in Rockhampton (ALA 2020). Unlikely to occur.
South-eastern Long-eared Bat ( <i>Nyctophilus corbeni</i> )	0	V	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83395">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83395</a>	Site contains generic potential foraging habitat for this species, however no preferred foraging habitats are present. Not detected on site during targeted surveys, or during previous surveys on MCPL land. Expert advice suggests that the site is beyond the known distribution of this species (Greg Ford pers comm.). Unlikely to occur.
Large-eared Pied Bat ( <i>Chalinolobus dwyeri</i> )	0	V	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=183">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=183</a>	Site contains generic potential foraging habitat for this species, however the study area is beyond the known range of the species. Unlikely to occur.
Ghost Bat ( <i>Macroderma gigas</i> )	0	E	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=174">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=174</a>	Site unlikely to comprise suitable and no caves or mine tunnels which offer roosting habitat are known to occur in the study area. Unlikely to occur.
<b>Reptilia</b>					
Ornamental Snake ( <i>Denisonia maculata</i> )	1	V	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1193">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1193</a>	Recorded 600 m to the north of the study in 2010. Not found in the study area or during this or previous surveys by Biodiversity Australia despite targeted searches. The site contains some preferred Brigalow and gilgai habitats. However, these habitats have been disturbed as a result of cattle grazing and weed invasion. <b>Low to fair chance of occurrence.</b>
Yakka Skink ( <i>Egernia rugosa</i> )	0	V	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1420">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1420</a>	Site contains broadly suitable vegetation associations and habitat components for this species however it has not been recorded on site despite targeted surveys or on MCPL lands during previous surveys. Unlikely to occur.



Species	No. of Records	NC Act	EPBC Act	Link to Profile	Likelihood of Occurrence
Golden-tailed Gecko ( <i>Strophurus taenicauda</i> )	0	NT	-	<a href="https://www.ehp.qld.gov.au/wildlife/threatened-species/near-threatened/goldentailed_gecko.html">https://www.ehp.qld.gov.au/wildlife/threatened-species/near-threatened/goldentailed_gecko.html</a>	Site contains broadly suitable vegetation associations and habitat components for this species however it has not been recorded on MCPL lands during previous surveys. Disturbance history of the locality and presence of feral predators would also reduce potential to occur. Unlikely to occur.
Dunmall's Snake ( <i>Furina dunmali</i> )	0	V	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59254">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59254</a>	Some potential habitat occurs on site however no local records and not recorded on MCPL lands to date. Disturbance history, local fragmentation and modification of surrounding habitats would also reduce potential to occur. Unlikely to occur.
Collared Delma ( <i>Delma torquata</i> )	0	V	V	<a href="http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656">http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656</a>	As for Dunmall's Snake. Unlikely to occur.
Common Death Adder ( <i>Acanthophis antarcticus</i> )	0	V	-	<a href="https://www.ehp.qld.gov.au/wildlife/animals-az/common_death_adder.html">https://www.ehp.qld.gov.au/wildlife/animals-az/common_death_adder.html</a>	No typical or preferred habitat for this species is present on site and no local records. Unlikely to occur.
Southern Snapping Turtle ( <i>Eseya albagula</i> )	0	E	CE	<a href="https://www.ehp.qld.gov.au/wildlife/animals-az/whitethroated_snapping_turtle.html">https://www.ehp.qld.gov.au/wildlife/animals-az/whitethroated_snapping_turtle.html</a>	No suitable habitat occurs on the site or adjacent. Unlikely to occur.
Retro Slider ( <i>Lerista allanae</i> )	0	E	E	<a href="https://www.ehp.qld.gov.au/wildlife/animals-az/allans_lerista.html">https://www.ehp.qld.gov.au/wildlife/animals-az/allans_lerista.html</a>	No suitable habitat occurs on the site or adjacent. Unlikely to occur.
Fitzroy River Turtle ( <i>Rheodytes leukops</i> )	0	V	V	<a href="https://www.ehp.qld.gov.au/wildlife/animals-az/fitzroy_river_turtle.html">https://www.ehp.qld.gov.au/wildlife/animals-az/fitzroy_river_turtle.html</a>	No suitable habitat occurs on the site or adjacent. Unlikely to occur.
Key: Critically Endangered (CE), Endangered (E), Vulnerable (V), Near Threatened (NT), Migratory (M).					



## A-2 Site Flora Species List

Table 33: Comprehensive flora list

Common Name	Scientific Name	Frequency
<b>Canopy Trees</b>		
Brigalow	<i>Acacia harpophylla</i>	U
Clarkson's Bloodwood	<i>Corymbia clarksoniana</i>	O
Ghost Gum	<i>Corymbia dallachiana</i>	R
Moreton Bay Ash	<i>Corymbia tessellaris</i>	C
Brown Bloodwood	<i>Corymbia trachyphloia</i>	R
Reid River Box	<i>Eucalyptus brownii</i>	R
Dawson's Gum	<i>Eucalyptus cambageana</i>	U
Narrow-leaved Ironbark	<i>Eucalyptus crebra</i>	U
Poplar Box	<i>Eucalyptus populnea</i>	D
Queensland Blue Gum	<i>Eucalyptus tereticornis</i>	C
Weeping Paperbark	<i>Melaleuca leucadendra</i>	R
<b>Small Trees and Shrubs</b>		
Chalky Wattle	<i>Acacia cretata</i>	R
Ironwood	<i>Acacia excelsa</i>	U
Mimosa Bush	<i>Acacia farnesiana*</i>	U
Native Willow	<i>Acacia salicina</i>	O
Lancewood	<i>Acacia shirleyi</i>	O
Red Ash	<i>Alphitonia excelsa</i>	U
Bitter Bark	<i>Alstonia constricta</i>	U
Dead Finish	<i>Archidendropsis basaltica</i>	U
Whitewood	<i>Atalaya hemiglauca</i>	O
Coffee Bush	<i>Breynia oblongifolia</i>	O
Wild Orange	<i>Capparis canescens</i>	O
Nepine	<i>Capparis lasiantha</i>	C
-	<i>Capparis loranthifolia</i>	C
Wild Orange	<i>Capparis mitchellii</i>	U
Currant Bush	<i>Carissa ovata</i>	C
Leichardt Bean	<i>Cassia brewsteri</i>	C
River Oak	<i>Casuarina cunninghamiana</i>	U
Limebush	<i>Citrus glauca</i>	R
Lollybush	<i>Clerodendrum floribundum</i>	O
Medicine Bush	<i>Coelospermum reticulatum</i>	R
-	<i>Denhamia cunninghamii</i>	R
Sticky Hop Bush	<i>Dodonaea viscosa</i>	O
Ellangowan Poison Bush	<i>Eremophila deserti</i>	O



Common Name	Scientific Name	Frequency
False Sandalwood	<i>Eremophila mitchellii</i>	O
Turkey Bush	<i>Erythroxylum australe</i>	U
Scrub Leopardwood	<i>Flindersia dissosperma</i>	U
Sandpaper Fig	<i>Ficus opposita</i>	U
Wilga	<i>Geijera parviflora</i>	O
Silver Oak	<i>Grevillea parallela</i>	U
Beefwood	<i>Grevillea striata</i>	U
Dysentery Bush	<i>Grewia latifolia</i>	C
Bootlace Oak	<i>Hakea lorea</i>	O
Harrisia Cactus	<i>Harrisia martini*</i>	R
Queensland Ebony	<i>Lysiphyllum carronii</i>	R
Black Tea Tree	<i>Melaleuca bracteata</i>	R
White Cedar	<i>Melia azaderach</i>	R
Western Boobialla	<i>Myoporum montanum</i>	
Prickly Pear	<i>Opuntia stricta*</i>	U
Velvet Tree Pear	<i>Opuntia tomentosa*</i>	U
Emu Apple	<i>Owenia acidula</i>	R
Quinine Tree	<i>Petalostigma pubescens</i>	U
-	<i>Psydrax attenuata</i>	U
Castor Oil Plant	<i>Ricinus communis*</i>	U
Sandalwood	<i>Santalum lanceolatum</i>	U
Potato Bush	<i>Solanum ellipticum</i>	U
Bead Bush	<i>Spartothamnella juncea</i>	R
Yellow-wood	<i>Terminalia oblongata</i>	R
Vine Tree	<i>Ventilago viminalis</i>	U
<b>Grasses</b>		
Cockatoo Grass	<i>Alloteropsis semialata</i>	U
Hooky Grass	<i>Ancistrachne uncinulata</i>	
Dark Wiregrass	<i>Aristida calycina</i>	O
Bunched Kerosene Grass	<i>Aristida contorta</i>	U
Jericho Wiregrass	<i>Aristida jerichoensis</i>	O
Purple Wire-grass	<i>Aristida personata</i>	U
Forest Blue Grass	<i>Bothriochloa bladhii</i>	U
Pitted Bluegrass	<i>Bothriochloa decipiens</i>	U
Tableland Couch	<i>Calyptochloa gracillima</i>	U
Buffel Grass	<i>Cenchrus ciliaris*</i>	D
Slender Chloris	<i>Chloris divaricata</i>	O
Rhodes Grass	<i>Chloris gayana*</i>	U
Windmill Grass	<i>Chloris truncata</i>	C



Common Name	Scientific Name	Frequency
Golden Beard Grass	<i>Chrysopogon fallax</i>	U
Barbed Wire Grass	<i>Cymbopogon refractus</i>	U
Couch Grass	<i>Cynodon dactylon</i>	O
Queensland Bluegrass	<i>Dichanthium sericeum</i>	C
Umbrella Grass	<i>Digitaria divaricatissima</i>	U
-	<i>Enteropogon acicularis</i>	U
Wiry Panic	<i>Entolasia stricta</i>	R
Brown's Lovegrass	<i>Eragrostis brownii</i>	U
Clustered Lovegrass	<i>Eragrostis elongata</i>	U
Purple Lovegrass	<i>Eragrostis lacunaria</i>	U
Silky Browntop	<i>Eulalia aurea</i>	U
Black Speargrass	<i>Heteropogon contortus</i>	O
Swamp Ricegrass	<i>Leersia hexandra</i>	U
Green Panic	<i>Megathyrsus maximus*</i>	C
Red Natal Grass	<i>Melinis repens*</i>	C
Native Millet	<i>Panicum decompositum</i>	O
Hairy Panic	<i>Panicum effusum</i>	O
Yabila Grass	<i>Panicum queenslandicum</i>	U
Brigalow Grass	<i>Paspalidium caespitosum</i>	U
-	<i>Paspalidium distans</i>	U
Freshwater Couch	<i>Paspalum distichum</i>	R
Vasey Grass	<i>Paspalum urvillei</i>	O
Comet Grass	<i>Perotis rara</i>	U
Fairy Grass	<i>Sporobolus caroli</i>	R
Kangaroo Grass	<i>Themeda triandra</i>	R
Sabi Grass	<i>Urochloa mosambicensis*</i>	D
<b>Groundcovers</b>		
Chaff Flower	<i>Achyranthes aspera</i>	U
Khaki Weed	<i>Alternanthera pungens*</i>	U
-	<i>Alternanthera sp.</i>	R
Prickly Poppy	<i>Argemone ochroleuca</i>	U
Cobbler's Pegs	<i>Bidens pilosa*</i>	O
Blue Trumpet	<i>Brunoniella australis</i>	C
Mother of Millions	<i>Bryophyllum delagoense*</i>	U
-	<i>Calotis sp.</i>	U
Yellow Buttons	<i>Chrysocephalum apiculatum</i>	C
-	<i>Commelina cyanea</i>	O
Native Wandering Jew	<i>Commelina diffusa</i>	O
Scurvy Grass	<i>Commelina ensifolia</i>	U



Common Name	Scientific Name	Frequency
Darling Lily	<i>Crinum flaccidum</i>	U
Gambia Pea	<i>Crotalaria goreensis*</i>	O
Yellow Rattlepod	<i>Crotalaria mitchellii</i>	O
Ruby Saltbush	<i>Enchylaena tomentosa</i>	U
Winter Apple	<i>Eremophila debilis</i>	O
Tropical Speedwell	<i>Evolvulus alsinoides</i>	C
Gomphrena Weed	<i>Gomphrena celosioides</i>	O
-	<i>Goodenia rotundifolia</i>	U
Slender Violet-bush	<i>Hybanthus monopetalus</i>	U
Narrow-leaved Indigo	<i>Indigofera linifolia</i>	U
Spiny Matrush	<i>Lomandra longifolia</i>	O
Wattle Matrush	<i>Lomandra filiformis</i>	U
Phasey Bean	<i>Macroptilium lathryodes</i>	C
-	<i>Oxalis perennans</i>	U
Hairy Pigweed	<i>Portucaca pilosa</i>	O
Pigweed	<i>Portulaca oleracea</i>	C
-	<i>Rostellularia adscendens</i>	O
Soft Roly-poly	<i>Salsola australis</i>	O
-	<i>Sauropus hirtellus</i>	U
Sesbania Pea	<i>Sesbania cannabina</i>	O
-	<i>Sida cordifolia</i>	O
Fine Sida	<i>Sida filiformis</i>	O
Flannel Weed	<i>Sida hackettiana*</i>	C
Paddy's Lucerne	<i>Sida rhombifolia*</i>	U
Spiked Sida	<i>Sida subspicata</i>	C
Grass Trigger Plant	<i>Stylidium graminifolium</i>	U
Stylo	<i>Stylosanthes scabra*</i>	D
Caltrop	<i>Tribulus terrestris</i>	O
Australian Bluebell	<i>Wahlenbergia gracilis</i>	U
<b>Climbers and Orchids</b>		
Headache Vine	<i>Clematis glycinoides</i>	U
Pepper Vine	<i>Clematacissus opaca</i>	U
Tiger Orchid	<i>Cymbidium canaliculatum</i>	U
Caustic Vine	<i>Cynanchum viminale</i>	U
Siratro	<i>Macroptilium atropurpureum*</i>	O
Bush Banana	<i>Marsdenia viridiflora</i>	U
Morning Glory	<i>Ipomoea indica</i>	O
Red Passionflower	<i>Passiflora aurantia</i>	U
Native Tick Trefoil	<i>Rhynchosia australis</i>	U



Common Name	Scientific Name	Frequency
<b>Aquatics</b>		
Giant Sedge	<i>Cyperus exaltatus</i>	U
-	<i>Cyperus sp.</i>	U
-	<i>Cyperus gracilis</i>	
Common Fringe-Rush	<i>Fimbristylis dichotoma</i>	C
-	<i>Juncus usitatus</i>	U
Water Primrose	<i>Ludwigia peploides</i>	O
Bog Hyacinth	<i>Monochoria cyanea</i>	U
Water Snowflake	<i>Nymphoides indica</i>	R
Swamp Lily	<i>Ottelia ovalifolia</i>	U
Key: Dominant (D), Common (C), Occasional (O), Uncommon (U), Rare (R), Exotic Species (*).		



## A-3 Site Fauna Species List

Table 34: Comprehensive fauna list

Common Name	Scientific Name	Detection Method
<b>Amphibia</b>		
Rough-collared Frog	<i>Cyclorana verrucosa</i>	OBS
Desert Tree Frog	<i>Litoria rubella</i>	HC
Cane Toad*	<i>Rhinella marina*</i>	OBS
<b>Aves</b>		
Indian Mynah	<i>Acridotheres tristis</i>	OBS
Pacific Black Duck	<i>Anas superciliosa</i>	OBS
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	OBS, HC
Wedge-tailed Eagle	<i>Aquila audax</i>	OBS
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	OBS, HC
Pheasant Coucal	<i>Centropus phasianinus</i>	OBS, HC
Wood Duck	<i>Chenonetta jubata</i>	OBS
Golden-headed Cisticola	<i>Cisticola exilis</i>	HC
Grey Strike-thrush	<i>Colluricincla harmonica</i>	OBS, HC
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	OBS, HC
Torresian Crow	<i>Corvus orru*</i>	HC
Pied Butcherbird	<i>Cracticus nigrogularis</i>	OBS, HC
Black Swan	<i>Cygnus atratus</i>	OBS
Blue-winged Kookaburra	<i>Dacelo leachii</i>	HC
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	OBS
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>	OBS, HC
Eastern Koel	<i>Eudynamys orientalis</i>	HC
Dollar Bird	<i>Eurystomus orientalis</i>	OBS, HC
Nankeen Kestrel	<i>Falco cenchroides</i>	OBS
Australian Hobby	<i>Falco longipennis</i>	OBS
<b>Squatter Pigeon (southern subspecies)</b>	<b><i>Geophaps scripta scripta</i></b>	<b>OBS</b>
Bar-shouldered Dove	<i>Geopelia humeralis</i>	OBS
Peaceful Dove	<i>Geopelia placida</i>	OBS
White-throated Gerygone	<i>Gerygone albogularis</i>	HC
Magpie Lark	<i>Grallina cyanoleuca</i>	OBS
Australian Magpie	<i>Gymnorhina tibicen</i>	HC
Whistling Kite	<i>Haliastur sphenurus</i>	OBS
Singing Honeyeater	<i>Lichenostomus virescens</i>	OBS
Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>	OBS
Superb Fairy Wren	<i>Malurus cyaneus</i>	OBS
Variegated Fairy Wren	<i>Malurus lamberti</i>	OBS



Red-backed Fairy-wren	<i>Malurus melanocephalus</i>	OBS
Noisy Miner	<i>Manorina melanocephala</i>	OBS, HC
Rainbow Bee-eater	<i>Merops ornatus</i>	HC
White-naped Honeyeater	<i>Melithreptus lunatus</i>	HC
Black Kite	<i>Milvus migrans</i>	OBS
Southern Boobook	<i>Ninox boobook</i>	OBS
Crested Pigeon	<i>Ocyphaps lophotes</i>	OBS
Rufous Whistler	<i>Pachycephala rufiventris</i>	OBS
Striated Pardalote	<i>Pardalotus striatus</i>	OBS, HC
Little Friarbird	<i>Philemon citreogularis</i>	OBS, HC
Noisy Friarbird	<i>Philemon corniculatus</i>	OBS
Pale-headed Rosella	<i>Platycercus adscitus</i>	OBS
Tawny Frogmouth	<i>Podargus strigoides</i>	OBS
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	HC
Willie Wagtail	<i>Rhipidura leucophrys</i>	OBS
Weebill	<i>Smicromnis brevirostris</i>	HC
Double-barred Finch	<i>Taeniopygia bichenovii</i>	OBS
Crested Tern <sup>1</sup>	<i>Thalasseus bergii</i> <sup>‡</sup>	OBS
Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>	OBS
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	OBS, HC
Masked lapwing	<i>Vanellus miles</i>	OBS
<b>Mammalia</b>		
Rufous Bettong	<i>Aepyprymnus rufescens</i>	OBS, CAM
Wild Dog*	<i>Canis lupus familiaris</i> *	TR
Northern Freetail Bat	<i>Chaerephon jobensis</i>	ANA
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	ANA
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	ANA
Little Pied Bat	<i>Chalinolobus picatus</i>	ANA
Feral Cat*	<i>Felis catus</i> *	TR
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	OBS
Little Bent-wing Bat	<i>Miniopterus australis</i>	ANA
Long-eared Bat	<i>Nyctophilus sp.</i>	ANA
European Rabbit*	<i>Oryctolagus cuniculus</i> *	OBS
Northern Free-tailed Bat	<i>Ozimops lumsdenae</i>	ANA
Eastern Free-tailed Bat	<i>Ozimops ridei</i>	ANA
<b>Greater Glider</b>	<b><i>Petauroides volans</i></b>	<b>OBS</b>
Sugar Glider	<i>Petaurus breviceps</i>	OBS
Squirrel Glider	<i>Petaurus norfolcensis</i>	OBS
<b>Koala</b>	<b><i>Phascolarctos cinereus</i></b>	<b>SC</b>
Yellow-bellied Sheath-tailed Bat	<i>Saccolaimus flaviventris</i>	ANA



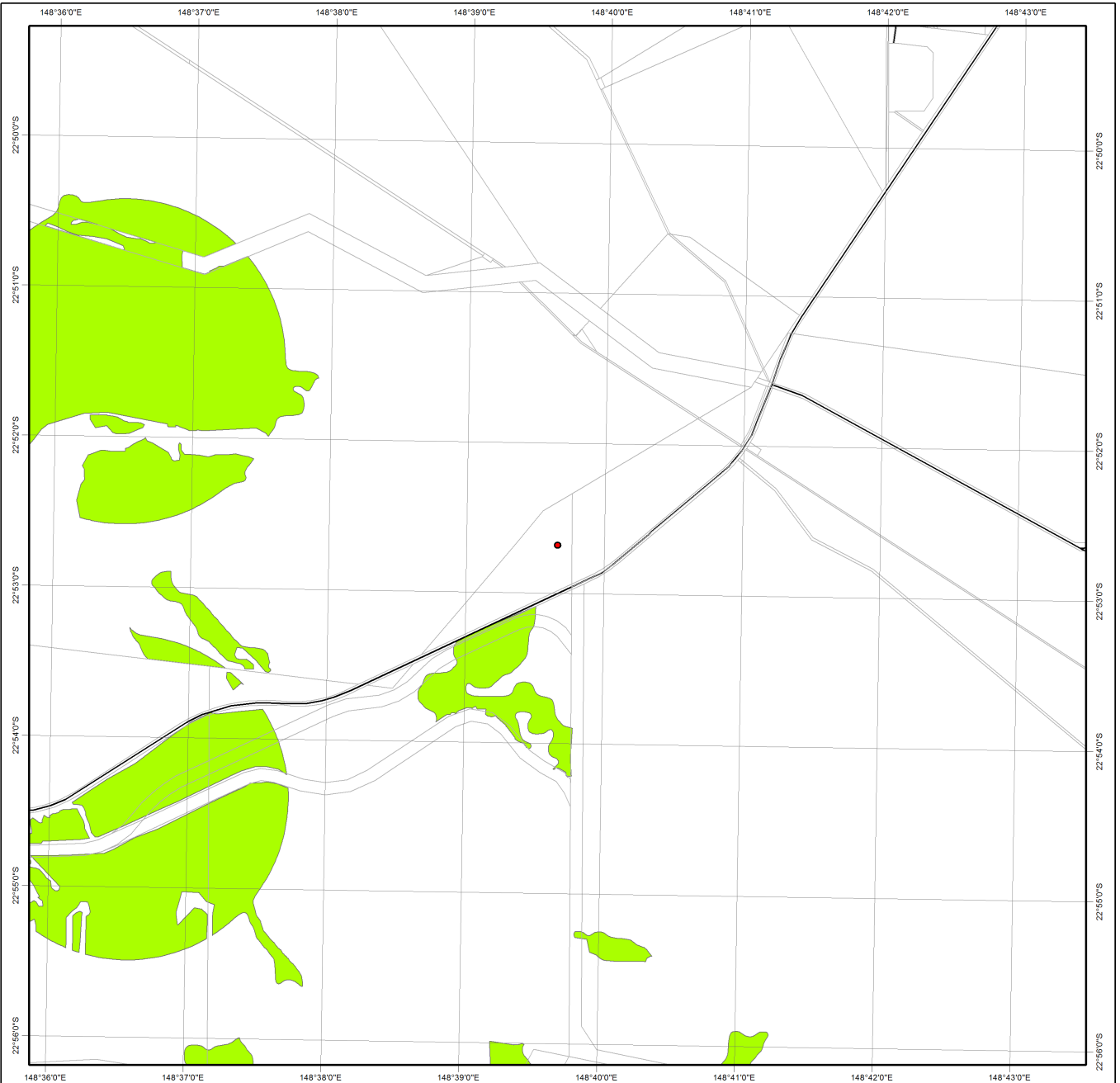
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	ANA
Little Broad-nosed Bat	<i>Scotorepens greyii</i>	ANA
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	OBS
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	OBS
Inland Forest Bat	<i>Vespadelus baverstocki</i>	ANA
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	ANA
<b>Reptilia</b>		
Lined Rainbow Skink	<i>Carlia jarnoldae</i>	OBS
Fence Skink	<i>Cryptoblepharus virgatus</i>	OBS
Copper-tailed Skink	<i>Ctenotus taeniolatus</i>	OBS
Chain-backed Dtellia	<i>Gehrya catenata</i>	OBS
Bynoe's Gecko	<i>Heteronotia binoei</i>	OBS
Ocellated Velvet Gecko	<i>Oedura monilis</i>	OBS
Eastern Brown Snake	<i>Pseudonaja textilis</i>	OBS
Key: Observed (OBS), Heard Call (HC), PIR Camera (CAM), Scat (SC), Anabat Recording (ANA), Tracks (TR), Introduced Species (*), Threatened Species under EPBC Act and/or NC Act (bold), Migratory Species ( <sup>1</sup> ).		



## **A-4 Database Search Results**

### A-4-1 High Risk Vegetation Trigger Report





### Protected Plants Flora Survey Trigger Map

#### Legend

- Coordinates
- High risk area
- Cadastral line
- Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets



This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at [palm@ehp.qld.gov.au](mailto:palm@ehp.qld.gov.au)



This product is projected into:  
GDA 1994 Queensland Albers

**Disclaimer:**  
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

# Protected plants flora survey trigger map

The protected plants flora survey trigger map identifies 'high risk areas' where endangered, vulnerable or near threatened plants are known to exist or are likely to exist. Under the *Nature Conservation Act 1992* (the Act) it is an offence to clear protected plants that are 'in the wild' unless you are authorised or the clearing is exempt, for more information see [section 89](#) of the Act.

Please see the Department of Environment and Science webpage on the [clearing of protected plants](#) for information on what exemptions may apply in your circumstances, whether you may need to undertake a flora survey, and whether you may need a protected plants clearing permit.

## Updates to the data informing the flora survey trigger map

The flora survey trigger map will be reviewed, and updated if necessary, at least every 12 months to ensure the map reflects the most up-to-date and accurate data available.

## Species information

Please note that flora survey trigger maps do not identify species associated with 'high risk areas'. While some species information may be publicly available, for example via the [Queensland Spatial Catalogue](#), the Department of Environment and Science does not provide species information on request. Regardless of whether species information is available for a particular high risk area, clearing plants in a high risk area may require a flora survey and/or clearing permit. Please see the Department of Environment and Science webpage on the [clearing of protected plants](#) for more information.

## A-4-2 Wildlife Online





# Queensland Government

## Wildlife Online Extract

Search Criteria: Species List for a Specified Point  
Species: All  
Type: All  
Status: Rare and threatened species  
Records: All  
Date: All  
Latitude: -22.878  
Longitude: 148.665  
Distance: 10  
Email: will.steggall@biodiversityaust.com.au  
Date submitted: Tuesday 10 Mar 2020 15:53:24  
Date extracted: Tuesday 10 Mar 2020 16:00:02

The number of records retrieved = 3

### **Disclaimer**

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	mammals	Phascolarctidae	<i>Phascolarctos cinereus</i>	koala		V	V	1
animals	mammals	Pseudocheiridae	<i>Petauroides volans</i>	greater glider		V	V	3
plants	land plants	Apocynaceae	<i>Cerbera dumicola</i>			NT		2/2

#### CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.

A-4-3 Regional Ecosystem Report





**Queensland** Government

**Department of Environment and Science**

Environmental Reports

## **Regional Ecosystems**

### ***Biodiversity Status***

For the selected area of interest  
Longitude: 148.665 Latitude: -22.878 with 2 kilometre radius

## Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

### Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Natural Resources, Mines and Energy website

<https://www.dnrme.qld.gov.au/>

Please direct queries about these reports to: Queensland.Herbarium@dsiti.qld.gov.au

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## Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

**Table 1: Area of interest details: Longitude: 148.665 Latitude: -22.878 with 2 kilometre radius**

Size (ha)	1,256.55
Local Government(s)	Isaac Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Isaac - Comet Downs
Catchment(s)	Fitzroy

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

**Table 2: Summary table, biodiversity status of regional ecosystems within the AOI**

Biodiversity Status	Area (Ha)	% of AOI
Endangered	45.69	3.64
Of concern	134.32	10.69
No concern at present	61.52	4.9
Total remnant vegetation	241.53	19.22

Refer to **Map 2** for further information.

# Regional Ecosystems

## 1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2017) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Natural Resources, Mines and Energy website.

<https://www.dnrme.qld.gov.au/>

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss\*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare\*\* regional ecosystem subject to a threatening process.\*\*\*

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.\*\*\*\*

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

*\*Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

*\*\*Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

*\*\*\*Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

\*\*\*\*Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.

## 2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

**Table 3: Remnant regional ecosystems, description and status within the AOI**

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	20.13	1.6
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	35.31	2.81
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	37.18	2.96
11.3.7	Corymbia spp. woodland on alluvial plains	Of concern	13.88	1.1
11.4.9b	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	25.56	2.03
11.5.18	Micromyrtus capricornia open shrubland on Cainozoic sand plains and/or remnant surfaces	Of concern	3.41	0.27
11.5.2	Eucalyptus crebra, Corymbia spp., with E. moluccana woodland on lower slopes of Cainozoic sand plains and/or remnant surfaces	No concern at present	1.92	0.15
11.5.3	Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces	No concern at present	1.43	0.11
11.5.9b	Eucalyptus crebra and other Eucalyptus spp. and Corymbia spp. woodland on Cainozoic sand plains and/or remnant surfaces	No concern at present	5.12	0.41
11.7.1	Acacia harpophylla and/or Casuarina cristata and Eucalyptus thozetiana or E. microcarpa woodland on lower scarp slopes on Cainozoic lateritic duricrust	Of concern	44.54	3.54
11.7.2	Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	No concern at present	53.05	4.22
non-rem	None	None	1,015.02	80.78

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

**Table 4** provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

**Table 4: Remnant regional ecosystems within the AOI, additional information**

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.3.1	Pre-clearing 781000 ha; Remnant 2017 78000 ha	25a	None	Low
11.3.2	Pre-clearing 1926000 ha; Remnant 2017 506000 ha	17a	Contains palustrine wetland (e.g. in swales).	Low
11.3.25	Pre-clearing 795000 ha; Remnant 2017 512000 ha	16a	Riverine wetland or fringing riverine wetland.	Low
11.3.7	Pre-clearing 139000 ha; Remnant 2017 62000 ha	9e	None	Low
11.4.9b	Pre-clearing 999000 ha; Remnant 2017 90000 ha	25a	None	Low
11.5.18	Pre-clearing 7000 ha; Remnant 2017 4000 ha	29b	None	Medium
11.5.2	Pre-clearing 360000 ha; Remnant 2017 190000 ha	18b	None	Low
11.5.3	Pre-clearing 981000 ha; Remnant 2017 372000 ha	17a	None	Low
11.5.9b	Pre-clearing 365000 ha; Remnant 2017 238000 ha	18b	None	Low
11.7.1	Pre-clearing 201000 ha; Remnant 2017 78000 ha	25a	None	Low
11.7.2	Pre-clearing 565000 ha; Remnant 2017 366000 ha	24a	None	Low
non-rem	None	None	None	None

*Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.*

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

**Table 5: Remnant regional ecosystems within the AOI, special values**

Regional Ecosystem	Special Values
11.3.1	Habitat for threatened fauna species including painted honeyeater, <i>Grantiella picta</i> particularly in subregion 35 (Oliver et al. 2003).
11.3.2	Habitat for threatened flora species <i>Homopholis belsonii</i> .
11.3.25	Shown to be associated with a high fauna species richness in the Taroom area (Venz et al. 2002). Within parts of the Fitzroy catchment, this RE is known habitat for the threatened freshwater turtle <i>Rheodytes leukops</i> . Known to be important habitat for other riparian freshwater turtle species.
11.3.7	Habitat of the endangered northern hairy-nosed wombat, <i>Lasiorhinus krefftii</i> .
11.4.9b	Potential habitat for NCA listed species: <i>Cadellia pentastylis</i> , <i>Solanum adenophorum</i> , <i>Solanum dissectum</i> , <i>Solanum elachophyllum</i> , <i>Solanum johnsonianum</i> , <i>Xerothamnella herbacea</i>
11.5.18	None
11.5.2	Potential habitat for NCA listed species: <i>Acacia storyi</i>
11.5.3	Potential habitat for NCA listed species: <i>Sannantha brachypoda</i>

Regional Ecosystem	Special Values
11.5.9b	Potential habitat for NCA listed species: <i>Cerbera dumicola</i> , <i>Cossinia australiana</i> , <i>Cycas ophiolitica</i> , <i>Solanum elachophyllum</i>
11.7.1	Habitat for threatened plant species including <i>Cadellia pentastylis</i> .
11.7.2	Habitat for threatened plant species including <i>Acacia wardellii</i> .
non-rem	None

### 3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

<https://publications.qld.gov.au/dataset/redd/resource/>

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

**Table 6: Broad vegetation groups (1 million) within the AOI**

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	1,015.02	80.78
16a	Open forest and woodlands dominated by <i>Eucalyptus camaldulensis</i> (river red gum) (or <i>E. tereticornis</i> (blue gum)) and/or <i>E. coolabah</i> (coolabah) (or <i>E. microtheca</i> (coolabah)) fringing drainage lines. Associated species may include <i>Melaleuca</i> spp., <i>Corymbia tessellaris</i> (carbeen), <i>Angophora</i> spp., <i>Casuarina cunninghamiana</i> (riveroak). Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded. (land zone 3) (MGD, BRB, GUP, CHC, MUL, DEU, EIU, NWH, SEQ, [NET, WET]) (All bioregions except CYP and CQC)	37.18	2.96
17a	Woodlands dominated by <i>Eucalyptus populnea</i> (poplar box) (or <i>E. brownii</i> (Reid River box)) on alluvium, sand plains and footslopes of hills and ranges. (land zones 3, 5, 10, 9, 4, 11, 12, [8]) (BRB, MUL, DEU, MUL, EIU)	36.74	2.92
18b	Woodlands dominated <i>Eucalyptus crebra</i> (sens. lat.) (narrow-leaved red ironbark) frequently with <i>Corymbia</i> spp. or <i>Callitris</i> spp. on flat to undulating plains. (land zones 5, 3) (BRB, DEU, EIU, GUP, CYP)	7.04	0.56
24a	Low woodlands to tall shrublands dominated by <i>Acacia</i> spp. on residuals. Species include <i>A. shirleyi</i> (lancewood), <i>A. catenulata</i> (bendee), <i>A. microsperma</i> (bowyakka), <i>A. clivicola</i> , <i>A. sibirica</i> , <i>A. rhodoxylon</i> (rosewood) and <i>A. leptostachya</i> (Townsville wattle). (land zones 7, 10, 5, 12, 11, [9, 3]) (MUL, CHC, BRB, GUP, EIU, MGD, DEU, NWH, [CYP])	53.05	4.22
25a	Open forests to woodlands dominated by <i>Acacia harpophylla</i> (brigalow) sometimes with <i>Casuarina cristata</i> (belah) on heavy clay soils. Includes areas co-dominated with <i>A. cambagei</i> (gidgee) and/or emergent eucalypts (land zones 4, 9, 3, 11, 7, 12, [5, 8]) (BRB, MUL, MGD, DEU, [SEQ])	90.22	7.18

BVG (1 Million)	Description	Area (Ha)	% of AOI
29b	Open shrublands to open heaths in montane frequently rocky locations. (land zones 7, 12, 11, 5, 8, 10) (BRB, NWH, WET, CYP, EIU, SEQ, DEU, [NET, CQC])	3.41	0.27
9e	Open forests, woodlands and open woodlands dominated by <i>Corymbia clarksoniana</i> (grey bloodwood) (or <i>C. novoguineensis</i> or <i>C. intermedia</i> (pink bloodwood) or <i>C. polycarpa</i> (long-fruited bloodwood)) frequently with <i>Erythrophleum chlorostachys</i> (red ironwood) or <i>Eucalyptus platyphylla</i> (poplar gum) predominantly on coastal sandplains and alluvia. (land zones 3, 5, 2) (CYP, BRB, CQC, WET, EIU)	13.88	1.1

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

#### 4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

The descriptions are compiled using site survey data from the Queensland Herbarium's CORVEG database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2012 (PDF))\* section 3.3.1 of:

<https://publications.qld.gov.au/dataset/redd/resource/>

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

**Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available**

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.3.1	Available	Not currently available
11.3.2	Available	Not currently available
11.3.25	Available	Not currently available
11.3.7	Available	Not currently available
11.4.9b	Available	Not currently available
11.5.18	Available	Not currently available

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<b>Regional ecosystems mapped as within the AOI</b>	<b>Technical Descriptions</b>	<b>Biocondition Benchmarks</b>
11.5.2	Available	Not currently available
11.5.3	Available	Not currently available
11.5.9b	Available	Not currently available
11.7.1	Available	Not currently available
11.7.2	Available	Not currently available
non-rem	Not currently available	Not currently available

# Maps

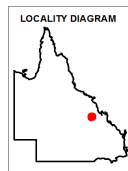
## Map 1 - Location



### Locality Map

#### Legend

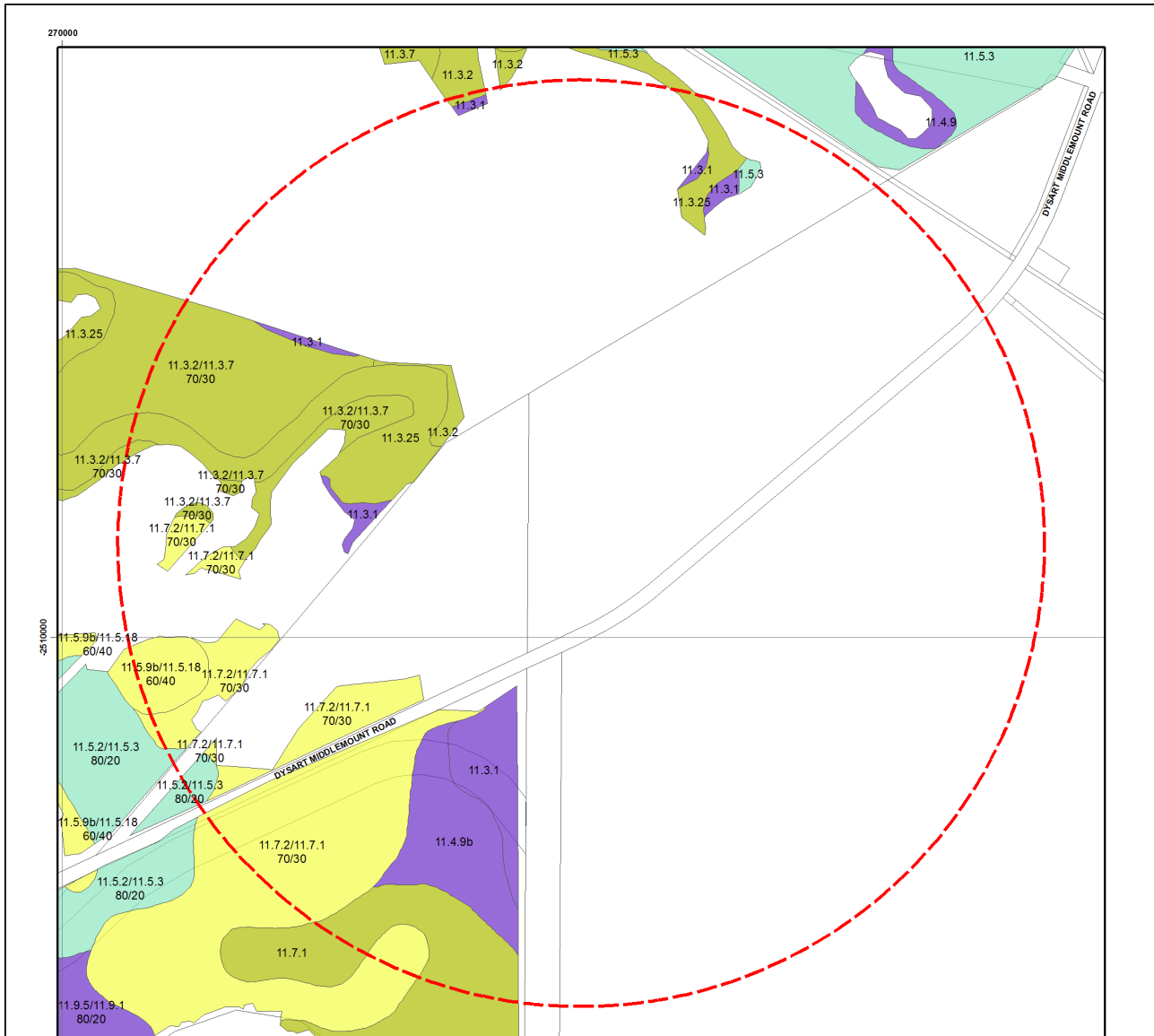
- 2 kilometre buffer
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



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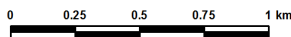
## Map 2 - Remnant 2017 regional ecosystems



### Remnant 2017 Regional Ecosystems

#### Biodiversity Status

- 2 kilometre buffer
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species, e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy. Non-remnant vegetation includes regrowth and disturbed native vegetation.





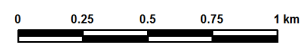
### Map 5 - Pre-clearing regional ecosystems by BVG (5M)



### Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

#### Broad Vegetation Groups BVG5M Description (BVG1M codes)

- 2 kilometre buffer
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries



This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.

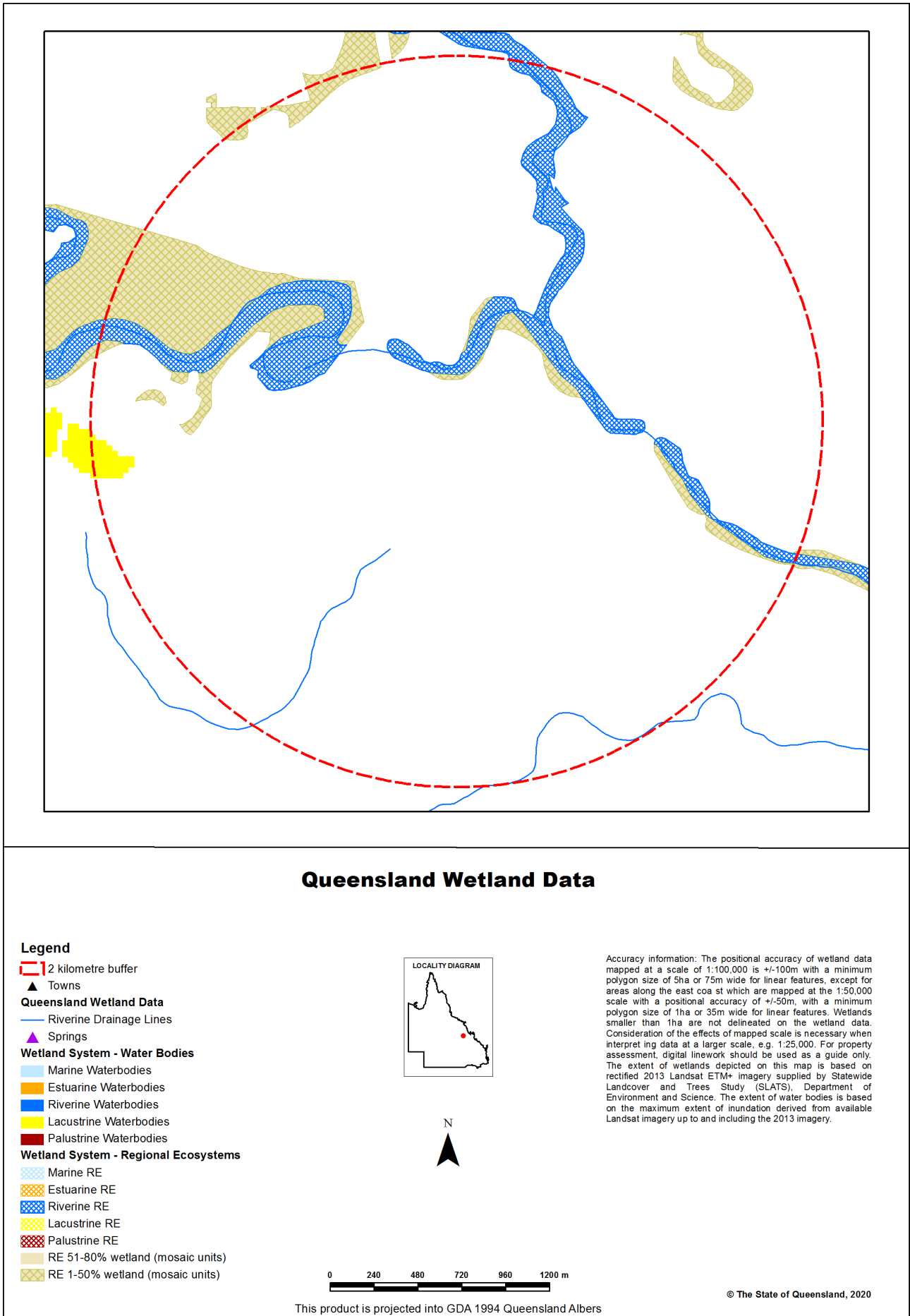
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem line work reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of line work is 100 metres.

Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".

Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

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### Map 6 - Wetlands and waterways



## Links and Other Information Sources

The Department of Environment and Science's Website -

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/>

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

The methodology for mapping regional ecosystems can be downloaded from:

<https://publications.qld.gov.au/dataset/redd/resource/>

Technical descriptions for regional ecosystems can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/>

Benchmarks can be obtained from:

<http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/>

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

<http://dds.information.qld.gov.au/dds/>

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

<http://www.dnrm.qld.gov.au/mapping-data/queensland-globe>

## References

Neldner, V.J., Niehus R.E., Wilson, B.A. McDonald, W.J.F., Ford, A.J. and Accad, A. (2017) The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 3.0. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts.

<https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086>

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S. and Butler, D.W. (2017) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 4.0. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts.

<https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4>

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

## Appendices

### Appendix 1 - Source Data

The dataset listed below is available for download from:

<http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/>

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

<http://dds.information.qld.gov.au/dds/>

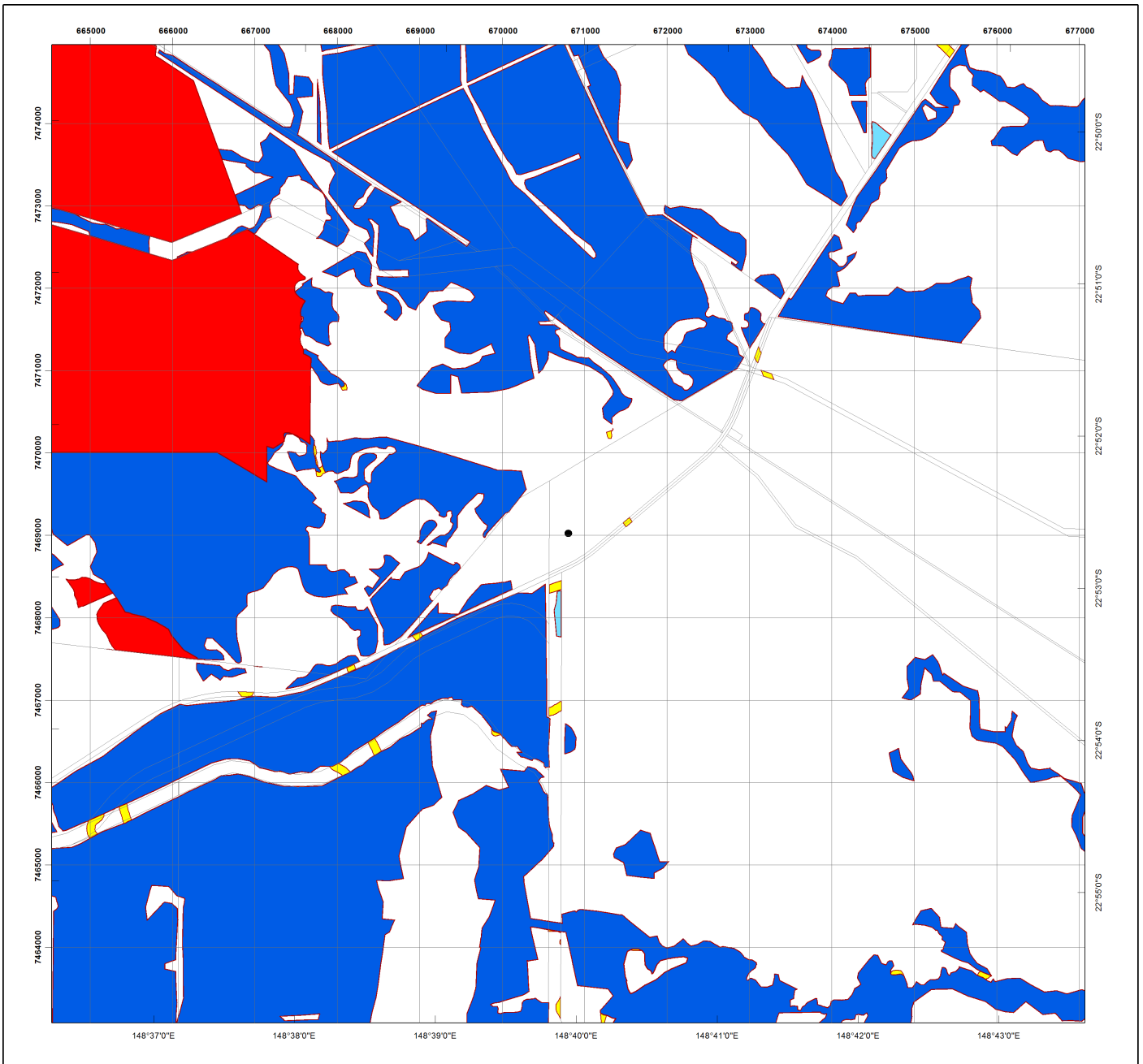
- Biodiversity status of pre-clearing and 2017 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

## Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- <i>Vegetation Management Act 1999</i>

A-4-4 Regulated Vegetation Report

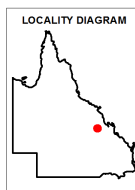




## Regulated Vegetation Management Map

### Legend

- Coordinates
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Area not categorised
- Other land parcel boundaries



This product is projected into:  
GDA 1994 MGA Zone 55

### Disclaimer:

While every care is taken to ensure the accuracy of this product, the Department of Natural Resources, Mines and Energy makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

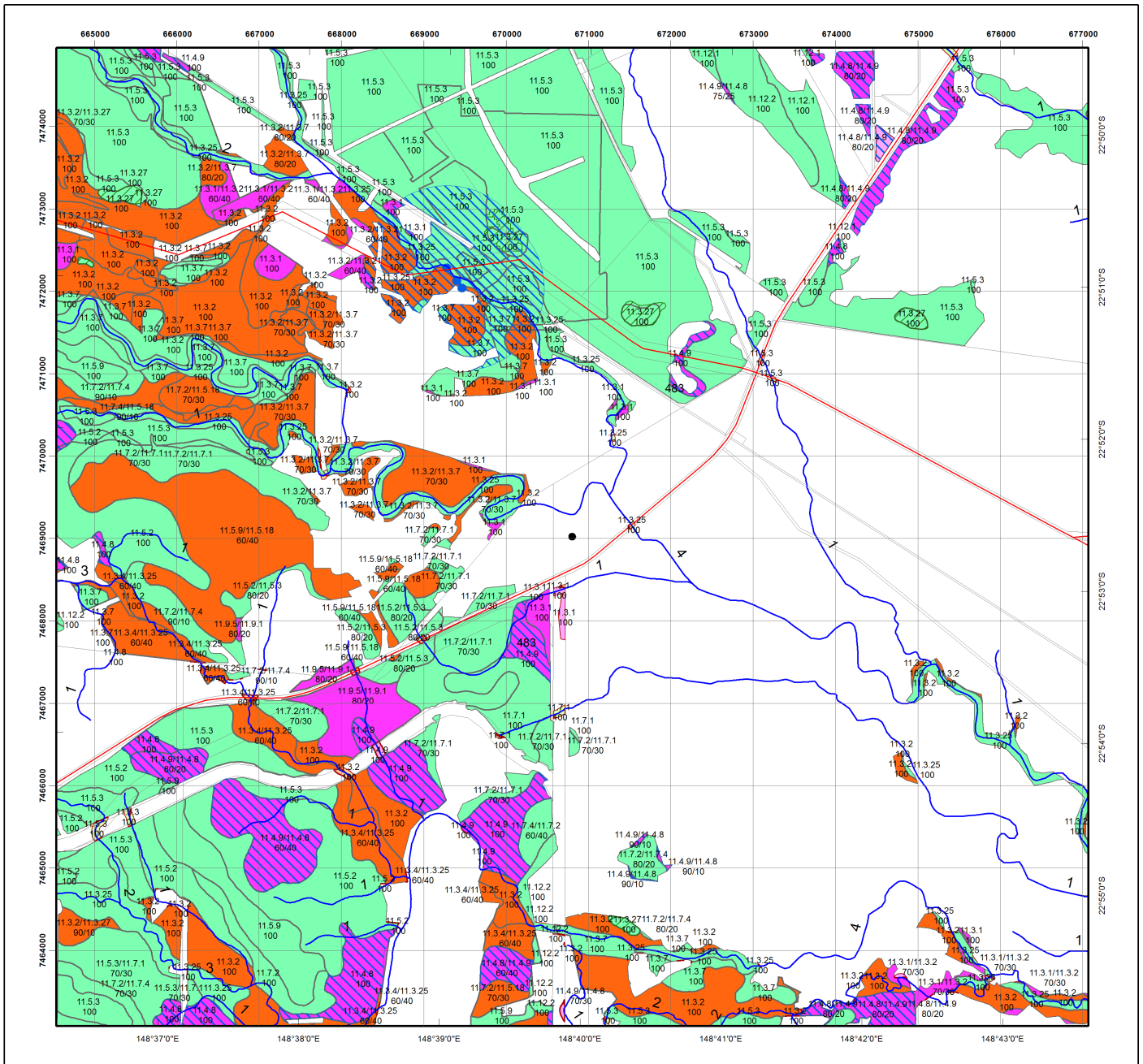
Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: [www.dnrme.qld.gov.au](http://www.dnrme.qld.gov.au) or contact the Department of Natural Resources, Mines and Energy.

Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at <http://www.information.qld.gov.au/>

Land parcel boundaries are provided as locational aid only.

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

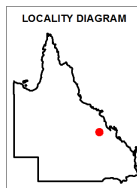




## Vegetation Management Supporting Map

### Legend

- Coordinates
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category A or B area under Section 20AH  
These areas are edged in yellow and filled with the remnant RE Status
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category C area under Section 20AI  
These areas are edged in purple and filled with the remnant RE Status
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map  
(Stream order shown as black number against stream where available)
- Roads
- National Parks, State Forest and other reserves
- Other land parcel boundaries



This product is projected into:  
GDA 1994 MGA Zone 55

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

#### Disclaimer:

While every care is taken to ensure the accuracy of this product, the Department of Natural Resources, Mines and Energy makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: [www.dnrme.qld.gov.au](http://www.dnrme.qld.gov.au) or contact the Department of Natural Resources, Mines and Energy.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at <http://www.information.qld.gov.au/>

Land parcel boundaries are provided as locational aid only.



## Vegetation Management Act 1999 - Extract from the essential habitat database

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - State Code 16: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Planning Act 2016*; and
- Accepted development vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Natural Resources, Mines and Energy website (<http://www.dnrme.qld.gov.au>) has more information on how the layer is applied under the State Development Assessment Provisions - State Code 16: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

- 1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or
- 2) in which the protected wildlife, at any stage of its life cycle, is located.

Protected wildlife includes endangered, vulnerable or near-threatened native wildlife prescribed under the *Nature Conservation Act 1992*.

### Essential habitat in Category A and/or Category B and/or Category C

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
483	<i>Denisonia maculata</i>	ornamental snake	V	Riparian woodland/open forest and shrub/woodland including Brigalow Acacia harpophylla; into drier habitats in summer.	100-450m.	Cracking clay with gilgai/soil crack microrelief and sandy loam substrates.	Near freshwater waterholes/creeks and low lying poorly drained areas that are frequently inundated by freshwater.

Label	Regional Ecosystem (mandatory unless otherwise specified)
483	10.3.2, 10.3.3, 10.3.4, 10.3.7, 10.3.13, 10.3.14, 10.3.15, 10.3.16, 10.3.27, 10.3.30, 10.3.31, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.4.6, 10.4.7, 10.4.8, 10.5.5, 10.9.1, 10.9.6, 10.9.7, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.9, 11.3.10, 11.3.12, 11.3.15, 11.3.21, 11.3.23, 11.3.24, 11.3.25, 11.3.27, 11.3.28, 11.3.31, 11.3.34, 11.3.37, 11.3.38, 11.3.40, 11.4.2, 11.4.3, 11.4.4, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.11, 11.5.2, 11.5.3, 11.5.16, 11.8.11, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.7, 11.9.11, 11.9.12, 11.9.14, 11.11.15, 11.12.6

A-4-5 Matters of National Significance Report





# EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 08/05/20 09:34:57

[Summary](#)

[Details](#)

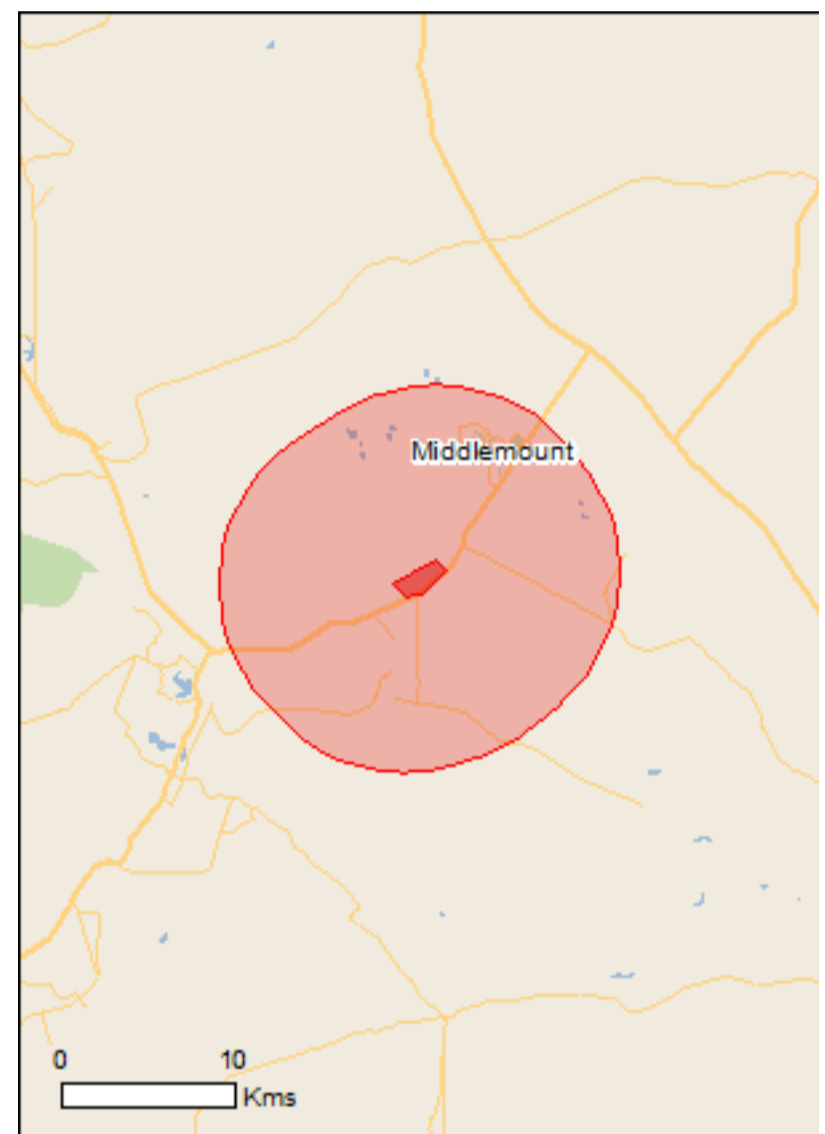
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

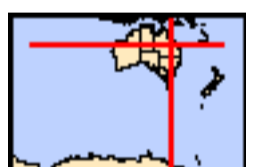
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

[Buffer: 10.0Km](#)



# Summary

## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	3
<a href="#">Listed Threatened Species:</a>	23
<a href="#">Listed Migratory Species:</a>	12

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	18
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	15
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Ecological Communities

[\[ Resource Information \]](#)

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

Name	Status	Type of Presence
<a href="#">Brigalow (Acacia harpophylla dominant and co-dominant)</a>	Endangered	Community known to occur within area
<a href="#">Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin</a>	Endangered	Community likely to occur within area
<a href="#">Poplar Box Grassy Woodland on Alluvial Plains</a>	Endangered	Community likely to occur within area

### Listed Threatened Species

[\[ Resource Information \]](#)

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Erythrotriorchis radiatus</a> Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Geophaps scripta scripta</a> Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Neochmia ruficauda ruficauda</a> Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
<a href="#">Poephila cincta cincta</a> Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Chalinolobus dwyeri</a> Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Nyctophilus corbeni</a> Corben's Long-eared Bat, South-eastern Long-	Vulnerable	Species or species

Name	Status	Type of Presence
<a href="#">Eared Bat [83395]</a>		habitat may occur within area
<a href="#">Petauroides volans</a> Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a> Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
<a href="#">Pteropus poliocephalus</a> Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
<b>Plants</b>		
<a href="#">Cadellia pentastylis</a> Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Dichanthium queenslandicum</a> King Blue-grass [5481]	Endangered	Species or species habitat may occur within area
<a href="#">Dichanthium setosum</a> bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
<b>Reptiles</b>		
<a href="#">Delma torquata</a> Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
<a href="#">Denisonia maculata</a> Ornamental Snake [1193]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Egernia rugosa</a> Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
<a href="#">Elseya albagula</a> Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Furina dunmali</a> Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
<a href="#">Lerista allanae</a> Allan's Lerista, Retro Slider [1378]	Endangered	Species or species habitat may occur within area
<a href="#">Rheodytes leukops</a> Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat likely to occur within area
<b>Listed Migratory Species</b> <a href="#">[ Resource Information ]</a>		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat may occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species	<a href="#">[ Resource Information ]</a>	
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Anseranas semipalmata</a> Magpie Goose [978]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Chrysococcyx osculans</a> Black-eared Cuckoo [705]		Species or species habitat may occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat may occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

## Extra Information

### Invasive Species [\[ Resource Information \]](#)

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

Name	Status	Type of Presence
<b>Birds</b>		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
<b>Frogs</b>		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
<b>Mammals</b>		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area

# Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

# Coordinates

-22.884111 148.65788,-22.877547 148.651357,-22.865369 148.673758,-22.871458 148.678479,-22.881739 148.66569,-22.884111 148.65788

# Acknowledgements

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

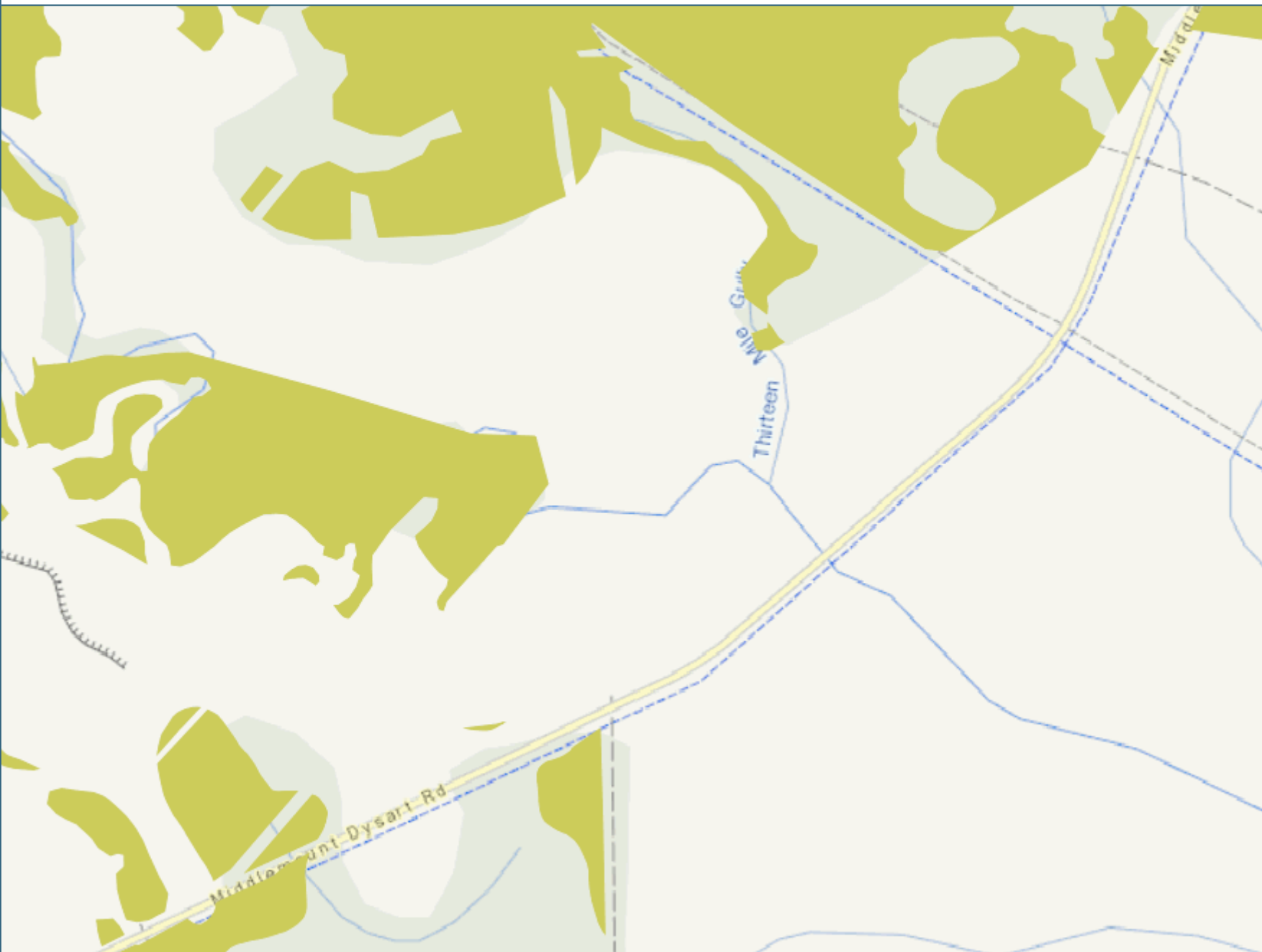
- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
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- [-State Herbarium of South Australia](#)
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- [-Western Australian Herbarium](#)
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- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

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

Please feel free to provide feedback via the [Contact Us](#) page.

A-4-6 Groundwater Dependant Ecosystems





Terrestrial GDE (no data)



No ecosystems analysed

Terrestrial GDE



Known GDE  
(regional study)



High potential GDE  
(regional study)



Moderate potential GDE  
(regional study)



Low potential GDE  
(regional study)



Unclassified potential GDE  
(regional study)



High potential GDE  
(national assessment)



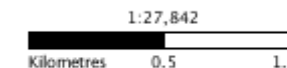
Moderate potential GDE  
(national assessment)



Low potential GDE  
(national assessment)



Unclassified potential GDE  
(national assessment)




Data Source: Bureau of Meteorology, Geoscience Australia and State/Territory lead water agencies. Refer to metadata for further information: [Click here](#)

Australian Albers GDA94














Terrestrial GDE (no data)

 No ecosystems analysed

Terrestrial GDE

-  Known GDE (regional study)
-  High potential GDE (regional study)
-  Moderate potential GDE (regional study)
-  Low potential GDE (regional study)
-  Unclassified potential GDE (regional study)
-  High potential GDE (national assessment)
-  Moderate potential GDE (national assessment)
-  Low potential GDE (national assessment)
-  Unclassified potential GDE (national assessment)

N

1:27,842

Kilometres 0.5 1.0

Data Source: Bureau of Meteorology, Geoscience Australia and State/Territory lead water agencies. Refer to metadata for further information: [Click here](#)

Australian Albers GDA94



## A-5 Habitat Quality Assessment Data

### A-5-1 Species Habitat Attribute Scoring

Table 35: Species attribute scoring

Species Habitat Attribute	Score
<b>Greater Glider</b>	
<b>Quality and availability of food and habitat required for foraging</b>	
Abundance of preferred foraging species	4
Extent of preferred riparian habitat	4
Access to foraging habitat	2
<i>Average</i>	<b>3.33</b>
<b>Quality and availability of habitat required for shelter and breeding</b>	
Abundance of hollows	4
Patch sizes	2
Connectivity to other populations to maintain genetics	1
Level of stressors/threats	3
<i>Average</i>	<b>2.50</b>
<b>Quality and availability of habitat required for mobility</b>	
Connectivity	2
Width of corridors	2
Local barriers	2
Level of threats when mobile	4
<i>Average</i>	<b>2.50</b>
<b>Absence of threats</b>	
Abundance of feral predators	1
Barbed wire fences	2
Habitat clearing and fragmentation	2
<i>Average</i>	<b>1.67</b>
<b>Koala</b>	
<b>Quality and availability of food and habitat required for foraging</b>	
Abundance of Koala food trees	2
Soil quality	4
Access to foraging habitat	3
<i>Average</i>	<b>3.00</b>
<b>Quality and availability of habitat required for shelter and breeding</b>	
Abundance of Koala food trees	2
Patch sizes	2
Connectivity to other Koalas and populations to maintain genetics	2
Level of stressors/threats	2
<i>Average</i>	<b>2.00</b>



<b>Quality and availability of habitat required for mobility</b>	
Connectivity	2
Width of corridors	2
Local barriers	3
Risk of car strike and dog attack when mobile	3
<i>Average</i>	<b>2.50</b>
<b>Absence of threats</b>	
Abundance of feral predators	1
Risk of vehicle strike	2
Habitat clearing and fragmentation	2
<i>Average</i>	<b>1.67</b>
<b>Squatter Pigeon (southern)</b>	
<b>Quality and availability of food and habitat required for foraging</b>	
Abundance of preferred foraging habitat	4
Extent of native grass seeds	2
Access to foraging habitat	5
<i>Average</i>	<b>3.67</b>
<b>Quality and availability of habitat required for shelter and breeding</b>	
Extent of shelter	4
Connectivity to other populations to maintain genetics	5
<i>Average</i>	<b>4.50</b>
<b>Quality and availability of habitat required for mobility</b>	
Connectivity	5
Width of corridors	2
Local barriers	5
<i>Average</i>	<b>4.00</b>
<b>Absence of threats</b>	
Abundance of feral predators	1
Risk of road strike	3
Habitat clearing and fragmentation	2
<i>Average</i>	<b>2.00</b>
<b>Ornamental Snake</b>	
<b>Quality and availability of food and habitat required for foraging</b>	
Abundance of preferred foraging habitat	3
Extent of gilgai habitat	2
Access to foraging habitat	2
Prey abundance	3
<i>Average</i>	<b>2.50</b>
<b>Quality and availability of habitat required for shelter and breeding</b>	
Extent of shelter and CWD	4



Connectivity to other populations to maintain genetics	2
<i>Average</i>	<b>3.00</b>
<b>Quality and availability of habitat required for mobility</b>	
Connectivity	2
Width of corridors	2
Local barriers	2
<i>Average</i>	<b>2.00</b>
<b>Absence of threats</b>	
Abundance of feral predators	1
Risk of road strike	3
Habitat clearing and fragmentation	1
<i>Average</i>	<b>1.67</b>



A-5-2 Site Attribute Scoring



Table 36: Habitat quality calculations

Attributes/Scores	AU1		AU2				AU3		AU4		AU5			
	-	Remnant	-	Remnant			-	Remnant	-	Remnant	-	Remnant		Regrowth
	Benchmark	Score (T7)	Benchmark	Score (T1)	Score (T6)	Score (T10)	Benchmark	Score (T2)	Benchmark	Score (T12)	Benchmark	Score (T4)	Score (T5)	Score (T3)
Number of large native trees	170	0	22	5	5	15	21	10	10	15	10	15	10	5
Tree canopy height	-	5	-	5	5	5	-	5	16	5	-	5	2.5	2.5
Recruitment of woody perennial species	100	5	100	5	5	3	100	5	100	5	100	5	5	5
Tree canopy cover (%)	-	2.5	-	5	5	5	-	3	24	3	-	2.5	2.5	1
Native shrub layer cover (%)	8	3	2	3	3	0	1	3	2	3	3	3	3	3
Coarse woody debris	1752	2	307	5	2	5	375	2	164	5	314	2	2	2
Native plant species richness: Tree	3	5	2	5	5	5	4	5	5	5	6	5	5	5
Native plant species richness: Shrub	5	2.5	2	5	5	2.5	2	5	3	2.5	6	2.5	2.5	2.5
Native plant species richness: Grass	4	0	9	0	2.5	2.5	8	0	7	2.5	6	2.5	5	2.5
Native plant species richness: Forbs/others	8	5	17	0	2.5	2.5	12	2.5	9	2.5	10	2.5	2.5	2.5
Non-native plant cover	0	3	0	0	0	3	0	0	0	0	0	0	3	0
Native perennial grass cover (%)	8	0	35	0	1	1	12	0	14	0	19	1	5	1
Organic litter cover	34	5	30	5	5	5	15	5	17	3	20	5	3	3
<b>BioCondition Score - Sampling Site</b>		0.48		0.54	0.58	0.68		0.57		0.64		0.64	0.64	0.44
<b>BioCondition Score - Assessment Unit</b>		0.48		0.60				0.57		0.64		0.64		0.44
<b>Weighted BioCondition Score</b>		0.004		0.045				0.029		0.014		0.104		0.016

Attributes/Scores	AU6		AU7		AU 8			AU 9					AU 10		
	-	Remnant	-	Remnant	-	Non-remnant		-	Non-remnant				-	Non-remnant	
	Benchmark	Score (T8)	Benchmark	Score (T9)	Benchmark	Score (T13)	Score (T15)	Benchmark	Score (T14)	Score (T16)	Score (T17)	Score (T18)	Benchmark	Score (T10)	Score (T3)
Number of large native trees	36	5	21	10	170	0	0	22	0	0	0	0	10	0	5
Tree canopy height	-	2.5	-	5	-	0	0	-	0	0	0	0	-	0	2.5
Recruitment of woody perennial species	100	5	100	5	100	5	5	100	5	5	5	5	100	5	5
Tree canopy cover (%)	-	1.5	-	2.5	-	0	0	-	0	0	2	0	-	0	1
Native shrub layer cover (%)	4	0	7	5	8	3	3	2	3	3	3	3	3	3	3
Coarse woody debris	1214	5	320	5	1752	2	2	307	5	2	5	2	314	5	2
Native plant species richness: Tree	3	5	4	5	3	2.5	2.5	2	5	5	5	5	6	5	5
Native plant species richness: Shrub	4	2.5	6	2.5	5	2.5	2.5	2	5	5	5	5	6	2.5	2.5
Native plant species richness: Grass	5	2.5	7	2.5	4	2.5	0	9	2.5	0	2.5	2.5	6	2.5	2.5
Native plant species richness: Forbs/others	5	5	9	5	8	2.5	2.5	17	0	2.5	0	0	10	2.5	2.5
Non-native plant cover	0	5	0	5	0	3	0	0	0	0	0	0	0	0	0
Native perennial grass cover (%)	15	5	12	3	8	0	0	35	1	0	0	0	19	5	1
Organic litter cover	20	3	50	3	34	5	5	30	3	3	5	5	20	5	3
<b>BioCondition Score - Sampling Site</b>		0.59		0.73		0.35	0.28		0.37	0.32	0.41	0.34		0.44	0.44
<b>BioCondition Score - Assessment Unit</b>		0.59		0.73		0.32			0.36					0.44	
<b>Weighted BioCondition Score</b>		0.002		0.004		0.064			0.115					0.065	
<b>BioCondition Score (/10)</b>	<b>4.45</b>														



# A-6 Landscape Fragmentation and Connectivity Tool Output



Department of Environment and Heritage Protection (DEHP)

Landscape Fragmentation and Connectivity (LFC) Tool version 1.4 LOGFILE

Process started at 29-06-2020 01:10:21 PM

Python version: 2.7.14 (v2.7.14:84471935ed, Sep 16 2017, 20:19:30) [MSC v.1500 32 bit (Intel)]

Arcpy version: 10.6

Username: Libby

#### INPUT PARAMETERS

Output Workspace: H:\LFC Tool\Middlemount\_SE\_Run1

Threshold lookup table: H:\LFC

Tool\LFC\_TOOL\_June2020\LFC\_data.gdb\tbl\_Regional\_frag\_local\_threshold

Remnant cover layer: H:\LFC

Tool\LFC\_TOOL\_June2020\LFC\_data.gdb\QLD\_VEG\_RVM\_100K\_v2p0\_EDITED

Remnant cover layer edited: True

Regional buffer extent: 20 kilometres

Local buffer extent: 5 kilometres

Impact layer: H:\LFC Tool\Middlemount\_SE\_Run1\SE\_DisturbanceExtent.shp

layer projection: GCS\_GDA\_1994

Raster cell resolution for analysis: 10 metres

Edge Width: 50 metres

(The distance from non-remnant landscapes through to the core ecosystem - the edge of remnant ecosystems)

Default projection: H:\LFC Tool\LFC\_TOOL\_June2020\scripts\QLD Albers Equal Area Conic.prj

13:10:21       Checking out the spatial analyst tool - required for LFC

13:10:21       \_\_\_\_\_BEGINNING LANDSCAPE FRAGMENTATION AND CONNECTIVITY  
ANALYSIS\_\_\_\_\_

13:10:21       This tool will categorise the landscape into:

{0: 'non-rem', 1: 'patch', 2: 'edge', 3: 'perforated', 4: 'core (< 100 hectares)', 5: 'core (100-500 hectares)', 6: 'core (> 500 hectares)', 7: 'water'}

13:10:25 H:\LFC Tool\Middlemount\_SE\_Run1\lyr\_file does not exist, creating it now.  
13:10:26 Copying across impact site feature(s) and calculating area in hectares (AreaHA)  
13:10:27 Making a local copy of the impact site  
13:10:28 Preparing remnant cover layer for analysis  
13:10:30 Created regional scale buffer of 20 kilometres  
13:10:34 Created local scale buffer of 5 kilometres  
13:10:43 Clipped the remnant cover to the regional buffer extent  
13:10:45 Unioned the pre impact remnant layer with the impact site  
13:10:51 Attributed the impact area as not RVM Cat B  
13:10:51 Area of RVM Cat B clearing is 68.05 hectares  
13:10:51 SQL selection used is "RVM\_CAT" = 'B' and "Cover" = 'Not RVM Cat B' on shapefile  
H:\LFC Tool\Middlemount\_SE\_Run1\main\_output\clip\_remcover\_post.shp

13:10:54 Categorized the cover attributes in clip\_remcover\_pre.shp ready for raster  
conversion

13:11:10 Converted clip\_remcover\_pre.shp to raster

13:11:14 Categorized the cover attributes in clip\_remcover\_post.shp ready for raster  
conversion

13:11:30 Converted clip\_remcover\_post.shp to raster

13:11:30 Run Landscape fragmentation analysis on the pre impact regional landscape

REGULATED VEGETATION TYPES BEING EXTRACTED FROM LAND COVER

IDENTIFICATION OF CORE, PATCH, EDGE AND PERFORATIONS

COMBINING FRAGMENTATION CLASSES

CLASSIFYING CORE FOREST PATCHES BY AREA

COMPOSING FINAL FRAGMENTATION MAP

COMPOSING FINAL FRAGMENTATION MAP

(FRAGMENTATION CALCULATION TIME WAS 7.4 MINUTES)

13:18:53 Run Landscape fragmentation analysis on the post impact regional landscape

REGULATED VEGETATION TYPES BEING EXTRACTED FROM LAND COVER

IDENTIFICATION OF CORE, PATCH, EDGE AND PERFORATIONS

COMBINING FRAGMENTATION CLASSES

CLASSIFYING CORE FOREST PATCHES BY AREA

COMPOSING FINAL FRAGMENTATION MAP

COMPOSING FINAL FRAGMENTATION MAP

(FRAGMENTATION CALCULATION TIME WAS 6.8 MINUTES)

Extracting a local subset of lfc\_regional\_pre\_impact

Extracting a local subset of lfc\_regional\_post\_impact

Collating pre and post impact statistics and trigger assessment

13:26:11 Summarising area statistics for: lfc\_localmsk\_pre\_impact

13:26:11 Summarising area statistics for: lfc\_localmsk\_post\_impact

13:26:11 Summarising area statistics for: lfc\_regional\_pre\_impact

13:26:12 Summarising patch count for lfc\_localmsk\_pre\_impact

13:26:20 Summarising patch count for lfc\_localmsk\_post\_impact

Analysing impact on Connectivity Areas

SIGNIFICANCE TEST ONE

The regional total area is 158182.91

The regional extent of core remnant is 36952.14

The regional extent of core remnant is 23.36 percent

This level of regional fragmentation sets a local impact threshold of: 5.0 percent

The table below lists the local impact thresholds for categories of regional core remnant extent:

REGIONAL CORE CATEGORY	LOCAL IMPACT THRESHOLD
< 10	2.0
10 - 30	5.0
30 - 50	10.0
50 - 70	20.0
70 - 90	30.0
>90	50.0

Area of core at the local scale (pre impact): 3408.06

Area of core at the local scale (post impact): 3389.09

Percent change of core at the local scale (post impact): 0.56 percent

#### SIGNIFICANCE TEST TWO

The number of core remnant areas occurring on the site: 7

The number of core remnant areas remaining on the site post impact: 3

(Only core polygons greater than or equal to 1 hectare are included)

#### RESULT

13:26:36 This analysis has determined a SIGNIFICANT impact on connectivity areas

(A significant reduction in core remnant at the local scale is False OR a change from core to non-core remnant at the site scale is True)

(Total area of RVM Cat B clearing is 68.05 hectares)

The significance table has been written to: ..\main\_output\lfc\_significance\_assessment.csv

The local scale summary table has been written to: ..\main\_output\lfc\_local\_scale\_summary.csv

The site scale summary table has been written to: ..\main\_output\lfc\_site\_scale\_summary.csv

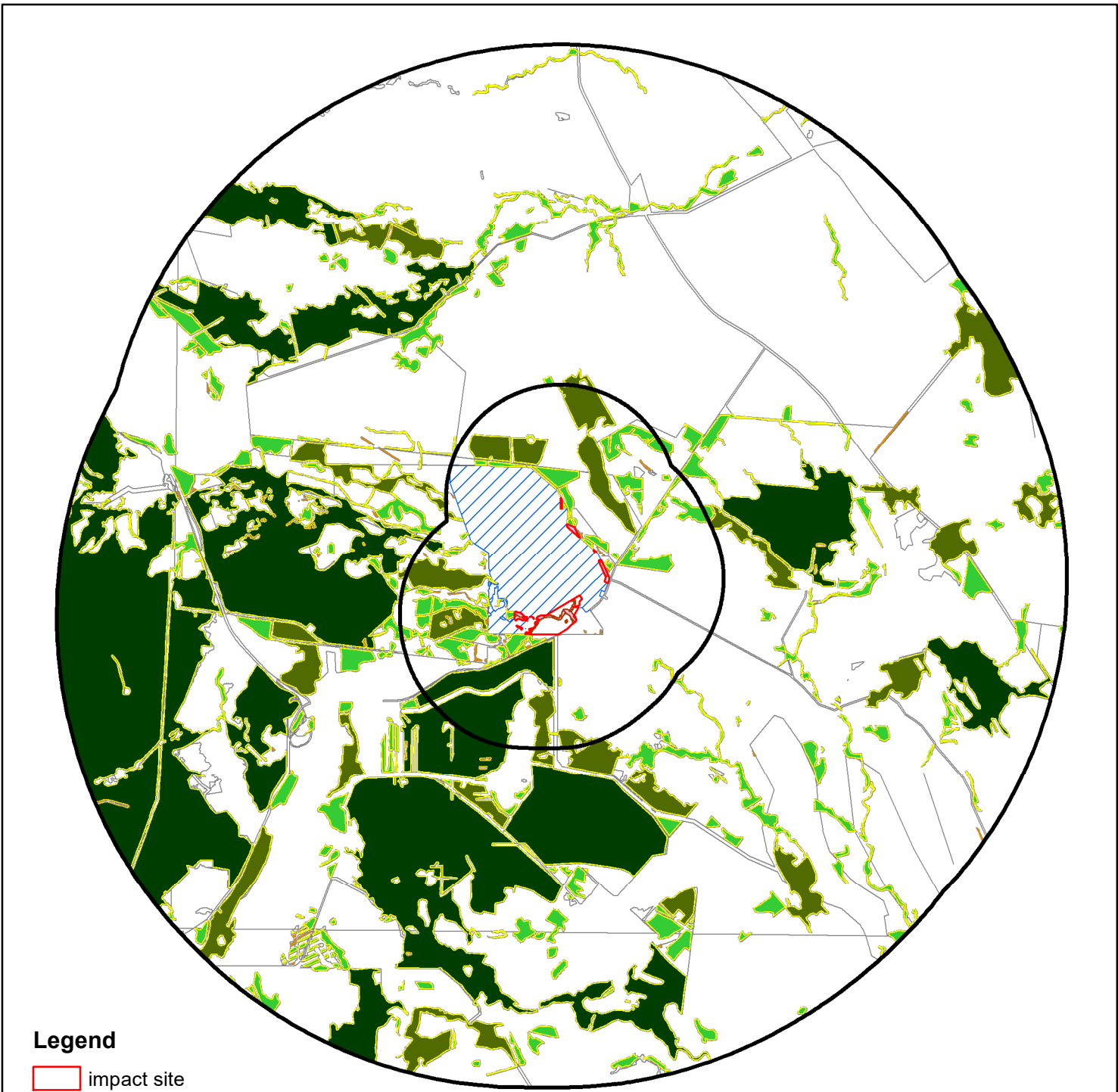
GIS layer files copied into folder \lyr\_file within the project folder.

View layers in ArcMAP using.. \H:\LFC Tool\Middlemount\_SE\_Run1\lyr\_file\lyr\_file\Connectivity Area Impact Assessment.lyr

Please scrutinise the output tables and spatial layers to confirm the desktop modelling of connectivity area impact

This analysis used an edited version of the Regulated Vegetation layer.

13:29:12 \_\_\_\_\_ COMPLETED LANDSCAPE FRAGMENTATION AND CONNECTIVITY  
ANALYSIS \_\_\_\_\_



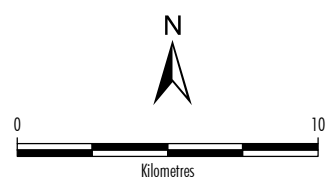
**Legend**

- impact site
- Cleared regulated vegetation (Cat. B)
- impact site local buffer
- impact site regional buffer
- patch
- edge
- perforated
- core (< 100 hectares)
- core (100-500 hectares)
- core (> 500 hectares)
- other

**clip\_remcover\_pre**

**Cover**

- Regulated vegetation (Cat. B)
- Not regulated vegetation (Cat. B)
- Water
- Approved MCO Footprint



GDA 1994 MGA Zone 55

**MIDDMOUNT COAL MINE  
Southern Extension Project  
LFC Run 1**

## A-7 Anabat Analysis Report





## Microbat Call Identification Report

<b>Prepared for (“Client”):</b>	Biodiversity Australia
<b>Survey location/project name:</b>	Middlemount, Qld
<b>Survey dates:</b>	3-6 March 2020
<b>Client project reference:</b>	EC3680
<b>Job no.:</b>	BIA-2002
<b>Report date:</b>	17 April 2020

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## Methods

### Data received

*Balance! Environmental* received seven ZCA data files and associated log files, recorded on two Anabat Express detectors deployed over three consecutive nights (3-6 March 2020).

Prior to analysis, the ZCA files were converted to zero-crossing analysis sequence files (ZC files) using *Anabat Insight* (Version 1.9.2; Titley Scientific, Brisbane). The conversion process applied a noise filter to separate those ZC files that contained only non-bat background noise.

### Call identification

Call analysis and identification was performed in *Anabat Insight*. All ZC files that passed the noise filter were processed manually and species identities confirmed by comparing the spectrograms and derived call metrics of each file with those of regionally relevant reference calls and/or with published call descriptions (e.g. Reinhold *et al.* 2001; Pennay *et al.* 2004). Identification was also guided by considering probability of species' occurrence based on published distribution information (e.g. Churchill 2008; van Dyck *et al.* 2013) and on-line database records (e.g. <http://www.ala.org.au>).

Where calls could not be reliably allocated to a single species due to overlapping characteristics ("unresolved calls"), they were assigned to a multi-species group.

### Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au>.

Species nomenclature follows Jackson & Groves (2015).

## Results & Discussion

The ZCA conversion process yielded 9304 ZC files; however, noise filtering excluded 8391 of those files from further analysis. The remaining 913 files contained 955 identifiable bat calls.

More than 75% (725) of the identifiable calls were positively attributed to one of 12 species or the undifferentiated *Nyctophilus* genus (see upper portion of **Table 1**). The other 229 calls could not be reliably identified and were allocated to seven unresolved species groups, all of which represented species that were positively identified from other calls (see lower half of **Table 1**).

**Appendix 1** contains sample sonograms extracted from the data set for each identified species or unresolved group.

**Table 1** Bat species recorded during the Middlemount survey, 3-6 March 2020.  
Number of calls allocated to each species or unresolved species group.

Detector:	Unit 1_SN428712			Unit 2_SN428732			Species total
	Night:	3-Mar	4-Mar	5-Mar	3-Mar	4-Mar	
<b>Positively identified calls</b>							
<i>Chalinolobus gouldii</i>	10	16	3	31	3	37	100
<i>Chalinolobus morio</i>				5	1	3	9
<i>Chalinolobus picatus</i>	6	10	16	3	15		50
<i>Nyctophilus</i> sp.		1	2		3	1	7
<i>Scotorepens balstoni</i>	1	3	2	10	4	1	21
<i>Scotorepens greyii</i>		5	1	26	23	5	60
<i>Vespadelus baverstocki</i>	1	1		10	5	2	19
<i>Vespadelus troughtoni</i>	2			9	20	21	52
<i>Miniopterus australis</i>				1	1		2
<i>Chaerephon jobensis</i>	63	14	2	79	79	20	257
<i>Ozimops lumsdenae</i>	4	1	1	32	8	14	60
<i>Ozimops ridei</i>	1	5		8	4	5	23
<i>Saccolaimus flaviventris</i>	18	5		30	4	9	66
<b>Unresolved calls</b>							
<i>C. gouldii</i> / <i>O. ridei</i>	10	14	6	17	9	11	67
<i>C. gouldii</i> / <i>S. balstoni</i>		3			6	5	14
<i>C. morio</i> / <i>V. troughtoni</i>	1			2	5	10	18
<i>C. picatus</i> / <i>S. greyii</i>	3	8	4	9	17	14	55
<i>C. picatus</i> / <i>V. baverstocki</i>		26	1	6	1	1	35
<i>S. flaviventris</i> / <i>C. jobensis</i>	7	4	7	10	2	4	34
<i>S. flaviventris</i> / <i>O. lumsdenae</i>	2	2		2			6
Detector-night total	129	118	45	290	209	163	955

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- Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.
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**Appendix 1** Representative call sequences from the Middlemount survey, 3-6 March 2020.  
 x-axis (time) = 0.01 sec per tick (time between pulses removed); y-axis = frequency (kHz)





